For Esther


IX

Turkmen Carpets

A New Perspective

An Interdisciplinary Study based on
Radiocarbon Dating, Dye, Mordant,
and Technical Analyses, as well as
Historical and Art Historical Sources

Jürg Rageth

In collaboration with Hans Christian Sienknecht
With contributions by Georges Bonani,
Jan Wouters, and Ina Vanden Berghe

English translation edited by DeWitt Mallary

Volume 1

Volume 1

Volume 2

Lenders

Dr. Ernst Albegger, Graz
François Ang, Paris
Dr. Peter Baumann, Linz
Edoardo Concaro, Villanterio
Hans Elmby, Copenhagen
Elly and Jean Pierre Gersbach, Basel
Dr. Hans Giger, Zurich
Ruedi Haller, Zurich
Marie and George Hecksher, San Francisco
Ursula and Peter Hoffmeister, Dörfles-Esbach
Marion and Hans König, Minusio
Antje and Prof. Dieter Ladewig, Bettingen
Dr. Hans Geib, Gifhorn
David d'Heurle, Atlanta
Dr. Urs Meier, Winterthur
Nancy Jeffries and Kurt Munkacsi, New York
Robert Pinner, London
Dr. David Reuben, London
Dr. Giovanni Rubini, Udine
Dr. Hanno Schwarz, Linz
Hans Christian Sienknecht, Hamburg
Adolf Siegrist, Basel
Moshe Tabibnia, Milano
Martin Tischer, Weissenfels
Mathias Wohlgemuth, Neuhausen
Marilyn and Marshall R. Wolf, Toronto
The Metropolitan Museum of Art, New York
The Museum of Islamic Art, Doha
The Hermitage Museum, St. Petersburg
The Russian Museum of Ethnography, St. Petersburg
The State Russian Museum, St. Petersburg
The Textile Museum, Washington, D.C.
The de Young Museum, San Francisco
Trésor de la Cathédrale de Liège

Acknowledgements

The production of this volume and the organization of the preceding symposium would not have been possible without the generous help and support of many friends and patrons.

First of all, I would like to express my gratitude to the Basel Rug Society "Freunde des Orientteppichs", particularly to Rudolf J. Graf, Gerd Näf, Jörg Affentranger, and Hanspeter Forlen, for having given me all possible freedom and support for this project wherever they could.

I am most grateful for the unconditional cooperation of all the owners of the weavings, who provided their treasures for radiocarbon dating at ETH Zurich, for exhibition during the symposium, and finally for publication in this book.

I also would like to express my sincere thanks to the various museums, and their experts in charge, who provided pieces for this project. My special thanks go to Sheila Canby, Florica Zaharia, Janina Poskrobko, Tony Frantz, and Prof. Walter Denny from the Metropolitan Museum of Art in New York; to Michael Franses and the Museum of Islamic Art in Doha; to Dr. Elena Tsareva and the Hermitage, the Russian Museum for Ethnography, and the Russian Museum, all in St. Petersburg. Furthermore I am grateful to Daniel Walker and Sumru Belger Krody from the Textile Museum in Washington, D.C., Diane Mott and Jill D'Allesandro from the de Young Museum in San Francisco, and Françoise Pirenne from the Trésor de la Cathédrale de Liege.

Regarding the initial dating project, I am deeply indebted to Dr. Georges Bonani and Dr. Irka Hajdas of the ETH Laboratory of Ion Beam Physics in Zurich. Georges Bonani brought his patience, great understanding, and profound expertise to help steer this project to a successful completion. The final realization of this volume was only possible due to his constant encouragement and help.

Dr. Harald Böhmer first drew my attention to the importance of dye analysis. The first sets of tests for this study were done by him, awakening my interest and indicating the possibilities offered by an integrated use of this method.

I also owe a great debt of gratitude to Dr. Jan Wouters, independent scientist, and Ina Vanden Berghe from the Institut Royal du Patrimoine Artistique KIK-IRPA in Brussels for their fruitful collaboration during the many analyses they have done for this study. Jan Wouters has to be particularly acknowledged for his pioneering work in the detection of insect dyestuffs, specifically in differentiating between types of cochineal from the old and new worlds.

In connection with dyes, I had many interesting and instructive discussions with Barbara Bigler, a master weaver and dyer from Aesch, near Basel.

Moreover, I have to express my sincere thanks to many friends and experts for constructive and stimulating discussions and suggestions, asking for forgiveness if I have forgotten anyone:

Dr. Peter Andrews, London; François Ang, Paris; Siawosch Azadi, Hamburg; Dr. Christoph Baumer, Hergiswil; Edoardo Concaro, Villanterio; Stefan Drechsle, Lörrach; Dr. Volkmar Enderlein, Berlin; Ben Evans, London; Michael Franses, London; Dr. Albert Gabbaï, Geneva; Dr. Bernhard Gardi, Basel; Jean-Pierre Gersbach, Basel; Ruedi Haller, Zurich; George Hecksher, San Francisco; Gisela Helmecke, Berlin; Peter Hoffmeister, Dörfles-Esbach; Rina and Norman Indictor, New York; Stefano Ionescu, Rome; Dr. Richard Isaacson, Arlington; Dr. Oskar Kaelin, Basel; Hans König, Minusio; Prof. Zvi Koren, Ramat-Gan; Annette Korolnik, Carona; Dr. Jens Kröger, Berlin; Axel Langer, Museum Rietberg Zurich; DeWitt Mallary, Vermont; Dr. Urs Meier, Winterthur; Kurt Munkacsi, New York; Thomas Murray, Mill Valley; Dr. Karel Otavsky, Prague; Robert Pinner, London; Dr. Hans Ritter, Munich; Lena Renz, Basel; Hermann Rudolph, Beilstein; Sandra Sardjono, Los Angeles; Dr. Werner Schneider, Reinach; Dr. Sabine Schrenk, Cologne; Niklaus Seiler, Basel; Daniel Shaffer, London; Martin Tischer, Weissenfels; Elena Tsareva, St. Petersburg; Dr. Ulrich Türck, Marl; Chris Lammens Verhecken and Dr. André Verhecken, Mortsel; Dr. André Wiese, Basel; Mathias Wohlgemuth, Neuhausen; Dr. Johannes Wolff-Diepenbrock, Munich.

A very special word of thanks goes to the staff of the Abegg-Stiftung in Riggisberg. It is an extremely lucky coincidence for me to have such an institution so acessible. First, I would like to express my appreciation to Dr. Regula Schorta for many interesting and instructive discussions on early textiles. When proposing relationships between Turkmen carpets and early textile designs, I always found her an attentive, but critical, listener. She was not only willing to enable viewing textiles from the Abegg-Stiftung Collection, but also granted unconditional commitment for their publication in this book. From Dr. Henry Hohmann and Dr. Michael Peter I received many revealing suggestions from the field of art history, as well as many helpful instructions for further reading and on the production of this volume. For other in-depth discussions, I thank curators Dr. Anna Joly and Dr. Evelin Wetter, and Bettina Niekamp, the head of conservation. Catherine Depierraz was of help regarding the image material I needed.

Finally I owe gratitude to all my friends who provided their help in critically reviewing my texts:

Dr. Hans Ritter, Dr. Bernhard Gardi, Dr. Johannes Wolff-Diepenbrock, Anna Wilde, Ingrid Siedek, Dr. Albert Gabbaï, and Dr. Werner Sackmann were helpful finding errors and inconsistencies and improving the linguistic expression. The scientific texts were carefully reviewed by Dr. Georges Bonani for radiocarbon dating issues, and the chemists Dr. Jean-Pierre Bonjour and Dr. André Verhecken.

Hans Christian Sienknecht critically reviewed my texts for language and style as well as for their subject-specific content. In countless discussions, he contributed important suggestions and additions. Without his profound knowledge and helpful assistance during the past 16 years, this book would not be all that it is.

Without the committed assistance and help of DeWitt Mallary, the English edition of this volume could never have come into existence. Over nearly three years, DeWitt has patiently edited chapter by chapter, suggesting many improvements concerning both language and content in the course of countless telephone calls. I owe him great thanks.

This publication could not have been realized without the generous financial support of the following institutions and friends: Lotteriefonds of the Kanton Basel-Landschaft and Basel-Stadt; Freunde des Orientteppichs, Basel; Silvia und Jörg Affentranger, Muttenz; Dr. Albert Gabbai, Geneva; Elly und Jean-Pierre Gersbach, Basel; Marie und George Hecksher, San Francisco; Marion und Hans und König, Minusio; Antje und Prof. Dieter Ladewig, Bettingen; Fritz Langauer, Vienna; Caroline McCoy Jones, Reno; Nancy Cheffries und Kurt Munkacsi, New York; Kristal Hale-Murray und Thomas Murray, Mill Valley; Amie und Michael Rothberg, Mill Valley; Hans Christian Sienknecht, Hamburg; Dr. Arch. Ignazio Vok, Padua; Marylin und Marshall R. Wolf, Toronto. I am deeply grateful to all of them.

Finally and most importantly, I have to wholeheartedly thank Esther, my beloved wife. Over the years, she has not only patiently tolerated my constant pre-occupation with this project, but even encouraged me in moments of doubt. Her manifold and steadfast support has allowed me to devote myself wholeheartedly to this project and to finalize it according to my often rather time-consuming standards.

Foreword

The beginning and development of this Project:

The foundation of this project was laid on the occasion of the 1997 symposium in Liestal on radiocarbon dating Anatolian kilims. Peter Hoffmeister and Hans Christian Sienknecht asked me for assistance in radiocarbon dating a group of Turkmen weavings from their collections. In May 1997, the first 10 pieces were sampled and tested at the ETH Zurich by Dr. Georges Bonani. The results of these first examinations were so promising that it seemed appropriate to continue testing. After a second series of 11 more pieces from these two collections, Elena Tsareva orchestrated the formation of a third series of 20 pieces from the collections of the Hermitage, the Ethnographic Museum, and the Russian Museum in St. Petersburg.

Based on the intriguing results of these first groups of tests, a symposium and an accompanying exhibition were realized in February 1999 in Liestal, Switzerland.[1] During this symposium, there was support for the idea of publishing these results, as had just been done with the results of the 1997 Kilim symposium. A request by the "Freunde des Orientteppichs" for financial support for this project to the Lotteriefonds Basel-Landschaft was answered positively; thus the starting signal for this publication was given. The 9th International Conference on Oriental Carpets (ICOC), held in Milan in autumn of the same year (1999), was an ideal occasion to approach other collectors about having Turkmen weavings from their collections radiocarbon dated. Toward that end, my recently released book on radiocarbon dating Anatolian kilims was of great help.[2] George Hecksher, a leading US collector, was the first to commit to participate, enthusiastically by providing a substantial financial grant and having 10 pieces of his collection radiocarbon dated. Moreover, he promised to encourage other US collectors to support both the dating and the publishing projects.

Growing knowledge and experience regarding the age of the weavings awakened my interest in some unusually bright red shades seen particularly in early pieces. Dr. Harald Böhmer performed the first 70 tests until the time came when thin layer chromatography, the method he used, reached its limits, not being able to differentiate between different types of cochineal. Dr. Norman Indictor drew my attention to the research work in the field of insect dyestuffs and their identification by HPLC analysis by Dr. Jan Wouters and Dr. André Verhecken,[3] which resulted in a visit to the lab of Dr. Wouters in Brussels in November 2002. The result of this visit was the initiation of a 4-year project in which 230 wool and silk samples were tested by HPLC (High Pressure Liquid Chromatography) analysis on special red dyestuffs and in some cases on the mordant used to achieve these brilliant reds.

Working with Turkmen carpets re-kindled my earlier interest in the origin and development of designs.[4] As my knowledge of the history of Central Asia and the ancient Near East grew, I found more and more evidence of extensive contacts between the early cultures of Central Asia and those of Iran and Mesopotamia, and a resulting exchange of innovations, ideas, and designs.

The selection of Turkmen weavings assembled for this study is mainly based on three criteria: age, dyes, and the origin of designs. It has never been my intention to compile a comprehensive survey of Turkmen weavings, but rather to elucidate some selected new aspects of the cultural and historical background of these fascinating textiles with their multifarious and ancient designs.

1 See Hali 104, 1999: 82–85.
2 Rageth 1999.
3 Verhecken/Wouters 1988/89:
4 Rageth 1990a; Rageth 1991a; Rageth 1993.

"A New Perspective"

Since the early 20th century, Russian anthropologists have suggested a local Iranian tradition for Turkmen carpet weaving and their designs,[1] while English and German speaking researchers, in contrast, have assumed an origin from the domain of Turkic speaking nomadic people from the eastern steppes.

Newer research on the history and archaeology of the steppes seems to indicate that the origin of pile carpet weaving from a nomadic environment is rather unlikely.[2] Robert Pinner drew such a conclusion in commenting on an article by Russian archaeologist Igor Khlopin.[3] Pinner writes: "… we need not assume today that West and Central Asia learned carpet making from the Turkic nomads…".[4]

Turkic speaking nomads do not appear in historical records until the 3rd century A.D. From the 6th century on, they became increasingly influential (among them the Oghuz, the supposed ancestors of the Turkmen),[5] and in the 10th century, they seized power, overthrew the last Iranian dynasties which they had served as soldiers and generals, adopted Islam, and made Turkic the lingua franca.

Before the 10th century and over a period of approximately 2500 years, settled Iranian speaking people shaped the fertile oasis cultures of Transcaspia, Transoxiana,[6] and the Tarim basin.[7] Trade centres there with relations to India, Iran, and Mesopotamia were already established in the 3rd millennium B.C. In the 6th century B.C. these oases became satrapies of the Achaemenid Empire, and in turn were conquered and Hellenised by Alexander the Great. Important oases like Margiana (Merv), Bactria (Balkh), Khoresmia (Khiva), Ferghana, and particularly Bukhara and Samarkand (Sogdiana), bear eloquent witness to a great cultural historical past. Before the invasion of the Turks, these early civilisations were overrun in several waves by Iranian speaking nomads from the steppes west of the Altai, including the Dahaes, Alans, Massagetae, and the Saka, all of whom, over time, were assimilated by the local sedentary population. Particularly known in the West were the Arsacids (Parthians), a sub-group of the Saka. The Arsacids and the Saka moved south around the middle of the first millennium B.C. The Arsacids conquered Persia and dominated it for more than 600 years. They entered history as great antagonists of the upcoming Roman Empire. Their relatives, the Saka, moved into more Eastern territories, leaving their traces in the Tarim basin (Shampula) and in south eastern Khorasan, the region becoming known as Sakastan (later Sistan). Staring in the the early 1st millennium B.C., Zoroastrianism, which developed from an ancient Iranian fire cult and various other religions, became the religion of these Iranian-speaking people.

During the Arsacid (Parthian) period, western Central Asia (Transcaspia and Transoxiana) was still divided into several independent principalities and kingdoms, e.g. Khoresmia, Sogdiana, Bactria, Margiana, and Kushan. This remained generally unchanged until the time of the Sassanids, who considered themselves descendants of the Achaemenids and therefore real Persians.

More radical cultural changes occurred as the Arabs swept northwards into these territories. There were battles over a 300 year period until Islam, adopted and supported by Turkic speaking nomads from the north-eastern steppes, took the upper hand. The names of most of the principalities and kingdoms then disappeared after having existed for more than one and a half millennia. One example of this is the Sogdians, at the height their power shortly before Islamisation. Even after the victory of Islam, the ruler of Khorezm continued the pre-Islamic Iranian tradition of calling himself Khorezm Shah until the arrival of the Mongols. The Mongol invasion in the 13th century was followed by troubled centuries under Timurid rule, until in the 16th century Uzbek dominion finally brought back some quiet decades. The vari-

1 Reinhold Schletzer provided access to many Russian texts with his German translations. However, some important contributions by Barthold, Bregel, and Kuzmina relevant in this context have been translated into English.
2 Parzinger 2006; Parzinger et al. 2007.
3 Khlopin 1982.
4 Hali 5/2, 1982: 115.
5 Al-Kashgari 1914–1916; Jahn 1980 (Rašid ad-Din).
6 In earlier literature called West Turkestan.
7 East Turkestan.

ous Turkmen tribes started to leave such inhospitable territories as the Mangïshlaq Peninsula and the Balkhan Mountains, to which they had moved to avoid the Mongols and the Timurids, returning to the oases in the East and the Southwest. It is from this period that the earliest Turkmen weavings survive.

The origin of the knotted pile carpet

The following discussion of the origin of carpet weaving might at first appear too exhaustive in the context of Turkmen carpets. However, as will be shown in the course of this volume, the "Turkmen carpet" is deeply rooted in the world of the Ancient Near East. Not only do many Turkmen carpet designs have their roots there, but so does carpet weaving in general. Thus, the following remarks on the historical origin of carpet weaving are of fundamental importance for a new and comprehensive understanding of Turkmen carpet weaving.

As suggested by archeological finds of carpet weaving tools dating from the middle of the 2nd millennium B.C. in the oases of western Central Asia, piled carpets have been woven over the last several millennia, [8] Horse-mounted nomads invading from the steppes in successive waves since at least the 1st millenium B.C. may have adopted this technology from the sedentary people. In the 8th century, the Oghuz arrived in a last great immigration wave, from which the Turkmen emerged. They too may well have adopted carpet weaving from the sedentary population.

Referring to the absence of the technology of piled carpet weaving among the eastern Turks, Mahmud al-Kashgari supports such an assumption.[9] Countless excavations in the steppe belt during the past three decades have confirmed al-Kashgari's statement; with very few exceptions, no piled carpets have been brought to light, only felts (as well as some other textiles).[10]

8 Khlopin 1982.
9 Andrews 1999: 213, footnotes 155 – 158.
10 Parzinger 2006; Parzinger et al. 2007.

The Pazyryk carpet is one of these exceptions. According to current thinking either a gift, trade good, or booty, made in Bactria.[11] Other than the symmetrically knotted Pazyryk carpet, only one other carpet fragment, knotted asymmetrically open left,[12] has been found in the steppes, in a kurgan in Bashadar[13] slightly west of Pazyryk.

These facts speak quite clearly against the invention of piled carpet weaving in a nomadic environment in the Eurasian steppes. This technology might rather have been gradually or even simultaneously developed in the oases of Central Asia, the Iranian plateau, or Mesopotamia.

There is also debate on the linguistic origin of the word *khali*, "knotted pile carpet". Some consider it to be Turkish, subsequently deriving the origin of knotted pile carpet weaving from Turkish speaking people. Others see Iranian roots in it, proposing even a Sogdian origin.[14] However, evidence for the accuracy of an Iranian origin becomes increasingly compelling.

That the invention of knotted pile carpet weaving has to have been considerably earlier than the 4th or 3rd century B.C. is clearly demonstrated by the high quality of the Pazyryk carpet. The beginnings of carpet weaving can not reasonably be accredited to nomadic people from the time of the Pazyryk culture, or even to the early 1st millenium B.C.

A number of authors have discussed possible origins of knotted pile carpet weaving.[15] In the meantime, however, a number of early carpets have come to light, confirming Pinner's skepticism.[16] In addition, new text material has become known, likely excluding an origin of

11 In an editorial article in Hali, Robert Pinner mentions the Achaemenid empire as a possible place of origin for the Pazyryk carpet (Hali 5/2, 1982: 113). Etienne de la Vaissière mentions Bactria, a satrapie of the Achaemenid empire (de la Vaissière 2005: 21). David Stronach too sees one of the eastern satrapies of the Achaemenids as the place of origin for the Pazyryk carpet (Stronach 1993).
12 Barkova 1999: 69.
13 Schiltz 1994: 262.
14 Sogdian is an Indo-Iranian language. See also the comment on the *etymon* for *khali*, as quoted in the editorial in Hali since issue 80 (Hali 80, 1995: 5)
15 E.g. Robert Pinner in Hali 5/2 1982: 111 – 115, Clothilde Galera-Blanc 1996: 18 – 29, Jon Thompson 1988: 35 – 40.
16 Hali 5/2, 1982: 115.

pile carpet weaving from Turkic speaking nomads. [17] Furthermore, a number of Turkmen carpet designs point to local Central Asian traditions, to a Sassanian, Parthian, or even Achaemenid origin, and beyond that even to Mesopotamia and Assyria, hence to a western, rather than an eastern, origin.

The presumably earliest knotted textile fragment was found in Ur, Mesopotamia, and dates from around 2600 B.C. It was discovered by Leonard Woolley and is described by him as probably the fragment of a *kaunakes*, a garment, imitating the fleece of a sheep or a goat. [18] Starting in at least the 3rd millennium B.C., Mesopotamian priests and kings wore the *kaunakes*.[19] Although the fragment excavated by Woolley was not from a carpet, it could indeed be a remnant of the earliest known knotted textile.

The earliest reference to floor carpets is found in a palace text from Mari, a Mesopotamian city-state, from the time of King Zimrilim (1775 – 1761 B.C.),[20] although it is not clear whether a knotted or a flat woven carpet was described. Knotting specifically is first clearly mentioned in a document found in the palace of the city of Nuzi (Mesopotamia, 15th/14th century B.C.), with a clear reference to floor carpets made by knotters (*kasiru*). These texts also show that knotted objects, or at least objects with knotted sections, were used for different purposes.[21] The same emerges from palace texts of the Assyrian King Tukulti Ninurta I. (1243 – 1207 B.C.). Knotted textiles of various types are also mentioned there, among them carpets, Assyrian *mardatu*, made by knotters, *kasiru*. [22] However, different authors interpret the Assyrian word *kasiru* differently. Marie-Thèrese Barrelet discusses the various translations, which can be "knotter", but also "weaver" (tapestry weaver).[23]

The earliest preserved symmetrically knotted textiles come from Egypt.[24] They show that the technique of knotting was used for various types of objects, confirming the texts from Mari and Nuzi. These Egyptian examples with all likelihood represent an adoption of this technology from Mesopotamia. Instead of wool and goat hair of the Mesopotamian textiles, linen was used in Egypt. The Egyptian textiles, consisting of garments (*kaunakes*), and throne and bed covers, date from the middle of the 14th century B.C.[25] Knotted pile carpets for the floor from this period are so far unknown, although they might have existed, perhaps even in fine quality. The latter notion is based on the existence of extremely fine woven tapestries, e.g the fragment of a royal garment with a cartouche of Amenhotep II (1425 – 1397 B.C.).[26] Syrian weavers likely wove this garment in Egypt. The high quality of this tapestry at least suggests the possibility of a comparable quality for knotted carpets.

Real knotted Oriental carpets are only known 900 years later: the already mentioned symmetrically knotted Pazyryk carpet and the asymmetrically open left knotted fragment from Bashadar.[27] With a knot density of 6000[28] or 7000[29] knots per dm^2, the Bashadar fragment is twice as fine as the Pazyryk carpet. The design is no longer recognisable.[30] However, it is the earliest asymmetrically open left knotted carpet fragment known so far.

A number of carpet fragments with various types of knots are known from the 1st millennium A.D. Some are from the Tarim Basin, others from the eastern Mediterranean (Coptic Egypt), and some from north

17 Al-Kashgari, quoted in Andrews 1999: 213, footnotes 155 – 158.
18 Woolley 1934: 238. See also Barber 1991: 164, Hirsch 1991, and Eiland III 1993: 11.
19 See figs. 6 – 10 in the chapter "Streams of Paradise".
20 Mayer 1977: 178.
21 Mayer 1977: 180 – 184.
22 Köcher 1957 – 1958; on *mardatu*, carpet, see also Mayer 1977.
23 Barrelet 1977: 58 et seq.

24 Udo Hirsch first identified and described these textiles as symmetrically knotted (Hirsch 1991).
25 See Hirsch 1991: a *kaunakes* (fig. 16), bed covers (figs. 17 and 18), and throne covers (figs. 9 and 15).
26 Carter/Newberry 1904: Plate 1.
27 The kurgans of Bashadar were built approximately 100 years later than those of Pazyryk. This results from dendrochronological research (see Schiltz 1994: 262).
28 Barkova 1999: 69.
29 Rudenko 1970: 302.
30 Rudenko 1970: 302. Illustrated in colour in Hali 107, 1999: 69, fig. 8. I thank Daniel Shaffer from Hali for this information.

Afghanistan. Yet all have something in common; they show influences from Sassanid Persia.

Known since the early 20th century are the carpet fragments found by Aurel Stein in Loulan, in the Tarim Basin (1st–3rd century A.D.). They are symmetrically knotted, have a very low knot density, and a large number of wefts between rows of knots.[31] Their designs are geometric.

Later discoveries from the Tarim Basin are more diverse in structure and design, but date from the same period. Some of them are still in good condition, having measurements up to 2 × 3 meters. They show geometric, floral, or animal designs and are knotted symmetrically or with a knot on a single warp.[32] Like the Stein fragments, they all have a low knot density (app. 300–500 knots per dm^2). The arguably most spectacular piece is a large lion rug (1.78 × 3.12 m) found in Yingpan in the tomb of a Sogdian merchant.[33] The lion is shown in profile with his head turned towards the viewer, like the lions seen on both sides of the stairways to the throne hall (*apadana*) of Darius I in Persepolis. In both design and technique, all these knotted pile weavings from the Tarim Basin can be traced back to Sassanian and/or Sogdian influence.

The chronologically next example, which might be related to the fragments from the Tarim Basin, is a carpet fragment sold at Christie's in London.[34] Its place of discovery is unknown; it dates from the 5th century A.D (^{14}C dated), is asymmetrically knotted, has 6–8 wefts per row of knots and a knot density comparable to the fragments of the Tarim Basin. Of particular interest are the tapestry woven skirts at bottom and top. They each have a frieze with striding lions, showing surprising similarities to Achaemenid lion representations, down to small details of the design such as the drawing of the muscular system.[35] The lion frieze is accompanied at bottom and top by a frieze of lotus flowers and buds in the Egyptian/Assyrian style. This is surprising for a 5th century A.D. carpet. The question remains how these representations survived without considerable changes over a period of more than 1000 years. The field design is largely destroyed, but surprisingly shows similarities to 19th century Luri carpets.[36]

A number of carpet fragments, allegedly found in the province of Samangan in northern Afghanistan, recently presented by Friedrich Spuhler, show some similarities to the above mentioned fragments from the Tarim Basin. They date approximately from the same time,[37] have a comparable low knot density (1–7 wefts between rows of knots),[38] show both floral and animal designs, and come from a traditional rural (or nomadic?) environment.

Finally, the 4th – 9th century knotted carpet fragments from Coptic Egypt and the eastern Mediterranean have to be mentioned.[39] They usually show a knot on a single warp, also known as the "Spanish" knot.[40]

There are certainly other early examples, which go beyond the scope of this introduction. Much has been written and published addressing the history of Oriental carpets since the 14th century. The earliest extant Turkmen carpets are only from the 15th/16th century.

The Turkmen

The origin of the name "Turkmen" and when it was first mentioned remain a matter of debate.[41] The people called "Turkmen" since at least the 10th century, the time of the Islamisation of western Central Asia,

31 Galea-Blanc 1996: Figs. 14 and 15; Whitfield 2004: 152, fig. 51
32 Zhao/Yu 2000: 80, no. 38; Keller/Schorta 2001: Fig. 39 (see also fig. 114 in the chapter «The Salor»); Keller et al. 2001: Plates 14 and 220; Zhao 2002: 54, 55, plate 17.
33 Schorta 2006: 254, 255, figs. 198–200.
34 Christie's London, 4. October 2011: Lot 202A.
35 See the Achaemenid tapestry found in kurgan V in Pazyryk (Rudenko 1970: 298, fig. 140; for a colour illustration, see Schiltz 1994: 280, fig. 211).
36 See Tanavoli 1985: 117, no. 46. The rug published by Tanavoli, shows a border and tree motifs in the corners of the field, like the Sassanian rug sold by Christie's.
37 According to radiocarbon dating, the earlier examples date from the 2nd – 4th century, the later ones from the 8th/9th century.
38 The knot density varies between 180 and 675 knots per dm^2.
39 Such a fragment is illustrated in fig. 129 in the chapter „The Salor". Other examples are in Dimand/Mailey 1973: Fig. 14; Day et al. 1996: Figs. 16 and 17; Martiniani-Reber 1993: 120, no. 60.
40 On the possible Coptic origin of the Spanish knot, see Dimand/Mailey 1973: 9.
41 See the introduction to the chapter "The Salor", text referring to footnote 15. The earliest record allegedly comes from a Chinese source, referring to events of the 5th century A.D. [Barthold 1929 (1962): 79–80].

are a mixture of various people of Turko-Mongolian, Indo-European, and Caucasian origin, and the "new" name is based on historical developments in that region about that time. The 10th century was a time of fundamental change on a variety of levels: most importantly the transition of power from Iranian speaking sedentary dynasties to Turkic speaking horse-mounted nomads from the steppes. A consequence, over time, of this change of power, was a change of language from various Iranian tongues to Turkish, and also a change from various religious communities such as Zoroastrianism, Buddhism, Manichaeism, Christianity, and Judaism to Islam. All these changes had serious consequences for the Central Asian oases and their inhabitants. In the decorative arts, these changes are manifested by a preference for or neglect of specific styles. Interlaced designs were already known under Iranian/Zoroastrian domain and were also well represented in early Islam, but only became a dominant component of decorative arts after Turkic/Islamic supremacy. Most importantly, interlaced designs became geometric: circular forms were changed into octagonal forms. Animal representations, however, remained fashionable until the 14th century, although they also changed: some animal species disappeared completely from the repertoire. An example is the boar. The boar was of great importance among Iranian people and their beliefs as a representation of Verethragna, the god of war. Another example is water birds, which were largely replaced by birds of prey under Islamic dominion. In place of ducks and geese, commonly seen in 7th–9th century Sogdian silks, we find eagles and falcons in Islamic art. Although falcons also appear in Sogdian and Sassanian silks, they are far less common there. The roundel with a split palmette and confronted animals also went out of fashion during Turkic/Islamic rule. Other types of animal representations increasingly became favoured, although at first still in the form of round medallions. From the 10th century on octagons increasingly replaced round medallions, and the system of quartering replaced the two-part composition with confronted animals. Quartering eventually became standard for nearly all types of Turkmen carpet designs; the *tauk nuska* is a very clear example.

It is intriguing and illustrative that the Turkmen who moved further west seem to have abandoned the Central Asian traditions for carpet designs and colours. Although we find Turkmen people in Anatolia maintaining old tribal names – Salor, Karaman, Hotamish – their Central Asian designs, weaving techniques, and colour palette have disappeared, or are heavily adapted to local Anatolian traditions.[42] The structure of Turkmen carpets from Anatolia has little to do with the structure of Central Asian carpets, nor does the colour palette. The Anatolian Turkmen also no longer made typical Central Asian carpet products such as the *ensi* and the *kapunuk*. All of these factors support the notion that the "Turkmen carpet" of Central Asia did not originate from, and is not part of the cultural heritage of, Turkic speaking horse-mounted nomads of Oghuz origin.

Despite this work's subtitle, "A New Perspective", certainly not every "perspective" in this study is entirely new. It is new, however, to approach Turkmen carpets and the origin of their designs in a more comprehensive and broader cultural historical context. Furthermore, this is the first time scientific techniques, history, and art history have been used in combination to shed new light on this subject.

42 E.g. the border design in fig. 227 in the chapter "The Salor".

Turkmen weavings
Colour Plates and Technical Data
Cat. nos. 1 – 128

Ordered by Tribes and Type of Objects

Spelling of place names and tribal names follow those in Bregel 2003 (e.g. Chowdur, Sarïq etc.)

Spelling of types of weaving follow those in Andrews et al. 1993 (e.g. *khali*, *chuval* etc.)

Whenever possible, structural data are presented according to Mallett 1990, together with a reference to illustrations in her book (e.g. Mallett 1990: Fig. 22.1).

Turkish words and names are in lower case, in italics (e.g. *chuval*, *khali* etc.), and are not pluralized.

1

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Ensi; A Type design
115 × 170 cm / 45¼ × 65¼ in., fragmented
18th century

Private collection
Published: (1) Hali 6/2, 1984: 135; (2) TKF Wien 1986: No. 104; (3) Hali 60, 1991: 87; (4) Rippon Boswell 57, 2001: Lot 90; (5) Hali 132, 2004: 105

Comparable pieces

Only two other A Type Salor *ensi* are published: (1) Pinner/Franses 1980: 109; Eiland 2003: 168; (2) OCTS Vol.3, No. 2, 1989: 249; Hali 60, 1991: 88; a third comparison piece, slightly different in design, was sold on May 22, 2011 as Lot 805 at Grogan auctioneers, Boston

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z_2S, dark brown, some red
Pile:	Wool, 2Z; height 3–4 mm in some aereas 8 colours – Red; blue; light blue; yellow; ivory; brown; orange; green
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 44/42/42 × 61/57/61 vert. = 2684 – 2394 knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Collector; USA, September 2011

Dyes

No chemical analysis performed

Dating

Lab. No.:	ETH-28653.1/.2/.3
Radiocarbon age:	40 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1701–1730 (15.9%) AD 1819–1841 (10.9%) AD 1852–1852 (0.2%) AD 1882–1922 (58.8%) AD 1952–1965 (14.2%)

2

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Ensi; B Type design
127 × 186 cm / 50 × 73¼ in.
Before 1830

Collection of Marie and George Hecksher, San Francisco
Published: (1) Christie's NY, 29 November 1989, Lot 70; (2) Herrmann 2, 1990: No. 59

Comparable pieces

(1) Thompson 1983: 31; (2) Rippon Boswell 32, 1990: Lot 108; Hali 60, 1991: 94; (3) Hali 60, 1991: 97; (4) Sotheby's NY, 13 April 1995: Lot 117; Hali 80, 1995: 142; (5) Hali 95, 1997: 69; (6) Nagel, 9 November 1999, Lot 236; Besim 3, 2000: No. 1

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12

Structure

Warp:	Wool, Z_2S, ivory, light brown, and mottled brown
Weft:	Wool, 2Z and 3Z, brown
Pile:	Wool, 2Z, some 3–4Z; silk, 2Z; height 2–6 mm, silk 1–2 mm 14 colours – Wool: Red; light red (corroded); light crimson; crimson; purple, 3–4Z (Ra 707-1); light orange; orange; blue; dark blue; yellow; green; dark brown (corroded); ivory; Silk: Magenta (corroded)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 56 × 68 vert. = 3808 knots per dm^2; 1:1.2
Selvages / Ends:	Original not extant
Examined by:	Ulrike Herrmann, from Herrmann 2, 1990: No. 59 (Jürg Rageth, San Francisco, April 2006)

Dyes

Ra 707-1 purple, w, 3–4Z:	Lac dye (+ tin)
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

3

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Kapunuk; curled leaf meander design
130 × 130 cm / 51¼ × 51¼ in.
2nd half of the 17th or 18th century

Private collection
Published: Sotheby's NY, 15 December 2000, Lot 70.

Comparable pieces

(1) Schürmann 1969: No. 27; Andrews et al. 1993: No. 99; (2) Mackie / Thompson 1980: No. 15; (3) Herrmann 2, 1990: No. 58; (4) Andrews et al. 1993: No. 91 (with an Arabachi attribution. For a discussion see the introduction to the Salor *kapunuk* in Vol. 2); (5) Moshkova 1970 (1996): Fig. 75; (6) Rippon Boswell 64, 2004: Lot 169; (7) Hali 167, 2011: 45; (8) Austria Auction Company, 15 March 2014: Lot 89; (9) Felkersam 1914: 101; Tzareva 1984: Plate 4 (a Salor attribution for this piece is questionable, for a discussion see the introduction to the Salor *kapunuk* in Vol. 2)

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15
For metal thread analysis, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown and light red (Ra 266-3) – Both shots light brown, 2Z – Both shots light red, 2Z – Alternately first shot light red, 2Z, second shot light brown, 2Z, and vice versa; in some small areas only
Pile:	Wool, 2Z, some 6Z; silk, 2Z; height 3–4 mm 8 colours (+ 3 on silk, Z, for tassels only) Wool: Ivory; red; scarlet, 6Z (Ra 266-1); medium blue; black-blue (dark brown wool tip-dyed with indigo, in some places mixed with some knots in dark blue-green); reddish brown; dark brown Silk: Magenta (Ra 266-2); tassels only: medium blue, Z; dark blue green, Z; dark brown, Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps heavely depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 49–54 × 67–81 vert. = 3283–4374 knots/dm²; 1:1.4
Selvages:	2 warp units (2,2), overcast with blue wool, Z (Mallett 1998: 15.21)
Ends:	Horizontal top panel: Original not extant; left and right side panels: 2 cm weft faced tabby, wefts in red wool, 2Z; 22 cm tassels made of 3 cords 3(Z_2S), wrapped in polychrome silk, Z, and metal thread
Examined by:	Jürg Rageth; Riehen, July 2003

Dyes

Ra 266-1 scarlet, w, 6Z:	Lac dye, traces of madder (+tin)
Ra 266-2 magenta, s, 2Z:	Mexican or Armenian cochineal, madder (tin excl.)
Ra 266-3 light red, weft, w, Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-27701.1/.2
Radiocarbon age:	210 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1537–1542 (0.4%) AD 1641–1701 (30.6%) AD 1729–1820 (49.8%) AD 1841–1852 (0.9%) AD 1852–1881 (2.3%) AD 1922–1961 (16.0%)

4

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Ak yüp; cut into three pieces
Width: 33–35 cm/13–13¾ in. Length: (1) 167 cm/65¾ in.; (2) 973 cm/383 in.; (3) 158 cm/62¼ in., total 1280 cm/504 in. (+ braids with tassels, 60 cm/23½ in. long, at both ends)
17th or 18th century

Private collection; acquired by Wilhelm Hummel in Turkmenistan before 1898 (cf. Benardout 2002: 3)
Published: (1) Benardout 2002: 28–29; (2) Hali 126, 2002: 117, detail

Comparable pieces

(1) Rippon Boswell 85, 2014: Lot 15 (Fragment of a Salor *aq yüp*)

– Other tent bands with comparable Salor tent band design: (2) Schürmann 1969: No. 5; (3) Bausback 1976: 262; Bausback 1978: 472–476; (4, 5) Hali 2/4, 1980: 313, fig. 35 and 314, fig. 36; (6) Tzareva 1984: No. 86; Cat. Antwerp 1997: No. 40; (7) Pinner/Eiland 1999: Plate 27; (8) Diens/Reinisch 2001: No. 222; TKF Graz 1999: No. 77; (9) Isaacson 2007: No. 16; (10) cat. No. 39

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory and red-brown left side 20, right side 16 warps in red-brown
Weft:	Wool, Z, ivory, and cotton, Z, white; 2Z
Pile:	Wool, 2Z, some Z, 3Z; cotton, 2Z; silk, 2Z, some Z; height 2 mm; silk up to 2 mm 17 colours (14 on wool, 2 on silk, 1 on cotton) – Wool: Ivory; red; red-brown, some Z; orange-red; scarlet, 3Z (Ra 267-3); crimson, 3Z (Ra 267-4); magenta, 3Z; plying of orange-red, Z, and crimson, Z, 2Z*; dark blue; medium blue; blue-green; dark green; yellow; light yellow; Silk: Magenta, 2Z, some Z (corroded); yellow; cotton: white
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 224 warps by 80 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8) Horiz. 56 × 80 vert. = 4480 knots/dm²; 1:1.4
Selvages:	2 warp units (2,2) overcast with brown-red wool, Z (Mallett 1998, 15.21 and 23)
Ends:	Braids in ivory wool (length ca. 60 cm), decorated with red and blue woollen tassels (cf. Benardout 2002, p. 28–29)
Note:	* Observed at the beginning of the band only, e.g. in the first "compound-palmette-tree" design
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Ra 267-2 magenta, s, Z:	Mexican or Armenian cochineal
Ra 267-3 scarlet, w, 3Z:	Lac dye (+tin)
Ra 267-4 crimson, w, 3Z:	Lac dye and Mexican or Armenian cochineal (+tin)
Examined by:	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-27702.1/.2
Radiocarbon age:	165 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)

5

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Hanging (or *torba*?); *kejebe/darvaza* design, *kochanak* border, without “shoulders”
127 × 57 cm / 50 × 22½ in., fragment, originally 2 (or 3?) *darvaza gül*
18th or early 19th century

Private collection; formerly Whiting Collection, Cardiff
Published: Hali 158, 2008: 123.

Comparable pieces

with *kochanak* border, without “shoulders”: (1) Bogolyubov 1973: No. 7; (2) Herrmann 1, 1989: No. 53, top; Hali 43, 1989: 94; (3) Rippon Boswell 47, 1997: Lot 141

– Salor pieces with *kochanak* border, with “shoulders”: (4) Neugebauer/Orendi 1909: Tafel XIV, opp. p. 208; Gantzhorn 1990: Abb. 638, p. 447; (5, 6) Schürmann 1969: No. 6 and 7; (7) Mackie/Thompson 1980: No. 14; (8) Eskenazi 1983: No. 253; (9–11) Hali 6/2, 1984: 132, figs. 15–17, ; (12) Herrmann 1, 1989: No. 53, bottom; (13, 14) Jourdan 1989: No. 2 and 3; (15) Opie 1992: No. 17.1, detail, and 17.7; (16, 17) Sotheby’s NY, 16 December 1993: Lot 53 and 58; (18) Andrews et al. 1993: No. 103; (19) Elmby III 1996: No. 10; (20) Pinner/Eiland 1999: No. 4; (21) Concaro/Levi 1999: No. 107; (22) Hali 124, 2002: 127; Tsareva 2011: No. 9; (23) Wearden 2003: No. 97; (24) Rippon Boswell 64, 2004: Lot 106; (25) Rippon Boswell 79, 2011: Lot 150; (26) Rippon Boswell 83, 2013: Lot 100

– Salor pieces with “shoulders”, without *kochanak* border: (27) Loges 1978: No. 20; (28) Mackie/Thompson 1980: No. 9; (29) Tzareva 1984: No. 10; (30) Jourdan 1989: No. 4; (31) Loges 1978: No. 20; (32) Rippon Boswell 34, 1991: Lot 107

– Salor pieces with *kejebe* design, without *darvaza gül*: (33) Reed 1966: No. 9; (34) Schürmann 1979: 207; Hali 5/4, 1983: 512, fig. 5; (35) Herrmann III 1981: No. 103; (36) Dovodov/Chodzamuchammedov 1987: No. 48; (37) Hali 6/2, 1984: 132; (38) Hali 25, 1985: 86; (39) TKF Wien 1986: No. 105; (40) Sotheby’s NY, 16 December 1993: Lot 56, Dodds/Eiland 1996: No. 218; (41) Elmby V 2003: No. 9

– Sarïq hangings with *kejebe/darvaza* design: (42) Cassin/Hoffmeister 1988: Plate 6; Rippon Boswell 81, 2012: Lot 148; (43) Elmby 1, 1990: No. 10; (44) Rippon Boswell 68, 2006: Lot 91

– Ersarï hangings with *kejebe/darvaza* design: Cf. cat. no. 20

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown and light red (Ra 614-3) Alternately first shot brown, 2Z, second shot light red, 2Z, and vice versa
Pile:	Wool, 2Z, some 4–7Z. Silk 2Z, height up to 2 mm 10 colours – Wool: Red; scarlet, 4–7Z (Ra 614-1); orange-red; black-blue (natural dark brown wool tip-dyed with indigo); dark blue-green (2 shades?); light yellow; reddish brown; dark grey-brown; ivory. Silk: Magenta (Ra 614-2), [corroded]
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps heavely depressed
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 49–52 × 66–70 vert. = 3234–3640 knots/dm²; 1:1.3
Selvages:	2 warp units (2,2) overcast with red wool singles (Mallett 1998, 15.21)
Ends:	Remains of weft faced tabby in ivory wool, 2Z, folded to the back and sewn down
Examined by:	Jürg Rageth; Riehen, June 2004

Dyes

Ra 614-1 scarlet, w, 4–7Z:	Lac dye and traces of madder
Ra 614-2 magenta, s, 2–3Z:	Mexican or Armenian cochineal, traces of lac dye and madder
Ra 614-3 light red, weft, w, 2Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

– Arabachi and Chowdur hangings with *kejebe/darvaza* design: (45) Christie’s NY, 16 December 1993, Lot 31; (46) Elmby II, 1994: No. 33; (47) Dodds/Eiland 1996: No. 193; (48) Moshkova/O’Bannon 1996: fig. 132; (49) Besim 1, 1998: No. 79; and others

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1

6

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Hanging; *shemle gül* design
138 × 43 cm / 54½ × 17 in.
First half 19th century

Private collection
First publication

Comparable pieces

(1) McCoy Jones / Boucher 1973: No. 13; (2) Mackie / Thompson 1980: No. 11; (3) Eskenazi 1983: No. 252; Hali 6/2, 1984: 131; Jourdan 1989: No. 12; (4,5) Tzareva 1984: No. 13 and 14; (6) Jourdan 1989: No. 13; (8) Concaro / Levi 1999: No. 204 (error: description No. 175); (9) Langauer 2011: 51

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 3
For mordant (tin) analysis, see appendix III, table 13

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown and red (Ra 615-3); Alternately first shot, red, 2Z, second shot brown, 2Z, and vice versa
Pile:	Wool, 2Z, some 4–7Z; Silk, 2–3Z; Cotton, 2 Z; height 3 mm 9 colours (+ light blue cotton) – Wool: Scarlet, 4–7Z (Ra 615-1); red; dark blue; dark blue-green (in one place only); yellow (2 shades); red-brown; dark brown; ivory; Silk: Magenta (Ra 615-2); Cotton: Light blue (6 knots only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps heavely depressed
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation horiz. 52–53 × 70–71 vert. = 3640–3767 knots/dm²; 1:1.3
Selvages:	Original not extant
Ends:	Top: Remains of 2.5 cm tabby, wefts in red and ivory wool, 2Z, folded to the back and sewn down Bottom: Original not extant
Examined by:	Jürg Rageth; Riehen, December 2003

Dyes

Ra 615-1 scarlet, w, 4–7Z:	Lac dye (+tin), traces of madder
Ra 615-2 magenta, s, 2–3Z:	Mexican cochineal, traces of lac dye, madder, and tannin
Ra 615-3 red, weft, w, Z:	Madder
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

7

Salor

Middle reaches of the Amu-Darya, Merv Oasis, or Serakhs

Hanging; curled leaf meander design
130 × 45 cm / 51¼ × 17.7 in.
post 1880

Private collection
First publication

Comparable pieces

(1) Bogolyubov 1973: No. 38; Tzareva 1984: No. 12; Dodds/Eiland 1996: 133, No. 145

– Pre-1880, without synthetic dyestuffs: (2) Hali 2/2, 1979: 64; (3) Hali 2/4, 1980: 301, no. 3 ; (4) Thompson 1983: 62; (5) Eiland 1990: No. 107; (6) Hali 95, 1997: 61; (7) Wearden 2003: No. 99; (8) Rippon Boswell 68, 2006: Lot 54

For a discussion see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; height 3 mm 8 colours – Ivory; bright red (Ra 280-2); crimson (Ra 280-1); brownish purple; black-blue; reddish brown; dark brown; yellow
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 42–44 × 72–74 vert. = 3024–3256 knots/dm²; 1:1.7
Selvages:	Original not extant
Ends:	Top: Remains of 3 cm tabby, wefts in crimson and ivory wool, 2Z, folded to the back and sewn down Bottom: 3 cm tabby, wefts in ivory wool, 2Z, folded to the front side and sewn down; partly covered with dark blue wool fringe, up to 4 cm long
Examined by:	Jürg Rageth; Riehen, September 2003

Dyes

Ra 280-1 crimson, w, 2Z:	Mexican cochineal (tin excluded), traces of tannin
Ra 280-2 bright red, w, 2Z:	Ponceau RR and Ponceau G
Examined by:	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-27703.1/.2
Radiocarbon age:	80 ± 35 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1691–1737 (26.9%) AD 1813–1932 (71.8%) AD 1955–1959 (1.3%)

8

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Torba; 4 × 3 Memling *gül* design
104 × 43 cm / 41 × 17 in
18th or early 19th century

Collection of Nancy Jeffries and Kurt Munkacsi, New York
First publication

Comparable pieces

(1) Hali 2/4, 1980: 64; Rippon Boswell 62, 2003: Lot 63; (2) Hoffmeister 1980: No. 57; (3) Thompson 1983: 5; (4) TKF Wien 1986: No. 107 (owing to its polychrome fringe, a Salor attribution of the additionally illustraded piece is questionable. The piece was also published with a Salor attribution in Tsareva 2011: No. 5); (5) Hali 45, 1989: 47; (6) Eiland 1990: No. 109, fragment; (7) Baumann 2008: No. 3, fragment; (8) Tsareva 2011: No. 4.

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 1
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light red
Pile:	Wool; silk 10 colours – Wool: Red; ruby red (Ra 221-1); dark blue; dark blue-green; orange-red; red-brown; light yellow; brown; ivory; Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open right Horiz. 47 × 67 vert. = 3149 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Robert Pittenger, New York

Dyes

Ra 221-1 ruby red, w:	Lac dye
Examined by :	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-22414/-23438
Radiocarbon age:	130 ± 30 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1681–1782 (39.5%) AD 1805–1899 (44.4%) AD 1910–1946 (15.8%) AD 1957–1957 (0.2%)

9

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Torba; *ak su* design
86 × 46 cm / 18 × 34 in., fragment
17th or 18th century

Private collection; formerly Munkacsi Collection, New York
Published: Austrian Auction Company, 9 May 2015: Lot 220

Comparable pieces

(1) Hali 2/4, 1980: 60; (2) Hali 3/2, 1980: 169; (3) Benardout 1983: No. 63 (with Sarïq attribution); (4) Tzareva 1984: No. 11; (5) Hali 28, 1985: 90; (6) TKF Wien 1986: No. 108; (7) Jourdan 1989: No. 14; (8) Rippon Boswell 32, 1990: Lot 43

– Other Turkmen pieces with *ak su* design: (1) Reed 1966: No. 10 (Sarïq); (2, 3) Azadi 1975: No. 43 (Ersarï), No. 44 (Teke); (4, 5) Loges 1978: No. 28 (Sarïq), no. 67 (Chowdur); (6, 7) Jourdan 1989: No. 31 (Sarïq), no. 78 (Teke); (8) Langauer 2011: 53 (Sarïq)

– "Eagle" *gül* pieces with *ak su* design: Cf. cat. no. 112

For a discussion, see Vol. 2

Structure

Warp:	Wool (or goat hair?), Z_2S, ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z, some 4Z. Silk 2Z 9 colours – Wool: Red; rose-red, 4Z (Ra 474-1); red-brown; dark blue; blue; dark blue-green; dark brown; ivory; Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps deeply depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 51 × 71 vert. = 3621 knots/dm²; 1:1.4
Selvages:	Original not extant
Ends:	Top: Remains of up to 6mm tabby, wefts in red wool, 2Z Bottom: Remains of up to 12 mm tabby, wefts in ivory wool, 2Z preceded by stumps of jufti/four warp dark blue 2Z wool fringe
Examined by:	Peter Saunders, New York

Dyes

Ra 474-1 rose-red, w, 4Z:	Lac dye
Examined by :	Marmara University Istanbul

Dating

No radiocarbon dating performed

10

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Torba; star compartment design
50 (shortened) × 36 cm / 19¾ × 14¼ in., fragment
17th or 18th century

Private collection
Published: (1) Hali 104, 1999: 85; (2) OCTS VII, 2011: 184, fig. 3

Comparable pieces

(1) Mackie/Thompson 1980: No. 13; (2) Pinner/Franses 1980: Fig. 413; Thompson 1983: 90; (3) Jourdan 1989: No. 11

– Other Turkmen pieces with small scale compartment design: (1) Herrmann 1 1989: No. 47 (Teke); (2) Herrmann 1, 1989: No. 51 (Ersari); (3) Gombos 1975, No. 12

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and light brown fibres
Weft:	Wool, 2Z, dark brown, some red (Ra 279-3) – Both shots dark brown. 2Z; mainly – First shot dark brown, Z, loosely plied with light red, Z, 2Z; second shot dark brown, 2Z; some wefts in the *alem* only
Pile:	Wool, 2Z, some Z, 2–4Z; Silk, 2–3Z; height up to 1 mm, mainly worn 9 colours – Wool: Purple, 2–4Z (Ra 279-2); red; reddish brown; dark brownish purple; dark blue; blue-green; dark brown,Z; ivory Silk: Magenta (Ra 279-1)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 48 × 67 vert. = 3216 knots/dm²; 1:1.4
Selvages:	Original not extant
Ends:	Bottom: Remains of 4cm tabby, wefts in ivory wool, 2Z, folded to the back; remains of attached fringe in blue wool, 6Z Top: Original not extant
Examined by:	Jürg Rageth; Riehen, February 2003

Dyes

Ra 279-1 magenta, s, 2–3Z:	Mexican or Armenian cochineal, traces of madder
Ra 279-2 purple, w, 2–4Z:	Lac dye
Ra 279-3 red, weft, w, Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-18968/-27710
Radiocarbon age:	185 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1655–1700 (22.1%) AD 1730–1819 (56.8%) AD 1847–1847 (0.1%) AD 1859–1872 (1.5%) AD 1923–1960 (19.6%)

11

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; Salor *gül* design
44 × 76 cm / 17¼ × 30 in., fragment
17th or 18th century

Private collection
Published: (1) Lefevre, 14 July 1978: Lot 1; (2) Hodenhagen 1997: No. 7

Comparable pieces

(1) Loges 1978: No. 23; (2) Spuhler/König/Volkmann 1978: No. 74; Gantzhorn 1990: Abb. 642; (3) Mackie/Thompson 1980: No. 8; (4) Hali 2/4, 1980: 301, Wearden 2003: No. 97; (5) Hali 2/4, 1980: 304; (6) Herrmann III 1981: No. 104; (7) Tent & Town 1982: No. 4; (8) Eskenazi 1983: No. 251; (9) Hali 5/4, 1983: 55; Jourdan 1989: No. 6; Hali 62, 1992: 64; Christie's London, 30 April 1992: Lot 383; (10) Hali 41, 1988: 103; (11) Herrmann X, 1988: No. 93; (12) Hali 43, 1989: 34 and p. 94; Hodenhagen 1997: No. 1; (13) Hali 52, 1990: 80; (14) Hali 58, 1991: 18; (15) Hali 64, 1992: 93; (16) Pinner 1993: No. 11; (17) Hali 69, 1993, p. 155; (18) Hali 75, 1994, p. 23, Hali 103, 1999, p. 142; (19) Rippon Boswell 41, 1994: Lot 162; (20) Elmby II, 1994: No. 15; (21) Dodds/Eiland 1996: No. 199; (22) Hodenhagen 1997: No. 5; (23) Elmby IV, 1998: No. 16; (24) Pinner/Eiland 1999: No. 2; (25) Hali 124, 2002: 139; (26) Rippon Boswell 63, 2003: Lot 111; (27, 28) cat. no. 13 and 132

– With design variations: (29) Hali 3/1, 1980: 66; (30) Thompson 1983: 99; (31) Rippon Boswell 31, 1989: Lot 43; (32) TKF Graz 2002: No. 69; (33) Gantzhorn 1990: Abb. 634; (34) Grote-Hasenbalg 1922: plate 83, bottom; (35) TKF Wien 1986: No. 106; (36) Reed 1966: No. 2; (37) Dodds/Eiland 1996: No. 148; (38) Rippon Boswell 64, 2004: Lot 170; (39) Rippon Boswell 67, 2006: Lot 28

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z, some Z, 4–6Z; Silk, 2Z; height 2 mm, silk corroded 10 colours – Wool: Red (Ra 258-1); scarlet, 4–6Z (Ra 258-2A); light orange-red, Z; dark blue; blue; blackish blue-green; red-brown (Ra 258-4); dark brown; ivory Silk: Magenta (Ra 258-3A)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open right 5 symmetrical knots in the "dart of egg" design of the Salor *gül* Pile upside down in relation to object orientation Horiz. 49–50 × 70–72 vert. = 3430–3600 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, April 2004

Dyes

Ra 258-2A scarlet, w, 4–6Z:	Lac dye (+tin), traces of madder
Ra 258-3A magenta, s, 2Z:	Mexican or Armenian cochineal, tannin, madder
Examined by:	KIK-IRPA Brussels
Ra 258-1 red, w, 2Z:	Madder
Ra 258-4 red-brown, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. No.:	ETH-27699.1/.2
Radiocarbon age:	165 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)

12

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; Salor *gül* design
(a) 66 × 61 cm / 26 × 24 in.
(b) 61 × 59 cm / 24 × 23¼ in.
2 fragments
17th or 18th centuries

Private collections
Published: (a) Christie's NY, 16 December 1993: Lot 60; (b) Cassin/Hoffmeister 1988: Plate 5; Sotheby's NY, 8 December 1990: Lot 17
First simultaneous publication of both fragments

Comparable pieces
Cf. cat. no. 11

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure (b)

Warp:	Wool, Z_2S; ivory
Weft:	Wool, 2Z, brown, some red (Ra 259-4) – Alternately first shot brown, 2Z, second shot red, 2Z, and vice versa (18 cm at beginning of weave only) – Both shots brown, 2Z; mainly
Pile:	Wool, 2Z, some 4–6Z; Silk, 2Z; height 3–4 mm, 9 colours – Wool: Red (Ra 259-1); reddish purple, 4–6Z (Ra 259-2) [corroded]; light blue; black blue; dark blue-green; dark brownish purple (Ra 259-5); black; ivory, some 4Z, (or 2 × 2Z?); Silk: Magenta (Ra 259-3) [corroded]
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps deeply depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 56–56 × 75–80 vert. = 4200–4480 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, June 2003

Dyes (b)

Ra 259-2 purple, w, 4–6Z:	Lac dye (+tin)
Ra 259-3 magenta, s, 2–4Z:	Mexican or Armenian cochineal
Ra 259-4 red, weft, w, Z:	Madder
Examined by :	KIK-IRPA Brussels
Ra 259-1 red, w, 2Z:	Madder
Ra 259-5 dark purple, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating (b)

Lab. No.:	ETH-27700.1/.2
Radiocarbon age:	90 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1691–1737 (27.1%) AD 1812–1933 (71.8%) AD 1955–1959 (1.2%)

13

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; *chuval gül* design
94 × 67 cm / 37 × 26½ in., 2 fragments
(a) 38 × 67 cm / 15 × 26½ in.
(b) 56 × 67 cm / 22 × 26½ in.
17th or 18th century

Private collection
Published: (a) Hodenhagen 1997: No. 6; (b) Hali 104, 1999: 82
First simultaneous publication of both fragments

Comparable pieces

(1) Lefevre, 30 November 1979: Lot 1; Hali 2/4, 1980: 342, fig. 1 (the Lefevre fragment and the fragment illustrated here are probably a pair); (2) Cat. no. 15

– With *chuval gül* design variations: (3) Pinner/Eiland 1999: No. 3; (4) Beresneva 1976: No. 15; (5) Mackie/Thompson 1980: No. 6; (6, 7) Andrews et al. 1993: No. 100 und 101 (pair); (8, 9) TKF Graz 1999: No. 68 (pair); (10) Rippon Boswell 70, 2007: Lot 167; (11, 12) Cat. No. 133 and 134; cf. also *chuval* cat. no. 63

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure (a)

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, grey-brown, some light red (Si 15-4) – Both shots grey-brown, 2Z; mainly – First shot grey-brown, 2Z; second shot grey-brown, Z, loosely plied with light red, Z , 2Z (observed in three wefts only)
Pile:	Wool, 2Z, some 4–6Z; silk, 2–4Z; height up to 2 mm 9 colours – Wool: Red (Si 15-1); crimson, 4–6Z (Si 15-2); light orange-red; dark blue; medium blue; red-brown (Si 15-5); black brown; ivory; Silk: Magenta (Si 15-3)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 47–51 × 67–71 vert. = 3149–3621 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, January 2004

Dyes (a)

Si 15-2 crimson, w, 4–6Z:	Lac dye (tin excluded), traces of madder
Si 15-3 magenta, s, 2–4Z:	Mexican or Armenian cochineal, madder
Si 15-4 light red, weft, w, Z:	Madder
Examined by :	KIK-IRPA Brussels
Si 15-1 red, w, 2Z:	Madder
Si 15-5 red-brown, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating (a/b)

Lab. No.:	ETH-17871/-18967.1/.2/-27709
Radiocarbon age:	210 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1649–1691 (32.4%) AD 1738–1812 (52.3%) AD 1934–1960 (15.3%)

14

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; *chuval gül* design
132 × 85 cm / 52 × 33½ in.
18th or early 19th century

The Russian Ethnographic Museum, St. Petersburg
S.M. Dudin Collection, No. 26-79; purchased in Samarkand
Published: (1) Tzareva 1984: No. 6; (2) Hali 27, 1985: 18; (3) Tsareva 1993: No. 41

Comparable pieces
Cf. cat. no. 13

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z; silk, 2Z; height 5 mm 12 colours – Wool: 2 shades of light red; dark red; pinkish-red; violet-red; dark blue; blue; dark yellow; dark green; dark brown; ivory Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left 3675 knots per dm^2
Selvages/Ends:	Original not extant
Examined by:	from Tsareva 1984: No. 6

Dyes

No chemical analysis performed

Dating

Lab. No.:	ETH-19347.1/.2
Radiocarbon age:	155 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)

15

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; *chuval gül* design
150 × 81 cm / 59 × 32 in.
17th or 18th century

Collection of Nancy Jeffries and Kurt Munkacsi, New York
Published: (1) Cassin/Hoffmeister 1988: Plate 2; (2) Sotheby's NY, 8 December 1990: Lot 19; (3) Ghereh 17: 31; (4) Austrian Auction Company, 9 May 2015: Lot 192

Comparable pieces: (1) Mackie/Thompson 1980: No. 7; (2) Tsareva 1984: No. 8; ORR 11/1: 81, No. 1; (3) Benardout 1983: No. 60; (4) Hali 6/2, 1984: 128; (5) Cassin/Hoffmeister 1988: Plate 3; (6) Hali 38, 1988: 91, Skinner Bolton, 6 Dec. 1987: Lot 147; Hodenhagen 1997: No. 2; (7) Hali 45, 1989: 47; (8) Rippon Boswell 32, 1990: Lot 155; (9) Dodds/Eiland 1996: No. 201; (10, 11) Sotheby's NY, 16 December 1993: Lot 55 and 57; (12) Sotheby's London, 19 October 1994: Lot 5; (13) Rippon Boswell 43, 1995: Lot 79; (14) Hali 100, 1998: 106; (15) Hali 106, 1999: 100; (16) Rippon Boswell 64, 2004: Lot 202

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory, light brown
Weft:	Wool, 2Z, dark brown, some light red (four shots only)
Pile:	Wool, 2Z; Silk, 2Z 10 colours – Wool: medium red; purple (Ra 228-1); black blue; medium blue; yellow (Ra 228-2); dark green; dark brown; medium red-brown; ivory Silk: magenta (corroded)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Horiz. 55 × 78 vert. = 4290 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Robert Pittenger; New York

Dyes

Ra 228-1 purple, w, 2?Z:	Lac dye, madder
Ra 228-2 yellow, w, 2Z:	Persian larkspur
Examined by:	KIK-IRPA Brussels

Dating

Lab. No.:	ETH-23838/-25574
Radiocarbon age:	165 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1665–1712 (18.3%) AD 1724–1829 (49.2%) AD 1835–1890 (13.6%) AD 1917–1960 (18.9%)

16

Salor

Mangïshlaq, Balkhan Mountains, middle reaches of the Amu-Darya, or Merv

Khali; 5 × 12 Salor *gülli gül* design (with tertiary design)
240 × 328 cm / 94½ × 129 in.
Second half 16th or first half 17th century

Collection of Marie and George Hecksher, San Francisco
Unpublished

Comparable pieces

– 7 rows of *gülli gül*: (1) Hali 3/2, 1980: 42; Bausback 1980: 151; Rippon Boswell 44, 1996: Lot 138 [7 × 13]

– 6 rows of *gülli gül*: (2) Reed 1966: No. 15; Mackie/Thompson 1980: No. 4 [6 × 13]; (3) Loges 1978: No. 17 [6 × 10, shortened]; (4) Lefevre, 28 Nov. 1980: Lot 26 [6 × 12]; (5) Herrmann III, 1981: No. 102 [6 × 12]; (6) Sotheby's NY, April 1983: Lot 132; Bausback 1983, p. 143; Jourdan 1989: No. 1 [6 × 12]; (7) Tzareva 1984: No. 2 [6 × 13]; (8) TKF Wien 1986: No. 103 [6 × 13]; (9) Sotheby's NY, 16 December 1993: Lot 61 [6 × 13]; (10) Hali 101, 1998: 42 [6 × 9, shortened]; (11) Concaro/Levi 1999: No. 105 [6 × 13]; (12) Pinner/Eiland 1999: No. 1 [6 × 13]; (13) Hali 146, 2006: 93 [6 × 11]; (14) Rippon Boswell 82, 2013: Lot 47 [6 × 9, shortened]

– 5 rows of *gülli gül*: (15) McMullan 1965: No. 124 [5 × 12]; (16) Schürmann 1979: 223 (Sarïq or Salor?) [5 × 9]; (17) Christie's London, 18 April 1985 [5 × 11]; (18) TKF Wien 1986: No. 101 [5 × 9]; (19) TKF Wien 1986: No. 102 [5 × 11]; (20) Rippon Boswell 34, 1991: Lot 122 [5 × 12]; (21) Andrews et al. 1993: No. 96 [5 × 11]; (22) Sotheby's NY, 16 December 1993: Lot 54 [5 × 10]; (23) Christie's NY, 17 October 1995: Lot 462 [5 × 12]; (24) Phillips London, 23 April 1996: Lot 25 [5 × 12]; (25) Hali 129, 2003: 47 [5 × 10]; (26) Bonhams London, 8 April 2008: Lot 187 [5 × 11]; (27) Baumann 2008: Nr. 17 [5 × 11]; (28) Christie's at Cowdray Park, 13. – 15. September 2011, Sale 8014: Lot 1126 [5 × 12]; (29) Dorotheum Vienna, Auction 24 September 2013: Lot 71 [5 × 11]; (30) Cat. no. 17[5 × 10]

– 4 rows of *gülli gül*: (31) Grote-Hasenbalg 1922: Plate 93 [4/5? × 9/10?]; (32) Herrmann I 1978: No. 69 [4 × 11]

– Fragments: (33) McCoy Jones/Boucher 1973: No. 16; (34) Mackie/Thompson 1980: No. 5; (35) Hali 41, 1988: 73; (36) Sotheby's NY, 16 December 1993: Lot 59; (37) Rippon Boswell 49, 1998: Lot 96; (38) Rippon Boswell 62, 2004: Lot 50; (39) Cat. no. 18

Structure

Warp:	Wool, Z_2S, ivory, Z, plied with mix of ivory and brown fibres, Z
Weft:	Wool, 2Z, mix of ivory and brown fibers
Pile:	Wool, 2Z, some 4Z; height 4 mm 8 colours – Dark purple (Ra 214-2); medium red; medium orange-red; light purple, 4Z (Ra 214-1); bright dark blue; dark blue-green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open on the left Horiz. 39 – 42 × 54 – 57 vert. = 2106 – 2394 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, November 2001

Dating

Lab. No.:	ETH-22407.1/.2
Radiocarbon age:	290 ± 30 y BP
Calibrated age ranges:	AD 1497 – 1607 (67.1%)
(95.4% confidence limit)	AD 1618 – 1667 (32.9%)

Dyes

Ra 214-1 light purple, w, 4Z:	Mexican cochineal (tin excluded), madder, traces of young fustic
Ra 214-2 dark purple, w, 2Z:	madder
Examined by :	KIK-IRPA Brussels

– Other purple ground Salor weavings: (40) Neugebauer/Orendi 1909: Tafel XIV, opp. p. 208; Gantzhorn 1990: 447, Abb. 638; (41) Wearden 2003: 103, 143-1884

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

17

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Khali; 5 × 10 Salor *gülli gül* design
244 × 284 cm / 96 × 112 in.
18th century

Private collection; formerly Munkacsi Collection, New York
Published: (1) Hoffmeister 1980: Plate 56; (2) Hali 6/2, 1984: 126; (3) Sotheby's NY, 18 May 1985: Lot 76; (4) d'Heurle / Munkacsi / Saunders 2003: Plate 1; (4) Austria Auction Company, 9 May 2015: Lot 198

Comparable pieces
Cf. cat. no. 16

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S; ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z, some 3Z; Silk: 2–3Z; height 3 mm 9 colours – Wool: Red (KM 1418-A); orange-red; dark blue; light blue; yellow; light blue-green; purple brown; ivory, some 3Z Silk: Magenta (some 20 knots in the border only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 39 × 51 vert. = 1989 knots/dm²; 1:1.3
Selvages/Ends:	Original not extant
Examined by:	from Munkacsi / d'Heurle / Saunders 2003: 8

Dyes

KM 1418-A red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. No.:	ETH-17368.1/.2
Radiocarbon age:	100 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1686–1742 (28.2%) AD 1808–1940 (70.6%) AD 1954–1960 (1.2%)

18

Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis

Khali; Salor *gülli gül* design
(a) 52 × 46 cm / 20½ × 18 in.
(b) 39.5 × 25 cm / 15½ × 10 in.
2 fragments
18th or early 19th century

Private collection
Unpublished

Comparable piece
Cf. cat. no. 16

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 1
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mottled brown
Pile:	Wool, 2Z, some 4–6Z; Silk, 2–3Z; height 1 mm, silk corroded 11 colours – Wool: Red, some 3–4Z (Ra 260-3); orange-red; purple, 4–6Z (Ra 260-2); violet-red (Ra 260-4); yellow; light blue; dark blue; blue-green; ivory, some 4Z; dark brown Silk: Magenta (Ra 260-1)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps deeply depressed
Knot:	Asymmetrical, open left Horiz. 52 × 64 vert. = 3328 knots/dm²; 1:1.2
Selvages:	3 warp units (2,2,2); alternate warps completely depressed, with remains of original reinforcement in dark brown wool, Z (selvage similar to Mallett 15.13, 15.16, but depressed)
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2003

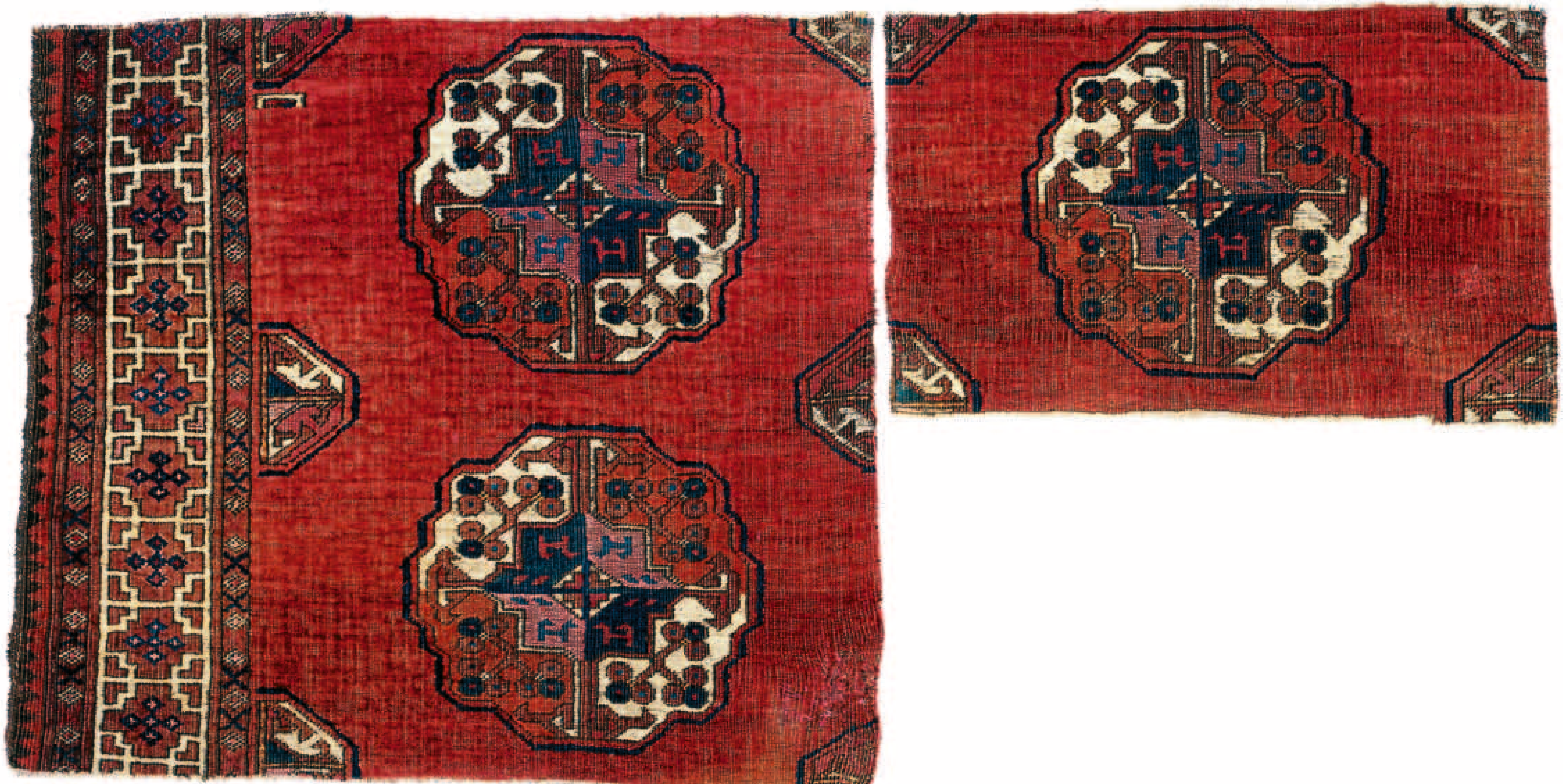
Dyes

Ra 260-1 megenta, s, 2–3Z:	Mexican or Armenian cochineal, tannin, madder
Ra 260-2 purple, w, 4–6Z:	Lac dye, Mexican or Armenian cochineal, traces of madder (+tin)
Examined by:	KIK-IRPA Brussels

Ra 260-3 red, w, 2Z:	Madder
Ra 260-4 violet-red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. No.:	ETH-27154.1/.2
Radiocarbon age:	130 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1681–1782 (39.5%) AD 1805–1899 (44.4%) AD 1910–1946 (15.8%) AD 1957 (0.2%)



19

Ersarï

Middle reaches of the Amu-Darya

Ensi
132 × 152 cm / 59¾ × 52 in., slightly shortened
18th or early 19th century

Private collection
Published: (1) Hoffmeister 1980: No. 15; (2) Eiland 2003: 176

Comparable pieces

(1) Lefevre, 30 November 1979: Lot 34; 15 July 1983: Lot 13; (2) Lefevre, 25 April 1980: Lot 64; (3) Lefevre, 28 November 1980: Lot 30; Thompson 1983: 91; Sotheby's NY, 16 December 1993: Lot 32; (4) Jourdan 1989: No. 250; (5) Elmby III, 1996: No. 42; Rippon Boswell 35, 1992: Lot 39

– Other Ersarï *ensi* with design variations: (7) Neugebauer / Orendi 1909: No. 141; (8) McCoy Jones / Boucher 1973: No. 31; (9) Azadi 1975: No. 17; (10) Lefevre, 6 February 1976: Lot 63; (11) Lefevre, 21 May 1976: Lot 17; (12) Lefevre, 25 March 1977: Lot 28; (13) Bausback 1977: 193; (14) Bausback 1976: 277; Bausback 1978: 504; (15, 16) Loges 1978: No. 85 and 86; (17) Landreau 1978: No. 94; (18) Straka / Mackie 1978: No. 43; (19, 20) Hoffmeister 1980: No. 14 & 16; Eiland 2003: 177; (21) Herrmann III, 198: No. 109; (22) Lefevre, 26 February 1982: Lot 32; Eiland 1990: 128; (23) Herrmann V, 1983: No. 83; (24) Lefevre, 17 February 1984: Lot 53; (25, 26) Cassin / Hoffmeister 1988: Plate 36 and 37; Eiland 2003: 178; (27–32) Jourdan 1989: No. 247–249 and 251–253; (33) Nagel 333, 13 October 1990: Lot 436; (34) O'Bannon 1990: No. 38; (35) Rippon Boswell 35, 1992: Lot 39; (36) Rippon Boswell 36, 1992: Lot 49; (37) Andrews et al. 1993: No. 122; (38) Rippon Boswell 41, 1994: Lot 85; (39) Rippon Boswell 42, 1996: Lot 31; (40) Moshkova 1970 (1996): Fig. 127; (41) Pinner / Eiland 1999: Plate 62; (42) Concaro / Levi 1999: No. 121; (43) Besim 2, 1999: No. 73; (44) Hali 106, 1999: 100; (45) Hali 111, 2000: 8; (46) Besim 3, 2000: No. 68; (47) Eiland 2003: 179; (48) Cat. no. 136 in this Vol.; Cassin / Hoffmeister 1988: Plate 38

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat hair (?), Z_2S, light brown (mix of ivory and brown fibres)
Weft:	Wool, 2Z, light brown (mix of ivory and brown fibres)
Pile:	Wool, 2Z, some Z; cotton, 2Z, some Z; height 5–6 mm 8 colours – Wool: Bright red, dark blue, blue, dark blue-green, ivory, orange, brown Cotton: White; light blue (plying of white, Z, and blue, Z; 2Z)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 weft per row of knots
Knot:	Asymmetrical, open right Horiz. 30 × 36–42 vert. = 1080–1260 knots/dm²; 1:1.3
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17872.1/.2
Radiocarbon age:	190 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1653–1699 (23.7%) AD 1731–1818 (57.0%) AD 1862–1862 (0.1%) AD 1924–1961 (19.3%)

20

Ersarï
Middle reaches of the Amu-Darya

Hanging; "cross and star" design
214 × 59 cm / 84½ × 24 in.
(18th or) early 19th century

Collection of David Reuben, London
Unpublished

Comparable pieces
– Ersarï hangings with "cross and star" design: (1) Azadi 1970: plate 29a; (2) McCoy Jones/Boucher 1975: No. 47; (3) Herrmann I, 1978: No. 74; Mackie/Thompson 1980: 193; (4) Hali 28, 1985: 91: No. 5; (5) Andrews et al. 1993: No. 124; (6) Edelmann New York, 23 May 1984: Lot 86; (7) Tzareva 1984: No. 107; Gantzhorn 1990: Fig. 637; (8) TKF Wien 1986: Opp. no. 123; (9, 10) Jourdan 1989: No. 268 and 269; (11) Dodds/Eiland 1996: No. 216

– Ersarï hangings with Salor *kejebe/darvaza* design: (12) Azadi 1970: Plate 28b; (13) Elmby IV, 1998: No. 56; (14) O'Bannon 1998: No. 89

– Salor, Sarïq and Arabachi hangings with *kejebe/darvaza* design: Cf. cat. no. 5

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, (1) both plies ivory, (2) plying of ivory and brown
Weft:	Wool, 2Z, ivory
Pile:	Wool, 2Z 8 colours – Brownish red, orange, dark blue, medium blue, yellow, blue-green, brown, ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open left Horiz. 30 × 37 vert. = 1110 knots/dm^2; 1:1.2 Pile upside down in relation to object orientation
Selvages:	Original not extant
Ends:	Top: remains of weft faced tabby in red wool at the beginning of the weave. Bottom: Original not extant
Examined by:	David Reuben; London, September 2007

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-27822.1/.2
Radiocarbon age:	95 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1688 – 1741 (27.8%) AD 1809 – 1937 (71.0%) AD 1954 – 1960 (1.3%)

21

Ersarï

Middle reaches of the Amu-Darya

Hanging; central star design
143 × 47 cm / 87½ × 110¼ in.
Pre-1850

Private collection
Published: (1) Herrmann V 1983: No. 84b; (2) Hodenhagen 1997: No. 39

Comparable pieces

(1) Thacher 1940 (1978): Plate 44; McMullan 1965: No. 130; (2) Reed 1966: No. 41; (3) Rippon Boswell 12, 1981: Lot 71; (4) Azadi 1970: No. 27a; (5) Azadi 1975: No. 36; (6) McCoy Jones/Boucher 1975: No. 44; (7) Bausback 1977: 184 top; (8–10) Loges 1978: No. 93–95; (11) Lefevre, 14 July 1978: Lot 3; Andrews et al. 1993: No. 126; Hodenhagen 1997: No. 38; (12) Straka/Mackie 1978: No. 37; (13) Denny 1979: No. 65; (14) Levefre, 22 June 1979: Lot 33; (15) Lefevre, 23 April 1982: Lot 37; (16) Lefevre, 1 October 1982: Lot 51; Lefevre, 25 November 1983: Lot 24; Hali 6/2, 1984: 218, no. 24; (17) Hali 32, 1986: 22; (18) Jourdan 1989: No. 271; (19) O'Bannon 1990: No. 41; (20) Rippon Boswell 34, 1991: Lot 46; (21) Besim 1, 1998: No. 75; (22) Reuben I, 1998: No. 46; (23) Sotheby's NY, 15 December 2000: Lot 18; (24) Christie's NY, 23 June 2006: Lot 114

– Other Ersarï hangings with central star design: (25) Bausback 1977: 184 bottom; (26) Edelmann NY, 25 April 1981: Lot 100; (27) Edelmann NY, 23 May 1984: Lot 86; (28–30) Jourdan 1989: No. 268–270; (31) Rippon Boswell 34, 1991: Lot 47; (32) Rippon Boswell 39, 1993: Lot 4; (33) Andrews et al. 1993: No. 127; (34) Moshkova 1970 (1996): Fig. 126; (35) Dodds/Eiland 1996: No. 227b

For a discussion, see Vol. 2

Structure

Warp:	Wool or goat hair, Z_2S; light brown with some brown fibres
Weft:	Wool or goat hair, 2Z, mix of light brown fibres
Pile:	Wool, 2Z; height 1–2 mm 8 colours – Red; brownish-orange; dark blue; light medium blue; greenish yellow; dark blue-green; medium brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – Some stacked knots in red observed in the centre of the eight pointed star (Mallett 1998: 2.29) Horiz. 30 × 42–44 vert. = 1260–1320 knots/dm²; 1:1.4
Selvages:	Two warp units (2,2) reinforced with an extra selvage yarn of red wool (Mallett 1998: 15.13); original not extant on left side
Ends:	Bottom: Original not extant Top: Ca. 5 cm tabby; 2.5 cm wefts in red and blue wool, 2Z, with borders of 2-colour, 2-span, countered twining in brownish-orange and dark blue wool (Mallett 1998: 4.3), followed by 2.5 cm wefts in light brown camel (?) hair; light brown tabby folded and sewn
Examined by:	Jürg Rageth; Riehen, June 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

22

Ersarï

Middle reaches of the Amu-Darya

Chuval; 3 × 4 *chuval gül* design
124–128 × 63–72 cm/48¾–50½ × 24¾–28¼ in.
18th or early 19th century

Private collection
Unpublished

Comparable pieces

(1) Schürmann 1969: No. 63; (2) Rippon Boswell 12, 1981: Lot 72; (3) Bausback 1978: 510; (4) Lefevre, 26 February 1982: Lot 30; (5) Dodds/Eiland 1996: No. 202; (6) Elmby III, 1996: No. 45; (7) Cat. no. 24

– Other Ersarï *chuval* with *chuval gül* design: (8) McCoy Jones/Boucher 1973: No. 35; (9) Bausback 1976: 272; (10, 11) Bausback 1977: 178 and 179; (12, 13) Bausback 1978: 508 and 510; (14) Mackie/Thompson 1980: No. 87; (15) Andrews et al. 1993: No. 125; (16) Elmby III, 1996: No. 44; (17–19) Reuben I, 1998: No. 39, 40, 42; (20) Elmby IV, 1998: No. 53; (21) Pinner/Eiland 1999: Plate 69; (22) Cat. no. 137; Reuben 1998: No. 41

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of light brown and ivory fibres
Pile:	Wool, 2Z, some 3–4Z; silk 2Z; height 4 mm 10 colours – Wool: Brownish red; orange-red; scarlet, 3–4Z (Ra 282-2); dark blue; light blue; light orange; green to blue-green; brown; ivory Silk: Magenta (Ra 281-1)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open left Horiz. 29–31 × 48–51 vert. = 1392–1581 knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 281-1 magenta, s, 2Z:	Mexican or Armenian cochineal, madder
Ra 281-2 scarlet, w, 3–4Z:	Mexican cochineal (tin)
Examined by :	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

23

Ersarï
Middle reaches of the Amu-Darya

Chuval; 3 × 6 *chuval gül* design
136 × 90 cm / 53½ × 35½ in.
Post-1880

Private collection
Unpublished

Comparable pieces
Cf. cat. no. 22

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of light brown and ivory fibres
Pile:	Wool, 2Z, some Z; height 1–2 mm 7 colours – Bluish red (Ra 403-1); orange-red, some Z (Ra 403-2); greenish dark blue; medium blue; yellow; blackish brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 46–47 × 68–73 vert. = 3128–3431 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 403-1 bluish red, w, 2Z:	Mexican cochineal (tin excluded)
Ra 403-2 orange-red, w, 2Z:	Acid red 26 (Ponceau RR), synthetic
Examined by :	KIK-IRPA Brussels

Dating
Dated post 1880 by synthetic dyestuff
No radiocarbon dating performed

24

Ersarï

Middle reaches of the Amu-Darya

Chuval; stripes partly with velvet *ikat* design
140 × 81 cm / 55 × 32 in.
Mid-19th century

Private collection
Unpublished

Comparable pieces

(1) McCoy Jones/Boucher 1975: No. 43; (2) Lefevre, 25 November 1977: Lot 48; (3) Lefevre, 25 March 1977: Lot 21; (4) Bausback 1977: 198; Bausback 1978: 520; (5) Thacher 1940 (1978): Plate 45; (6) Straka/Mackie 1978: No. 38; (7) Loges 1978: No. 100; (8) Lefevre, 14 July 1978: Lot 11; (9) Elmby I 1990: No. 34; (10) Moshkova 1970 (1996): Fig. 130; (11) Reuben II, 2001: No. 15; (12) Rippon Boswell 67, 2006: Lot 148; (13) Tsareva 2011: No. 132

– Striped Ersarï *chuval* without velvet *ikat* design: (14) Reed 1966: No. 42; (15) Azadi 1975: No. 37; (16) Gombos 1975: No. 52; (17) Lefevre, 26 November 1976: Lot 51, flatweave *chuval*; (18, 19) Bausback 1977: 198, bottom and 199; (20) Jourdan 1989: No. 263; (21) Elmby I, 1990: No. 41; (22) Reuben 1998: No. 45; (23) Pinner/Eiland 1999: Plate 61; (24) Concaro/Levi 1999: No. 122; (25) Rippon Boswell 66, 2005: Lot 33

– Ersarï pieces with velvet *ikat* design borders: (26, 27) Schürmann 1969: No. 50 and 53; (28) Lefevre, 4 July 1975: Lot 53; (29) Mackie/Thompson 1980: 201; (30) Hali 3/4, 1981: 301; (31, 32) Lefevre, 26 November 1982: Lot 38 and 42; (33) Rippon Boswell 32, 1990: Lot 92; (34) Pinner/Eiland 1990: Plate 72; (35) Nagel, 23 June 1993: Lot 3210; (36) Moshkova 1970 (1996): Fig. 135; (37) Reuben I, 1998: No. 34

– Comparable Uzbek velvet *ikat* designs: (38, 39) Fitz Gibbon/Hale 1997: Nos. 89 and 90

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, mix of grey and brown fibres
Weft:	Wool, 2Z, mix of light brown and ivory fibres
Pile:	Wool, 2Z; height ? 8 colours – Red; light red (in elem only); crimson (Ra 616-1); yellow; orange; blue-green; two shades of brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 28 × 38 vert. = 1064 knots/dm^2; 1:1.3
Selvages:	Two warp units (2,2) reinforced in pairs with an extra selvage yarn of light brown and red wool, both Z
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, October 2004

Dyes

Ra 616-1 crimson, w, 2Z:	Mexican cochineal, probably ammoniacal cochineal, and traces of madder
Examined by:	KIK-IRPA, Brussels

Dating

Dated post 1825 by ammoniacal cochineal
No radiocarbon dating performed

25

Ersarï

Middle reaches of the Amu-Darya

Chuval; *ak gajmak* (*ikat*) design
160 × 74 cm / 63 × 29 in.
18th or early 19th century

Private collection
Published: (1) Lefevre, 1 December 1978: Lot 23; (2) Hodenhagen 1997: No. 40

Comparable pieces

(1) Lefevre, 28 November 1975: Lot 6; (2) Thacher 1940 (1978): Plate 36; (3) Schürmann 1969: No. 45; McCoy Jones / Boucher 1975: No. 37

– *Chuval* with more than one row of ikat designs: (4) Lefevre, 29 November 1974: Lot 12; (5) Lefevre, 25 March 1977: Lot 24; (6) Lefevre, 8 July 1977: Lot 14; (7, 8) Straka / Mackie 1978: No. 34 and 35; (9) Landreau 1978: No. 83; (10) Lefevre, 9 Febraury 1979: Lot 5; (11) Denny 1979: Plate 24; (12) Lefevre, 23 November 1984: Lot 24; (13) Cassin / Hoffmeister 1988: Plate 31; (14, 15) Jourdan 1989: No. 259 and 261; (16) Elmby I, 1990: No. 33; (17) Rippon Boswell 41, 1994: Lot 205; (18) Nagel, 10 May 1996: Lot 116; (19) Christie's London, 15 October 1996: Lot 502; (20) Phillips London, 20 April 1999: Lot 104; (21) Besim 1, 1998: No. 76; (22) Pinner / Eiland 1999: Plate 63; (23) Rippon Boswell 51, 1999: Lot 48; (24) Skinner Boston, 29 April 2000: Lot 28; (25) Hali 111, 2000: 112; (26) Rippon Boswell 67, 2006: Lot 82; (27) Sotheby's London, 12 October 2005: Lot 6

– Hangings, *torba* and *mafrash*: (28) McCoy Jones / Boucher 1975: No. 49; (29) Loges 1978: No. 105; (30) Lefevre, 22 June 1979: Lot 34; (31) Lefevre, 30 November 1979: Lot 31; (32) Rippon Boswell, 29 March 1980: Lot 33; (33) Lefevre, 26 November 1982: Lot 38; (34) Jourdan 1989: No. 260; (35) O'Bannon 1990: No. 48; (36) Rippon Boswell 34, 1991: Lot 45; (37) Sotheby's NY, 15 April 1998: Lot 28

– *Khali* and small rugs: (38) Grote-Hasenbalg 1922: Plate 104 (51); (39) Lefevre, 29 November 1974: Lot 20; (40) McCoy Jones / Boucher 1975: No. 10; (41) Gombos 1975: No. 19: (42) Lefevre, 8 October 1976: Lot 19; (43) Spuhler / König / Volkmann 1978: No. 90; (44) Lefevre, 1 October 1982: Lot 51; (45) Eskenazi 1983: No. 280; (46) Tzareva 1984: No. 96; (47) Herrmann VI, 1984: No. 90; (48) Lefevre, 17 February 1984: Lot 49; (49) Bausback 1987: 193; Jourdan 1989: No. 293; (50) Herrmann 1 1989: No. 52; (51) O'Bannon 1990: No. 45; (52) Rippon Boswell 38, 1993: Lot 104; (53) Sotheby's NY, 16 December 1993: Lot 33; (54) Sotheby's London, 19 October 1994: Lot 36; (55, 56) Rippon Boswell 40, 1994: Lot 36 and 80; (57) Lederman 1996: No. 18; (58, 59) Reuben 1998: No. 26 and 29; (60) Rippon Boswell 59, 2002: Lot 168

– Comparable Uzbek *ikat* designs: (62) Kalter / Palavoi 1995: Fig. 365, cover; (63) Fitz Gibbon / Hale 1997: No. 55

– Related early *ikat* designs: (64) Matsumoto 1984: 128 and 144; Fitz Gibbon / Hale 1997: 31; (65) Raspopova 2006: Fig. 36 top right

For a discussion, see Vol. 2

Structure

Warp:	Wool (goat hair?), Z_2S, mix of light to dark brown fibres
Weft:	Wool (goat hair?), 2Z, mix of ivory and brown fibres
Pile:	Wool, 2Z, some 3–4Z; height up to 2 mm in the elem only, otherwise completely worn 7 colours – Red; orange; dark blue; yellow; blue-green; brown; ivory, some 3–4Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – A single dark blue marker (?) knot inserted from the back side observed (ca. 3 cm above lower border) – A single row of stacked knots (Mallett 1998: 2.29) observed in the lower left corner Horiz. 25–27 × 39–41 vert. = 975–1107 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Januray 2007

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

26

Ersarï

Middle reaches of the Amu-Darya

Chuval; *darak nuska* (ikat) design
156 × 101 cm / 61½ × 39¾ in.
late 17th or 18th century

Collection of Marion and Hans König, Minusio
Published: Lefevre, 1 December 1978: Lot 22

Comparable pieces

(1) Hali 45, 1989: 13; (2) Fitz Gibbon / Hale 1997: Fig. 142; (3) Vol. 2, fig. 49 in the chapter "The Ersarï"

– Uzbek *gilam* (*djulkhir*) with the same textile (ikat) design: (4) Rippon Boswell 54, 2000: Lot 131; (5) Skinner Boston, 23 September 2000: Lot 226; (6, 7) Ghereh 26, 2001: 16 and 17

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat hair (?), Z_2S, mix of ivory, grey, and brown fibres
Weft:	Wool, 2Z, ivory and light brown
Pile:	Wool, 2–3Z; height up to 1 mm in some areas, otherwise worn 7 colours – Light red, light orange, dark blue to medium blue, yellow, blue-green, brown, ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 26 × 34–38 vert. = 884–988 knots/dm²; 1:1.4
Selvages:	2 warp units (2,2) overcast with red wool, Z (Mallett 1998: 15.21)
Ends:	Original not extant
Examined by:	Elena Tsareva; Riehen, June 2002

Dating

Lab. no.:	ETH-25575
Radiocarbon age:	140 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1673–1786 (44.3%) AD 1802–1899 (37.8%) AD 1910–1958 (17.9%)

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

27

Ersarï

Middle reaches of the Amu-Darya

Khali; *Simurgh* design
127 × 253 cm / 50 × 103½ in.
early 19th century

Collection of David Reuben, London
Published: Reuben 1998: No. 34

Comparable pieces

(1) Lefevre, 28 November 1980: Lot 44; (2) Hali 3/4 1981: 301, fig. 5; (3) Hali 4/2, 1981: 138, fig. 11; (4) Lefevre, 26 November 1982: Lot 42; (5) Herrmann 3, 1991: No. 60; (6) Rippon Boswell 42, 1995: Lot. 103; (7) Elmby IV, 1998: No. 49; (8) Sotheby's NY, 19 May 2011: Lot 28

– Other weavings with *simurgh* design: (9) Moshkova 1970 (1996): Fig. 120

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, grey-brown
Weft:	Wool, 2Z, dyed orange
Pile:	Wool, 2Z 7 colours – Brick red, orange, ivory, yellow, brown, dark blue, blue-green.
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 24 × 38 vert. = 912 knots/dm^2; 1: 1.6
Selvages:	2 pairs of warp threads, each pair covered with blue-green wool
Ends:	Bottom: No original extant Top: Up to 2cm weft faced tabby in red wool
Examined by:	David Reuben, January 2011

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

28

Ersarï

Middle reaches of the Amu-Darya

Khali; *mina khani* design
146 × 302 cm / 57½ × 119 in., fragment,
assembled from 4 parts, original size unknown
18th century

The Textile Museum, Washington, DC: No. 2005.2
Gift of Richard Isaacson
Published: Eiland 2003: 256

Comparable pieces

(1) Loges 1978: No. 87; (2) Jourdan 1989: No. 279; (3) Reuben I 1998: No. 30; (4) Concaro / Levi 1999: No. 206; (5) Rippon Boswell 71, 2008: Lot 85; (6) Rippon Boswell 80, 2012: Lot 80

– Ersarï *chuval* with comparable *mina khani* design: (7) Schürmann 1969: No. 55; (8) McCoy Jones/Boucher 1973: No. 41; (9) Dimand / Mailey 1973: No. 194; (10) Bausback 1977: 186; (11) Mackie/Thompson 1980: No. 89; (12) Eskenazi 1983: No. 286; (13) Herrmann VII, 1985: No. 84b; (14) Jourdan 1989: No. 277; (15, 16) Moshkova 1970 (1996): Figs. 137 and 145; (17) Nagel, 15 November 1996: Lot 180; (18) O'Bannon 1998: No. 95; (19) TKF Graz 1999: No. 69 / 2; (20) Besim 3, 2000: No. 67a; (21) Rippon Boswell 54, 2000: Lot 41; (22) Rippon Boswell 71, 2008: Lot 86

– Ersarï *khali* with a *mina khani* design without diagonal grid: (23) McCoy Jones/ Boucher 1975: No. 22; Tent & Town 1982: 12; (24) Bausback 1987/88: 194; (25) Weber, 22 May 1989: Lot 17; (26) Lefevre, 23 April 1982: Lot 30; (27) Lefevre, 14 April 1978: Lot 44; (28) Lefevre, 31 October 1980: Lot 50; (29) Rippon Boswell 59, 2002: Lot 79; (30) Eskenazi 1983: No. 284

– Ersarï *chuval* with a *mina khani* design without diagonal grid: (31) Eiland 1990: No. 153

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat(?) hair, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, brown and light grey fibres
Pile:	Wool, 2Z 14 colours – Violet-red; red; light yellow; orange; light orange; greenish brown; brown; blue; light blue; greyish blue; 2 shades of turquoise; ivory; white
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open left Discontinuous knotting and wefts (Mallett 1998: 2.67) Horiz. 30–32 × 56–60 vert. = 1680–1920 knots/dm²; 1:1.9
Selvages/Ends:	No original extant
Examined by:	Elena Tsareva; Arlington 2002

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22417.1/.2
Radiocarbon age:	140 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)

29

Ersarï

Middle reaches of the Amu-Darya

Khali; Ersarï *gül* design
157 × 335 cm / 61¾ × 132 in.
First half 19th century

Collection of Marion and Hans König, Minusio
Published: (1) Schürmann 1969: No. 41; (2) McCoy Jones/Boucher 1975: No. 11; (3) Spuhler/König/Volkmann 1978: No. 91

Comparable pieces

(1) Besim 2, 1999: No. 71 (without Ersarï *gül*)

– Other pieces with Ersarï *gül*; (2, 3) Schürmann 1969: No. 51 and 53; (4) Lefevre, 21 March 1975: Lot 45; (5) Lefevre, 21 May 1976: Lot 15; (6) Lefevre, 8 October 1976: Lot 22; (7) Hali 6/1, 1983: 35; (8) Tzareva 1984: No. 89; (9) Herrmann VI 1984: No. 89; (10) Nagel 333, 13 November 1990: Lot 435; (11) Rippon Boswell 36, 1992: Lot 23; (12) Nagel, 23 June 1993: Lot 3211; (13) Rippon Boswell 43, 1995: Lot 143; (14) Rippon Boswell 44, 1996: Lot 89; (15) Rippon Boswell 45, 1996: Lot 106; (16) Moshkova 1970 (1996): Fig. 119; (17) Rippon Boswell 57, 2001: Lot 24

– Other pieces with octagonal medallions: (18) Schürmann 1969: No. 52; Lefevre, 8 October 1976: Lot 18; (19) Schürmann 1979: No. 213; (20) Rippon Boswell 58, 2002: Lot 48; Hali 128, 2003: 99; (21) Eiland 2003: 241; (22) Hali 141, 2005: 31; (23) Rippon Boswell 66, 2005: Lot 79

For a discussion, see Vol. 2
For radiocarbon dating details, see Vol. I, appendix IV, table 15

Structure

Warp:	Goat hair (?), Z_2S, mix of ivory, grey, and brown fibres
Weft:	Wool, 2Z, brown, ivory, light red – Mix of brown and ivory fibres, 2Z – Light red, 2Z – Light red, Z, plied with ivory, Z; 2Z
Pile:	Wool, 2Z, some 3Z; height 2–3 mm, 4 mm brown only 13 colours – Orange-red, some 3Z; red; claret-red; light orange; 2 shades of dark blue; medium blue; light blue, some 3Z; yellow; greenish blue; green; brown; white
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – One or two rows of symmetrical knots on left side, two or three rows on right side Horiz. 28–32 × 36–45 vert. = 1008–1440 knots per dm^2; 1:1.2
Selvages:	3 warp units (2,2,2) reinforced with brown goat hair (?), (Mallett 1998: 15.10 and 15.11)
Ends:	Bottom: 2cm weft faced tabby in red, 2Z; Top: 3cm weft faced tabby, wefts in light blue and red, 2Z;
Examined by:	Elena Tsareva; Riehen, January 2002

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-25309
Radiocarbon age:	95 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1685–1746 (27.8%) AD 1752–1768 (2.7%) AD 1807–1943 (68.0%) AD 1954–1960 (1.4%)

30

Ersarï

Middle reaches of the Amu-Darya

Khali fragment; compartment design
154 × 226 cm / 60½ × 89 in.
18th or 19th century

Collection of Marion and Hans König, Minusio
Published: (1) Spuhler / König / Volkmann 1978: No. 88; (2) Schürmann 1979: 219; (3) Mackie / Thompson 1980: 194

Comparable pieces

(1) Benardout 1974: No. 44; (2) Lefevre, 1 December 1978: Lot 63; (3) Fihl 2002: 441 (historical photography)

– Other Ersarï pieces with compartment design: (4, 5) Schürmann 1969: No. 43 and 64; (6) Azadi 1970: Plate 8 (possibly Kizil Ayak); (7) Lefevre, 3 October 1975: Lot 31; (8, 9) Lefevre, 6 February 1976: Lot 57 and 59; (10) Bausback 1976: 285; (11) Lefevre, 8 July 1977: Lot 18; (12) Loges 1978: No. 91; (13) Nagel, 6 May 1978: Lot 112: (14) Cat. Basel 1980: 117; (15, 16) Jourdan 1989: No. 287 & 288; (17) Herrmann II, 1980: No. 99; (18) Mackie/Thompson 1980: 201; (19) Herrmann V, 1983: No. 87; (20) Herrmann IX, 1987: No. 89; (21) Tzareva 1984: No. 96; (22) TKF Wien 1986: No. 121; (23) Rippon Boswell 37, 1992: Lot 17; (24) Rippon Boswell 41, 1994: Lot 94; (25) Rippon Boswell 42, 1995: Lot 98; (26) Rippon Boswell 43, 1995: Lot 97; Concaro / Levi 1999: No. 120; (27) Moshkova 1970 (1996): No. 118; (28) Christie's London, 29 April 1998: Lot 92; (29–31) Pinner/ Eiland 1999: Plate 71, 73,74; (32) Nagel, 11 May 1999: Lot 60; (33) Reuben II, 2001: No. 14; (34) Eiland 2003: 251 (possibly Kizil Ayak); (35, 36) Rippon Boswell 68, 2006: Lot 119 and 145; (37) Cat. no. 138

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory, grey, and brown fibres
Weft:	Wool, 2Z, light brown; cotton, Z, white – Wool, 2Z, light brown; mainly – Wool, Z, light brown, plied with cotton, Z, white, 2Z; at bottom only
Pile:	Wool, 2Z, some 3Z; height up to 6 mm 8 colours – Ivory; red; light orange; dark blue; yellow, some 3Z; dark blue-green; green to grey-green; dark brown;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 32–33 × 30–32 vert. = 960–1056 knots/dm²; 1:0.95
Selvages:	2 warp units (2,2) reinforced with brown goat (?) hair (Mallett 1998, 15.10 and 15.11)
Ends:	Striped weft-faced tabby in brown, blue-green, apricot wool, 2Z, with a line of yellow stitches (running stitch)
Examined by:	Elena Tsareva; Riehen, June 2002

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-25307
Radiocarbon age:	155 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1669–1792 (49.7%) AD 1797–1896 (32.2%) AD 1913–1959 (18.1%)

31

Ersarï

Balkhan Mountains or Akhal Oasis

Khali; 3 × 7 *gülli gül* design
220 × 280 cm / 86½ × 110¼ in.
16th or 17th century

Collection of David Reuben, London
Published: (1) Reuben 1998: No. 21; (2) Hali 99, 1998: 135

Comparable pieces

– With 2 rows of *gülli gül*: (1) Bausback 1977: 190; (2) Lefevre, 3 February 1978: Lot 36; (3) Loges 1978: No. 80; (4) Rippon Boswell 14, 1981: Lot 46; Herrmann IV, 1982: No. 90; (5) Nagel, 11 May 1999: Lot 78; (6) Reuben 2001: No. 10

– With 3 rows of *gülli gül*: (7) Lefevre, 14 July 1978: Lot 13; (8) Mackie/Thompson 1980: No. 85; Eiland 1990: No. 159; (9) Lefevre, 29 May 1981: Lot 31; (10) Eskenazi 1983: No. 278; (11) Herrmann VII, 1985: No. 82; (12) Reuben I, 1998: No. 22; (13–15) Pinner/Eiland 1999: Nos. 55–57; (16) Rippon Boswell 59, 2002: Lot 165; (17) Rippon Boswell 68, 2006: Lot 68

– Fragments with *gülli gül* design: (18) Eskenazi 1983: No. 277; (19) Pinner/Eiland 1999: No. 59

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light red, ivory One shot light red; one shot ivory
Pile:	Wool, 2Z 8 colours – Brownish purple; orange; dark blue; blue; green; yellow; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 29 × 32 vert. = 928 knots/dm^2; 1:1.1
Selvages/Ends:	Original not extant
Examined by:	David Reuben; London, December 2002

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-26223.1/.2
Radiocarbon age:	310 ± 40 y BP
Calibrated age range: (95.4% confidence limit)	AD 1477–1659 (100.0%)

32

Ersarï

Bukhara workshop

Namazlyk saph; multiple niche design
217 × 233 cm / 85½ × 91¾ in., fragment
Early 18th century (before 1712)

Museum of Islamic Art, Doha, Qatar
Published: (1) Sotheby's London, 29 April 1998: Lot 96; another fragment of probably the same piece is published in: (1) Christie's London, 17 October 2002: Lot 141; (2) Hali 124, 2002: 51

Comparable pieces

(1) Moshkova 1970 (1996): Fig. 129; OCTS V/1: 80, fig. 6; Bausback 2000: 192; cat. no. 33; Rippon Boswell 84, 2014: Lot 96

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, dark brown, ivory
Weft:	Wool, Z, dark brown, ivory
Pile:	Wool, 2Z 8 colours – Ivory; rose-red; brownish orange; black-blue; dark blue; medium blue; light yellow; medium brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 20–30 × 30 vert. = 600–900 knots/dm²; 1:1.2
Selvages:	Left selvage: 2 warp units (2,2) overcast with red wool Right selvage: Original not extant
Ends:	original not extant
Examined by:	ex Sotheby's London, 29 April 1998: Lot 96

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-19089
Radiocarbon age:	140 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1673–1786 (44.3%) AD 1802–1899 (37.8%) AD 1910–1958 (17.9%)

33

Ersarï

Bukhara workshop

Namazlyk saph; multiple niche design
146 × 325 cm / 57½ × 128 in., fragment
1875

Collection of Marshall and Marilyn R. Wolf
Unpublished

Comparable pieces

See cat. no. 32

For a discussion, see Vol. 2

Structure

Warp:	Wool or goat hair, Z_2S, dark brown, ivory
Weft:	Wool, Z, 2Z, brown
Pile:	Wool, 2Z 9 colours – Ivory; red; dark aubergine; pale orange; medium blue; dark blue; bluish green; bright yellow; brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right; woven from left to right Many rows of discontinuous knotting and wefts (Mallett 1998: 2.67) and stacked knots (Mallett 1998: 2.29) Horiz. 20–24 × 26–32 vert. = 520–768 knots/dm²; 1:1.3
Selvages:	Right selvage: 8 warp units overcast in tabby in 1/2 diamond design in medium blue wool, 3Z, and red wool, 4Z Left selvage: Original not extant
Ends:	Bottom: 3–4 cm weft faced tabby in red wool. 2Z Top: Original not extant
Notes:	Weave of the piece is very rough, and nearly like new. One diagonal line 74 cm through the last niche, probably a fold cut resewn, rather than a lazy line.
Examined by:	Robert Pittenger; New York, May 2002

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Dated post 1874 by a document
No radiocarbon dating performed

34

Ersarï

Bukhara workshop

Namazlyk; single niche design
110 × 185 cm / 43¼ × 72¾ in.
18th century

The Russian Museum of Ethnography, St. Petersburg
M.S. Dudin collection no. 26-61
Purchased 1901 in Bukhara, described as 'Kizil Ayak *namazlyk*'
Published: (1) Felkersam 1914 (1979); (2) Tzareva 1984: No. 98; (3) Hali 27, 1985: 14; (4) Eiland 1990: No. 278; (5) Tsareva 1993: No. 6

Comparable pieces

(1) Spuhler/König/Volkmann 1978: No. 100; Herrmann 3, 1991: No. 59; Jourdan 1989: No. 298; (2) Christie's London, 24 April 1979: Lot 422; Hali 50, 1990: 37; (3) Hali 151, 2007: 75, no. 2; (4) Hali 161, 2009: 126

– Other related Ersarï *namazlyk*: (5) McCoy Jones/Boucher 1972: No. 22; (6) Bausback 1978: 528; (7) Nagel, 25 May 1979: Lot 52; Hali 1/4, 1978: 59; (8) Lefevre, 9 February 1979: Lot 7; 31 October 1980: Lot 20; Hali 1/3, 1978: 12; (9) Herrmann VI, 1984: No. 89; (10) Bausback 1987/88: 190; Jourdan 1989: No. 299; (11) Eiland 1990: No. 154; (12) Rippon Boswell 37, 1992: Lot 106; Christie's London, 17 October 1996: Lot 510; Besim 3, 2000: No. 64; (13) Phillips London, 16 June 1992: Lot 5; (14) Rippon Boswell 41, 1994: Lot 104; (15) Christie's NY, 20 April 1994: Lot 26; Christie's London, 24 April 1997: Lot 422; (16) Hali 98, 1998: 27; (17) Elmby IV, 1998: No. 50; (18) Rippon Boswell 54, 2000: Lot 78; (19) Hali 151, 2007: 75, no. 3

– Pieces with comparable palmette field design: (20) Elmby I, 1990: No. 45; (21) Hali 135: 67; (22, 23) Sotheby's NY, 25 November 2008: Lot 51 and 71

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat hair (?), Z_2S, mix of grey, light brown, and ivory fibres
Weft:	Wool, 2Z, mix of brown and light grey fibres
Pile:	Wool, 2Z; cotton, 2Z; height 4–5 mm 17 colours/shades – Wool: ivory; red; violet-red; pinkish-red; orange-red; orange; black-blue; dark blue; blue; dark yellow; yellow; brownish yellow; blue-green; grey-brown; light brown; dark brown; Cotton: Light blue
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 30 × 44 vert. = 1320 knots/dm²; 1:1.5
Selvages/Ends:	No information
Examined by:	Elena Tsareva; St. Petersburg

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-18910.1/.2
Radiocarbon age:	90 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1691–1737 (27.1%) AD 1812–1933 (71.8%) AD 1955–1959 (1.2%)

35

Turkmen

Middle reaches of the Amu-Darya

Ensi
179 × 129 cm / 70½ × 50¾ in.
18th or early 19th century

Collection of Marion and Hans König, Minusio
Published: (1) Lefevre, 25 March 1977: Lot 18; (2) Spuhler/König/Volkmann 1978: No. 89; (3) Hali 5/3, 1983: 256; (4) Andrews et al. 1993: No. 114; (5) Eiland 2003: 181

Comparable pieces

(1) McCoy Jones/Boucher 1975: No. 8; (2) Edelmann NY, 15 April 1980; (3) Eiland 2003: 182

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat hair, Z_2S, mix of grey, brown, and ivory fibres
Weft:	Wool, 2Z; camel hair (?), 2Z; shades of brown and grey
Pile:	Wool, 2Z; camel hair (?), 2Z; height 1.5 mm (olive-brown 2.5 mm, brown in elem 3 mm) 14 colours/shades – Bluish-red; orange-red; carmine-red; 2 shades of dark blue; medium blue; bluish green; shades of green; greyish green; light yellow; yellow; greenish brown; ivory; brown (wool or camel hair? in the elem; some knots in rose-orange)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Horiz. 38 – 41 × 46 – 48 vert. = 1748 – 1968 knots/dm²; 1:1.2
Selvages:	3 warp units (2,2,2) reinforced in dark brown goat hair (Mallett 1998, 15.10 and 15.11)
Ends:	Bottom: 2 cm of red and grey-green striped weft-faced tabby Top: 1.5 cm of weft faced tabby in camel hair (?), folded to the back and sewn down. Red wool chain-stitch at the edge.
Examined by:	Elena Tsareva; Riehen, January 2002

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-25305
Radiocarbon age:	130 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1675 – 1784 (41.0%) AD 1803 – 1902 (41.8%) AD 1907 – 1949 (16.3%) AD 1955 – 1958 (0.9%)

36

Kïzïl Ayak (?)
Balkhan Mountains or Akhal Oasis

Khali; Qaradashlï *gül* design
69 × 142 cm / 27¼ × 56 in., fragment
16th or 17th century

Private collection
Published: (1) Nagel, 14 November 1997: Lot 281; (2) Hali 97, 1998: 139

Comparable pieces
No other Kïzïl Ayak *khali* with the same design is published

- Other Kïzïl Ayak *khali* with *tauk nuska gül*: (1) Grote-Hasenbalg 1922, Vol. III: 175, Abb. 103; (2) Schürmann 1969: No. 60; (3) Azadi 1970: Plate 10; (4) Gombos 1975: No. 21; (5) Loges 1978: No. 73; (6–8) Jourdan 1989: No. 237, 238 and 240; (9) Reuben 1998: No. 77

- Asymmetrically knotted pieces with Qaradashlï *gül* from other Turkmen groups: (10, 11) Loges 1978: No. 106 and 107; (12) Mackie / Thompson 1980: No. 48; (13 – 15) Rautenstengel / Azadi 1990: No. 22, 26 & 29; (16) Eiland 1990: No. 275; ORR, Vol. 11: No. 1, 1990: 92

- For other Turkmen pieces with Qaradashlï *gül* cf. cat. nos. 59 and 87

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z; some cotton, 3Z; height worn, in some areas remains of up to 3 mm 8 colours (+ some knots in white cotton; + some knots in bluish red wool); Wool: Brownish purple; orange; dark blue; light medium blue; medium blue-green; yellow; dark brown; ivory Cotton: white (one row of 27 knots only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – Several rows of symmetrical knots (Sy3) throughout the fragment; – One short row (ca. 2 cm) of asymmetrical overlapping knots (Mallett 1998, 2.28) observed slightly to the right 7 cm below a single red knot in the field between the two uppermost Qaradashli *gül*; – One row (ca. 8 cm) of white cotton knots 2–3Z, (As2) in the top main border; – 10 bluish red (Ra 462-1) knots in wool, 2Z; one in the field, 21 cm below top end on the vertical middle axis of the fragment, 9 scattered in the main border; Horiz. 35–36 × 50–53 vert. = 1750–1908 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 462-1 bluish-red, w, 2Z:	Mexican cochineal and a trace of madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-27707.1/.2
Radiocarbon age:	260 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1522–1600 (29.4%) AD 1623–1677 (56.3%) AD 1782–1806 (12.7%) AD 1947–1957 (1.6%)

37

Sarïq

Balkhan Mountains, Khiva Oasis or middle reaches of the Amu-Darya

Ensi
107 × 185 cm / 42¼ × 72¾ in., fragment
17th or 18th century

Collection of Marie and George Hecksher, San Francisco
Unpublished

Comparable pieces

– With a row of disconnected niches at the top: (1) Neugebauer/Orendi 1909: 216; (2) Grote-Hasenbalg 1922: Tafel 86; (3) Schürmann 1969: No. 36; Eiland 1990: No. 127; Pinner/Eiland 1999: Plate 7; (4) McCoy Jones/Boucher 1972: No. 13; (5) Dimand/Maily 1973: 288: No. 186; (6) Loges 1978: No. 27; (7) Bausback 1978: 511; (8) Herrmann II, 1979: No. 94; Rippon Boswell 55, 2000: Lot 130; (9) Lefevre, 27 April 1979: Lot 33; (10) Mackie/Thompson 1980: No. 24; (11) Hoffmeister 1980: No. 59: (12) Tsareva 1984: No. 18; Bogolyubov 1908/09 (1973): No. 4; Concaro/Levi 1999: No. 178; (13) Herrmann VII, 1985: No. 75; Lefevre, 8 March 1985: Lot 49; (14) Volkmann 1985: No. 83; Hodenhagen 1997: No. 99; (15) Cassin/Hoffmeister 1988: Plate 35; Eiland 2003: 171; (16) Rippon Boswell 27, 1988: Lot 63; (17) Pinner 1993: Plate 3; (18) Sotheby's NY, 16 December 1993: Lot 23; Eiland 2003: 170; (19) Andrews et al. 1993: No. 108; (20, 21) Rippon Boswell 39, 1993: Lot 64 & 103; Eskenazi 1983: No. 255; (22) Moshkova 1970 (1996): Fig. 79; (23) Sotheby's NY, 12 December 1997: Lot 70; Hali 97, 1998: 140; (24) Rippon Boswell 60, 2003: Lot 62

– With a row of connected niches at the top: (25) Grote-Hasenbalg 1922: Plate 87; (26) Clark 1922: Opp. page 114, plate B; Sotheby's London, 18 October 1995: Lot 79; (27) Thacher 1940 (1978): Plate 9; (28) Lefevre, 8 October 1976: Lot 8; (29) Bernheimer 1977: 27; (30, 31) Bausback 1977: 180 and 181; (32) Loges 1978: No. 26; (33) Bausback 1979: 146; (34) Lefevre, 26 November 1982: Lot 35; (35) Lefevre, 4 March 1983: Lot 10; (36) Tsareva 1984: No. 17; (37) Rippon Boswell 43, 1995: Lot 123; Rippon Boswell 56, 2001: Lot 104; (38, 39) Jourdan 1989: No. 21 and 22; (40) Besim 1, 1998: No. 70; (41) Hodenhagen 1999: No. 97; (42) Rippon Boswell 64, 2004: Lot 156; (43) Cat. no. 140 in this vol.; Cassin/Hoffmeister 1988: Plate 34; Eiland 2003: 172

– Without niches at the top: (44) Tsareva 1984: No. 16; Concaro/Levi 1999: No. 179

Structure

Warp:	Wool, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z; height 5 mm 8 colours – Dark red; orange-red; dark blue; blue-green; yellow; medium brown; light brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Symmetrical Offset knotting for floral pattern in borders and *alem* Horiz. 41–42 × 54–55 vert. = 2214–2310 knots/dm²; 1:1.3
Selvages:	2 warp units (2,2), no remaining evidence of overcasting (only 5 cm of original right selvage extant)
Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, December 2002

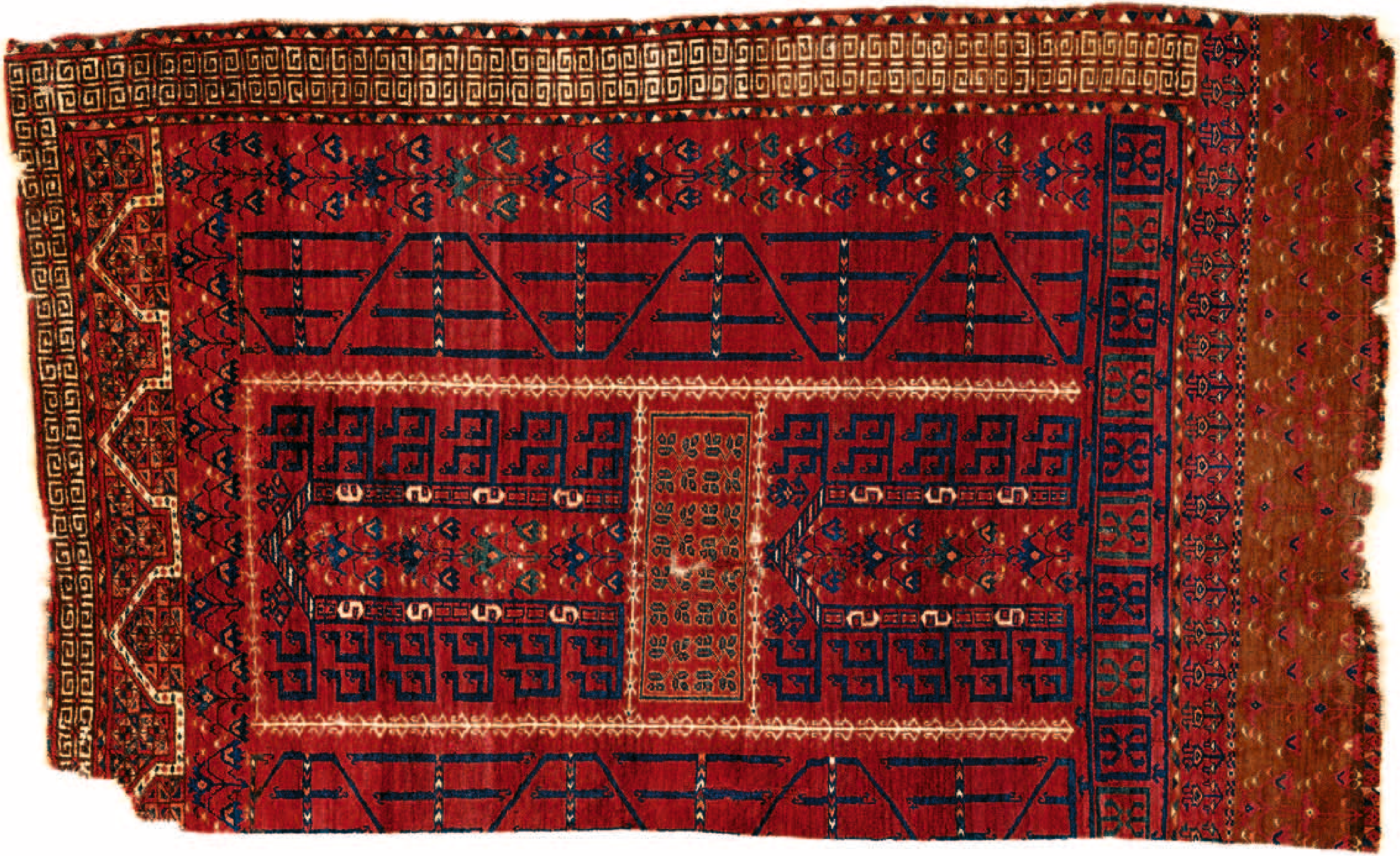
Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22408
Radiocarbon age:	105 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1679–1740 (27.4%) AD 1753–1756 (0.5%) AD 1804–1935 (68.0%) AD 1946–1953 (2.3%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



38

Sarïq

Balkhan Mountains, Khiva Oasis, or middle reaches of the Amu-Darya

Aq yüp (3 details)
25–27 × 1382 cm / 9¾–10½ × 544 in. without plaited cords
17th or 18th century

Private collection
Published: Neugebauer/Orendi 1909: Fig. 135

Comparable pieces
(1) Elmby I, 1990: No. 26; Andrews et al. 1993: No. 62a; (2) Pinner 1993: No. 62; (3) TKF Graz 1999: Plate 77/2; (4) Jsaacson 2007: No. 10; (5) Tsareva 2011: No. 159

For a discussion see Vol. 2
For dyestuff composition, see appendix II, table 5
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Note: In some places, single woollen (marker?) fibres in red, blue, or brown have been added to some single wefts in both cotton and wool. The additional coloured fibre is clearly thicker than the fibres of both weft materials. Although it seems to be an intentional addition by the weaver, its function remains unclear.

Structure

Warp:	Wool, Z_2S, ivory, brownish red, some brown (for selvages)
Weft:	Cotton, 2Z, white; Wool (?), 2Z, white system of wefting: – Cotton, 2Z, white; first 512 cm and end of the band, ca. 180 cm – Wool (?) 2Z, white; middle part of the band, ca. 690 cm
Pile:	Wool, 2Z, some Z, 3Z, 4Z; cotton, 3Z; silk, ?Z; height 1–2 mm 11 colours (8 on wool, 2 on silk, 1 on cotton) – Wool: Orange-red, some Z and 3Z (Ra 294-4); red-brown; scarlet, 4Z (Ra 294-1/-2); dark blue, some Z; medium blue; light to medium blue, some 4Z; medium blue-green; ivory Silk: Magenta (Ra 294-3); green (Ra 294-5); Cotton: White
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 216–240 warps by 75–78 wefts/dm
Knot:	symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8) Horiz. 54–60 × 75–78 vert. = 4050–4680 knots/dm²
Selvages:	3 warps in brown wool, overcast with blue and red wool, Z (Mallett 1998: 15.23 and 15.21, but 3 single warps)
End panels:	Panels of ca. 80 cm length each with bands of inlaid brocading (Mallett 1998: 8.31, 32) and 4 span counter twining in weft direction (Mallett 1998: similar to 4.3), all on top layer of warps; remaining warps of up to 40 cm length are plaited into thick cords at beginning and end
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 294-1 scarlet, w, 4Z:	Mexican cochineal (tin), madder
Ra 294-2 scarlet, w, 4Z:	Mexican cochineal (tin), madder, young fustic
Ra 294-3 magenta, s, 2Z:	Mexican or Armenian cochineal, madder
Ra 294-4 orange-red, w, 3Z:	Madder and berries, as e.g. yellow or Persian berries
Ra 294-5 green, s, 2Z:	Weld, indigoid dye source (indigo or woad), madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-27704
Radiocarbon age:	130 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1674–1777 (40.1%) AD 1800–1894 (43.0%) AD 1906–1941 (14.8%) AD 1946–1951 (2.1%)

39

Sarïq

Merv Oasis

Aq yüp; (2 details)
37–42 × 1068/96 /20/51 cm; 14½–16½ × 420/37¾/8/20 in., 4 fragments,
compl. length 1235 cm/486¼ in., ca. 35 cm/13¾ in. shortened at the weaving end
Fisrt half 19th century

Collection of François Ang, Paris
Published: Isaacson 2007: No. 15

Comparable pieces

(1) Schürmann 1969: No. 5; (2) Bausback 1976: 262; Bausback 1978: 472–476; (3, 4) Hali 2/4, 1980: 313, fig. 35, and 314, fig. 36; (5) Tzareva 1984: No. 86; Cat. Antwerp 1997: No. 40; (6) Pinner/Eiland 1999: Plate 27; (7) Diens/Reinisch 2001: No. 222; TKF Graz 1999: No. 77; (8) Isaacson 2007: No. 16

For a discussion, see Vol. 2
For dyestuff composition, see appendix II, table 4
For mordant (tin) analysis see, appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory, orange-red (24 warps at both edges at the beginning only)
Weft:	Cotton, Z, 2Z, white; Wool, Z, 2Z, white – First 315 cm: · Cotton, Z, loosely plied with wool, Z; 2Z, mainly · Cotton, 2Z, one strand fine, one very fine, loosely plied with very fine wool, 2Z; 4Z, only some few wefts of this type in this area – Remaning 753 cm: · Cotton, 2Z, one strand fine, one very fine, loosely plied with very fine wool, 2Z; 4Z · Cotton, 2Z, one strand fine, one very fine, loosely plied with very fine wool, Z; 3Z irregular use of 3Z and 4Z wefts – Unusual systems of wefting, using 2Z and 3–4Z wefts; the change from 2Z to 3–4Z is clearly visible in the lower detail to the right, resulting in a change in width which nearly coincides with a change in colour from orange-red to brownish red
Pile:	Wool, 2Z, some 3–4Z; cotton, 2Z; silk 2Z; height ? 16 colours (13 on wool, 2 on silk, 1 on cotton) – Wool: Brownish red; orange-red; orange, 3Z; dark brownish purple; scarlet, 4Z (Ra 618-1/-2/-3), purple, 2Z (Ra 618-4); dark blue; medium blue; light blue; dark blue-green; medium blue-green; yellow; brown Silk: Magenta (Ra 618-5); light yellow; cotton: white
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 236/208 warps by 82 (2Z)/70 (3 – 4Z) wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8) – Horiz. 59 × 82 vert. = 4838 knots/dm² (2Z wefts) – Horiz. 52 × 70 vert. = 3640 knots/dm² (3–4Z wefts)
Selvages:	Original not extant
Ends:	Beginning and end: 27–45 cm plaited cords in ivory wool (cf. Isaacson 2007: No. 15 in the leporello part)
Examined by:	Jürg Rageth; Riehen, April 2005

Dyes

Ra 618-1/-2/-3 scarlet, w, 4Z:	Mexican cochineal (tin)
Ra 618-4 purple, w, 2Z:	Mexican cochineal
Ra 618-5 magenta, s, 2Z:	Mexican or Armenian cochineal
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

40

Sarïq

Merv Oasis

Mafrash; 4-panel *ak yüp* design
69 × 32 cm / 27¼ × 12½ in.
18th or early 19th century

The Russian Museum of Ethnography, St. Petersburg
S.M. Dudin collection, no. 26-22, purchased in Merv in 1902,
Published: (1) Eiland 1990: No. 274; (2) ORR 11/1, 1990: 85; (3) Dodds/Eiland 1996: No. 133

Comparable pieces

No comparable Sarïq *mafrash* published

– Tekke *mafrash* and *kap* with *ak yüp* design: (1) Thacher 1940 (1978): Plate 26; (2) Loges 1978: No. 15; (3) Bausback 1979: 130; (4–6) Hoffmeister 1980: No. 44–46; Andrews et al. 1993: No. 27; (7) Mackie/Thompson 1980: 39; (8) Pinner/Franses 1980: No. 405; (9) Cat. Basel 1980: 123; (10) Walker 1982: No. 33; (11) Benardout 1983: No. 65; (12) Tzareva 1984: No. 60; (13, 14) Herrmann IX, 1987: No. 83b, and 83c; (15) Herrmann 1, 1989: No. 48c; (16) Jourdan 1989: No. 88; (17, 18) Elmby III, 1996: No. 7, 8; (19) Dodds/Eiland 1996: No. 230; (20) Benardout 1996: No. 68; Hali 86, 1996: 100; (21) Rippon Boswell 44, 1996: Lot 143; (22) Benardout 2002: 17; (23) Rippon Boswell 64, 2004: Lot 182; (24) Rippon Boswell 66, 2005: Lot 59; (25) Sotheby's NY, 6 June 2007: Lot 113

– Other Turkmen pieces with comparable *ak yüp* design: (26) Thacher 1940 (1978): Plate 26; (27) McMullan 1965: No. 129; Hali 4/1, 1981: 16, fig 21; (28) Bausback 1978: 469; (29) Bausback 1979: 128; (30) Elmby III, 1996: No. 20; (31) Hodenhagen 1997: No. 68; (32) Hali 105, 1999: 126; (33) Rippon Boswell 56, 2001: Lot 13; (34) Rippon Boswell 64, 2004: Lot 183; (35) Sotheby's NY, 14 December 2006: Lot 173

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown and orange
Pile:	Wool, 2Z; silk, 2Z; Cotton, 2Z; Height up to 3 mm (brown) 7 colours – Wool: Red; orange-red; dark blue; dark blue-green; brown; ivory Silk: Magenta; Cotton: White, some knots only
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	symmetrical – Some offset knotting for pattern (lower row of flowers) – Many rows of overlapping knots along both edges (Mallett 1998: 2.32–33) Horiz. 44–46 × 62–66 vert. = 2768–3035 knots/dm²; 1:1.4
Selvages:	2 warp units (2,2) overcast with medium blue wool (Mallett 1998, 15.21)
Ends:	Bottom: Weft faced tabby in red, dark-blue and ivory wool; back side cut, folded and sewn; remains of monochrome medium-blue fringe knotted on 6 warps Top: Weft faced tabby in red and ivory wool, folded and sewn
Examined by:	Elena Tsareva; St. Petersburg

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-18918
Radiocarbon age:	150 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1667–1712 (17.4%) AD 1717–1782 (32.7%) AD 1795–1886 (31.2%) AD 1911–1950 (18.7%)

41

Sarïq

Khiva Oasis, or middle reaches of the Amu-Darya

Chuval; 3 × 3 *chuval gül* and *kochanak* border design
129 × 65 cm/50¾ × 25½ in., fragment
17th/18th century

Private collection
Published: (1) Cassin/Hoffmeister 1988: Plate 7; (2) Sotheby's NY, 8 December 1990: Lot 34; (3) Hali 60, 1991: 129

Comparable pieces

(1) Andrews et al. 1993: No. 110; (2) Sotheby's NY, 14 December 2006: Lot 189

– Other *chuval* with 3 × 3 *chuval gül*: (3) Denny 1979: No. 23; (4) Mackie/Thompson 1980: No. 19; (5) Hali 2/4, 1980: 283; (6) Herrmann III, 1981: No.105; (7–9) Sotheby's NY, 16 December 1993: Lot 24, 25 and 28; (10) Elmby II, 1994: No. 11 (11) Besim 1, 1998: No, 69; (12) Reuben 1998: No. 18; (13) Rippon Boswell 69, 2007: Lot 91; (14) Nagel 49T, 2007: Lot 175

– *Chuval* with 3 × 4 *chuval gül*: (15) Lefevre, 25 March 1977: Lot 1; (16) Lefevre, 3 February 1978: Lot 23; Lefevre, 14 July 1978: Lot 8; (17) Nagel 279A, 25 May 1979: Lot 27; (18) Benardout 1983: No. 61; (19) Tzareva 1984: No. 22; (20) Hali 32, 1986: 24; (21) ORR 8/2, 1987: 34; Sotheby's NY, 14 December 2006: Lot 190; (22, 23) Pinner 1993: No. 5 and 6; (24) Nagel, 15 November 1996: Lot 158; (25–27) Dodds/Eiland 1996: No. 152, 158 & 160; (28) Moshkova 1970 (1996): Fig. 83; Ghereh 21, 1999: 24; (29, 30) Elmby IV 1998: No. 11 & 12; (31) Reuben 1998: No. 17; Hali 79, 1995: 123; (32) Christie's London, 17 October 2002: Lot 26; (33) Sotheby's London, 30 April 2003: Lot 59; (34) Rippon Boswell 66, 2005: Lot 168; (35) Rippon Boswell 70, 2007: Lot 119

For a discussion, see Vol. 2
For radiocarbon dating details see, appendix IV, table 15

Structure

Warp:	Wool, Z_2S, light ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; Cotton, 2Z; silk, 2Z; Height: completely worn 7 colours (5 on wool, 1 on cotton, 1 on silk)– Wool: dark brownish red; orange-red; black-blue; blue-green; grey-brown; Cotton: White; Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, one nearly strait, one sinuous; alternate warps slightly depressed
Knot:	Symmetrical – Multiple use of offset knotting in minor borders only – One short row of knots offset in undecorated area in the field – Some rows of overlapping knots (Mallett 1998: 2.32) – Some rows of stacked symmetrical knots (Mallett 1998: 2.29, but symmetrical), in orange-red wool observed in the border (instead of rows of overlapping knots?) Horiz. 40–42 × 70–71 vert. = 2800–2982 knots/dm^2; 1:1.7
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, January 2008

Dyes

Visual inspection does not suggest the use of insect dyestuffs on wool
No chemical analysis performed

Dating

Lab. Nr.:	ETH-50200
Radiocarbon age:	114 ± 26 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1680–1740 (27.5%) AD 1750–1770 (1.3%) AD 1800–1940 (66.6%)

42

Sarïq

Khiva Oasis, middle reaches of the Amu-Darya, or Merv Oasis

Chuval; originally 4 × 4 *chuval gül* and *kochanak* border design
66 × 80 cm / 26 × 31½ in., fragment, 2 × 4 *chuval gül*
18th century

Private collection
Published: (1) Lefevre, 30 November 1979: Lot 13; (2) Hodenhagen 1997: No. 14

Comparable pieces
(1) Cassin / Hoffmeister 1988: Plate 26; (2) Rippon Boswell 62, 2004: Lot 43

– Other *chuval* with 4 × 3 – 5 *chuval gül*: (3, 4) Gombos 1975: No. 40 and 42; (5) Bausback 1978: 506; (6) Bausback 1979: 148; (7) Lefevre, 17 July 1981: Lot 30; (8) Sotheby's NY, 16 December 1993: Lot 29; (9) Lefevre, 16 October 1981: Lot 1; (10) Lefevre, 1 October 1982: Lot 55; Lefevre, 8 March 1985: Lot 47; (11) Tzareva 1984: No. 23; (12) Rippon Boswell 35, 1992: Lot 68; (13) Elmby II, 1994: No. 10; (14) Elmby III, 1996: No. 11; (15) Rippon Boswell 54, 2000: Lot 168; (16) Rippon Boswell 62, 2004: Lot 43; (17) Rippon Boswell 64, 2004: Lot 200; (18) Myers 2004: No. 51, asymmetrical open right knotted

For a discussion, see Vol.2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool (?), 2Z, light brown
Pile:	Wool, 2Z, some 3 – 4Z; Cotton, 2Z; Silk, 2Z, Z; Height 2 – 3 mm 8 colours (and some knots magenta silk) – Wool: Dark brownish red, few 3Z and 4Z (in upper right corner); orange-red; black blue; medium blue; yellow; medium to dark green; brown; Cotton: white; Silk: magenta, some knots only Silk, Z, magenta, plied with wool, Z, deep red, 2Z, some knots only observed in the bottom row of *chemche* and of *chuval gül**
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Multiple use of offset knotting for floral pattern in *alem* – Multiple use of offset knotting in undecorated areas in field and *alem* – Some single rows of knots offset in undecorated area in the field – Some rows of overlapping knots in the *alem* (Mallett 1998: 2.32) – Some rows of knots 3Z and 4Z (stacked knots?, Mallett 1998, 2.29, but symmetrical), in deep red wool observed in undecorated area at upper end of the field (instead of rows of overlapping knots?) Horiz. 47 – 48 × 79 – 80 vert. = 3713 – 3840 knots/dm^2; 1:1.6
Selvages/Ends:	Original not extant
Note:	*This is a rare case of using pile yarns plied of silk and wool in two different shades of red, although only in some knots (cf. also the Salor tent band ca. no. 4 with pile yarn plied of two different shades of red, both on wool)
Examined by:	Jürg Rageth; Riehen, June 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs on wool
No chemical analysis performed

Dating
No radiocarbon dating performed

43

Sarïq

Middle reaches of the Amu-Darya, or Merv Oasis

Chuval; small *chuval gül* and *naldag* border design
126 × 95 cm / 49½ × 37.4 in.
18th or early 19th century

The Russian Museum of Ethnography, St. Petersburg
A.A. Bogolubov collection, no. 87-33
Published: Dodds/Eiland 1996, no. 159

Comparable pieces

(1) Bogolyubov 1908/09 (1973): No. 2; (2) Hali 3/1, 1980: 76, fragment; (3) Reuben I, 1998: No. 19; (4) Elmby IV, 1998: No. 15, fragment; (5) Concaro/Levi 1999: No. 180; Boguslavskaya 2001: No. 23

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool (?), Z_2S, ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z, some Z; Silk 2Z, some Z; Cotton, 2Z; Height 4 mm 9 colours – Wool: Red, some Z; orange; dark blue; dark blue-green; brown; Silk: White; light orange; magenta, Z; Cotton: White
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Symmetrical Horiz. 42 × 83 vert. = 3486 knots/dm^2; 1:1.9
Selvages:	Original not extant
Ends:	Bottom: remains of weft faced tabby in blue wool Top: Original not extant
Examined by:	Elena Tsareva; St. Petersburg

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-19346
Radiocarbon age:	205 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1640–1693 (29.7%) AD 1727–1813 (56.5%) AD 1853–1858 (0.4%) AD 1919–1949 (13.4%)

44

Sarïq

Merv Oasis

Chuval; Salor *gül* field and *naldag* border design
132 × 88 cm / 52 × 34½ in.
First half 19th century

The Russian Museum of Ethnography, St. Petersburg
S.M. Dudin collection, no. 26-75; purchased in 1901 in Samarkand, described as Teke kap

Published: (1) Tsareva 1984: No. 24; (2) Eiland 1990: No. 273; (3) ORR 11/1, 1990: 84; (4) Dodds/Eiland 1996: No. 162

Comparable pieces

No directly comparable piece published

– Other Sarïq *chuval* with unusual arrangement of Salor *gül*: (1) Sotheby's NY, 16 December 1993: Lot 21; (2) Cat. no. 44

– Sarïq *chuval* with 1–3 rows of Salor *gül* and *Sagdak-, chuval-* or Jaffarbey secondary motives: (3) Grote-Hasenbalg 1922: Plate 82 and 83 top; (4) McCoy Jones/Boucher 1972, 18, fig. 9; (5) Bogolyubov 1908/09 (1973): No. 3; (6) Benardout 1974: No. 7; (7) Bausback 1976: 267; Bausback 1978: 490; Rippon Boswell 43, 1995: Lot 42; (8) Bernheimer 1977: 33; (9) Bausback 1977: 189; (10) Engelhardt II, 1978: Plate 310; (11) Loges 1978: No. 33; Sotheby's London, 19 October 1994: Lot 2; (12, 13) Mackie/Thompson 1980: No. 21 and 22; (14) Hali 3/2, 1980: 55; (15) Rippon Boswell, 10 November 1984: Lot 50; (16) Tzareva 1984: No. 25; (17) Thompson 1988: No. 35; Sotheby's NY, 16 December 1993: Lot 26; (18) Jourdan 1989: No. 27; (19) Sotheby's London, 19 October 1994: Lot 2; (20) Dodds/Eiland 1996: No. 163

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of ivory and light brown fibres
Pile:	Wool, 2Z, some 2–4Z; Silk, 2–3Z; Cotton, 2Z; Height 2–4 mm 8 colours – Wool: red; crimson (insect dyed?) 2–4Z; orange 2–4Z; brown; dark blue; blue-green Silk: Magenta; Cotton: White
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Pile upside down in relation to object orientation Horiz. 43–47 × 60–68 vert. = 2640–3236 knots/dm²; 1:1.4
Selvages:	Original not extant
Ends:	Bottom: Original not extant Top: Remanins of tabby, wefts in red and ivory wool, 2Z, folded to the back and sewn
Examined by:	Elena Tsareva; St. Petersburg

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-19348
Radiocarbon age:	110 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1677–1761 (32.8%) AD 1803–1938 (64.9%) AD 1946–1952 (2.3%)

45

Sarïq

Merv Oasis

Chuval; Salor *gül* design
143 × 96 cm / 56½ × 38 in.
First half 19th century

Fine Arts Museum of San Francisco, 2001.143.15
Gift of Marie and George Hecksher
Unpublished

Comparable pieces

No directly comparable piece published

– Other Sarïq *chuval* with Salor *gül* design: Cf. cat. no. 44

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool(?), 2Z, light brown
Pile:	Wool, 2Z; Silk, 2Z; Cotton, 2Z; Height: worn 8 colours – Wool: Red; crimson (insect dyed?); light orange-red; dark blue; greenish medium blue; medium brown; Silk: Purple; Cotton: White
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Many rows of overlapping knots (Mallett 1998: 2.32 and 2.33) Horiz. 44–46 × 66–74 vert. = knots/dm²; 1:1.7
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; San Francisco, April 2006

Dyes

Insect dyes on both wool and silk observed by visual inspection
No chemical analysis performed

Dating

No radiocarbon dating performed

46

Sarïq

Balkhan mountains

Khali; 4 × 8 *temirjin gül* design
228 × 232 cm / 89¾ × 91¼ in.
16th or 17th century

Collection of Dr. Ernst Albegger, Graz
Published: (1) Neugebauer/Orendi 1909: Fig. 147; (2) Loges 1978: No. 24; (3) Gantzhorn 1990: Fig. 653

Comparable pieces

– 4 rows of *temirjin gül*: (1) Grote-Hasenbalg 1922: Plate 94; Elmby IV 1998: No. 61; (2) McCoy Jones/Boucher 1973: No. 12; Tent & Town 1982: No. 6; Hali 5/3, 1983: 346; (3) Herrmann I 1978: No. 73; Lefevre, 3 February 1978: Lot 25; Lefevre, 26 February 1982: Lot 26; Hali 4/4, 1982: 394; Volkmann 1985: No. 82; Rippon Boswell 53, 1999: Lot 98; (4) Eskenazi 1983: No. 254; Rippon Boswell 36, 1992: Lot 89; Pinner/Eiland 1999: No. 5; (5) Hali 39, 1988: 69; (6) Rippon Boswell 32, 1990: Lot 151; (7) Rippon Boswell 36, 1992: Lot 89; (8) Rippon Boswell 41, 1994: Lot 103; (9) Elmby IV, 1998: No. 61; (10) TKF Graz 1999: No. 66; (11) Hali 112, 2000: 59; Woolley & Wallis, 17 October 2000: Lot 277; (12) Sotheby's NY, 16 December 2004: Lot 10; (13) Christie's London, 28 April 2005: Lot 71; Hali 141, 2005: 96; (14) Rippon Boswell 80, 2012: Lot 199

– 5 rows of *temirjin gül*: (15) Hali 2/3, 1979: 257; Edelmann NY, 10 November 79: Lot 121; Rippon Boswell 46, 1996: Lot 76; Rippon Boswell 66, 2005: Lot 62; (16) Sotheby's London, 13 November 1991: Lot 349; Herrmann 4, 1992: No. 94; (17) d'Heurle/Munkacsi/Saunders 2003: No. 2; Christie's London, 27 April 1995: Lot 511; Christie's London, 19 October 1995: Lot 461; (18) Cat. no. 47

– Fragments: (19) Mackie/Thompson 1980: No. 16; (20) Sotheby's London, 17 September 1982: Lot 85; (21, 22) Pinner 1993: Plate 1 and 2

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mostly mix of light brown and ivory fibres, some dark brown
Pile:	Wool, 2Z, also 3Z in most of the colours; Height 4 mm 8 colours – Wool: Shades of red to a slightly tan orange-red; orange; dark blue; yellow; dark blue-green; medium blue-green; shades of light to medium brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous (alternate warps originally slightly depressed)
Knot:	Symmetrical – Some single rows of knots offset in plain field – Some short rows of overlapping knots (Mallett 1998: 2.32/33) Horiz. 27–30 × 46–47 vert. = 1242–1410 knots/dm²; 1:1.5
Selvages/Ends:	original not extant
Examined by:	Jürg Rageth; Graz, March 2009

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-27367.1/.2
Radiocarbon age:	295 ± 30 y BP
Calibrated age ranges:	AD 1492–1600 (69.9%)
(95.4% confidence limit)	AD 1614–1657 (30.1%)

47

Sarïq

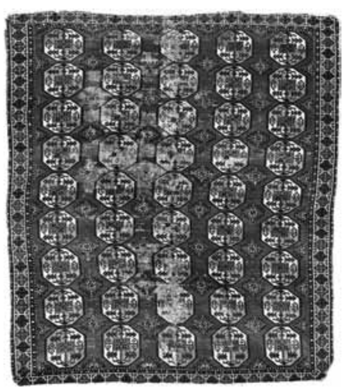
Balkhan mountains, Khiva Oasis, or middle reaches of the Amu-Darya

Khali; 5 × 9 *temirjin gül* design
250 × 285 cm / 98½ × 112¼ in.
17th or 18th century

Private collection
Published: (1) Sotheby's NY, 30 May 1987: Lot 40; (2) ORR 1988, no. 1, p. 8; (3) Andrews et al. 1993, no. 104

Comparable pieces
Cf. cat. no. 46

For a discussion, see Vol. 2
For dyestuff composition, see appendix II, table 3
For radiocarbon dating details, see appendix IV, table 15



Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool or camel hair (?), 2Z, light brown
Pile:	Wool, 2Z, some Z and 3Z; Silk 2Z; Cotton, 2Z; Height 2 mm, up to 4 mm in some areas 8 colours – Wool: Shades of reddish and brownish purple to red, some 3Z (Si 9-3/4); shades of orange, some 3Z (Si 9-2/5); dark blue; yellow, some 3Z; medium blue; dark blue green, some 3Z; brown; ivory, some Z Silk: Light magenta (Si 9-1) Cotton: White, one row of 9 knots only
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous; alternate warps slightly depressed in some areas
Knot:	Symmetrical (Sy2, some Sy4) Rows of overlapping knots mainly in the left side border and along the border in the field (Mallett 1998: 2.32/33) Horiz. 32–34 × 42–45 vert. = 1344–1518 knots/dm^2; 1:1.3
Selvage/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Si 9-1 magenta, s, 2Z:	Mexican or Armenian cochineal
Si 9-2 brownish orange, w, 2Z:	Madder
Si 9-3 brownish purple, w, 2Z:	Madder
Si 9-4 red, w, 2Z:	Madder
Si 9-5 brownish orange, w, 2Z:	Madder
Examined by:	Marmara University Istanbul
HCS 1103-1 magenta, s, 2Z:	Mexican or Armenian cochineal, tannin and madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-19039.1/.2
Radiocarbon age:	105 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1678–1744 (29.2%) AD 1747–1759 (2.1%) AD 1803–1937 (66.1%) AD 1946–1953 (2.6%)

48

Sarïq

Khiva Oasis, or middle reaches of the Amu-Darya

Khali; 3 × 9 Sarïq *gülli gül* design
220 × 242 cm / 86½ × 95¼ in.
17th or 18th century

Collection of David Reuben, London
Published: (1) Reuben 2001: No. 8; (2) Hali 118, 2001: 149

Comparable pieces

- With Sarïq *gülli gül*: (1) McMullan 1965: No. 127, fragment; Mackie / Thompson 1980: No. 17; OCTS I, 1985: 143, no. 2; (2) Sotheby's NY, 18 May 1985: Lot 75; Gantzhorn 1990: No. 650; Hali 26, 1985: 45; OCTS I, 1985: 143, no. 3; (3) OCTS I, 1985: 141; (4) Elmby I 1990: No. 9; Andrews et al. 1993: No. 105; Rippon Boswell 59, 2002: Lot 84; Rippon Boswell 69, 2007: Lot 90

- With Salor *gülli gül*: (5) Tent & Town 1982: No. 5; Hali 5/3, 1983: 347, no. 2; (6) Sotheby's NY, 30 October 1982: Lot 69; Hali 5/2, 1982: 202; Herrmann 4, 1992: No. 96; (7) ORR 8/2, 1988: 11; (8) Sotheby's NY, 16 December 1993: Lot 30; Elmby II, 1994: No. 9; (9) Sotheby's NY, 4 December 2003: Lot 154; Hali 133, 2004: 125; (10) Rippon Boswell 69, 2007: Lot 128

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown, in places red, 2Z
Pile:	Wool, 2–3Z 6 colours – red, orange, blue, blue-green, brown, ivory
Ground weave:	Tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Symmetrical Horiz. 40 × 64 vert. = 2560 knots/dm²; 1:1.6
Selvages:	2 warp threads covered in brown goat hair
Ends:	Original not extant
Examined by:	David Reuben; London, January 2003

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-26227
Radiocarbon age:	255 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1521–1583 (20.9%) AD 1625–1674 (63.7%) AD 1777–1801 (14.4%) AD 1941–1946 (1.0%)

49

Sarïq

Khiva Oasis, or middle reaches of the Amu-Darya

Khali; 5 × 10 Sarïq *chuval gül* with Salor border design
219 × 250 cm / 86¼ × 95¼ in.
17th or 18th century

Collection of David Reuben, London
Unpublished

Comparable pieces

– 4 rows of Sarïq *chuval gül*: (1) Thacher 1940 (1978): Plate 6; (2) Eiland 1973b: No. 19; Pinner /Eiland 1999: Plate 6; (3) Lefevre, 25 March 1977: Lot 2; Mackie/Thompson 1980: No. 18; Rippon Boswell 54, 2000: Lot 93; (4) Bausback 1981: 141; (5) Sotheby's NY, 5 November 1983: Lot 171; (6) Spuhler 1998: No. 70: (7) d'Heurle/Munkacsi/Saunders 2003: No. 3

– 5 rows of Sarïq *chuval gül*: (8) Schürmann 1969: No. 10; McCoy Jones/Boucher 1973: No. 11; (9) Lefevre, 21 March 1975: Lot 42; (10) Nagel 276A, 18 November 1978: Lot 134; Nagel 279A, 25 May 1979: Lot 73; Nagel 282A, 3 November 1979: Lot 85; (11) Hali 4/3, 1982: 14; (12) Hali 5/3, 1983: 267: No. 13; (13) Lefevre, 25 November 1983: Lot 20; Herrmann VI, 1984: No. 87; (14) Rippon Boswell 20, 10 November 1984: Lot 97; (15) ORR 8/2, 1988: 6; (16) Sotheby's London, 19 October 1994: Lot 1; (17) Reuben II, 2001: No. 9; (18) d'Heurle/Munkacsi/Saunders 2003: No. 4; (19) Rippon Boswell 70, 2007: Lot 120 (asymmetrical open right knotted)

– 6 rows of Sarïq *chuval gül*: (19) Lefevre, 8 March 1985: Lot 46; Nagel 288A, 8 November 1980: Lot 99

– Fragments: (20) Grote-Hasenbalg 1922: Plate 85; (21) Hoffmeister 1980: No. 60; (22) Hodenhagen 1997: No. 13; (23) Rippon Boswell 64, 2004: Lot 102

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, ivory and brown
Pile:	Wool, 2Z, some 3Z 6 colours – Red; orange; blue; blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Horiz. 33 × 50 vert. = 1650 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	David Reuben; London, January 2003

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-26225
Radiocarbon age:	225 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1639–1680 (46.3%) AD 1737–1805 (47.0%) AD 1934–1947 (6.7%)

50

Teke

Balkhan Mountains or Akhal Oasis

Ensi; with “candelabra” or “horse-shoe” (*gopuz*) border
114 × 156 cm / 45 × 61½ in.
18th century

Private collection
Published: (1) Loges 1978: No. 4; (2) Pinner/Franses 1980: Fig. 296, colour plate XIV; (3) Hodenhagen 1997: No. 89

Comparable pieces

(1) Mumford 1915: Plate XXI; Dilley 1959: No. LIII; Pinner/Franses 1980: Fig. 333; (2) Eiland 1973: Fig. 15; Eiland 1976: Fig. 114b; Pinner/Franses 1980: Fig. 335; (3) McCoy Jones/Boucher 1976: No. 2; Pinner/Franses 1980: Fig. 334; (4) Bernheimer 1977: 29 bottom; (5) Schürmann 1979: 205; (6) Bausback 1982: 129; (7) Jourdan 1989: No. 60; (8) Hali 90, 1997: 162; Bonhams, 28 January 1997: Lot 30; (9) Rippon Boswell 70, 2007: Lot 184; (10) Van Ham Kunstauktionen, 27. Oktober 2007: Lot 352b; (11) Rippon Boswell 83, 2013: Lot 39

– With “meander” (Sarïq) border: (12) Dunn 1910: 116; Pinner/Franses 1980: Fig. 320; (13) Grote-Hasenbalg 1922: Plate 89; Pinner/Franses 1980: Fig. 319; Hali 132, 2004: 98; (14) Orendi 1930: Vol. 2, p. 294, Abb. 1024; Hawley 1913: Plate 52; Pinner/Franses 1980: Fig. 321; (15) Ercoli 1942: 217; Pinner/Franses 1980: Fig. 328; (16) Lefevre, 28 November 1975: Lot 1; Pinner/Franses 1980: Fig. 325; (17) Bernheimer 1977; Frontispiece; Pinner/Franses 1980: Fig. 329; Andrews et al. 1993: No. 22; (18) Nagel 267, 23 April 1977: Lot 60; Pinner/Franses 1980: Fig. 322; (19) Pinner/Franses 1980: Fig. 266; Rippon Boswell 62, 2004: Lot 24; Hali 132, 2004: 96; (20, 21) Pinner/Franses 1980: Figs. 324, 327; (22) Pinner/Franses 1980: Fig. 326; Hoffmeister 1980: No. 20: (23) Herrmann V, 1983: No. 78; Lefevre, 17 June 1983: Lot 38; (24) Rippon Boswell 38, 1993: Lot 77; Pinner/Franses 1980: Fig. 323; (25) Spuhler 1987: No. 133; Pinner/Franses 1980: Fig. 331; (26, 27) Jourdan 1989: No. 57, 58; (28) Rippon Boswell 39, 1993: Lot 96; (29) Nagel 23T, 19 November 1994: Lot 1261; (30) Rippon Boswell 40, 1994: Lot 94; (31) Moshkova 1970 (1996): Fig. 86; (32) Ledermann 1996: No. 22; (33) Nagel 31 T, 10 November 1998: Lot 145; (34) TKF Graz 1999: Plate 67; Christie’s London, 6 April 2006: Lot 91; (35) Nagel 35 T, 7 November 2000: Lot 316; (36) Nagel 37 T, 6 November 2001: Lot 169; (37) Sotheby’s London, 30 April 2003: Lot 62; (38) Rippon Boswell 60, 2003: Lot 88

– With varying “tree design” borders: (39) Neugebauer/Orendi 1909: Abb. 143; (40) Clark 1922: 116; Pinner/Franses 1980: Fig. 345; (41) Sterner/Kinch 1929: Plate 122; Pinner/Franses 1980: Fig. 338; (42) Campana 1966: Fig. 159; Pinner/Franses 1980: Fig. 347; (43) Bausback 1969: 77; (44) Lefevre, 16 May 1975: Lot 12; (45) Lefevre, 8 October 1976: Lot 1; (46) Beresneva 1976: No. 33; (47) Sotheby’s London, 10 December 1976: Lot 206; Pinner/Franses 1980: Fig. 336; (48) Bernheimer 1977: 29 top; (49–51) Bausback 1977: 167, 173, 174; (52) Loges 1978: No. 5; Pinner/Franses 1980: Fig. 341; (53) Bausback 1978: 487; (54–58) Straka/Mackie 1978: No. 18–22; Eiland 1990: No. 128 a; Pinner/Eiland 1999: Plate 17; (59–67) Pinner/Franses 1980: Figs. 330, 337, 340, 342–344, 346, 348, 349; (68) Mackie/Thompson 1980: No. 45; Dodds/Eiland 1996: No. 194; Eiland 2003: 173; Hali 132, 2004: 104; (69) Tzareva 1984: No. 34; (70) Herrmann 2, 1990: No. 56; (71, 72) Eiland 1990: No. 128 a & b; Pinner/Eiland 1999: Plate 17, 18; (73) Rippon Boswell 33, 1991: Lot 126; (74) Rippon Boswell 34, 1991: Lot 133; (755) Nagel, 17 October 1992: Lot 2191; Hodenhagen 1997: No. 84; (76–79) Pinner 1993: Plates 12–15; (80) Rippon Boswell 38, 1993: Lot 44; (81) Elmby II, 1994: No. 2; (82) Moshkova 1970 (1996): Fig. 90; (83) Elmby III, 1996: No. 2; (84) Nagel, 11 May 1999: Lot 62; (85) Hali 112, 2000: 119; (86) Rippon Boswell 57, 2001: Lot 174; (87, 88) Eiland 2003: 174, 175; (89) Woolley & Wallis, 13 October 2003: Lot 492; (90) Rippon Boswell 68, 2006: Lot 30

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory, some brown fibres
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; height 2–5 mm 6 colours – Red; light orange-red; dark blue; blue-green; brown; ivory;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right One row of symmetrical knots along both edges Horiz. 34–36 × 45–47 vert. = 1530–1692 knots/dm^2; 1:1.3
Selvages:	Not original
Ends:	Bottom: Original not extant; Top: Up to 3.5 cm of tabby, wefts in ivory wool, 2Z, folded to the back and sewn
Examined by:	Jürg Rageth; Riehen, May 2007

Dating

No radiocarbon dating performed

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

51

Teke

Balkhan Mountains

Germech
79 × 33 cm / 31 × 13 in.
16th or 17th century

Private collection
Published: (1) Hali 124, 2002: 87; (2) Tzareva 2011: No. 35

Comparable pieces

(1) Azadi 1970: Plate 23c; Azadi 1975: No. 22; Hali 1/1, 1978: 31; (2) Hali 2/4, 1980: 309, fig. 17; (3) Tzareva 1984: No. 42; Boguslavskaya 2001: No. 6; (4) Jourdan 1989: No. 87; (5) Elmby I, 1990: No. 8; (6) Pinner 1993: No. 17; (7) Moshkova 1970 (1996): 46, fig. 3; (8) Elmby III, 1996: No. 9; Rippon Boswell 78, 2011: Lot 171 (not reproduced in the catalogue); (9) Hali 86, 1996: 122; (10) Rippon Boswell 80, 2012: Lot 139

– Teke *germech* with other field designs: (11) Jourdan 1989: No. 89; (12) Andrews et al. 1993: No. 24; Skinner Boston, 21 September 1996: Lot 82; (13) Hali 74, 1994: 18; (14) Moshkova 1970 (1996): Fig. 92

– *Germech* from other Turkmen groups: (15) Hoffmeister 1980: No. 49 (Arabachi); (16) Hali 37, 1988: 40 (Arabachi); (17) Rippon Boswell 62, 2004: Lot 110 (Ersarï)

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z_2S (loosely plied), olive bown
Pile:	Wool, 2Z, some 3Z; Silk 2Z; height up to 5 mm 11 colours – Wool: Cherry-red (Ho 11–2); claret; purple-red; purple and ivory mix spun and plied together, 3Z; orange-pink; green-blue; dark turquoise; dark blue; olive-brown; ivory (corroded) Silk: Magenta/pink (Ho 11–1)
Groudweave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – One row of symmetrical knots along the right side edge – Offsetting by missed warp; packing knots of different colours; sharing; Horiz. 32–40 × 70–64 vert. = 2496–2940 knots/dm²; 1:1.86
Selvages:	Remains of dark blue wrapping over two warps
Ends:	Top end: Red and ivory tabby, folded over to the back and sewn down; remanins of stiching Lower end: Red and ivory tabby, damaged
Examined by:	Elena Tsareva; after Tsareva 2011: 156, no. 35

Dyes

Ho 11-1 magenta, s, Z:	Mexican or Armenian cochineal
Ho 11-2 red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul (TLC analysis)

Dating

Lab. no.:	ETH-18900.1/.2
Radiocarbon age:	290 ± 35 y BP
$\delta^{13}C$:	-20.7 ± 1.0
Calibrated age ranges: (95.4% confidence limit)	AD 1492–1611 (67.1%) AD 1613–1670 (32.7%) AD 1792–1792 (0.1%)

52

Teke

Balkhan Mountains or Akhal Oasis

Kapunuk; curled leaf meander design
84.5 (24) × 81 (21) cm / 33½ (9½) × 32 (8½) in., without fringes, fragment
18th or early 19th century

Private collection
Unpublished

Comparable pieces

(1) Reed 1966: No. 20; (2) McCoy Jones / Boucher 1973: No. 8; (3) Benardout 1974: No. 27; (4) Gombos 1975: No. 30; (5) Bausback 1975: 294; Bausback 1978: 443; (6) Loges 1978: No. 14; (7) Lefevre, 30 November 1979: Lot 4; Bausback 1981b: 133; (8) Bausback 1979: 119; (9) Hali 2/4, 1980: 309, fig. 18; (10) Rippon Boswell 10, 15 November 1980: Lot 73; (11) Pinner/Franses 1980: No. 410; (12) Hoffmeister 1980: No. 54; (13) Rippon Boswell, 10 May 1980: Lot 15; (14) Lefevre, 16 October 1981: Lot 7; (15) Eskenazi 1983: No. 264; (16) Tzareva 1984: No. 36; (17) Herrmann VIII 1986: No. 100; (18) Rippon Boswell 28, 19 November 1988: Lot 87; (19) Jourdan 1989: No. 93; (20) Herrmann 3, 1991: No. 56; (21) Andrews et al. 1993: No. 23; OCTS I, 1985: 135, fig. 9; (22) Dodds/ Eiland 1996: No. 249; Sotheby's NY, 6 June 2007: Lot 14; (23) Concaro / Levi 1999: No. 117; (24) Besim 2 1999: No. 67; (25) Nagel 49T, 2007: Lot 1

– Teke *kapunuk* with slightly varying curled leaf meander design: (26) Felkersam 1914 (1979); (27) McMullan/Reichert (1970): No. 69; (28) Cat. Basel 1980: 121; (29) Tzareva 1984: No. 37; Dodds/Eiland 1996: No. 139; (30) Sotheby's London, 18 April 1984: Lot 475; TKF Wien 1986: No. 110; (31) Mackie / Thompson 1980: No. 46; Sotheby's NY, 5 November 1983: Lot 176; (32) Sotheby's NY, 5 November 1983: Lot 176; (33) Eiland 1990: No. 110; (34) Sotheby's NY, 17 September 1992: Lot 2; (35) Rippon Boswell 38, 1993: Lot 138; (36) Elmby II, 1994: No. 7; (37) Nagel, 7 May 1994: Lot 1259; Dodds/Eiland 1996: No. 140; (38) Hali 79, 1995: 68; Skinner Boston, 8 April 1995: Lot 98; (39) Dodds/Eiland 1996: Plate 248; (40) Pinner/Eiland 1999: Plate 24; (41) Rippon Boswell 63, 2004: Lot 111; (42) Rippon Boswell 64, 2004: Lot 127; (43) Christie's London, 16 April 2007: Lot 22

– Teke *kapunuk* with *mafrash aq yüp* design: (44) Pinner/Franses 1980: Fig. 406, plate XXIII; (45) Sotheby's NY, 16 December 1993: Lot 14; Elmby II, 1994: No. 8

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warph:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of light brown to brown fibres
Pile:	Wool, 2Z, some 3–4Z; silk 2Z; height 2 mm 9 colours – Wool: ivory; brownish red; orange-red; bluish red, 3–4Z (Ra 453-2); dark blue; medium blue; blue-green; dark brown Silk: Magenta (Ra 453-1)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 48–50 × 78–90 vert. = 3744–4500 knots/dm^2; 1:1.6
Selvages:	2 warp units (2,2) overcast with medium blue wool, Z (Mallett 1998, 15.21)
Ends:	Bottom vertical panels: Ca. 1.5 cm of weft faced tabby, wefts in ivory wool, 2Z, with attached fringe in brownish red, orange-red, dark blue and blue-green wool Horizontal panel: Ca. 1.5 cm of weft faced tabby, wefts in ivory wool, 2Z, folded to the back and sewn, with attached fringe like vertical panel Top: Ca. 1.5 cm of weft faced tabby, wefts in ivory and brownish red wool, 2Z, folded to the back and sewn
Examined by:	Jürg Rageth; Riehen, January 2005

Dyes

Ra 453-1 light crimson, s, 2Z:	Mexican or Armenian cochineal
Ra 453-2 bluish red, w, 3–4Z:	lac dye
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

53

Teke (?)

Balkhan Mountains or Akhal Oasis

Aq yüp (details of fragment a, top; b, bottom)
(a) 24 × 236/9½ × 93
(b) 24 × 266 cm 9½ × 104¾ in., 2 fragments
17th or 18th century

Private collection
Unpublished

Comparable pieces

(1) Rippon Boswell 20, 1984: Lot 73 (additional fragment to cat. no. 53)

– Related pieces: (2) TKF Wien 1986: No. 124; Christie's NY, 8 April 1989: Lot 135; (3) Rippon Boswell 32, 1990: Lot 66; (4) Dodds/Eiland 1996: No. 243a; (5) Sotheby's NY, 15 December 2000: Lot 57; Isaacson 2007: No. 13

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

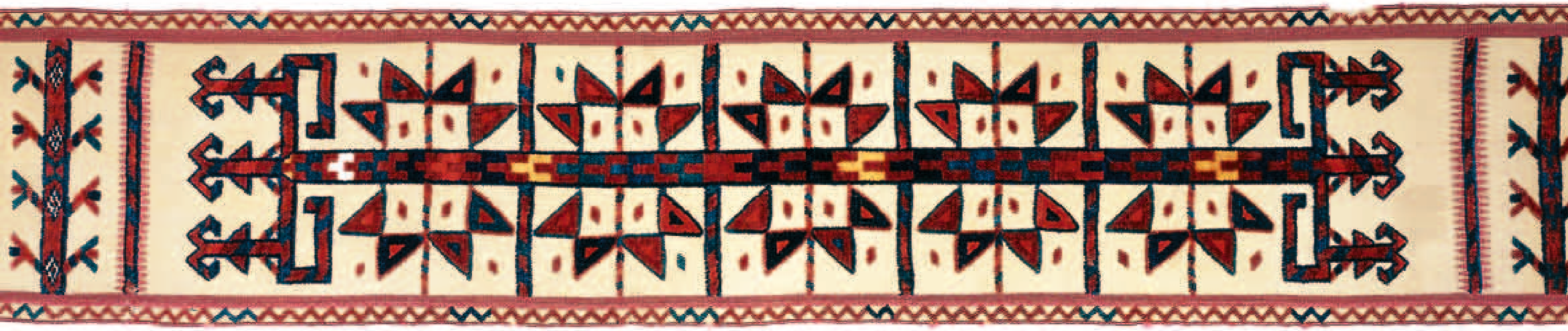
Warp:	Wool, Z_2S, dark ivory
Weft:	Wool, 2Z, ivory Stripes of inlaid brocading in brownish red wool
Pile:	Wool, 2Z, some Z, some 3–4Z; cotton, 2Z; silk, Z; height 2 mm 10 colours (8 on wool, 1 on cotton, 1 on silk) – Wool: Brownish red; orange-red; bright orange-red (Ra 467-3); crimson, 4Z (Ra 467-1); pale crimson, 4Z (Ra 467-2); dark blue; medium blue, 3Z; yellow, Z; medium blue-green Silk: Bright crimson (6 knots only); Cotton: White
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 202–214 warps by 67 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8) Horiz. 50–53 × 67 vert. = 3584/3383 knots per dm^2
Selvages:	Possibly not original
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 467-1 crimson, w, 4Z:	Mexican cochineal (+ tin), madder and a trace of young fustic
Ra 467-2 pale crimson, w, 4Z:	Mexican cochineal, madder and a trace of young fustic
Ra 467-3 orange-red, w, 2Z:	Madder (+ tin)
Examined by:	KIK-IRPA Brussles

Dating

Lab. no.:	ETH-27708.1/.2
Radiocarbon age:	160 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1668–1713 (17.7%) AD 1724–1831 (47.6%) AD 1833–1892 (6.2%) AD 1917–1959 (18.5%)




54

Teke

Akhal Oasis

Asmalïq; animal tree design with curled leaf meander border
130 × 69.2 cm / 51 × 27¼ in.
18th or early 19th century

Fine Arts Museum of San Francisco
Gift of Marie and George Hecksher
Published: (1) Sotheby's NY, 1 December 1984: Lot 97; (2) Dodds/Eiland 1996: No. 241; (3) Hali 25 years anniversary edition, 2004: 37, top

Comparable pieces

No directly comparable piece published

- Comparable Teke animal tree *asmalïq*:(1) Felkersam 1914 (1979); Pinner/Franses 1980: 231; No. 144 in this vol.; (2–6) Pinner/Franses 1980: No. 233–236, (colour plates X & XXVII); Tzareva 1984: No. 45 (Pinner/Franses no. 233); Rippon Boswell 62, 2004: Lot 78 (Pinner/Franses 1980: No. 234); (7) TKF Wien 1986: No. 111; (8) Rippon Boswell 27, 1988: Lot 85; Andrews et al. 1993: No. 28; (9) Sotheby's London, 16 October 1996: Lot 82

- Comparable Teke bird *asmalïq*: (10) Felkersam 1914 (1979); Pinner Franses 1980: Fig. 214; No. 144 in this vol.; (11, 12) Goguel 1927: 254, fig. A & B; Pinner/Franses 1980: No. 216, 217; Tzareva 1974: No. 46; (13) Herrmann I, 1978: Cover; (14) Sotheby's London, 29 March 1978: Lot 99; Hali 1/1, 1978: 27, adv.; Pinner Franses 1980: No. 230; (15 – 22) Pinner/Franses 1980: Nos. 215, 222 – 225, 228 (colour plates VI – IX); Tzareva 1984: No. 43, 44, 46 (Pinner/Franses 1980: No. 215, 217, 223); (23) Eskenazi 1983: No. 263; Thompson 1983: 92; (24) Hali 33, 1987: 12; Hali, 25 years anniversary edition, 2004: 37, bottom left; (25) Christie's NY, 6 December 1988: Lot 35; ORR 8/6, 1988, p. 9; (26) ORR 8/2, 1988: 46–47; ORR 8/6, 1988: 50; (27) Sotheby's NY, 20 January 1990: Lot 65; Herrmann 2, 1990: No. 57; (28) Sotheby's NY, 10 April 1991: Lot 114; (29) Herrmann 3, 1991: No. 57; Ghereh no. 19: 55; Dodds/Eiland 1996: No. 240; (30) Hali 109, 2000: 146; (31) Christie's London, 29 April 2004: Lot 65

- Other Turkmen *asmalïq with* animal tree design: (32) Pinner/Franses 1980: No. 240 (colour plate XI); (33) Dodds/Eiland 1996: No. 242; Hali, 25 years anniversary edition, 2004: 37, bottom left

For a discussion, see Vol. 2
For radiocarbon dating, details see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory and some light brown fibres
Weft:	Wool, 2Z, light brown, some orange (one single weft light brown, Z, plied with orange, Z, 2Z (working unit)
Pile:	Wool, 2Z; height 2 mm 6 colours – Brownish red; light orange; blue; blue-green; medium brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 42–48 × 64–71 vert. = 2688–3408 knots/dm²; 1:1.5
Selvages	Two warp units (2,2) reinforced with orange wool
Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, March 2008

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22412.1/.2
Radiocarbon age:	90 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1691–1737 (27.1%) AD 1812–1933 (71.8%) AD 1955–1959 (1.2%)

55

Teke

Akhal Oasis

Torba; 3 × 2 *chuval gü*l field and floral border design
105 × 45 cm / 41¼ × 18 in.
18th century

Private collection
Published: Hodenhagen 1997, no. 93

Comparable pieces

- With floral borders: (1) Hoffmeister 1980: No. 26; (2) Lefevre, 25 November 1983: Lot 21; (3) Rippon Boswell 59, 2002: Lot 170; (4–7) Rippon Boswell 62, 2004: Lot 57, 102, 103, 107; (8) Rippon Boswell 64, 2004: Lot 138

- With various types of borders : (9–11) McMullan/Reichert (1970): No. 58–60; (12) Lefevre, 8 October 1976: Lot 5; (13, 14) Hali 1/1, 1978: 79; (15) Cat. Basel 1980: 129; (16) Cassin/Hoffmeister 1988: Plate 8; (17) Herrmann V, 1983: No. 81b; (18) Rippon Boswell 26, 1987: Lot 62; Herrmann X, 1988: No. 91b; (19) O'Bannon 1990: No. 50; (20) Elmby III, 1996: No. 4; (21) Dodds/Eiland 1996: No. 220; (22) Rippon Boswell 47, 1997: Lot 66; (23) Elmby IV, 1998: No. 7; (24) Pazyryk Gesellschaft 1998: Plate 14; (25) Hali 122, 2002: 77; (26) Elmby V, 2003: No. 3; (27, 28) Rippon Boswell 61, 2003: Lot 84 & 107; (29, 30) Rippon Boswell 62, 2004: Lot 82 & 86; (31) Rippon Boswell 68, 2006: Lot 88; (32) Plate 55

- With *kochanak* borders: (33) Lefevre, 8 October 1976: Lot 6; (34) Loges 1978: No. 6; (35) Thompson 1983: 38; (36) Christie's NY, 8 April 1989: Lot 105; (37) O'Bannon 1990: No. 46; (38) Rippon Boswell 32, 1990: Lot 154; (39, 40) Pinner 1993: No. 26, 27; (41, 42) Sotheby's NY, 16 December 1993: Lot 10 & 13; (43–46) Elmby II, 1994: No. 3–5; (47, 48) Dodds/Eiland 1996: No. 219 and 225; (49) Benardout 1996: No. 62; (50–52) Hodenhagen 1997: Nos. 80, 91, 95; (53, 54) Elmby IV, 1998: Nos. 5 and 6; (55) Rippon Boswell 55, 2000: Lot 100; (56) Elmby V, 2003: No. 4; (57–63) Rippon Boswell 62, 2004: Lot 26, 35, 48, 56, 90, 98, 100; (64) Rippon Boswell 66, 2005: Lot 108; (65) Rippon Boswell 68, 2006: Lot 55

- Cf. *torba* cat. nos. 56 and 57

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool (?), 2Z, light brown
Pile:	Wool, 2Z, some Z; Cotton, Z; height 2 mm 6 colours (+ some white cotton) – Wool: Saturated medium red; orange-red; dark blue, some Z; greenish medium blue, some Z; brown, some Z; light ivory (bleached?), some Z cotton: white (cotton, Z, plied with wool, Z, 2Z), some knots only
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 51–54 × 95–113 vert. = 4845–6102 knots/dm^2; 1:2
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, January 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

56

Teke
Balkhan Mountains

Torba; 3 × 2 *chuval gül* field, and *naldag/pseudo-Kufic* border design
99 × 42 cm / 39 × 16½ in.
16th or 17th century

Hoffmeister Collection, Esbach
Published: (1) Hoffmeister 1980: No. 25; (2) Hali 102, 1999: 69; (3) Tsareva 2011: No. 40

Comparable pieces
(1) Cassel-Pihl et al. 2003: 204–207, no. 52A

– Teke *torba* with *naldag/pseudo-Kufic* border design: (1) Lefevre, 9 February 1979: Lot 1; (2) Sotheby's NY, 16 December 1993: Lot 18; (3) Cat. no. 145

– Other Turkmen *torba* with a stilized *naldag/pseudo-Kufic* border design: (4) Jourdan 1989: No. 32, Sarïq; (5, 6) Hodenhagen 1997: No. 10, Sarïq; no. 53, "Eagle"*gül* group II (?); (7, 8) Christie's London, 5 April 2011: Lot 151 and 182, both Ersarï

– Turkmen *khordjin* with *naldag/pseudo-Kufic* stripe design: (4) Bogolyubov 1908/09 (1973): No. 43; (5) Jourdan 1989: No. 36; (6) Sotheby's NY, 16 December 1993: Lot 22; (7)Moshkova 1970 (1996): Fig. 85

– "Eagle"*gül* group II *torba* with the same secondary motif ("satellite"*gül*): Cf. cat. no. 96

– For other Teke *torba* cf. cat. nos. 55, 57–59

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, light mix
Weft:	Wool, light brown and ivory, Z
Pile:	Wool, 2Z, some 3Z, 4Z; cotton, 2Z; height 3 mm 11 colours – Cherry-red, 3Z; cherry (abrash), 3Z, 4Z; orange (Ra 719-1); green (abrash), 4Z; green-blue; 2 shades of mid-blue; dark blue; dark brown; ivory, 3Z Cotton: Light-blue
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 40 × 54–92 vert. = 2160 – 3680 knots/dm²; 1:1.8
Selvages/Ends:	Original not extant
Ends:	Original not extant
Analyse:	Elena Tsareva; after Tsareva 2011: 156, no. 40

Dyes

Ra 719-1 light orange, w:	Most probably Lady's Bedstrow or Yellow Bedstraw (*Galium verum* L.) TLC Analysis Pseudopurpurin exclusively; madder (*Rubia tinctorum* L.), Indian madder (*Rubia cordifolia*) and Japanese madder (*Rubia akane* Nakel) can be excluded (Harald Böhmer)
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-17366.1/.2
Radiocarbon age:	375 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1449–1535 (57.9%) AD 1552–1640 (42.1%)

57

Teke

Akhal or Merv Oasis

Torba; 3 × 1 (6 × ½) *chuval gül* design
115 × 44 cm / 45¼ × 17¼ in.
Mid 19th century

Private collection
Published: Elmby IV, 1998: No. 8

Comparable pieces

(1) Sotheby's London, 15 October 1980: Lot 115; Hali 3/3, 1981: 255; (2) TKF 1986: No. 109; (3) Cassin/Hoffmeister 1988: Plate 24; (4) Rippon Boswell 28, 1988: Lot 89; (5) Christie's NY, 8 April 1989: Lot 106; (6) Sotheby's NY, 12 April 1996: Lot 29; (7) Hali 145, 2006: 101, Teke or "Eagle" *gül* group II

– Other Turkmen *torbas* with "Eagle" *gül* group II *torba* design composition: (8) Hali 103, 1999: 123; (9) Cat. no. 114

– For "Eagle" *gül* group II *torba,* see comparable pieces to cat. no. 114

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, mix of ivory and some brown fibres
Weft:	Wool, 2Z, mix of ivory and some brown fibres, some blue and red – One short blue weft in lower border – Three short red wefts (of 12 mm length only), in field, upper border, and 14 cm from bottom in right side *chemche gül*
Pile:	Wool, 2Z 7 colours – medium red; medium orange-red; dark blue; medium blue (in *chemche gül* only); blue-green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots; alternate warps slightly depressed in some areas Area of 2 cm with two wefts per row of knots on complete width of *alem* directly underneath the lower border
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – 3 to 5 symmetrical knots at both edges horiz. 46–47 × 92–92 vert. = 4232–4324 knots/dm²; 1:2
Selvages:	Remains of 2 warp units (2,2) originally reinforced (?) with red wool (Mallett 1998: 15.10)
Ends:	Lower end: Original not extant Upper end: 0.5 cm of weft faced tabby, wefts medium red and ivory wool, both 2Z; (originally folded to the back and sewn)
Examined by:	Jürg Rageth; Riehen, March 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

58

Teke

Balkhan Mountains or Akhal Oasis

Torba; 4 × 3 small *chuval gül* design
122 × 51 cm / 48 × 20 in.
18th or early 19th century

Collection of Nancy Jeffries and Kurt Munkacsi, New York; col. no. 1384
Published: Nagel, 9 November 1999: Lot 235

Comparable pieces

(1) Rippon Boswell 47, 1997: Lot 140; Hali 94, 1997: 129

– Other Teke pieces with the same border: (2) Hoffmeister 1980: No. 47; Andrews et al. 1993: Nno. 31; (3) Pinner 1993: No. 42; (4) Andrews et al. 1993: No. 30; (5) Benar-dout 1996: No. 61; (6) Pazyryk Gesellschaft 1998: Plate 14; (7) Benardout 2002: 19

– Sarïq pieces with the same border: (8) Tzareva 1984: No. 20

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool 8 colours – Shades of saturated red; medium orange; medium blue; light blue; blue green; medium brown; light brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 47 × 70 vert. = 3290 knots/dm²; 1:1.5
Selvages:	Remains of 4 warp units (2,2,2,2); inner 2 warp units (2,2) knotted with asymmetrical knot, open right, in field colour; outer 2 warp units (2,2) double looped with red wool (Mallett 1998, 15.67)
Ends:	Original not extant
Examined by:	Robert Pittenger; New York

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22415.1/.2
Radiocarbon age:	140 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1674 – 1786 (44.4%) AD 1802 – 1898 (37.8%) AD 1911 – 1958 (17.8%)

59

Turkmen

Teke and/or Qaradashlï influence
Akhal Oasis

Torba; 3 × 2 Qaradashlï *gül* design
110 × 35 cm / 43¼ × 13¾ in.
18th (?) or 19th century

The Russian Museum of Ethnography, St. Petersburg
S.M. Dudin collection, no. 26-27
Purchased in Merv in 1901, described as Teke *mafrash*
Published: (1) Tsareva 1984: No. 27; (2) Eiland 1990: No. 272; (3) ORR 11/1, 1990: 84; (4) Dodds/Eiland 1996: No. 130

Comparable pieces

No directly comparable piece known

- Teke pieces with Qaradashlï *gül*: (1) Thacher 1940 (1978: Plate 22; (2) McMullan 1965: No. 131; (3) Loges 1976: No. 7; (4) Mackie/Thompson 1980: No. 37; (5) Herrmann VII, 1985: No. 73a; (6) Eiland 1990: No. 116; Pinner/Eiland 1999: No. 23; (7) O'Bannon 1990: No. 51; (9, 10) Sotheby's NY, 16 December 1993: Lot 4 & 15; Hali 74, 1994: 75; (11) Dodds/Eiland 1996: No. 221 and 232; (12, 13) Hodenhagen 1997: No. 85 and 90; (14) Hali 109, 2000: 147; (15) Nagel 48T, 8 May 2007: Lot 156

- For other Turkmen pieces with Qaradshlï *gül* cf. cat. nos. 36 and 87

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown and red
Pile:	Wool, 2Z, some Z, 3Z or 4Z; silk, 2Z; height 2–3 mm 8 colours – Wool: red, some 4Z, Z; orange, some Z; blue; dark blue; green; brown; ivory, some 3Z Silk: Crimson
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Symmetrical Some offset knotting Horiz. 42–44 × 75–100 vert. = 3150–4400 knots/dm²; 1:2
Selvages:	Overcasting in red wool
Ends:	Top: weft faced plain weave, wefts in red and ivory wool, folded to the back and sewn Bottom: plain weave, wefts in ivory wool, cut; remains of multi-coloured fringe knotted on 4 warps
Examined by:	Elena Tsareva; St. Petersburg

Dyes

Visual inspection does not suggest the use of insect dyestuffs on wool
No chemical analysis performed

Dating

Lab. no.:	ETH-18917.1/.2
Radiocarbon age:	170 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit:)	AD 1661–1710 (19.0%) AD 1724–1827 (50.6%) AD 1837–1889 (11.3%) AD 1917–1960 (19.1%)

60

Teke

Akhal or Merv Oasis

Chuval; 4 × 4 small *chuval gül* design
119 × 73 cm / 46¾ × 28¾ in.
18th century

Private collection
Unpublished

Comparable pieces

(1) Hali 1/2, 1978: 39; (2) Reuben I, 1998: No. 8; (3) Besim 2, 1999: No. 69; (4) OCTS V/1, 1999: 92; (5) Cat. no. 61

– Other Teke pieces with the same border design: (6) Cat. Basel 1980: 128; (7) Elmby III, 1996: No. 4; (8) Rippon Boswell 61, 2003: Lot 107

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, dark brown
Pile:	Wool, 2Z; height: worn, in some areas up to 2 mm 7 colours – Red; orange red; dark blue; blue-green; yellow; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Asymmetrical, open right Horiz. 45–49 × 87–89 vert. = 3915–4361 knots/dm²; 1:1.9
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, September 2003

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

61

Teke

Akhal or Merv Oasis

Chuval; 4 × 4 small *chuval gül* design
111 × 75 cm / 43¾ × 29½ in.
ca. 1850 – 1875

Private collection
Published: cat. Basel 1980, p. 127

Comparable pieces

Cf. cat. no. 60

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 11

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of light brown fibres
Pile:	Wool, 2Z; Cotton, 2Z; height 3 mm 9 colours – Wool: Reddish purple; orange; crimson (Ra 265-1); light crimson; dark blue; light blue; dark green; brown; Cotton: White (all white is cotton)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Asymmetrical, open right Horiz. 41 × 86 vert. = 3526 knots/dm²; 1:2.1
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, May 2003

Dyes

Ra 265-1 crimson, w, 2Z:	Mexican cochineal (tin excluded) and a trace of madder
Examined by:	KIK-IRPA Brussels

Dating

Dated post 1850 by the use of Mexican cochineal (without tin treatment)
No radiocarbon dating performed

62

Teke

Merv Oasis

Chuval; 3 × 2 Salor *gül* design
124 × 80 cm / 48¾ × 31½ in.
Mid 19th century

Private collection
Unpublished

Comparable pieces

– 3 × 1 (6 × ½) Salor *gül* design: (1) Loges 1978: No. 9; (2) Mackie/Thompson 1980: No. 31; (3) Lefevre, 8 March 1985: Lot 48; (4) Rippon Boswell 32, 1990: Lot 153; (5) Pinner 1993: No. 18; (6) Sotheby's NY, 16 December 1993: Lot 20; (7) Moshkova 1970 (1996): Fig. 89; (8) Rippon Boswell 47, 1997: Lot 139; (9) Pinner/Eiland 1999: Plate 19; (10, 11) Benardout 2002: 11, pair; (12) Rippon Boswell 58, 2002: Lot 158; (13) Elmby V, 2003: No. 2; (14) Rippon Boswell 62, 2004: Lot 25

– 3 × 2 Salor *gül* design: (15) Neugebauer/Orendi 1909: No. 140; (16) Reed 1966: No. 3; Denny 1979: Plate 21; (17, 18) Azadi 1970: No. 19a and 21b; Azadi 1975: No. 19 & 20; (19–21) Benardout 1974: No. 8–10; (22) Bausback 1976: 265; (23) Bausback 1978: 489, top; (24, 25) Engelhardt II, 1978: No. 322 and 332; (26) Bausback 1979: 144; (27) Mackie/Thompson 1980: No. 32; (28, 29) Jourdan 1989: No. 63 and 64; (30) O'Bannon 1990: No. 27; (31) Gantzhorn 1990: Fig. 643; (32) Rippon Boswell 34, 1991: Lot 28; (33) Boguslavskaya 2001: No. 9; (34, 35) Benardout 2002: 13, pair; (36) Rippon Boswell 62, 2004: Lot 91

– 3 × 3 Salor *gül* design: (37) Jourdan 1989: No. 65; (38) Cat. no. 63

– 2 × 4 Salor *gül* design: (39) McMullan/Reichert (o.J.): No. 71

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 11

Structure

Warp:	Wool, Z_2S
Weft:	Wool, 2Z, mix of ivory, grey, and brown fibres
Pile:	Wool, 2Z, some 2–3Z 9 colours – Red; crimson (Ra 290-1); scarlet, 2–3Z (Ra 290-2), 14 knots only in lower row right side Salor *gül*;purple, 2–3Z, (Ra 290-3); dark blue; medium blue; blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 54–57 × 80–88 vertical = 4320–5016 knots/dm²; 1:1.5
Selvages:	Left side: 3 warp units (1,2,2) reinforced with red wool, Z (Mallett 1998, 15.10); Right side: 2 warp units (2,2) reinforced with red wool, Z (Mallett 1998: 15.10)
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, January 2005

Dyes

Ra 290-1 crimson, w, 2Z:	Mexican cochineal (tin excluded)
Ra 290-2 scarlet, w, 2–3Z:	Mexican cochineal (+ tin)
Ra 290-3 purple, w, 2–3Z:	Mexican cochineal and tannin
Examined by:	KIK-IRPA Brussels

Dating

Dated by the specific use of Mexican cochineal and tin as a mordant
No radiocarbon dating performed

63

Teke

Merv Oasis

Chuval; 3 × 3 Salor *gül* design
142 × 81 cm / 56 × 32 in.
End 19th century

Private collection
Unpublished

Comparable pieces

Cf. cat. no. 62

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 11

Structure

Warp:	Wool, Z_2S; ivory, brown – Both ivory – Ivory plied with brown; some warps only
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z 8 colours – Crimson (Ra 270-1); bright red (Ra 270-2); brownish red; dark blue; medium blue; dark blue-green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 42–48 × 83–93 vert. = 3486–4464 knots/dm²; 1:2
Selvages:	Attached single loop selvage in red wool, 4Z, on two warp units (2,2) (Mallett 1998: fig. 15.69)
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, May 2003

Dyes

Ra 270-1 crimson, w, 2Z:	Mexican cochineal (tin excluded) and a trace of madder
Ra 270-2 bright red, w, 2Z:	Ponceau RR (acid red 26)
Examined by:	KIK-IRPA Brussels

Dating

Dated post 1880 by synthetic dyestuff
No radiocarbon dating performed

64

Turkmen

Teke (?) with Salor design
Merv Oasis

Chuval; 3 × 3 *chuval gül* design
115 × 66 cm / 45¼ × 26 in.
18th or 19th century

Collection of Nancy Jeffries and Kurt Munkacsi, New York, col. no. 1460
Published: (1) Hali 55, 1991: 99; (2) OCTS V/1, 1999: 60, fig. 1b; (3) Austrian Auction Company, 9 May 2015: Lot 213

Comparable pieces

(1) Rippon Boswell 58, 2002: Lot 72; Hali 131, 2003: 93

– Other Teke pieces with Salor design: (2) Rippon Boswell 62: Lot 81; (3) Loges 1978: No. 8; (4) Mackie / Thompson 1980: No. 38; (5) Herrmann X, 1988: No. 91a; (6) Andrews et al. 1993: No. 25; (7) Hodenhagen 1997: No. 88; (8) Rippon Boswell 62, 2004: Lot 20

– Salor *chuval* with comparable design: (9) Beresneva 1976: No. 15; (10) Mackie / Thompson 1980: No. 6; (11, 12) Andrews et al. 1993: No. 100 and 101; (13, 14) TKF Graz 1999: No. 68; (15, 16) Cat. no. 133 and 134; Tzareva 1984: No. 7 and 9

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown (mix of brown and ivory fibres); at upper and lower ends some wefts with mix of ivory, brown, and some light blue woollen fibres
Pile:	Wool, 2Z; silk, 2Z; height mostly worn, in some areas up to 2 mm 8 colours (7 on wool, 1 on silk) – Wool: Shades of brownish red (Ra 709-1); shades of orange-red (Ra 709-2); dark blue; dark greenish blue; medium greenish blue; brown (slightly faded on front side); ivory; Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – One row of stacked knots (Mallett 1998: 2.29) in orange red wool observed in the *alem*, 40 cm from right hand side Horiz. 53 – 55 × 71 – 82 vert. = 3763 – 4510 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, May 2006

Dyes

Ra 709-1 brownish red, w, 2Z:	Madder
Ra 709-2 orange-red, w, 2Z:	Madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-32417
Radiocarbon age:	25 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1699 – 1732 (18.9%) AD 1817 – 1861 (17.8%) AD 1870 – 1925 (49.5%) AD 1953 – 1966 (13.9%)

65

Teke

Akhal or Merv Oasis

Kizil chuval; 9 stripe pattern, with "cross & star" design; all pile
114 (107) × 79 cm / 45 (42) × 31 in.
First half 19th century

The Russian Museum of Ethnography, St. Petersburg
Purchased by Isamuhammedov in 1900, no. 2016-1
Published: (1) Tsareva 1993: No. 27; (2) Dodds/Eiland 1996: Plate 127

Comparable pieces

(1) Thacher 1940 (1978): No. 16; Hali 2/4, 1980: 338, fig. 2; ORR 8/2, 1988: 22; (2) Mackie/Thompson 1980: No. 34; Hali 127, 2001: 41; (3) Sotheby's NY, 16 December 1993: Lot 11; (4) Rippon Boswell 47: Lot 68; (5) Concaro/Levi 1999: No. 207; (6) Cat. no. 66

– Other Turkmen *chuval* with "cross & star" band design: (7) Reed 1966: No. 42; (8) Gombos 1975: No. 6, *alem* of Teke *khali*; (9) Loges 1978: No. 98; (10, 11) Bausback 1979: 131, Yomut *khali,* and 145, Yomut *mafrash*; Jourdan 1989: No. 175; (12) Tzareva 1984: No. 141; (13) Elmby 1, 1990: No. 41; (14) Rautenstengel/Azadi 1990: No. 30, "Eagle" *gül* III *chuval*; (15) Sotheby's London, 19 October 1994: Lot 32; (16) Moshkova 1970 (1996): Fig. 95; (17) Reuben I, 1998: No. 45; (18) Elmby IV, 1998: No. 52

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of light brown and ivory fibres
Pile:	Wool, 2Z; height 2 mm 9 colours – Red; orange-red; crimson; light bluish red; orange; dark blue; blue; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – Multiple use of offset knotting in both designed and plain bands, but not in the *alem* – 2 to 3 rows of symmetrical knots at the remaining edges 2208 (*alem*) – 5280 (design) knots/dm²
Selvages:	Remains of overcasting in red wool on three warps
Ends:	Top: Dark-blue and ivory weft faced plain weave, folded to the back and sewn Bottom: Dark blue and ivory weft faced plain weave, cut
Examined by:	Elena Tsareva; St. Peterburg 1993

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-18912.1/.2
Radiocarbon age:	90 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1686–1743 (27.7%) AD 1762–1762 (0.1%) AD 1808–1941 (70.7%) AD 1954–1960 (1.5%)

66

Teke

Akhal or Merv Oasis

Kizil chuval; 9 stripe pattern, with "cross & star" design; all-pile
109–112 × 79–81 cm / 44 × 32 in.
First half 19th century

Private collection
Unpublished

Comparable pieces

Cf. cat. no. 65

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix grey, brown, and ivory fibres
Pile:	Wool, 2Z, some 3Z; Silk, 2Z; height 2 mm 10 colours (8 on wool, 2 on silk) – Wool: Shades of reddish brown, some 3Z; orange-red; pale crimson (Ra 434-1); dark blue; light medium blue; dark blue-green; dark brown; ivory; Silk: Light crimson (insect dyed); light blue
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous in *alem* and first plain stripe 1 sinuous weft per row of knots in the designed bands and in all following plain stripes; slightly depressed in some areas
Knot:	Asymmetrical, open right – Multiple use of offset knotting for the design (Mallett 1998: ?) – Some areas with offset knotting in plain stripes – Some single rows of knots offset in *alem* and plain stripes – Some rows of 3Z knots in plain stripes Horiz. 45 × 116–132 vert. = 5220–5940 knots/dm²; designed bands, 1 weft per row of knots; 1:2.8 Horiz. 45 × 88–96 vert. = 3960–4320 knots/dm²; plain stripes, 1 weft per row of knots; 1:2.1 Horiz. 45 × 71 vert. = 3195 knots/dm²; plain *alem*, 2 wefts; 1:1.5
Selvages:	Original not extant
Ends:	Top; 2 cm tabby, wefts in reddish brown and ivory wool, 2Z, folded to the back and sewn; Bottom: Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 434-1 pale crimson, w, 2Z: Mexican cochineal, and madder	
Examined:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

67

Teke

Akhal or Merv Oasis

Kizil chuval; 9 stripe pattern, with "cross & star" design; mixed technique
106 × 82 (161) cm / 41¾ × 32¼ (63½) in.
3rd quarter 19th century

Private collection
Unpublished

Comparable pieces

(1) Azadi 1975: No. 35; (2) Housego 1978: No. 132; (3) Nagel, 3 November 1979: Lot 44 (plate 13); (4) Lefevre, 1 October 1982: Lot 52; (5) Hali 6/1, 1983: 46; Dodds / Eiland 1996: No. 212; (6) Jourdan 1989: No. 81; (7) Moshkova 1970 (1996): Fig. 95; (8) Reuben I, 1998: No. 10; (9) Pazyryk Gesellschaft 1998: Plate 8; (10) Rippon Boswell 62, 2004: Lot 45, fragment; (11) Cat. no. 67

– Cf. also cat. nos. 65 and 66

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Pile: camel (?) hair or wool (?), light brown, 2Z Plain weave: wool, 2Z;
Pile:	Wool, 1–3Z, cotton, 2Z; height 1.5 mm 10 colours – Wool: Red, 1–2Z; orange-red, Z; light crimson, 1–3Z (Ra 643-1); dark blue, 2Z; medium blue, 1–2Z; blue-green, Z; bright yellow, 1–2Z; dark brown, Z; ivory, Z Cotton: White
Plain weave:	Front: 3 colours – red (Ra 643-2); medium blue; dark blue, orange-red Back: Dark ivory
Ground weave:	Pile: weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots; Plain weave: weft faced tabby on front, tabby on side 98–100 warps by 320 wefts/dm (front)
Knot:	Asymmetrical, open right Frequent use of offset knotting for the design (Mallett 1998: 2.21) Horiz. 49–50 × 140–144 vert. = 6860–7200 knots/dm²
Selvages:	Pile: Two warp units (2,2) reinforced with red wool (Mallet 1998) Flatweave: Simple weft return
Ends:	Top: 2 cm tabby, wefts in ivory wool, 2Z, folded to the back and sewn; Bottom: 79 cm tabby, wefts in dark ivory wool, 2Z, folded to form back of *chuval*
Examined by:	Jürg Rageth; Riehen, March 2005

Dyes

Ra 643-1 light crimson, w, 1–3Z:	Mexican cochineal, madder, and young fustic
Ra 643-2 red, w, 2Z:	madder
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

68

Teke

Akhal or Merv Oasis

Kizil chuval; 9 stripe pattern, with "cross & star" design; mixed technique
115 × 82 (164) cm / 45¼ × 32¼ (64½) in.
Post 1880

Private collection; purchased in Buchara, April 2005
Unpublished

Comparable pieces
Cf. cat. no. 67

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, ivory, mixed with some brown fibres
Weft:	Pile: camel hair (?) or wool (?), 2Z; light brown; Plain weave: wool, 2Z;
Pile:	Wool, 2Z, some Z; camel hair (?), 2Z 6 colours – Brownish purple; orange-red, Z (Ra 661-2); blue; blue green; brown; dark ivory (camel hair?)
Plain weave:	Front: 3 colours – crimson (Ra 661-1); medium blue; dark brown; Back: Dark ivory
Ground weave:	Pile: weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous; Plain weave: weft faced tabby on front, tabby on back 62 – 64 warps by 216 wefts per dm (front)
Knot:	Asymmetrical, open right Frequent use of offset knotting for the design (Mallett 1998: 2.21) Horiz. 31 – 32 × 104 – 108 vert. = 3224 – 3456 knots/dm^2
Selvages:	Pile: two warp units (2,2) reinforced with red wool (Mallett 1998) Plain weave: simple weft return; blue cord attached at both sides of the *alem*
Ends:	Top: 5 cm tabby, wefts in brown and ivory wool, 2Z, folded to the back and sewn; Bottom: 82 cm tabby, wefts in dark ivory wool, 2Z, folded to form back of *chuval*
Examined by:	Jürg Rageth; Riehen, April 2005

Dyes

Ra 661-1 crimson, w, 2Z:	Mexican cochineal, probably ammoniacal cochineal, traces of madder and tannin
Ra 661-2 orange-red, w, Z:	Ponceau G (acid orange 14) and Ponceau 3RO (acid red 25)
Examined by:	KIK-IRPA Brussels

Dating

Dated post 1880 by synthetic dyestuff
No radiocarbon dating performed

69

Teke

Akhal or Merv Oasis

Ak chuval; 12 stripe pattern; all-pile
128–136 × 78 cm / 50½–53½ × 30¾ in.
Post 1880

Private collection
Unpublished

Comparable pieces

Rippon Boswell 66, 2005: Lot 60

– Other Teke all-pile *ak chuval*; (1, 2) Hali 2/3, 1979: 234

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of grey, light brown, and ivory fibres, light rose-red in places
Pile:	Wool, 2Z, some Z; height 2 mm, 9 colours – Dark crimson (Ra 464-1); med. crimson, some Z; orange-red; orange, ?Z (Ra 464-2); dark blue; medium blue; yellow; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots
Knot:	Asymmetrical, open right – Pile upside down in relation to object orientation – Edge knots in some places on both sides (Mallett 1998: 2.31) – Multiple use of offset knotting for the design (Mallett 1998: 2.21) – Single rows of knots offset in plain stripes Horiz. 44 × 112–120 vert. = 4928–5280 knots/dm²; patterned bands Horiz. 44 × 108–112 vert. = 4752–4928 knots/dm²; patterned *alem* and plain stripes; 1:2.5
Selvages:	Original not extant
Ends:	Top; 3 cm tabby, wefts in ivory wool, 2Z, folded and sewn; Bottom; Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 464-1 dark crimson, w, 2Z:	Mexican cochinel, tannin, and a trace of madder
Ra 464-2 orange, w, ?Z:	No dyes detected (colour runs, synthetic)
Examined:	KIK-IRPA Brussels

Dating

Dated post 1880 by synthetic (?) dyestuff
No radiocarbon dating performed

70

Teke

Akhal or Merv Oasis

Ak chuval; 12 stripe pattern; mixed techinque
120 × 71 cm / 47¼ × 28 in.
Post 1880

Private collection
Unpublished

Comparable pieces

(1) Felkersam 1914; (2) Reed 1966: No. 28; (3) Schürmann 1969: No. 55; (4) Azadi 1975: No. 34; (5) Bernheimer 1977: 30; (6) Mackie / Thompson 1980: No. 33; (7) Nagel, 6 May 1978: Lot 28; (8) Herrmann I, 1981: No. 101; (9) Walker 1982: No. 31; (10) Tzareva 1984: No. 53; (11) TKF Wien, 1986: No. 110A; (12) Jourdan 1989: No. 80; (13) Christie's NY, 8 April 1989: Lot 144; (14) O'Bannon 1990: No. 35; (15) Rippon Boswell 34, 1991: Lot 94; (16) Rippon Boswell 36, 1992: Lot 50; (17) Christie's NY, 16 December 1993: Lot 16; (18–21) Pinner 1993: Nos. 22–25; (22) ORR XIII, 1993: Cover; (23, 24) Moshkova 1970 (1996): Nos. 93, and 94; (25, 26) Moschkowa 1970 (1998): Fig. 57; (27) Pinner / Eiland 1999: No. 2; Christie's NY, 22 June 2005: Lot 4

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 4

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Pile: silk, ivory, 2Z (1 strand finer than the other) Plain weave: wool, 2Z; cotton, 2Z
Plain weave:	Front side: 3 colours – wool: crimson (Ra 648-1); dark blue and orange; cotton: white
Pile:	Wool, 2Z (some Z, dark brown and ivory for spotted border line); Cotton, white, 2Z (some Z, for spotted border lines); height 1.5 mm 9 colours – Wool: Crimson; orange, 2–4Z (Ra 648-2); red-brown; dark blue; yellow; dark blue-green; dark brown (for spotted border lines); ivory, Z; Cotton: White
Ground weave:	Pile: Weft faced tabby with taut warps and inserted rows of knots; 1 sinuous weft per row of knots; Plain weave: Weft faced tabby, 90 warps by 344 wefts/dm (front side)
Knot:	Asymmetrical, open right Multiple use of offset knotting for the design (Mallett 1998: 2.21) Horiz. 45 × 162 vert. = 7290 knots/dm^2; 1:3.6
Selvages:	Pile: Two warp units (2,2) reinforced with wool (Mallet 1998); Flatweave: Simple weft return
Ends:	Top: 2 cm tabby, wefts in light brown wool, 2Z, folded to the back and sewn Bottom: Original not extant
Examined by:	Jürg Rageth; Riehen, March 2005

Dyes

Ra 648-1 crimson, w, 2Z:	Mexican cochineal, probably amoniacal cochineal
Ra 648-2 orange, w, 2–4Z:	Synthetic: Acid Orange II (Orange 7) and Ponceau G (Acid Orange 14)
Examined by:	KIK-IRPA Brussles

Dating

Dated post 1880 by synthetic dyestuff
No radiopcarbon dating performed

71

Teke

Balkhan Mountains or Akhal Oasis

Khali; 4 × 9 Teke *gül* and *gurbaga* secondary motif
153 × 242 cm/60 × 95 in., fragment
16th or 17th century

Collection of Nancy Jeffries and Kurt Munkacsi, New York, col. no. 1198
Published: (1) Hali 77, 1994: 140; (2) d'Heurle/Munkacsi/Saunders 2003: Plate 5

Comparable pieces

(1, 2) Mackie/Thompson 1980: No. 26, 27; (3) Spuhler 1987: No. 129; (4) Dodds/Eiland 1996: No. 184; (5) Christie's London, 24 April 1997: Lot 419; (6) Skinner Boston, 25 April 1998: Lot 74; (7) Rippon Boswell 62, 2004: Lot 83

– Other Teke *khali* with *gurbaghe* secondary motif: (8) McMullan/Reichert (1970): No. 53; (9) McCoy Jones/Boucher 1973: No. 1; (10–13) Gombos 1975: Nos. 3, and 6–8; (14, 15) Azadi 1975: No. 3 & 5; Hali 30, 1986: 9; Rippon Boswell 62, 2004: Lot 8; (16) Lefevre, 8 October 1976: Lot 4; Thompson 1983: 64; Rippon Boswell 39, 1993: Lot 105; (17) Bausback 1977: 172; (18) Loges 1978: No. 2; (19) Bausback 1978: 482; (20) Lefevre, 9 February 1979: Lot 11; Herrmann II, 1980: No. 81; (21) Hoffmeister 1980: No. 3; (22) Edelmann NY, 14 June 1980: Lot 202; (23) Edelmann NY, 25 April 1981: Lot 276; (24) Herrmann III, 1981: No. 98; (25) Lefevre, 27 November 1981: Lot 34; (26) Edelmann NY, 24 April 1982: Lot 435; (27) Eskenazi 1983: No. 257; (28) Rippon Boswell 20, 1984: Lot 90; Jourdan 1989: No. 37; Opie 1992: 305; (29) Rippon Boswell 27, 1988: Lot 86; (30) Rippon Boswell 39, 1993: Lot 105; (31) Rippon Boswell 43, 1995: Lot 40; (32) Pinner/Eiland 1999: Plate 10; (33) Rippon Boswell 55, 2000: Lot 40; (34) Rippon Boswell 58, 2002: Lot 119; (35) Rippon Boswell 62, 2004: Lot 49

– Teke *khali* with *chemche gül* secondary motif: (36) Grote-Hasenbalg 1922, Tafel 80; (37) Thacher 1978 (1940): Plate 11; (38–40) Schürmann 1969: No. 1–3; (41, 42) Gombos 1975: No. 2, 4; (43, 44) Azadi 1975: No. 4, 6; (45) Lefevre, 21 May 1976: Lot 9; (46) Bausback 1977: 170; (47) Lefevre, 25 March 1977: Lot 7; (48) Bernheimer 1977: 7; (49) Bausback 1977: 169; (50) Loges 1978: No. 1; (51) Bausback 1978: 481; (52) Cat. Basel 1980: 118; (53) Lefevre, 4 July 1980: Lot 38; (54) Lefevre, 15 July 1983: Lot 8; (55) Rippon Boswell 30, 1989: Lot 95; (56) Sotheby's NY, 16 December 1993: Lot 12, fragment; (57) Rippon Boswell 42, 1995: Lot 124; (58) Rippon Boswell 43, 1995: Lot 74; (59) Rippon Boswell 44, 1996: Lot 103; (60–62) Pinner/Eiland 1999: Plate 11–13; (61) Rippon Boswell 55, 2000: Lot 101; (62) Rippon Boswell 62, 2004: Lot 42, fragment; (51) Rippon Boswell 66, 2005, Lot 106

Structure

Warp:	Wool, Z_2S, dark ivory
Weft:	Wool, 2Z, medium brown
Pile:	Wool, 2Z; height ca. 3 mm 6 colours – Medium red; orange red; dark blue; medium blue-green; medium brown; ivory;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 39 × 59 vert. = 2301 knots/dm²; 1:1.5
Selvages:	Original not extant
Ends:	Bottom and top; Remains of up to 3 mm weft faced tabby, wefts in light red wool, 2Z
Examined by:	Peter Saunders; New York, 2003

Dyes

No insect dyes observed by visual inspection
No chemical analysis performed

Dating

Lab. no.:	ETH-25573.1/.2/3.
Radiocarbon age:	275 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1502–1508 (0.8%) AD 1517–1605 (50.7%) AD 1620–1673 (44.7%) AD 1787–1802 (3.9%)

– Cf, also Teke *khali* plates 72–74

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

72

Teke

Balkhan Mountains or Akhal Oasis

Khali; 4 (originally 5?) × 10 Teke *gül* and Salor *khali* secondary motif
142–149 × 234–242 cm / 56 × 95 in., fragment
18th century

Private collection
Published: Lefevre London, 3 February 1978: Lot 28

Comparable pieces

– With Salor *khali* sekondary motifs: (1) Nagel 250, 30 April 1974: Lot 726; (2) Bausback 1977: 171; (3) Mackie / Thompson 1980: No. 28; (4) Hali 5/3, 1983: 251; (5) Sotheby's New York, 19 May 1984: Lot 96; (6) Jourdan 1989: No. 39; (7) Reuben I 1998: No. 4; Christie's London, 10 November 1990: Lot 30; Christie's London, 17 October 2002: Lot 29; (8) Elmby II, 1994: No. 1; (9) Rippon Boswell 44, 1996: Lot 129; (10) Sotheby's London, 15 June 2004: Lot 28; (11) Rippon Boswell 69, 2007: Lot 38; (12) Cat. no. 151

– With small *chuval gül* secondary motifs: (13) Lefevre, 18 June 1982: Lot 43; (14) Herrmann V, 1983: No. 79; (15) Rippon Boswell 32, 1990: Lot 101; (16) Rippon Boswell 38, 1993: Lot 135

– With Teke *gül* with "shoulders": (17) Spuhler 1987: No. 129, p. 269; (18) Herrmann III, 198: No. 98; (19) Rippon Boswell 44, 1996: Lot 103; (20) Rippon Boswell 62, 2004: Lot 49

– With Teke *gül* with little tucks: (21) Mackie/Thompson 1980: No. 26; (22) Hali 5/3, 1983: 251; (23) Sotheby's London, 15 June 2004: Lot 28; (24) Rippon Boswell 66, 2005: Lot 106

– Arabachi *chuval* with Arabachi *gülli gül*: (1, 2) Dimand/Mailey 1973: No. 184; Mackie/Thompson 1980: No. 54; (3) Loges 1978: No. 110; (4) Herrmann III, 1981: No. 96; Jourdan 1989: No. 209; (5) Edelmann, October 1982: Lot 84; (6) Hali 5/3, 1983: 252; Rippon Boswell 51, 1999: Lot 63; (7) Volkmann 1985: No. 97; Hodenhagen 1997: No. 15; (8) Herrmann VII, 1985: No. 76; (9) Christie's NY, 8 April 1989: Lot 138; Christie's NY, 7 October 1999: Lot 164; (10) Gantzhorn 1990: Fig. 645; (11) Sotheby's NY, April 1993: Lot 13; (12) Nagel 21. Auktion, November 1993: Lot 198; (13) Dodds/Eiland 1996: No. 204; (14) Hali 86, 1996: 115; (15) Besim 1, 1998: No. 78; (16) Rippon Boswell 49, 1998: Lot 182; (17) Hali 96, 1998: 94; (18) Rippon Boswell 53, 1999: Lot 65; (19) Rippon Boswell 63, 2004: Lot 96

Structure

Warp:	Wool, Z_2S, ivory, some light brown fibres
Weft:	Wool, 2Z; light brown, some ivory fibres
Pile:	Wool, 2Z, some 3Z; height 2–3 mm 6 colours – red, some 3Z; orange-red (Ra 691-1); blue; blue green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 35–37 × 59–68 vert.= 2065–2516 knots/dm²; 1:1.7
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 691-1 orange-red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-17363.1/.2
Radiocarbon age:	165 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

73

Teke

Balkhan Mountains

Khali; 4 × 9 Teke *gül* and white ground curled leaf meander border design
188 × 240 cm / 74 × 94½ in.
16th or 17th century

Collection of David Reuben, London
Published: (1) Bonhams London, 3 May 2001: Lot 115; (2) Hali 117, 2001: 113; (3) Reuben II, 2001: No. 1; (4) Hali 142, 2005: 23

Comparable pieces

(1) Sotheby's London, 27 June 1980: Lot 92; Hali 3/2, 1980: 161; Netherhampton Salesrooms Salisbury, 3 March 2005: Lot 945; Hali 140, 2005: 127; (2, 3) Pinner/Franses 1980: 104, 112, no. 174 (colour plate V), and no. 213; (4) Rippon Boswell 64: Lot 181, Hali 142, p. 23; (5) Cat. no. 74

– Teke *khali* with various white ground borders: (6) Volkmann 1985: No. 81; (7) Sotheby's NY, December 1987: Lot 64; Herrmann X, 1988: No. 92; Rippon Boswell 47, 1997: Lot 65; (8) Nagel, 12 November 1993: Lot 197; (9) Rippon Boswell 44, 1996: Lot 80; (10) Skinner Boston, 28 April 2001: Lot 27; (11) Sotheby's London, 15 June 2004: Lot 28; (12) Hali 144, 2006: 41; (13) Cat. no. 150; Tzareva 1984: No. 32

For a discussion. see Vol. 2
For radiocarbon dating details. see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z 6 colours – Brownish purple; orange-red; dark blue; blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous; alternate warps slightly depressed in some areas
Knot:	Asymmetrical, open right Horiz. 39 × 56 vert. = 2184 knots/dm²; 1:1.4
Selvages:	Original not extant
Ends:	Top: 2–3 cm of weft faced tabby in red wool, 2Z
Examined by:	David Reuben; London, February 2003

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-26226.1/.2
Radiocarbon age:	280 ± 30
Calibrated age ranges: (95.4% confidence limit)	AD 1502–1509 (1.1%) AD 1517–1605 (56.3%) AD 1620–1671 (40.5%) AD 1789–1799 (2.1%)

74

Teke

Balkhan Mountains or Akhal Oasis

Khali; 3 (4) × 9 Teke *gül* and white ground curled leaf meander border design
165–173 (ca. 40 cm missing) × 228 cm (pile), 260 cm incl. *alem*/65–68 (ca. 15¾ in. missing) × 89¾ in. (pile), 102½ in. incl. *alem*; fragment
Second half 17th or 18th century

Private collection; former Robert and Lesley Pinner Collection
Published: (1) Pinner/Franses 1980: Colour plate IV; (2) Rippon Boswell 62: Lot 33

Comparable pieces
Cf. cat. no. 73

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Note: At least three different reds have been used for the ground colour (shades of red): (1) a more bluish-red (mainly), (2) a purplish red, and (3) another more orange-red have been used unsystematically to produce a nearly invisible "abrash"

Structure

Warp:	Wool, Z_2S, ivory, some brown fibres
Weft:	Wool, 2Z; medium to light brown, with some dark brown fibres
Pile:	Wool, 2Z; height 2–3 mm 6 colours – Shades of red (see note), some 3Z, some stacked knots 2 × 2Z; orange-red; dark blue; blue-green, some stacked knots 2 × 2Z; dark to black-brown, 2Z; ivory, 2Z, some stacked knots 2 × 2Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right – 3 or 4 symmetrical knots on both sides along the edges – Stacked knots, 2 × 2Z (Mallett 1998: 2.29) observed in several places; e.g. in the field adjoining the right side main border, 33 cm from top end of pile area Horiz. 32–37 × 57–62 = 1824–2294 knots/dm²; 1:1.7
Selvages:	Original not extant
Ends:	Bottom: 15 cm weft faced tabby, wefts in red wool, 2Z, with three narrow stripes in medium blue wool, 2Z; the whole *alem* was cut off and sewn on again, but seems to be original, matching the top end, which has not been cut off; Top: 15 cm weft faced tabby, wefts in red wool, 2Z, with three narrow stripes in medium blue wool, 2Z
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-26226/-26226/-30746
Radiocarbon age:	180 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1658–1701 (20.6%) AD 1729–1820 (55.8%) AD 1842–1850 (1.0%) AD 1855–1877 (2.9%) AD 1922–1960 (19.7%)

75

Turkmen

Balkhan Mountains, Gorgan/Atrek Plain or Akhal Oasis

Ensi; with *pekwesh* field design
124 × 165 cm/48¾ × 65 in.
18th or early 19th century

Private collection
Published: Rippon Boswell 68, 2006: Lot 157

Comparable pieces

Some similarities can be observed in comparable pieces 1–10

– Asymmetrically open right knotted *ensi* with similar features: (1) Herrmann IV, 1982: No. 84; (2, 3) Jourdan 1989: No. 141 & 148; (4) Rippon Boswell 41, 1994: Lot 39; (5) Rippon Boswell 51, 1999: Lot 28; (6) Hali 107, 1999: 111; Eiland 2003: 188; Hali 153, 2007: fig. 2; (7) Rippon Boswell 57, 2001: Lot 174; Hali 153, 2007: 61; (8, 9) Rippon Boswell 62, 2004: Lot 38 and 58; (10) Hali 153, 2007: 63; for some other asymmetrically open right knotted *ensi* see Reuben 2007

– Symmetrically knotted Yomut *ensi* with *pekwesh* design in field or *alem*: (11) Reed 1966: No. 33; (12) Lefevre, 6 February 1976: Lot 6; (13) Hoffmeister 1980: No. 18; Eiland 2003: 191; (14) Walker 1982: No, 38; (15) Tzareva 1984: No. 71; (16) Rippon Boswell 35, 1992: Lot 40; (17) Elmby III, 1996: No. 15; (18) Völker 2001: No. 142; (19) Rippon Boswell 49, 1998: Lot 20; (20) Rippon Boswell 69, 2007: Lot 40

– For other Turkmen weavings with stylized flower designed *alem,* see cat. no. 93

– For Turkmen weavings with *pekwesh* design other than *ensi*, see cat. no. 104

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory with some brown fibres
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z, few 3Z; height 1 mm, 2–3 mm in *alem* only 8 colours – red-brown; orange-red; medium blue; dark blue; yellow; blue-green; brown; ivory, few 3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical open right – One short row of asymmetrical knots offset in the upper part of the field – Four symmetrical knots along both edges from bottom to top – Area of 57 × 1.5 cm symmetrical knotting in upper right part Horiz. 34–36 × 60–64 vert. = 2040–2304 knots/dm²; 1:1.8
Selvages:	Original not extant
Ends:	Bottom: remains of up to 1 cm tabby in red and blue wool
Examined by:	Jürg Rageth; Riehen, May 2007

Dyes

Visual inspection does not suggets the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

76

Qaradashlï

Akhal Oasis

Asmalyk; erre gül design
104 × 75 cm / 41 × 29½ in.
17th or 18th century

Private collection
Published: Hali 78: 117

Comparable pieces

(1) Thacher 1940: Plate 24; (2) Schürmann 1969: No. 33; (3) Beresneva 1976: No. 23; (4) Bausback 1977: 165; (5, 6) Loges 1978: Nos. 43 and 44; (7) Mackie/Thompson 1980: No. 75; (8) Hoffmeister 1980: No. 33; (9) Herrmann II, 1980: No. 88; (10) Herrmann IV, 1982: No. 88; (11) Volkmann 1985: No. 96; (12) Pinner/Eiland 1990: Plate 44; (13) Rippon Boswell 32, 1990: Lot 41; (14) O'Bannon 1990: No. 2; (15) Rippon Boswell 34, 1991: Lot 43; (16) Pinner 1993: No. 48; (17) Andrews et al. 1993: No. 7; (18) Dodds/Eiland 1996: No. 243b; (19) Hali 115, 2201: 45; (20) Rippon Boswell 59, 2002: Lot 43; (21) Rippon Boswell 62, 2004: Lot 23 and 41; (22) Rippon Boswell 69, 2007: Lot 24; (23) Nagel 51T, 4 November 2008: Lot 3046; (24, 25) Cat. nos. 77 and 78

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool (?), or camel hair (?), Z_2S, light brown
Weft:	Cotton, 1–3Z; wool (?), 1–2Z; several unsystematic combinations of plyings of cotton and wool (?) or camel hair (?) (mostly cotton only) – Cotton, Z, plied with wool (?), Z; 2Z – Cotton, 2Z, plied with wool (?), Z; 3Z – Cotton, 3Z, plied with wool (?), Z; 4Z – First weft: cotton, 2Z; second weft: cotton plied with wool (?), 2Z – Both wefts cotton 2Z – Both wefts wool (?), 2Z; (some only at the top)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Pile:	Wool, 2Z; height worn 8 colours – ivory; red; brownish red; blue; dark blue, some 4Z; yellow; green; black-brown
Knot:	Symmetrical – Multiple use of offset knotting all over the piece (for pattern) – Multiple use of single rows of knots offset in the field (for structure?) – Some knots on one warp (for pattern) – Some overlapping knots (2 knots on three warps, to form small diamonds, for pattern) Horiz. 40–42 × 66–71 vertical = 2640–2982 knots/dm²; 1:1.7
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, September 2003

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-27369.1/.2
Radiocarbon age:	195 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1648–1689 (24.6%) AD 1729–1811 (60.5%) AD 1922–1948 (14.9%)

77

Qaradashlï
Akhal Oasis

Asmalyk; erre gül design
134 × 72 cm / 52¾ × 28¼ in.
First half 19th century

Private collection
Unpublished

Comparable pieces
See cat. no. 76

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 5

Structure

Warp:	Wool (?) or camel hair (?), Z_2S, mix of ivory and light brown fibres
Weft:	Wool (?), 2Z, mix of ivory to light brown fibres
Pile:	Wool, 2Z, some 4Z; height 1–2 mm 10 colours – ivory (2 shades); orange red; brownish red; brownish purple; violet-red, 4Z (Ra 460-1); rose-red (Ra 460-2), some knots only; greenish medium blue; dark blue; light yellow; medium brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Multiple use of offset knotting all over the piece (for pattern) – Some single rows of knots offset in the field (for structure?) – Multiple use of knots on one warp (for pattern), some skipped warps Horiz. 38–38 × 71–74 vert. = 2698–2812 knots/dm²; 1:1.9
Selvages:	Remains of 2 warp units (2.2) reinforced with brown wool Z (Mallett 1998: 15.10)
Ends:	Bottom: original not extant Top: remains of weft faced tabby, wefts in brownish red wool, 2Z, folded to the back and sewn
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Ra 460-1 violet-red, w, 4Z:	Lac dye
Ra 460-2 rose-red, w, 2Z:	Madder
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

78

Qaradashlï
Akhal Oasis

Asmalyk; erre gül design
129 × 77 cm / 50¾ × 30¼ in.
Post-1880

Private collection
Unpublished

Comparable pieces
See cat. no. 76

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 5

Structure

Warp:	Wool, Z_2S, mix of ivory and some light brown fibres
Weft:	Pile area: Wool, 2Z, light brown
Pile:	Wool, 2Z, some 3Z; 3–4 mm 8 colours – ivory, some 3Z; red; orange-red; faded orange (Ra 629-1); reddish brown; dark blue; dark blue-green; dark brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; generally 2 wefts per row of knots, some single wefts observed
Knot:	Symmetrical – Multiple use of offset knotting in field and borders (for pattern) – Few single rows of knots offset in the field (for structure?) – Some short rows of overlapping knots in plain areas (Mallett 1998: 2.32-33) – Some rows of stacked knots in plain areas of ivory field (Mallett 1998: 2.29, but symmetrical) – Some knots on single warps (for pattern) Horiz. 42 × 70 vert. = 2940 knots/dm^2; 1:1.6
Selvages.	2 warp units (2,2) overcast with red wool, Z (Mallett 1998,15.21)
Ends:	Top and bottom: Weft faced tabby, wefts in blue wool, 2Z, folded to the back and sewn; decorated with back-wrapped and bound border in red and blue wool, 2Z (Mallett 1998: 14.9)
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Ra 629-1 faded orange, w, 2Z:	Synthetic (Ponceau G) and madder
Examined by:	KIK-IRPA Brussels

Dating

Dated post 1880 by synthetic dyestuff
No radiocarbon dating performed

79

Qaradashlï
Akhal Oasis

Torba; 3 × 3 *chuval gül* design
120 × 58 cm/47¼ × 22¾ in.
Mid 15th to mid 17th century

Private collection
Published: (1) Elmby I, 1990: No. 19; (2) Hali 50: 176; (3) Hodenhagen 1997: No. 58

Comparable pieces
(1) Azadi 1975: No. 25; Andrews et al. 1993: No. 69; Rippon Boswell 71, 2008: Lot 204; (2) Mackie/Thompson 1980: No. 73; (3) Pinner/Eiland 1993: Plate 43; (4) Andrews et al. 1993: No. 67; (5, 6) Hodenhagen 1997: No. 56, 57; (7) Cat. no. 79

– Pieces with a comparable secondary motif: comparable piece no. 3 (see above, Pinner/Eiland 1993: Plate 43, another Qaradashlï *torba*); (8, 9) Nos. 133 and 134; Tzareva 1984: No. 7 and 9, Salor *chuval*; (10) Rippon Boswell 44, 1996: Lot 128, Kordi rug

– Other Qaradashlï *torba*: (11) Elmby III, 1996: No. 19; (12) Hodenhagen 1997: No. 55;

– For Qaradashlï *chuval,* see cat. nos. 80–82

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and some light brown fibres
Weft:	Pile area: Cotton, 2Z
Pile:	Wool, 2Z, some 3Z; height up to 2 mm, mainly worn 8 (+1) colours – pile: light orange-red, 2–3Z; orange-red (*alem*); reddish brown (upper end); dark blue; greyish light blue (lower third of torba); shades of bluish grey-green; dark brown; ivory; (light blue, for weft faced tabby at top only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some single rows of knots offset in plain areas of the field (Mallett 1998, 2.34) – Some short rows of overlapping knots in the field (Mallett 1998: 2.32, 2.33) – Some inserted warps at the bottom of the field (for field pattern?) – Multiple use of offset knotting (both complete areas and single rows only) in plain areas in the *alem* (for structure?) Horiz. 39–41 × 85–89 vert. = 3315–3649 knots/dm²; 1:2.2
Selvages:	Original not extant
Ends:	Top: 2 cm weft faced plain weave, wefts in brownish red and light blue wool, 2Z, folded to the back and sewn; Bottom: original not extant
Examined by:	Jürg Rageth; Riehen, September 2003

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-27368.1/.2
Radiocarbon age:	365 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1448–1529 (50.8%) AD 1548–1634 (49.2%)

80

Qaradashlĭ

Akhal Oasis

Torba; 3 × 3 *chuval gül* design
120 × 57 cm (incl. back side 115 cm) / 47¼ × 22½ in. (45¼ in.)
End 17th or 18th century

Private collection
Published: (1) Cassin/Hoffmeister 1988: Plate 17; (2) Sotheby's NY, 8 December 1990: Lot 20

Comparable pieces
See cat. no. 78

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Pile area: Wool, dark brown, Z, plied white cotton, Z; 2Z Back side: Wool (?), ivory, 2Z, and light brown, 2Z
Pile:	Wool, 2Z; height up to 1 mm in some areas, otherwise worn 7 colours – reddish brown 1; reddish brown 2 (*alem*); orange; black blue; blue green; dark brown; bleached (?) white;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some single rows of knots offset in plain areas in the field (Mallett 1998, 2.34); for structure? – Some short rows of overlapping knots in the field (Mallett 1998: 2.32, 2.33); for structure? – Multiple use of offset knotting (both complete areas and single rows only) in plain areas in the *alem*; for structure? Horiz. 40–41 × 95–98 vert. = 3800–4018 knots/dm²; 1:2.4
Selvages:	Original not extant
Ends:	Top: 2 cm of weft faced tabby, wefts in brownish red wool, 2Z, folded to the back and sewn; Bottom: 58 cm weft faced tabby, wefts in ivory and light brown wool (camel hair ?), 2Z, folded at the end of pile area to form back
	Examined by: Jürg Rageth; Riehen, September 2003

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-27819.1/.2/.3
Radiocarbon age:	90 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1688–1729 (26.3%) AD 1810–1923 (70.9%) AD 1948–1953 (2.8%)

81

Qaradashlï
Akhal Oasis

Chuval; 3 × 3 archetypal *chuval gül* design
112 × 76 cm / 44 × 30 in.
End 17th or 18th century

Private collection
Unpublished

Comparable pieces
(1–3) Gombos 1975: No. 41, 45 and 55; (4) Mackie/Thompson 1980: No. 71, 3 × 4 *güls*; (5) Rippon Boswell, 10 November 1984: Lot 70; (6) Volkmann 1985: No. 99; (7, 8) Cassin/Hoffmeister 1988: Plates 18 & 25, both fragments; (9) Rippon Boswell 29, 1989: Lot 138; (10) Jourdan 1989: No. 155; (11) Rippon Boswell 33, 1991: Lot 104; (12) Elmby II, 1994: No. 23; (13, 14) Hodenhagen 1997: Nos. 59 and 61; (15, 16) Elmby IV, 1998: No. 21, 22: (17) Reuben I, 1998: No. 73; (18, 19) Reuben II, 2001: No. 22, 26; (20) Hali 129, 2003: 92; (21) Elmby V, 2003: No. 15; (22) Rippon Boswell 62, 2004: Lot 88; (23) Rippon Boswell 66, 2005: Lot 28, 130 and 132; (24) Rippon Boswell 68, 2006: Lot 84; (25) Nagel, 11 May 1999: Lot 143

– 3 × 3 *chuval gül* with "flags": (26, 27) Gombos 1975: No. 44, 57; (28) Mackie/Thompson 1980: No. 70; (29) Eskenazi 1983: No. 271; Hali 5/3, 1983: 253; (30) Andrews et al. 1993: No. 65; (31) Christie's NY, 16 December 1993: Lot 38; (32) Sotheby's London, 19 October 1994: Lot 15; (33) Dodds/Eiland 1996: No. 255; (34) Hodenhagen 1997: No. 41; (35–37) Reuben II, 2001: No. 25, 28 and 44; (38) Elmby V, 2003: No. 16; (39) Rippon Boswell 68, 2006: Lot 137, 143

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and some light brown fibres
Weft:	Wool, mix of brown, some light brown and ivory fibres, 2Z
Pile:	Wool, 2Z; height worn 8 colours – reddish brown (2 shades in *alem*); orange-red; black blue; light medium blue; brownish yellow; blue-green; dark brown; bleached (?) white
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps originally depressed
Knot:	Symmetrical – Area of 50 × 10 cm with asymmetrical knots, open right (As2) on the lower left side of the *chuval* – Multiple use of offset knotting for design in secondary border only – Multiple use of offset knotting (complete areas and single rows) in plain areas in field and *alem* (for structure?) – One single row of overlapping knots observed in border of upper right corner (Mallett 1998: 2.32–33) – Marker (?) knots along the vertical middle axis of the *chuval* with intervals from bottom to top of: 5.0/4.9/5.4/6.4/10.6/5.3/5.3/4.9/5.7/5.8 cm (The knots are always additional, if they would be removed, nothing of the design would be missing!) Horiz. 37–37 × 70–73 vert. = 2590–2701 knots/dm^2; 1:1.9
Selvages/Ends:	original not extant
Examined by:	Jürg Rageth; Riehen, March 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-30794.1/.2
Radiocarbon age:	140 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1671–1779 (45.1%) AD 1798–1889 (37.1%) AD 1910–1944 (15.6%) AD 1945–1950 (2.2%)

82

Qaradashlï
Akhal Oasis

Chuval; 2 × 4 (orig. 4 × 4) archetypal *chuval gül* design
53.9 × 69 cm / 21¼ × 27¼ in., fragment
17th or 18th century

Private collection
Unpublished

Comparable pieces
(1) Andrews et al. 1993: No. 4; (2) Rippon Boswell 41, 1994: Lot 38; (3) Reuben I, 1998: No. 69

– 4 × 4 *chuval gül* with "flags": (4, 5) Gombos 1975: No. 43, 46; (6, 7) Jourdan 1989: No. 150, 153; (8) Rippon Boswell 47, 1997: Lot 85; (9) Rippon Boswell 55, 2000: Lot 129; (10) Rippon Boswell 69, 2007: Lot 26

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool or camel hair (?), Z_2S, light brown
Weft:	Wool, Z, dark brown, plied with cotton, Z,white, 2Z
Pile:	Wool, 2Z; height worn, up to 1 mm in some areas 8 colours – reddish brown; orange-red; dark blue (centre of bottem left *chuval gül* only); greenish blue; dark blue-green, corroded (centre of a single *chuval gül* only); light orange (centre of secondary güls); dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some rows of knots offset in plain areas in field and *alem* – Some rows of overlapping knots in the field Horiz. 41–44 × 75–80 vert. = 3075–3520 knots/dm²; 1:1.8
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, June 2004

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22706.1/.2
Radiocarbon age:	205 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1645–1684 (29.7%) AD 1732–1808 (58.2%) AD 1927–1948 (12.1%)

83

Qaradashlï
Akhal Oasis

Chuval, 9 stripe design; flatweave
109 × 84 (164) cm / 43 × 33 in.
2nd half 19th century

Private collection
Unpublished

Comparable pieces
(1) Gombos 1975: No. 61; (2) Engelhardt I, 1977: No. 131; (3) Nagel, 6 May 1978: Lot 26; (4) Lefevre, 17 July 1981: Lot 35; (5) Moshkova 1970: Fig. 59; (6) Nagel, 3 November 1979: Lot 43 (plate 12); (7) Dovodov/Chozamuchamedov 1987 (1983): No. 87

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, light brown (mix of ivory and brown fibres)
Weft:	– Weft faced tabby (front side): wool, 2Z, reddish brown – Tabby (back side): wool, light brown?, 2Z – Wrapping yarns (front side): wool, 2Z; cotton, 2Z 7 colours – wool: shades of reddish brown; orange; blue; light blue; green; brown; cotton: white
Techniques:	– Weft faced tabby (basic structure, front side) – Tabby (basic structure, back side) – 3/2 uncountered weftless soumak (two rows of uncountered soumak with no wefts only for horizontal lines of pattern) – 2/1 and 3/2 diagonal wrapping (Mallett 1998: ?) – Vertical wrapping over 1 or 2 warps – Two small pick-and-pack bands (Mallett 1998: ?)at the very top – Two colour double span twining in brown wool and white cotton, both 2Z, for narrow borders of all patterned bands – 2/1 uncountered soumak, only for some horizontal lines (Mallett 1998)
Weave density:	Weft faced tabby, stripes: 68 warps by 192–240 wefts/dm wrapping, patterned bands: – 2/1 and 3/2 diagonal wrapping: 68 warps by 120 wefts/dm (Mallett 1998: ?); – Vertical wrapping over 1 or 2 warps: 68 warps by 100 wefts/dm (Mallett 1998);
Selvages:	2 pairs of warpas (2,2)
Ends:	Top: original not extant Bottom: 84 cm tabby, wefts in dark ivory wool, 2Z, folded to form back of *chuval*
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating
No radiocarbon dating performed

84

Qaradashlï

Akhal Oasis

Khali; 3 × 10 *chuval gül* design; with Mughal flower style designed *alem* at the beginning only
142 × 247 cm / 56 × 97¼ in., fragment
First half 17th century

Private collection
Published: Hali 104, 1999: 83

Comparable pieces

No directly comparable piece published

– Related pieces with 3 rows of *chuval gül* field design: (1, 2) Cat. nos. 84 and 85

– Related pieces with Mughal flower style designed *alem*: (3) Goguel 1927: Fig. C,D,E; (4–6) Cat. nos. 101–103

– For other *khali* with *chuval gül* field design, see cat. no. 104

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z, 2Z, brown, light brown; cotton, Z, white – Wool, 2Z, brown; both shots, mainly area of 35 cm in upper part of the piece: – First shot: wool, Z, plied with cotton, Z, 2Z; second shot: wool, 2Z, light brown
Pile:	Wool, 2Z, some 3–4Z; height up to 2 mm in some areas, otherwise worn 11 colours – reddish brown 1; reddish brown 2 (lower *alem*), some 3Z; orange-red, some 3Z (Si 3-2); red; dark bluish green, some 3–4Z; bluish green, some 3Z; light bluish grey-green, some 3Z; dark blue; yellow, some 3Z; ivory, some 3Z; dark brown, some 3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – 5 rows of asymmetrical knots, open right (As2), (ca. 20 cm long) in plain area of the field (for a discussion, see Vol. 2) – Multiple use of offset knotting in field and borders in patterned and plain areas (Mallett 1998: 2.21–2.26); no offset knotting in flower style *alem* – Multiple use of single rows of knots offset in the field (for structure?) – Some rows of overlapping knots in plain areas in lower left corner of the field (Mallett 1998: 2.32–2.33) – Some discontinued warps Horiz. 34–35 × 55–57 vertical = 1870–1995 knots/dm^2; 1:1.6
Selvage/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, October 2003

Dyes

Si 3-1 yellow, w, 2Z:	No result
Si 3-2 orange-red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-17362.1/.2/.3
Radiocarbon age:	310 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1487–1605 (74.6%) AD 1605–1650 (25.4%)

85

Qaradashlï
Akhal Oasis

Khali; 3 × 10 *chuval gül* design
144 × 259 cm / 102 × 56¾ in.
17th or 18th century

Private collection
Unpublished

Comparable pieces
See cat. nos. 83 and 104 for other *khali* with *chuval gül* field design

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool (or camel hair?), Z_2S, ivory and brown
Weft:	Wool, Z, 2Z, brown; cotton, Z, white System of wefting: – Wool (or camel hair?), Z, plied with cotton, Z, 2Z; mainly – Wool (or camel hair?), 2Z; in some areas – Alternately one shot cotton, white, Z, and one shot wool, brown 2Z; in some areas
Pile:	Wool, 2Z; cotton, 3Z; height in some areas up to 3 mm 8 (+2) colours – wool: brownish purple; orange-red; dark-blue; medium blue; shades of green to turquoise-green; yellow (Ra 249-1); black-brown; ivory; Cotton: white; light blue, some single knots only
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Symmetrical – All over use of single rows of knots offset in the field (Mallett 1998: 2.34) – Multitude of rows of overlapping knots all over the field (Mallett 1998: Fig. 2.32) – In one place 9, in another 16 rows of asymmetrical knots, open right, in mostly plain areas in the field (one about 30, the other about 70 cm wide) Horiz. 35 × 50 vert. = 1750 knots/dm²; 1:1.4
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, October 2002

Dyes

Ra 249-1 yellow, w, 2Z:	Dye source unclear
Examined by :	Marmara University Istanbul

Dating

Lab. no.:	ETH-26219.1/.2
Radiocarbon age:	245 ± 30 y BP
Calibrated age ranges: 95% confidence limit	AD 1524 – 1561 (9.2%) AD 1629 – 1677 (63.1%) AD 1761 – 1803 (25.3%) AD 1937 – 1947 (2.5%)

86

Qaradashlï

Khoresm, Khiva Oasis

Khali; 3 × 9 *chuval gül* design
148 × 230 (245) cm / 58¼ × 90½ (96½) in.
Early 20th century

Private collection
Unpublished

Comparable pieces

See cat. noS. 83 and 104 for other *khali* with *chuval gül* field design

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, (or camel hair?), Z_2S, mix of dark ivory to brown fibres
Weft:	Wool (or camel hair?), 2Z, light brown to brown
Pile:	Wool, 2Z; height 2–3 mm 8 colours – reddish brown; brownish purple; red; orange-red; dark-blue; dark blue-green; ivory; dark brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Symmetrical – Multiple use of offset knotting for design in the borders only (Mallett 1998: 2.26) – All over use of single rows of knots offset in field and *alem* (Mallett 1998: 2.34) – 2 rows of overlapping knots at beginning and end of the piece (Mallett 1998: 2.32). – Edge knots along both sides (Mallett 1998: 2.31) area of ca. 3 × 38 cm in the lower half of the left side with short horizontal rows of more than 1 knot Horiz. 34–35 × 50-54 vert. = 1700–1890 knots/dm²
Selvages:	2 warp units (2.2) reinforced and overcast with blue wool, Z; edge knots on the left side
Ends:	Top: Up to 7.5 cm weft faced tabby in red and ivory wool, 2Z; two red and one blue weft at the end of the ivory stripe. Bottom: Up to 8 cm weft faced plain weave in red and ivory wool, 2Z; three red and two blue wefts at the end of the ivory stripe
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-27705.1/.2/.3
Radiocarbon age:	175 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1659–1693 (17.9%) AD 1726–1813 (62.0%) AD 1850–1863 (1.3%) AD 1918–1949 (18.8%)

87

Qaradashlï

Akhal Oasis

Khali; 3 × 9 *chuval gül* design
156 × 280 cm / 61½ × 110¼ in.
18th century

Collection of David Reuben, London
Published: Reuben 2001: No. 19

Comparable pieces

See cat. nos. 83 and 104 for other *khali* with *chuval gül* field design

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool , Z, 2Z, grey; cotton, Z, white System of wefting: – Wool, 2Z; about ¾ of the piece – Wool, Z, plied with cotton, Z, 2Z
Pile:	Wool, 2Z, some 3Z 9 colours – light aubergine, brown-red, red-orange, blue, blue-green, green, yellow, ivory, black
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some rows of overlapping knots in the field – Some areas of knots offset in plain area of the field (Mallett 1998, 2.32-2.33) Horiz. 32 × 48 vert. = 1536 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	David Reuben; London, February 2003

Dyes

No chemical analysis performed

Dating

Lab. no.:	ETH-26224.1/.2
Radiocarbon age:	210 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1644–1682 (33.0%) AD 1733–1807 (56.5%) AD 1930–1947 (10.5%)]

88

Qaradashlï

Akhal Oasis

Khali; 4 × 13 Qaradashlï *gül* and lotus flower *alem* design
176–184 × 326 cm / 69¼–72½ × 128¼ in.
18th or early 19th century

Private collection
Unpublished

Comparable pieces

– With four rows of Qaradashlï *gül*: (1) Hali 89, 1996: 152

– With three rows of Qaradashlï *gül*: (2) McMullan 1965: No. 126; (3) Mackie/Thompson 1980: No. 48; (4) Herrmann III 1980: No. 92; (5) Eskenazi 1983: No. 267; (6) Volkmann 1985: No. 85; (7) Bausback 1987/88: 212; Hali 32, 1986: 23; Jourdan 1989: No. 111; (8) Rosetti 1992, Tafel VI; (9) Andrews et al. 1993: No. 61; (10) Sotheby's NY, 16 December 1993: Lot 45; (11) Dodds/Eiland 1996: No. 186; (12) Hali 130, 2003: 35

– Yomut and "Eagle" *gül* bags with Qaradashlï *gül*: (13) Walker 1982: No. 41; (14) Mackie/Thompson 1980: No. 59; (15) TKF Wien 1986: No. 116; (16) Herrmann 2, 1990: No. 60; (17) Rautenstengel/Azadi 1990: Nos. 22 and 29; (18) Sotheby's NY, 16 December 1993: Lot 51; (19–23) Hodenhagen 1997: Nos. 44, 46, 50, 54, 55

– For other Turkmen pieces with Qaradashlï *gül,* see cat. nos. 36 and 59

– Other Turkmen pieces with comparable lotus flower design: (24) Herrmann II, 1979: No. 86, *khali*, lotus flowers in part of one *alem*; Rippon Boswell 71, 2008: Lot 203; (25) Pinner/Franses 1980: Plate XIII, Qaradashlï *ensi,* field pattern; (26) Skinner, 20 November 1985: Lot 145, both *alem* of *khali* with *kepse gül* field pattern; (27) Herrmann 4, 1992: No. 91c, Qaradashlï *mafrash*; (28) Rippon Boswell 36, 1992: Lot 64, Yomut *khali*; (29) Rippon Boswell 67, 2006: Lot 81, Qaradashlï *ensi,* in first *alem*

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 5

Structure

Warp:	Wool, Z_2S, mix of brown and ivory fibres
Weft:	Wool, 2Z, medium brown
Pile:	Wool, 2Z some 3Z; height worn, up to 1–3 mm in some areas 7 colours – purple (Ra 677-1); orange-red, some 3Z; blue; blue green; light yellow, some 3Z; brown, some 3Z; ivory, some 3Z;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Symmetrical – Few single rows of knots offset in plain areas of *alem* and field (Mallett 1998: 2.34) – Short rows of overlapping knots (3–4 knots) along the edges (Mallett 1998: 2.32, 2.33) – Orange-red marker (?) knots along the middle axis Horiz. 35–36 × 52–53 vert. = 1820–1908 (*alem*) knots/dm² Horiz. 36–37 × 56–61 vert. = 2016–2257 (field) knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 677-1 purple, w, 2Z:	Madder and a trace of tannin
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

89

Qaradashlï

Akhal Oasis

Khali; 3 × 10 *tauk nuska* design
247 (302) × 176 cm / 97¼ (119) × 69¼ in.
16th or 17th century

Private collection
Published: (1) Sothebys NY, 5 November 1983: Lot 169; (2) Nagel 308, 1 October 1984: Lot 3390; (3) Bausback 1987: 196; (4) Jourdan 1989: No. 110; (5) Nagel, 21. Spezialauktion, 12 November 1993: Lot 192; (6) Rippon Boswell 47, 1997: Lot 52

Comparable pieces

– With *chemche gül* secondary motif: (1) Schürmann 1969: No. 19; Spuhler/König/Volkmann 1978: No. 78; (2) Lefevre, 6 February 1976: Lot 54; (3) Bernheimer 1977: 15; (4) Loges 1978: No. 36; (5) Edelmann NY, 25 October 1980: Lot 296; (6) Edelmann NY, 30 May 1981: Lot ?; (7) Sotheby's NY, 5 November 1983: Lot 174; Sotheby's NY, 17 September 1992: Lot 117; (8) Rippon Boswell 27, 1988: Lot 105; (9) Jourdan 1989: No. 109; (10) Elmby IV, 1998: No. 18; (11) Pinner/Eiland 1999: No. 35, 36; (12) d'Heurle/Munkacsi/Saunders 2003: Plate 18; (13) Myers 2004: No. 48

– With other secondary motifs: (14) Azadi 1970: No. 11; Azadi 1975: No. 10; (15) Lefevre, 26 November 1982: Lot 31; (16) Eskenazi 1983: No. 268: (17) Benardout 1983: 84; (18) Herrmann IV, 1988: No. 83; (19) Jourdan 1989: No. 108; (20) Sotheby's NY, 7 April 1992: Lot 9; (21) Sotheby's London, 19 October 1994: Lot 2; (22) Elmby III, 1996: No. 13; (23) Sotheby's NY, 12 December 1997: Lot 39; (24) Nagel 11 May 1999: Lot 141; (25) Pinner/Eiland 1999: Plate 35; (26) Rippon Boswell 56, 2001: Lot 127; (27) Rippon Boswell 59, 2002: Lot 42

– With 4 rows of *tauk nuska gül*: (28) Elmby II, 1994, no, 18; (29) Rippon Boswell 58, 2002: Lot 82; (30) Wearden 2003: Plate 95

– For Yomut *tauk nuska khali* with C-*gül, dyrnak* or hooked diamond secondary motifs, see cat. no. 90, 91, and 92 and comparable pieces

– For "P-Chowdur" group *tauk nuska khali,* see cat. no. 121

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool (or goat hair?), Z_2S, mix of ivory and some brown fibres
Weft:	Wool, Z, 2Z, brown; cotton, Z, 2Z, white. System of wefting: – First shot cotton, white, 2Z; second shot wool, 2Z, and vice versa; mainly – First shot wool, 2Z, brown; second shot wool, Z, brown, plied with cotton, Z, white, and vice versa; in some areas – Both shots wool, Z, brown, plied with cotton, Z, white; some wefts only
Pile:	Wool, 2–3Z; height 3-4mm 7 colours – brownish-red; orange-red; dark blue; light yellow; blue-green; dark-brown; greyish ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some rows of knots offset in plain areas in the field – Some rows of overlapping knots (Mallett 1998: 2.32) – Discontinuous knotting and wefts in outer right side minor border and field (Mallett 1998: 2.67) Horiz. 38–39 × 51–54 vert. = 1989–2106 knots/dm²; 1: 1.3 Horiz. 38–39 × 64–69 vert. = 2432–2691 knots/dm² at the beginning of the piece only
Selvages:	Original not extant
Ends:	22 cm of weft faced tabby, wefts in brownish red wool, 2Z, with stripes in blue-green wool, 2Z
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 722-1 orange-red, w, 2-3Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-19040.1/.2
Radiocarbon age:	280 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1492–1601 (58.8%) AD 1613–1667 (39.1%) AD 1783–1793 (2.2%)

90

Qaradashlï
Akhal Oasis

Khali; 3 × 10 *tauk nuska* field and "double cross" border design
175–185 × 260–264 cm/69–72¾ × 102½ – 104 in.
Southwest Turkmenistan
17th or 18th century

Collection of Edoardo Concaro, Vilantario, Italy
Unpublished

Comparable pieces
- With C-*gül* secondary motif: (1) Schürmann 1969: No. 17; (2) Lefevre, 21 March 1975: Lot 43; (3) Bausback 1978: 465; Bausback 1975: 329; (4) Bausback 1987/88: 200; Hali 47, 1989: 35; (5) Rippon Boswell 47, 1997: Lot 121; (6) Christie's London, 14 October 1999: Lot 85 (4 × 11 *güls*); (7) Rippon Boswell 56, 2001: Lot 12; (8) Nagel, 6 November 2001: Lot 210; Nagel, 7 May 2002: Lot 164; (9) Nagel, 5 November 2002: Lot 117; Nagel, 27 May 2003: Lot 38; (10) Sotheby's NY, 1 April 2003: Lot 38

- For symmetrically knotted *khali* with "double cross" border: (11) Hali 112, 2000: 49

- For Yomut *tauk nuska khali* with *chemche gül, dyrnak* or hooked diamond secondary motif, see cat. nos. 89, 91 and 103

- For Yomut *tauk nuska khali* with other secondary motifs, see cat. no. 88

- For asymmetrically knotted "Eagle" *gül khali* with "double cross" borders (in most cases only on the sides), see cat. no. 116

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory w. some brown fibres
Weft:	Cotton, white, Z, 2Z; wool, dark brown, Z, 2Z System of wefting: – First shot cotton, Z, plied with wool, Z, (2Z); second shot cotton, Z, plied with wool, 2Z, (3Z), and alternately reverse; mainly – Both shots cotton, Z, plied with wool, Z, (2Z) – First shot cotton, Z, plied with wool, Z, (2Z); second shot wool, dark brown, 2Z, and alternately reverse – Both shots wool, dark brown, 2Z; end of the piece only
Pile:	Wool, 2Z, few 3Z; height up to 2 mm in some areas, mainly worn 6 colours (possibly also pale yellow, now faded and not anymore distinguishable from yellowish ivory) – brownish red; bright orange-red (lighter shade at beginning and end of the piece only); dark blue; medium blue (every second C-*gül*; originally blue-green?); black-brown; yellowish ivory, few 3Z Two sections of asymmetrical knots open right in undecorated areas of the field, one 9 rows × 30cm wide, one 16 rows × 70cm wide.
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; slightly depressed in some areas
Knot:	Symmetrical – Some rows of knots offset in plain area of the field – Stacked knots in ivory in one place (Mallett 1998: 2.29) – Some rows of overlapping knots in the field (Mallett 1998: 2.32) – Unusual knotting structure over an area of 4 cm, 33.5 cm from the top of the piece Horiz. 40–42 × 51–55 vert. = 2040–2310 knots/dm²; 1:1.3
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, June 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-30795.1/.2
Radiocarbon age:	155 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1665–1709 (17.1%) AD 1718–1784 (35.3%) AD 1790–1823 (11.9%) AD 1826–1885 (16.9%) AD 1912–1950 (18.8%)

91

Qaradashlï

Akhal Oasis

Khali; 3 × 10 t*auk nuska* field design with hooked diamond secondary motif
184 × 314 cm / 123½ × 72½ in.
End of 17th or early 18th century

Private collection
Published: (1) Skinner, 20 November 1985: Lot 147; (2) Elmby I, 1990: No. 15

Comparable pieces

– With hooked diamond secondary motif: (1, 2) Lettenmair 1962: 198; (3) Bennett 1978: 166; (4) Mackie / Thompson 1980: No. 69; Straka / Mackie 1978: No. 2; (5) Hali 4/1, 1981: 31; Skinner, 31 September 1996: Lot 89; (6) Benardout 1983: 84; Hali 4/3, 1982: 269; (7) Phillips London, 20 June 1989: Lot 55; (8) Rippon Boswell 32, 1990: Lot 149; Rippon Boswell 51, 1999: Lot 120; (9) Elmby II, 1994: No. 17; (10) Rippon Boswell 41, 1994: Lot 194; (11) Sotheby's NY, 12 December 1997: Lot 21; (12) Reuben I, 1998: No. 59; (13) Hali 109, 2000: 146; (14) Rippon Boswell 58, 2002: Lot 82; (15) Rippon Boswell 61, 2003: Lot 83; (16) Rippon Boswell 62, 2003: Lot 75; (17) d'Heurles / Munkacsi / Saunders 2003: Plate 17; (18) Sotheby's London, 11 October 2004: Lot 11; Sotheby's London, 27 April 2005: Lot 51; (19) Sotheby's NY, 16 December 2005: Lot 136; (20) Rippon Boswell 66, 2005: Lot 29; (21) Christie's NY, 12 December 2006: Lot 21; (22) Christie's NY, 3 June 2008: Lot 41

– For other *tauk nuska khali* with *chemche*, c-*gül,* or *dyrnak* secondary motif, see cat. nos. 88–90

– For *tauk nuska khali* with other secondary motifs, see cat. no. 88

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory, some brown fibres
Weft:	Wool, Z, brown, plied with wool, Z, light brownish orange, 2Z
Pile:	Wool, 2Z, some 3Z; height up to 2 mm in some areas, mainly worn 8 colours – light reddish brown, some 3Z; orange-red, some 3Z; dark blue, some 3Z; medium blue; pale yellow; medium blue green to green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps originally slightly depressed
Knot:	Symmetrical – Multiple rows of overlapping knots (Mallett 1998: 2.32, 2.33) in the field, but mainly in the borders; the frequent use of adjacent short rows of overlapping knots in the minor borders with *gyak* design almost resembles sumak! – Some single rows of knots offset – 1 row of 12 asymmetrical knots, open right (As4), in lower left corner, 30–35 cm from left hand edge and 75 cm from bottom end Horiz. 36–37 × 52–60 vert. = 1872–2220 knots/dm²; 1:1.5
Selvages:	2 warp units (2,2) originally overcast (?) or reinforced (?) with wool (Mallett 1998: 15.21)
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-19041
Radiocarbon age:	80 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1679–1739 (27.3%) AD 1755–1755 (0.1%) AD 1804–1935 (68.8%) AD 1947–1955 (3.8%)

92

Qaradashlï

Akhal Oasis

Khali; 3 × 8 (orig. 10 ?) *tauk nuska* design
157 × 202 cm / 61¾ × 79½ in., fragment
18th century

Private collection
Unpublished

Comparable pieces

- With *dyrnak* secondary motif: (1) Herrmann III, 1981: No. 95; Rippon Boswell 38, 1993: Lot 76; (2) Walker 1982: No. 37

- For *tauk nuska* with *chemche gül,* c-*gül,* or hooked diamond secondary motif, see cat. nos. 88, 89, and 102

- For *tauk nuska* with other secondary motif, see cat. no. 88

For a discussion, see Vol.2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory;
Weft:	Wool, Z, dark-brown, plied with cotton, Z, white, 2Z
Pile:	Wool, 2Z, some 3Z; camel hair (?), 2Z, some 3Z; height up to 2 mm in some areas, mainly worn 7 colours – brownish red, some 3Z; orange-red; dark blue; pale brownish yellow; blue-green, 2 shades, some 3Z; dark brown; dark ivory (wool or camel hair?), some 3Z;
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; originally slightly depressed
Knot:	Symmetrical – Some single rows of knots offset in plain areas of the field (Mallett 1998: 2.34) – Small areas of offset knotting in plain areas in the field (Mallett 1998: 2.34) – Some discontinuous knotting and wefts (Mallett 1998: 2.67) – 3 rows of asymmetrical knots, open left; 43 cm from bottom edge between middle and right side *tauk nuska gül* Horiz. 34–36 × 57–59 vert. = 1938–2124 knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17869.1/.2
Radiocarbon age:	155 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1661–1892 (83.2%) AD 1908–1951 (16.8%)

93

Qaradashlï
Akhal Oasis

Khali; *dyrnak* design
285 × 155 cm/112¼ × 61 in., shortened by approx. 30 cm/12 in.
18th century

Private collection
Unpublished

Comparable pieces
No directly comparable piece published

– For other *khali* with *dyrnak* design, see cat. no. 105

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown and grey-brown
Pile:	Wool, 2Z; height worn 7 colours – reddish brown; red; dark blue; bluish green; very light orange-red or beige; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; originally alternate warps depressed
Knot:	Symmetrical – 2 to 4 rows of asymmetrical knots open right (As2) from left side edge through half of the field, at 135 cm from bottom edge – Multiple use of offset knotting in vertical minor borders (Mallett 1998: 2.21, 2.22) – Some single rows of knots offset in undecorated areas of the field (Mallett 1998: 2.34) – Some short rows of overlapping knots in field and *alem* (Mallett 1998: 2.32, 2.33) Horiz. 30–32 × 52–60 vert. = 1560–1920 knots/dm^2; 1:1.8
Selvages:	Original not extant
Ends:	Bottom: Remains of up to 3 wefts in white cotton, 2Z Top: Remains of up to 4 wefts in white cotton, 2Z
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17868.1/.2
Radiocarbon age:	190 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1644–1702 (23.4%) AD 1722–1816 (53.1%) AD 1830–1881 (7.6%) AD 1914–1950 (15.9%)

94

Qaradashlï
Akhal Oasis

Khali; *kepse gül* design
202 × 157 cm / 79½ × 61¾ in.
18th century

Private collection
Published: Hali 4/1, 1981: 94

Comparable pieces
See cat. no. 105

– Other Turkmen pieces with stylized flower designed *alem*; (21) Tzareva 1984: No. 48, Teke *chuval*; (22) Hali 153, 2007: Fig. 3, Yomut *ensi*; (23) Cat. no. 95, Turkmen *ensi*

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool or goat hair, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z; height mainly worn, up to 2 mm in some areas 7 colours – reddish brown; brownish orange, some 3Z; dark blue; blue-green; yellow; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; originally slightly depressed
Knot:	Symmetrical – Rows of asymmetrical knots, open right, observed in two places in the middle of the lower part of the piece, e.g. 65-75 cm from left hand edge and 68 cm from bottom end. – Muliple use of rows of overlapping knots (Mallett 1998: 2,23) – Some short rows of stacked knots (Mallett 1998: 2.29) – Many single rows of knots offset (Mallett 1998: 2.34) Horiz. 36–39 × 51–53 vert. = 1836–2067 knots/dm²; 1:1.
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17867.1/.2
Radiocarbon age:	135 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1673–1778 (42.5%) AD 1799–1891 (40.1%) AD 1908–1942 (15.1%) AD 1945–1951 (2.3%)

95

Qaradashlï
Akhal Oasis

Khali; *kepse gül* field and stylised flower *alem* design
163 × 290 cm/64 × 114 in.
19th century

Fine Arts Museum of San Francisco
M.H. de Young Memorial Museum 1997.142.21
The Wiedersperg Collection
Published: Pinner/Eiland 1999: Plate 33

Comparable pieces
(1) Tsareva 1984: Plate 69; Tsareva 1993: Plate 7; (2) Herrmann X, 1988: Plate 95; (3) Herrmann IX, 1987: No. 82

– For comparable flower deigns in the *alem,* see also cat. nos. 84 and 100–102

– For other comparable Yomut *khali* with *kepse gü*l, see cat. no. 105

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, light brown
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z 7 colours – purple brown; apricot; medium blue; blue green; light yellow; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Some rows of knots offset in the field and in one of the *alem* Horiz. 39 × 35 vert. = 1365 knots/dm²; 1:0.9
Selvages:	Original not extant
Ends:	Traces of weft faced tabby, wefts in ivory wool, 2Z
Examined by:	From Pinner/Eiland 1999: 129

Dyes
Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating
No radiocarbon dating performed

96

Turkmen

Balkhan Mountains, Gorgan/Atrek Plain, Astarabad, or Akhal Oasis

Torba; chuval gül design
120 × 46 cm/47 × 18 in.
17th century

Fine Arts Museums of San Francisco, 2001.143.6
Gift of Marie and George Hecksher
Published: Hali 143, 2005: 79

Comparable pieces

No symmetrically knotted comparable piece known

– Comparable design in "Eagle" *gül* group II *torba* and trappings (knotted asymmetrical open right): (1) Haack 1956: 29, no. 9; Rautenstengel/Azadi 1990: Fig. 25; Andrews et al 1993: No. 41; (2) Loges 1976: No. 116; (3) Mackie/Thompson 1980: No. 61; (4) Edelmann NY, 23 May 1984: Lot 83; (5) Herrmann VIII, 1986: No. 102 a; Hodenhagen 1997: No. 48; (6) Christies NY, 8 April 1989: Lot 152; Hali 45, 1989: 84; (7) Rippon Boswell 34, 1991: Lot 108; (8) Pinner 1993: No. 50; (9) Sotheby's NY, 16 December 1993: Lot 49; Elmby II, 1994: No. 29; (10) Elmby II, 1994: No. 30; (11) Moshkova 1970 (1996): Fig. 112; (12) Dodds/Eiland 1996: No. 247; (13) Reuben I, 1998: No. 79; (14) OCTS V/1, 1999: 60, fig. 1c; (15) Rippon Boswell 51, 1999: Lot 89; (16) Rippon Boswell 55, 2000: Lot 114; Sotheby's NY, 14 December 2006: Lot 174; (17) Hali 128, 2003: 113; (18, 19) Rippon Boswell 63, 2004: Lot 63 und 112; (20) Hali 139, 2005: 103; (21) Skinner Boston, 22 April 2006: Lot 185; (22) Sotheby's NY, 2 June 2010: Lot 41; (23) Langauer 2011: 29

– Other Turkmen pieces with "Eagle" *gül* group II related *chuval gül* design; (24) Hali 103, 1999: 123, Arabachi; (25) Rippon Boswell 62, 2004: Lot 61; (26) Rippon Boswell 71, 2008: Lot 128

– Tekke *torba* with "Eagle" *gül* group II related *chuval gül* design: Cf. cat. no. 57

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix III, table 15

Structure

Warp:	Wool or goat hair, Z_2S, mix of ivory and medium brown fibres
Weft:	Wool, 2Z, medium brown
Pile:	Wool, 2Z, some 3–4Z; height 2-3 mm 8 colours – Dark brownish purple; orange-red; light bluish red, 3–4Z (insect dyed?); dark blue; medium greenish blue; light blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical No offset knotting Horiz. 43–44 × 69–71 vert. = 2967–3124 knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, January 2007

Dyes

Light bluish red in centre of *chuval gül* most probably dyed with an insect dyestuff
No chemical analysis performed

Dating

Lab. no.:	ETH-22411
Radiocarbon age:	250 ± 30 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1527–1580 (14.9%) AD 1632–1684 (59.0%) AD 1770–1807 (22.2%) AD 1943–1959 (3.9%)

97

Turkmen

Balkhan Mountains, Gorgan/Atrek Plain, Astarabad, or Akhal Oasis

Chuval; 3 × 3 *chuval gül* design
98 × 82 cm / 38½ × 32¼ in., slightly reduced at both sides
First half 19th century

Private collection
Published: Loges 1978, no. 57

Comparable pieces
(1) Eskenazi 1983: No. 271; Hali 5/3, 1983: 253; (2) Christie's NY, 16 December 1993: Lot 38

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z, 2Z, dark brown; silk, Z, ivory; – Wool dark brown, plied with silk, Z, ivory; 2Z; mainly – Wool, 2Z, dark brown; 17 cm at the beginning in the *elem* only
Pile:	Wool, 2Z; height up to 2 mm in the *elem* 8 colours – Reddish brown; orange-red; dark blue; light blue; brownish yellow; blue-green; black-brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some rows of overlapping knots in *elem* only (Mallett 1998: 2.32, 2.33) – One row of symmetrical stacked knots (like Mallett 1998: 2.29) or 4Z knots(?) in upper right corner Horiz. 43–44 × 67–67 vert. = 2881–2948 knots/dm²; 1:1.5
Selvages:	original not extant
Ends:	Bottom: Original not extant Top: Remains of up to 2.5 cm tabby, wefts in light orange wool, folded to the back and sewn
Note:	The complete piece has a slightly yellowish shade, perhaps remains of a smoke patina
Examined by:	Jürg Rageth; Riehen, March 2005

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

No radiocarbon dating performed

98

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Akhal Oasis

Aq yüp; all-pile
(a) 27 × 69 cm / 10¼ × 27¾ in.
(b) 27 × 207 cm / 10¼ × 81½ in.
2 fragments
17th or 18th century

(a) Fine Arts Museum of San Francisco, 2000.186.3
Gift of Marie and George Hecksher
(b) Collection of Marie and George Hecksher, San Francisco
Published: (a) Dodds/Eiland 1996: No. 257; (b) First publication

Comparable pieces

– Symmetrically knotted all-pile *aq yüp*: (1) Mackie/Thompson 1980: No. 1; (2) Hali IV/1, 1981: Back cover; (3) TKF, Wien 1986: No. 125; Diens/Reinisch 2001: No. 224; (4) Herrmann 4, 1992: No. 93b; (5) Sotheby's NY, 16 December 1993: Lot 39; (6) Cat. no. 98; Herrmann VIII, 1986: No. 105

– For asymmetrically open right knotted all-pile *aq yüp,* see cat. no. 118

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 6
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure (a and b)

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, ivory
Pile:	Wool, 2Z, some 3Z; height 2 mm 9 colours – Ivory; red-brown; orange-red; violet-red (Ra 708-1), 2–3Z; light brownish orange; dark blue; blue-green; light yellow; dark greenish brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Symmetrical Horiz. 49 × 70–76 vert. = 3430–3724 knots/dm²; 1:1.5
Selvages/ends:	Original not extant
Note:	Violet-red (Ra 708-1) only observed in fragment (b)
Examined by:	Diane Mott; San Francisco, December 2001

Dyes (b)

Ra 708-1 violet-red. w, 2–3Z:	Mexican cochineal (tin) and madder
Examined by:	KIK-IRPA Brussels

Dating (a & b)

Lab. no.:	ETH-22410
Radiocarbon age:	125 ± 30 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1681–1782 (37.0%) AD 1804–1902 (6.5%) AD 1907–1946 (15.8%) AD 1955–1958 (0.7%)

99

Yomut

Gorgan/Atrek Plain or Astarabad

Aq yüp; all-pile, last two design sections in mixed technique
28 × 1382 cm / 11 × 544 in.
2nd half 17th century

Private collection
Published: (1) Sotheby's London, 16 October 1985: Lot 750; (2) Herrmann VIII, 1986: No. 105; (3) Hali 29, 1986: 80; (4) Hali 32, 1986: 97

Comparable pieces

No directly comparable piece known

– For other all-pile *aq yüp*, see cat. nos. 98 and 117

– Other 18th/19th century Yomut *aq yüp* with Mughal flower style design: (1) Grote-Hasenbalg 1922: Vol. III, p. XVI, no. 1; (2, 3) Milhofer 1966: No. 90, 94; (4) Azadi 1970: No. 55; (5) Eiland/Shockley 1976: No. 11; (6) Spuhler/König/Volkmann 1978: No. 81; (7) Hoffmeister 1980: No. 37; (8) Lefevre, 22 April 1983: Lot 36; (9) Tzareva 1984: No. 87, 88; Tsareva 1993: No. 43; (10) Volkmann 1985: No. 94; Andrews et al. 1992: No. 2; (11) Mangisch Zurich, 19 March 1988: Lot 3046; (12) Mangisch Zurich, 12 November 1988: Lot 3061; (13) Elmby I, 1990: No. 25; (14) O'Bannon 1990: No. 9; (15) Hali 58, 1991: 154; (16) Rippon Boswell 33, 1991: Lot 121; (17) Dienes/Reinisch 2001: No. 225; (18) Hali 116, 2001: 134; (19) Rippon Boswell 58, 2002: Lot 83; (20) Rippon Boswell 68, 2006: Lot 11; (21) Rippon Boswell 74, 2009: Lot 127; (22, 23) Cat. nos. 99 and 152

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 6
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Piled area: cotton, 2–3Z, unbleached flat weave area: cotton, 2–3Z, unbleached
Pile:	Wool, 2Z, some 3Z, few 4Z; height 2–3 mm 8 colours – Ivory; orange-red; red; scarlet, 4Z (Ra 247-1); dark blue; medium blue; blue-green; red-brown
Ground weave:	All-pile area: weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas; 100 warps by 232 wefts/dm Mixed technique area: weft faced tabby with 1 taut weft per row of knots; 100 warps by 380 wefts/dm
Knot:	Symmetrical Multiple use of offset knotting for borders and flower pattern in all-pile area Horiz. 50 × 116 vert. = 5800 knots/dm²; 1:2.3
Selvages:	3 warps (1,1,1) overcast with red and blue-green wool, Z (Mallett 1998: 15.23)
Ends	Beginning: 75 cm weft faced tabby in unbleached cotton, with stripes in multi-coloured pile, inlaid brocading and twining in red and blue-green wool End: Like beginning, but 134 cm
Examined by:	Jürg Rageth, Bad Leonfelden, July 2009

Dyes

Ra 247-1 scarlet. w, 4Z:	Mexican cochineal (+tin) and madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-26217.1/.2/.3
Radiocarbon age:	220 ± 25 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1648–1686 (42.1%) AD 1744–1757 (2.9%) AD 1767–1808 (43.6%) AD 1942–1959 (11.4%)

100

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Akhal Oasis

Aq yüp; mixed technique, 2 fragments
with stylized Safavid/Mughal flower style design
(a) 42 × 80 cm/16½ × 31½ in.
(b) 42 × 80 cm/16½ × 31½ in.

18th century

Private collection
Unpublished

Comparable pieces

(1) Volkmann 1985: No. 94; Andrews et al. 1992: No. 2; (2) Elmby 1990: No. 25

– For *aq yüp* with comparable Mughal flower style design, see cat. no. 99

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 6

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Cotton, Z, 2Z; silk, Z – Cotton, white, Z, plied with silk, ivory, Z; 2Z (piled area) – Cotton, white, 2Z; in weft faced tabby at beginning and/or end only (not shown on image to the right)
Pile:	Wool, 2Z, some 4–6Z; height 2 mm 10 colours – Reddish brown; red; rose-red; bluish red, 4–6Z (Ra 283-1), very finely; dark blue; medium blue; light blue green (in brocaded ends only); dark blue-green; blackish green; orange;
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft 210 warps by ca. 80 wefts per dm
Knot:	Symmetrical tent band knot tied on alternate 2/4 warps (caused by warp faced tabby, cf. Mallett 1998: 3.1–3.4) Horiz. 52 × 76 vert. = 3952 knots per dm^2; 1:1.5
Salvages:	4 warp selvage (1,1,1,1), (originally overcast with multi coloured wool)
Ends:	Not shown on image: 2 fragments (c) and (d), decorated with inlaid brocading in dark blue, reddish brown, light blue-green, and red wool singles (Mallett 1998: 8.31 & 8.32)
Examined by:	Jürg Rageth; Riehen, December 2004

Dyes

Ra 283-1 bluish red, w, 4–6Z:	Lac dye, madder, and young fustic
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

101

Yomut

Gorgan/Atrek Plain or Astarabad

Khali; 4 × 10 *chuval gül* design; with Mughal flower style decorated *alem* at beginning and end
191 × 310 cm / 75¼ × 122 in.
17th century

Collection of Edoardo Concaro, Vilantario, Italy
Published: (1) Concaro / Levi 1999: No. 108; (2) Hali 108: 75

Comparable pieces

(1) Goguel 1927: Fig. C,D,E; (2–4) Cat. nos. 102, 103, and cat. no. 84 with 3 rows of *chuval gül*

– Yomut *khali* with *kepse gül* and stylized Mughal flower style motifs in one or both *alem*: (5) Tzareva 1984: Plate 69; Tsareva 1993: Plate 7; (6) Herrmann IX, 1987: No. 82; (7) Herrmann X, 1988: Plate 95; (8) Cat. no. 95

– Yomut *khali* with simplified version of Mughal flower style motifs from tent bands: (9) Hoffmeister 1980: No. 2, and fig. 13, p. 26, Yomut *khali* with *kepse gül* design; (10) Lefevre, 17 July 1981: No. 23, Yomut *khali* with *kepse gül* design; (11) Herrmann VI, 1984: No. 83, Yomut *khali* with *dyrnak gül* design; (12) Christie's NY, 6 February 1993: Lot 70, Yomut *khali* with *kepse gül* design; (13) Besim 2, 1999: No. 61, Yomut *khali* with c-*gül* design; (14) Rippon Boswell 56, 2001: Lot 76, Yomut *khali* with *kepse gül* design; (15) Nagel, 5 November 2002: Lot 177, Yomut *khali* with *kepse gül* design

– Other Turkmen weavings with simplified version of Mughal flower style motifs from tent bands: (16) Pinner / Franses 1980: Plate XIII, fig. 264, Yomut *ensi*

– For other *khali* with *chuval gül* design, see cat. no. 104

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory – Some discontinued warps in both *alem* – Some inserted warps in the field
Weft:	Wool or camel hair, 2Z, mix of different shades of brown Cotton, 2Z, white, used only between the first ten rows of knots at the beginning of the piece
Pile:	Wool, 2Z, some 3Z 10 colours – Brownish red, some 3Z; 2 shades of orange-red, some 3Z (Ra 201-3) ; 3 shades of blue, some 3Z; 2 shades of green (Ra 201-1); dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Symmetrical – Multiple use of offset knotting for pattern in borders and *elems* (Mallett 1998: 2.21-26) – Multiple use of rows of overlapping knots (Mallett 1998: 2.32-33) – Some single rows of knots offset (Mallett 1998: 2.34) – Discontinuous knotting and wefts in some areas (Mallett 1998: 2.67) – One row of overlapping/packing knots in the border – Some ivory marker (?) knots along the vertical middle axis Horiz. 38–40 × 50–60 vert. = 1900–2400 knots/dm²; 1:1.4
Selvages:	Remains of 2 warp units (2,2) reinforced? (Mallett 1998: 15.10) or overcast? (Mallett 1998: 15.21) with wool, Z
Ends:	No original extant
Examined by:	Elena Tsareva; Riehen, June 2002

Dyes

Ra 201-1 green, w, 2Z:	Persian larkspur and indigo
Ra 201-3 orange-red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-21736
Radiocarbon age:	260 ± 25 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1528–1576 (20.6%) AD 1633–1675 (68.1%) AD 1785–1804 (11.2%) AD 1952–1952 (0.1%)

102

Yomut

Gorgan/Atrek Plain or Astarabad

Khali; 4 × 9 *chuval gül* design; with Mughal flower style decorated *elem* at beginning and end
176.5 × 319 cm/69½ × 125 in.
17th century

The Textile Museum, Washington, DC, no. R 37.5.2
Collection of George Hewitt Myers, acquired in 1914

Published: (1) Schürmann 1969: No. 18; (2) Mackie/Pollard Rowe 1976: Fig. 18; (3) Mackie/Thompson 1980: No. 67; (4) Bier 1987: No. 98; (5) Brend 1991: Fig. 118

Comparable pieces
See cat. no. 101

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z2S, ivory
Weft:	Wool, 2Z, light browns
Pile:	Wool, 2Z 8 colours – Dark brownish purple; red; light blue; medium blue; blue-green; dark blue-green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Offset knotting for pattern in the borders Horiz. 39 × 59 vert. = 2301 knots/dm^2
Selvages/Ends:	Original not extant
Examined by:	ex Mackie/Thompson 1980: No. 67

Dyes
No insect dyes observed by visual inspection
No chemical analysis performed

Dating

Lab. no.:	ETH-23311
Radiocarbon age:	235 ± 45 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1517 – 1605 (15.1%) AD 1620 – 1699 (37.9%) AD 1731 – 1818 (36.2%) AD 1924 – 1961 (10.8%)

103

Yomut

Gorgan/Atrek Plain or Astarabad

Khali; 4 × 10 *chuval gül* design; with Mughal flower style patterned *alem* at beginning and end
166 × 284 cm/69½ × 111¾ in.
End 17th or 18th century

Collection of Moshe Tabibnia, Milan
Published: (1) Cyr Auctions Gray, Maine, 5 May 1999; (2) Hali 105, 1999: 145

Comparable pieces
See cat. no. 101

For a discussion, see Vol. 2

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Piled area; wool or camel hair, 2Z, mix of different shades of brown
Pile:	Wool, 2Z, also 3Z; cotton, 4Z (one short row of knots only) 8 colours (plus some white cotton)– Wool: Reddish brown, also 3Z; lighter shade of reddish brown (top elem only); bright orange-red; 2 shades of blue, also 3Z; blue-green, also 3Z; dark brown; ivory, also 3Z Cotton: White
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Symmetrical – Multiple use of offset knotting for pattern in borders and *elems* (Mallett 1998: 2.21-26) – Some rows of overlapping knots (Mallett 1998: 2.32-33) – Some red marker (?) knots along the vertical middle axis Horiz. 38–39 × 58–60 vert. = 2204–2340 knots/dm²; 1:1.5
Selvages:	Remains of 2 warp units (4,4) overcast with alternating orange-red and dark blue wool, Z (Mallett 1998: 15.21)
Ends:	Remains of up to 1 cm weft faced tabby in reddish brown wool, 2Z, and white cotton, 2Z; one two-colour back-wrapped and bound border in orange-red and dark blue wool, both 4Z (like Mallett 1998: 14.9)
Examined by:	Jürg Rageth; Milan, May 2007

Dyes
No insect dyes observed by visual inspection
No chemical analysis performed

Dating
No radiocarbon dating performed

104

Yomut

Gorgan/Atrek Plain or Astarabad

Khali; 4 × 10 *chuval gül* with *pekwesh alem* design
(291) 302 × (154) 162 cm/119 × 63¾ in.
18th century

Private collection
Unpublished

Comparable pieces

– Yomut and/or Qaradashlï *khali* with 3 columns of *chuval gül*: (1) Lefevre, 26 November 1976: Lot 50; (2) Bausback 1977: 156; (3) Lefevre, 14 April 1978: Lot 47; (4) Lefevre, 30 November 1979: Lot 27; (5) Lefevre, 15 February 1980: Lot 49; (6) Bausback 1981: 129; (7) Sotheby's NY, 30 April 1983: Lot 122; Hali 5/4, 1983: 541; (8) Jourdan 1989: No. 117; (9) Nagel 333, 13 October 1990: Lot 427; (10) Herrmann 4, 1992: No. 92; (11) Rippon Boswell 40, 1994: Lot 39; (12, 13) Pinner/Eiland 1999: No. 37 and 38; (14) Hali 118, 2001: 52; (15) Benardout 2002: 35; (16) Hali 121, 2002: 131; (17–20) Cf. cat. nos. 84–87

– Yomut *khali* with 4 or 5 columns of *chuval gül*: (21) Loges 1978: No. 38; (22) Tsareva 1984: Plate 69; Tsareva 1993: Plate 7; (23) Herrmann VII, 1985: No. 78; (24) Sotheby's London, 19 October 1994: Lot 22; (25) Dodds/Eilands 1996: No. 185; (26) Reuben 1998: No. 72; (27) Rippon Boswell 62, 2004: Lot 76

– Teke, Chowdur, and Ersarï *khali* with *chuval gül* design: (28) Schürmann 1969: No. 4, Teke; (29) Herrmann V, 1983: No. 80; Hali 5/4 1983: 508, Teke; (30) Lefevre, 17 June 1983: Lot 39, Teke; (31) Dodds/Eiland 1996: No. 189, Teke; (32) Rippon Boswell 50, 1998: Lot 173, Teke; (33) Rippon Boswell 51, 1999: Lot 52, Ersarï; (34) Rippon Boswell 54, 2000: Lot 76; Hali 114, 2001: 103, Chodor (?); (35) Rippon Boswell 58, 2002: Lot 153, Teke; (36) Rippon Boswell 67, 2006: Lot 206; (37) Sotheby's NY, Dec. 2007: Lot 61

– Sarïq *khali* with *chuval gül* design: Cf. cat. no. 49

– Other Turkmen pieces with *pekwesh* design: (38–40) Andrews et al. 1993: No. 66, 70, 71; (41) Rippon Boswell 40, 1994: Lot 63; (42) Cat. no. 96;

Structure

Warp:	Wool, Z_2S, mix of ivory and light brown fibres
Weft:	Cotton, Z, 2Z, white; wool, dark brown, Z system of wefting: – Both wefts cotton, white, 2Z; mainly – First weft cotton, Z, plied with wool, Z, 2Z; second weft cotton only, 2Z; and vice versa; area starts 190 cm, ends 260 from bottom
Pile:	Wool, 2Z 7 colours – Brownish red; bright red (Ra 250-1); dark blue; blue-green; light yellow or beige; black-brown; white (bleached?), some 3Z in border
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Symmetrical – Multiple use of offset knotting for pattern in the borders (Mallett 1998: 2.21–2.26) – Multiple use of single rows of knots offset and places of offset knotting in undecorated area of the field (for structure?) – Short rows of overlapping knots observed in right and left side borders (Mallett 1998: 2.32, 2.33) – 5 yellow and 12 red marker (?) knots along the vertical axis Horiz. 39 × 57–60 Vert. = 2223–2340 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 250-1 bright-red, w, 2Z:	Madder (tin excluded)
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-26220
Radiocarbon age:	220 ± 30 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1647–1689 (39.3%) AD 1740–1811 (48.1%) AD 1937–1959 (12.6%)

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 6
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

105

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Astarabad

Khali; *dyrnak* design and pomegranate patterned *alem*
295 × 181 cm/116 × 71¼ in.
16th or 17th century

Collection of Marie and George Hecksher, San Francisco
Published: Andrews et al 1993: No. 1

Comparable pieces

(1) Rippon Boswell 29, 1989: Lot 112; (2) Elmby III, 1996: No. 12

– Yomut *khali* with *dyrnak* design and pomegranate patterned *alem*: (3) Besim 3, 2000: No. 58; Rippon Boswell 59, 2002: Lot 125; (cf. also comparable piece no. 22: Dienes/Reinisch 2001: No. 227)

– Some other Yomut *khali* with *dyrnak* design: (4) Bausback 1977: 157; (5) Loges 1978: No. 35; (6) Lefevre, 30 November 1979: Lot 22; (7) Herrmann II, 1980: No. 87; (8) Mackie/Thompson 1980: No. 68; (9) Lefevre, 27 November 1981: Lot 36; (10) Hali 5/3, 1983: 252; (11) Herrmann 1, 1989: No. 49; (12) Elmby I, 1990: No. 27; (13) Rippon Boswell 36, 1992: Lot 64; (14) Rippon Boswell 39, 1993: Lot 30; (15) Elmby II, 1994: No. 19; (16) Sotheby's London, 19 October 1994: Lot 16; (17) Elmby III, 1996: No. 14; (18) Hali 108, 2000: 141; (19) Rippon Boswell 56, 2001: Lot 27; (20) Dienes/Reinisch 2001: No. 227; (21) Rippon Boswell 66, 2005: Lot 136; (22) Rippon Boswell 68, 2006: Lot 34; (23) Rippon Boswell 69, 2007: Lot 23; (24) Rippon Boswell 71, 2008: Lot 222; (25) Cat. no. 92

– See also "Eagle" *gül* group *khali* cat. nos. 112 and 115

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory to medium brown fibres
Weft:	Wool, 2Z, mix of ivory and light to medium brown fibres
Pile:	Wool, 2Z, some 3Z; height 4–5 mm 7 colours – Dark reddish brown; orange-red; dark blue; blue-green; yellow; ivory; black-brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Some rows of knots offset in plain areas in the field Horiz. 36–39 × 58–59 vert. = 2088–2301 knots/dm^2; 1: 1.5
Selvages/Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, December 2001

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22405
Radiocarbon age:	290 ± 30 y BP
Calibrated age ranges: (95.4 % confidence limit)	AD 1493–1600 (66.6%) AD 1615–1660 (33.4%)

106

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Astarabad

Khali; multiple *gül* design
320 × 176 cm / 126 × 69¼ in.
Mid 15th to mid 17th century

Private collection
Published: Sotheby's NY, October 1998: Lot 173

Comparable pieces

- (1) Hali 5/3, 1983: 255; Mackie/Thompson 1980: 147, fig. 42; Hali 47, 1989: 31; (2) Cat. no. 107

- For multiple *gül khali* with symmetrically coloured early *kepse gül* see cat. no. 108

- *Khali* with C-*gül* design: (3) Neugebauer/Orendi 1909: 211, fig. 137; (4) McMullan 1965: No. 122; Schürmann 1969: No. 15; Hali 47, 1989: Cover; (5) Schürmann 1969: No. 16; Mackie/Thompson 1980: No. 64; (6) Herrmann II, 1979: No. 86; Hali 47, 1989: 37; (7) Azadi 1970: Plate 12; (8) Azadi 1975: No. 11; (9–11) Hali 3/2, 1980: 6, 49, and 163; (12) Hoffmeister 1980: No. 11; (13) Lefevre, 16 October 1981: Lot 16; Hali 47, 1989: 36, figs. 15; (14) Herrmann V, 1983: No. 82; Hali 47, 1989: 33, fig. 8; (15) Herrmann VI, 1984: No. 84; (16) Hali 47, 1989: 36, fig. 14; Herrmann 4, 1992: No. 90; (17–19) Hali 47, 1989: 33–39, figs. 9–11; (20) Jourdan 1989: No. 116; (21) Elmby I, 1990: No. 12; d'Heurle/Munkacsi/Saunders 2003: Plate 9; (22) Andrews et al. 1993: No. 47; Rippon Boswell 40, 1994: Lot 155; (23) Rippon Boswell 38, 1993: Lot 122; (24) Rippon Boswell 41, 1994: Lot 164; (25) Reuben I, 1998: No. 60; (26) Elmby IV, 1998: No. 17; (27) Besim 2, 1999: No. 61; (28) Pinner/Eiland 1999: Plate 31; (29) Sumner/Feltham 1999: 39; (30) Nagel, 15 May 2001: Lot 1740; d'Heurle/Munkacsi/Saunders 2003: Plate 10

- *Khali* with "classic" *kepse gül*: Cf. cat. nos. 94, 95, and 109

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and some brown fibres
Weft:	Wool, Z, 2Z, brown; cotton, white Z, System of wefting: – Wool, 2Z; mainly – Wool, Z, plied with cotton, Z; 2Z (5 wefts in the lower half of the piece only)
Pile:	Wool, 2Z, some 3Z; height in some areas up to 3 mm, mainly worn 9 colours – Reddish brown, some 3Z; dark reddish brown (*alem*); orange-red (Ra 242-1); dark blue; black blue; yellow; dark blue green; dark brown; ivory, some 3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Symmetrical – Single rows of knots offset in plain areas of the field – Large areas of offset knotting in plain areas of the field – Offset knotting for pattern in horizontal minor borders only – A single row of overlapping knots in top elem – A single row (97 cm from top, 34 cm long) of asymmetric knots open right in upper left side of the field Horiz. 35–36 × 49–57 vert. = 1715–2052 knots/dm²; 1:1.5
Selvages:	Original not extant
Ends:	Remains of weft faced tabby in cotton, white, 2Z
Examined by:	Jürg Rageth, July 2005

Dyes

Ra 242-1 orange-red, w, 2Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-25310
Radiocarbon age:	365 ± 45 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1452–1642 (100.0%)

107

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Astarabad

Khali; multiple *gül* design
164 × 290 cm/64½ × 114¼ in.
16th or 17th century

Museum fünf Kontinente, München, inv. no. 86-308 031
Formerly Woger collection no. 13
Published: Hali 47, 1989: 32 (detail)

Comparable pieces

– Multiple *gül khali* with early and "classic" *kepse gül*: (1) Mackie/Thompson 1980: No. 63; Hali 47, 1989: 32, no. 7; (2) Skinner Bolton, 29 November 1984: Lot 85, and December 1990: Lot 117; Hali 47, 1989: 32; Hali 57: 92; (3) Hali 6/1, 1983: 13, advert.; Hali 28, 1985: Back cover inside; (4) Rippon Boswell 73, 2009: Lot 137; (5) Cat. no. 108

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and some brown fibres
Weft:	Wool, 2Z; light brown, Z, plied with dark brown, Z
Pile:	Wool, 2Z, some 3Z; height: worn; many small areas of repair 8 colours – Red-brown; red; dark blue; medium blue; green-blue, some 3Z; yellow; dark brown; ivory The piece looks slightly faded; probably due to a chemical treatment (?) to subdue the colours
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some single rows of knots offset in plain areas in field and *elems* – Some rows of overlapping knots in field and *elems* (Mallett 1998: 2.32, 2.33) Horiz. 34–37 × 42–62 vert. = 1428–2294 knots/dm²; 1:1.5
Selvages:	Remains of 2 warp units (2.2) reinforced with dark brown wool
Ends:	Original not extant
Examined by:	Jürg Rageth; Munich, October 2003

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-26218
Radiocarbon age:	285 ± 40 y BP
Calibrated age ranges:	AD 1487–1672 (97.1%)
(95.4% confidence limit)	AD 1788–1801 (2.9%)

108

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Astarabad

Khali; multiple *gül* design
166 × 312 cm / 65½ × 123 in.
17th or 18th century

Fine Arts Museums of San Francisco, 2001.173
Gift of Marie and George Hecksher
Published: Hali 130, 2003: 80

Komparable pieces

– Multiple *gül khali* with early and "classic" *kepse gül*: (1) Mackie/Thompson 1980: No. 63; Hali 47, 1989: 32, no. 7; (2) Skinner Bolton, 29 November 1984: Lot 85, and December 1990: Lot 117; Hali 47, 1989: 32; Hali 57: 92; (3) Hali 6/1, 1983: 13, advert.; Hali 28, 1985: Back cover inside; (4) Rippon Boswell 73, 2009: Lot 137; (5) Cat. no. 108

– For "Eagle" *gül* group *khali* with multiple (two) *gül* field design, see cat. no. 112

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and medium brown fibres
Weft:	Wool, 2Z, mix of medium brown fibres
Pile:	Wool, 2Z; height 3 mm 8 colours – Dark red-brown; orange-red; brown; dark blue; medium blue; blue-green; yellow; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical Horiz. 32–33 × 51–52 vertical = 1716–1632 knots/dm^2; 1:1.6
Selvages:	2 warp units (2,2) overcast with four Z-spun wool, Z, in blue and blue-green. (Mallett 1998: 15.21)
Ends:	Bottom: original not extant Top: remains of weft-faced tabby, wefts in red-brown and ivory wool, 2Z, two colour chaining in orange and medium blue wool
Examined by:	Diane Mott; San Francisco, December 2001

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22404
Radiocarbon age:	230 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1642–1688 (48.1%) AD 1741–1809 (42.1%) AD 1939–1960 (9.8%)

109

Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Astarabad

Khali; *kepse gül* design
236 × 145 cm / 93 × 57 in
18th century

Formerly collection of Nancy Jeffries and Kurt Munkacsi, New York
Published: (1) Sterner/Kinch 1937: No. 116; (2) Elmby I, 1990: No. 13; (3) d'Heurle/Munkacsi/Saunders 2003: No. 11; (4) Hali 129, 2003: 87; (4) Austrian Auction Company, 9 May 2015: Lot 89

Comparable pieces

(1) Elmby I, 1990: No. 14; (2) Rippon Boswell 32, 1990: Lot 72; (3) Herrmann 4, 1992: No. 89; (4) Rippon Boswell 45, 1996: Lot 129; (5) Elmby V, 2003: No. 11: (6) Sotheby's NY, 14 December 2006: Lot 203; (7, 8) Cat. nos. 94 and 95

– A selection of Yomut *khali* with diagonally arranged "classic" *kepse gül*: (9) Grote-Hasenbalg 1922: Plate 88; (10) Lefevre, 6 February 1976: Lot 55; (11) Herrmann II, 1980: No. 85; (12) Mackie/Thompson 1980: No. 66; (13) Herrmann III, 1981: No. 94; (14) Herrmann VIII, 1986: No. 104; (15) Rippon Boswell 35, 1992: Lot 149; (16) Rippon Boswell 40, 1994: Lot 132; (17) Besim 2 1999: No. 62; (18) Rippon Boswell 56, 2001: Lot 76; (19) Rippon Boswell 57, 2001: Lot 2

For a discussion, see Vol. 2
For radiocarbon dating dtails, see appendix III, table 15

Structure

Warp:	Goat hair, Z_2S, natural medium grey
Weft:	Wool, dark brown, Z, 2Z; cotton, white, Z – Wool, Z, plied with cotton, Z; 2Z – Wool, 2Z
Pile:	Wool, 2Z, some 3Z; cotton, 3Z 8 colours (+ blue cotton) – Wool: Reddish brown; orange-red; dark blue; yellow; blue-green; black; brown; ivory Cotton: Medium blue (one knot only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Symmetrical – Some rows of knots offset in the field – Some rows of overlapping knots in field and minor border Horiz. 35 × 51 vert. = 1785 knots/dm²; 1:1.4
Selvages:	Original not extant
Ends:	Top: Original not extent Bottom: Traces of weft faced tabby, wefts in dark brown wool, 2Z
Examined by:	Peter Saunders; New York

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22416
Radiocarbon age:	190 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1653 – 1699 (23.7%) AD 1731 – 1818 (57.0%) AD 1862 – 1862 (0.1%) AD 1924 – 1961 (19.3%)

110

“Eagle” *gül* Groups

“Eagle” *gül* group I (?)
Presumably from a workshop in Astarabad

Aq yüp
18.5 × 1270 cm/7¼ × 500 in. (ca. 60cm/23¾ in. missing at the beginning)
17th century

Private collection
Published; Rippon Boswell Basel, 29 November 1975: Lot 139

Comparable pieces
(1) Herrmann 1, 1989: Plate 48a; (2) Andrews et al. 1993: No. 43;
(3) Rippon Boswell 58, 2002: Lot 84 (fragment); (4, 5) Isaacson 2007: No. 5 and 6 (fragment); Rippon Boswell 74, 2009: Lot 128: (6, 7) Cat. nos. 111 and 156

– Eventually later relatives: (8) Jourdan 1989: Plate 137; (9) Tsareva 1993: Plate 44 (with silk wefts); (10) Dorotheum Vienna, Auction 24 September 2013: Lot 16

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 7
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory, brownish purple
Weft:	(1) Silk, Z, ivory, loosely plied with cotton, Z, ivory, Z_2S (mostly) (2) Silk, Z_2S, ivory, loosely plied (two areas: 30 cm and 197 cm in the area of the third primary design)
Pile:	Wool, 2Z, some Z and 3Z; silk 2–5Z; height 3–4 mm 12 colours (8 on wool, 4 on silk) – Wool: Red; scarlet, 2–4Z (Ra 264-1); blue, some 3Z; dark blue, some Z; blue-green, 3Z; dark blue-green, some 3Z; brownish purple 2Z; dark brown, 3Z; Silk: Light blue, 4Z; light green, 3Z; yellow, 2Z, 3Z, 5Z; orange, 4Z
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 236–256 warps by 84–87 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998, 3.1–3.4, 3.8) Horiz. 59–64 × 84–87 vert. = 4956–5568 knots/dm² 1:1.14
Selvages:	No additional finish
Ends:	Beginning: Up to 50 cm braided cords, panel of 18 cm length with 1 row of 2/1 two colour counter twining (Mallett 1998: 61) at the beginning, followed by 1 triple stripe, then cut. Middle stripe in red and dark blue 2/2 two colour counter twining, flanking stripes both in red horizontal wrapping (4/2). Sewn to the following rest of the band (see Vol. 2, Fig. 1, in the chapter “The Eagle *gül* Groups”) End: Up to 40 cm braided cords, panel of 70 cm length, with 4 sets of triple stripes. Middle stripe in 3/3 two colour twining, flanking stripes both in horizontal wrapping (2/1). 2 rows of 2/1 twining at the end
Examined by:	Jürg Rageth; Riehen, July 2003

Dyes

Ra 264-1, scarlet, w, 2–4Z:	Mexican cochineal, madder (+tin)
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-27155.1/.2/-32562.1
Radiocarbon age:	270 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1518–1596 (43.1%) AD 1620–1669 (52.5%) AD 1781–1796 (4.4%)

111

“Eagle” *gül* Groups

“Eagle” *gül* group I (?)
Presumably from a workshop in Astarabad

Aq yüp
21 × 1400 cm/8¼ × 551¼ in.
17th or early 18th century

Private collection
Published: (1) Hali 6/1, 1983: 12; (2) Hali 28, 1985: Inside cover;
(3) Rautenstengel/Azadi 1990: Fig. 23; (4) Andrews et al. 1993: No. 33

Comparable pieces
Cf. cat. no. 110

For a discussion, see vol. 2
For dye analysis, see appendix II, table 7
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory, red-brown
Weft:	Silk, 2Z, ivory
Pile:	Wool, 2–4Z; height 2 mm 7 colours (+2 for silk in floating weft pattern stripes) – Wool: Red-brown, 3Z, some 2Z; pale red-brown, 3Z, some 2Z; bright red, 2Z (Ra 694-2) ; scarlet, 4Z (Ra 694-1), dark blue to black-blue, 2Z some 3Z; dark to medium blue-green, 2Z; black-brown, 2Z Silk for floating weft pattern: Greenish dark brown, Z, light blue, Z
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 244–256 warps by 90–93 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998, 3.1–3.4, 3.8) Some single overlapping knots (to adjust pattern ?) Horiz. 61–64 × 90–93 vert. = 5490–5952 knots/dm²; 1:1.4
Brocading:	Five stripes 1 cm wide in inlaid brocading, four in greenish dark brown silk, 2Z, and red-brown wool, 3Z , one in light blue silk, 2Z, and red-brown wool, 3Z
Selvages:	No additional finishing
Ends:	70 cm long panels, each with 4 triple stripes; middle of triple stripe 2/1 two colour counter twining (Mallett 1998: 61); flanking stripes both in horizontal wrapping (2/1); one row of 2/1 twining at beginning and 2 adjacent rows of red 2/1 twining at the end
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 694-1 scarlet, w, 4Z:	Mexican cochineal, madder (+tin)
Ra 694-2 red, w, 2Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-19042.1/.2
Radiocarbon age:	155 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1665–1709 (17.1%) AD 1718–1784 (35.3%) AD 1790–1823 (11.9%) AD 1826–1885 (16.9%) AD 1912–1950 (18.8%)

112

“Eagle” *gül* Groups

“Eagle” *gül* group III (?)
Presumably from a workshop in Astarabad

Torba; *ak su* design
123 × 48 cm/48½ × 19 in.
Pre 1850

Private collection
Unpublished

Comparable pieces

(1) Grote-Hasenbalg 1922: Plate 91, 2; (2) Thacher 1940 (1978): Plate 8; (3) Thompson 1980: No. 58;(4) Eskenazi 1983: No. 272; (5) Lefevre, 4 March 1983: Lot 13; (6) Lefevre, 4 April 1983: Lot 13; (7) Lefevre, 21 October 1983: Lot 19; (8) Skinner Bolton, 3 November 1983, lot 68; (9) Rippon Boswell, 10 November 1984: Lot 84; Jourdan 1989: No. 172; (10) Herrmann VII, 1985: No. 73b; Rautenstengel/Azadi 1990: Plate 21a; (11) Christie’s NY, 8 April 1989: Lot 126; (12) Rautenstengel/Azadi 1990: Plate 21b; (13) Nagel, 13 October 1990: Lot 432; (14) Andrews et al. 1993: No. 34; (15) Sotheby’s NY, 16 December 1993: Lot 52; Dodds/Eiland 1996: No. 214; (16) Elmby II, 1994: No. 28; (17) Nagel, 11 November 1995: Lot 1184; (18) Dodds/Eiland 1996: No 213; Sotheby’s NY, 10 April 1991: Lot 76; (19) Eiland 2003: 252; (20) Sotheby’s NY, 25 November 2008: Lot 86

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 7
For mordant (tin) analysis, see appendix III, table 12

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z, light brown, reddish brown (Ra 414-3); silk, Z, ivory, pale red (Ra 414-4); cotton, Z, medium blue Wefting sequenzes: – First shot wool, Z, light brown, plied with cotton, 2Z, medium blue, 3Z; second shot wool, Z, light brown,, plied with silk, Z, ivory, 2Z; and vice versa; mainly – Both shots wool, Z, light brown, plied with cotton, 2Z, medium blue, 3Z; in field and elem – Both shots wool, Z, reddish brown, plied with silk, Z, pale red, 2Z; in the elem only – First shot wool, Z, reddish brown, plied with silk, Z, pale red, 2Z, second shot wool, Z, light brown, plied with cotton, 2Z, medium blue, 3Z; and vice versa – First shot wool, Z, light brown, plied with cotton, 2Z, medium blue, 3Z; second shot wool, Z, light brown, plied with silk, Z, pale red, 2Z
Pile:	Wool, 2Z, 3Z, some 9(Z_2S), bluish red only 8 colours (+ second shade of lac dye) – Brownish purple, 2–3Z; red, 2–3Z; rose-red, 3–6Z (Ra 414-1); bright red, 9(Z_2S) [Ra 414-2]; orange, 2Z; black-blue, 2Z; dark blue-green (2–3Z); dark brown, 2Z; ivory, 2Z, some 3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open left Horiz. 39–42 × 87–93 vert.= 3393–3906 knots/dm²; 1:2.2
Selvages:	2 warp units (2,2) reinforced with orange wool (Mallett 1998: 15.10)
Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 414-1 rose red, w, 3–6Z:	Lac dye and madder
Ra 414-2 bright red, w, 9(Z_2S):	Lac dye, traces of tannin and madder (tin excluded)
Ra 414-3 reddish brown, wefts, w, Z:	Madder, traces of tannin and a luteolin-containing dyestuff
Ra 414-4 pale red, wefts, s, Z:	Madder and a trace of tannin
Examined by :	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

113

“Eagle” *gül* Groups
“Eagle” *gül* group I
Workshop in Astarabad

Khali fragment; multiple *gül* design *(dyrnak* and “Eagle” *gül*)
175 × 209 cm / 69 × 82¼ in (pile), fragment,
reconstructed length: 234 cm / 92 in.
17th or early 18th century

Private collection
Published: (1) Neugebauer / Orendi 1909: No. 138; (2) Rautenstengel/Azadi 1990: No. 1

Comaparable pieces
(1–6) Rautenstengel/Azadi 1990: Nos. 2–7

– For other multiple *gül khali,* see cat. nos. 106–108 and 117

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 7
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, light ivory
Weft:	Wool, Z, brown, light brown, red (Ra 626-2); silk, Z, pale red (Ra 626-3) Sequence of wefting: First shot wool, Z, red, plied with silk, Z, pale red, 2Z; second shot wool, Z, light brown, plied with wool, Z, brown, 2Z, and vice versa
Pile:	Wool, 3Z 8 colours – Dark red-brown; medium red ; pale peach; purple corroded (Ra 626-1), navy blue; dark blue-green; dark brown; dark ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Asymmetrical, open left Horiz. 42 × 70 vert. = 2940 knots/dm²; 1:1.7
Selvages:	Original not extant
Ends:	Lower end: Up to 7.5 cm weft faced tabby with multi-coloured stripes; with barber pole pattern (for a more detailed analysis see: Rautenstengel/Azadi 1990: Appendix, no. 1) Upper end: Up to 5 cm weft faced tabby with multi coloured stripes; with barber pole pattern (for a more detailed analysis see: Rautenstengel/Azadi 1990: Appendix, no. 1)
Examined by:	Hans Christian Sienknecht

Dyes

Ra 626-1, purple corr. w, 3Z:	Mexican cochineal, madder (+tin)
Ra 626-2, red, wefts, w, Z:	Madder, tannin
Ra 626-3, pale red, wefts, s, Z:	Madder and a trace of tannin
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-30254
Radiocarbon age:	140 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1671–1779 (45.1%) AD 1798–1889 (37.1%) AD 1910–1944 (15.6%) AD 1945–1950 (2.2%)

114

“Eagle” *gül* Groups

“Eagle” *gül* group II (?)
Yomut, Göklen, Yemreli, Oqlï or other
Balkhan Mountains, Gorgan/Atrek Plain (Astarabad?) or Sumbar Valley

Hanging or *torba*
106 × 33 (66) cm/41¾ × 13 (26) in.
Post 1880

Private collection
Unpublished

Comparable pieces

– Asymmetrical open right knotted pieces with comparable design: (1) Gombos 1975: No. 56; (2) Nagel, 23 April 1977: Lot 3; (3) Loges 1978: No. 63; (4) Tsareva 1984: No. 61; (5) Bausback 1987: 214; (6) Eiland 1990: No. 157

– “Eagle” *gül* group II *torba* with wrapped blue fringes: (7) Rautenstengel/Azadi 1990: Plate 25; (8) Pinner 1993: No. 50; (9) Sotheby’s NY, 16 December 1993: Lot 49; Elmby II, 1994: No. 29; (10) Moshkova 1970 (1996): Fig. 112; (11) Hali 139, 2005: 103; (12) Sotheby’s NY, 7 December 2010: Lot 53; (13) Sotheby’s NY, 31 January 2014: Lot 75; (14) Rippon Boswell 84, 2014: Lot. 120

– Other “Eagle” *gül* group II (?) pieces with wrapped blue fringes: (15) Benardout 1974: No. 17, *khalik*; Pinner Franses 1980: No. 417

– “Eagle” *gül* group II (?) pieces with “chequered” triangles: (16) Pinner 1993: No. 50, *torba*; (17) Eiland 2003: 193, *ensi* (type of knot unknown, As2?)

– Ersarï and Kizil Ayak pieces with monochrome blue fringes: (18) Tzareva 1984: No. 107, Ersarï; (19) Herrmann 4, 1992: No. 95b, Ersarï or Kizil Ayak (?); (20) Pinner 1993: No. 52, Ersarï; (21) Andrews et al. 1993: No. 119, Kizil Ayak; (22) Elmby IV, 1998: No. 58, Kizil Ayak; (23) Besim 2, 1999: No. 74, Ersarï

For a discussion, see Vol. 2

Structure

Warp:	Camel hair (?) or wool (?), Z_2S, light brown with some brown fibres
Weft:	Varying systems of wefting in piled area: (1) Wool, 2Z, dark brown; (area of ca. 9 cm) (2) Wool (?), 2Z, light brown; (area of ca. 8.5 cm) (3) Wool (?), 2Z, light brown; system of wefting: (2)//(1)//(2)//(1) etc. (area ca. 6 cm) (4) Wool (?), 2Z, light brown; (area of ca. 4 cm) (5) Wool, 2Z, light red; (area of ca. 3 cm) (6) Wool, 2Z, light red; (9 wefts only, area of ca. 0.8 cm)
Pile:	Wool (?), 2Z, some 3Z, some 8Z; cotton, Z, plied with wool, Z, 2Z (3 knots only); height 4–5 mm 9 colours – Dark brownish purple; orange (8Z, synthetic?); medium violet-red (Mexican cochineal?); dark blue; yellow (2–3Z); blue-green; brown; light brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 1 weft per row of knots, in one area 2 wefts per row of knots
Knot:	Asymmetrical, open right Horiz. 28 × 92 vert.: = 2576 knots/dm^2; 1:3.3
Selvages:	2 warp units (2,2) reinforced with dark brownish purple wool (Mallett 1998: 15.10, 15.11)
Ends:	Top: ca. 2.5 cm weft faced tabby in wool, 2Z, green-blue and brownish purple; folded and sewn. Bottom: Back side in weft faced tabby, wool, 2Z, dark ivory, plied with cotton, Z, white; 3Z. Upper end of back folded and sewn
Fringe:	Wool, ca. 2 × 6Z, dark blue, up to 28 cm long, attached with light brown wool (?). Area of up to ca. 13 cm wrapped: (1) Brownish purple/red, (2) red/dark blue, (3) brownish purple/yellow, (4) red/green, (5) red/white cotton. The colours for wrapping yarns (except for blue) differ from the corresponding pile colours
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Orange wool, 8Z, presumably synthetic (tip-faded)
No chemical analysis performed

Dating

Dated post 1880 by synthetic (?) dyestuff
No radiocarbon dating performed

115

"Eagle" *gül* Groups

Related to, or "Eagle" *gül* group II
Yomut, Göklen, Yemreli, Oqlï or other
Balkhan Mountains, Gorgan/Atrek Plain (Astarabad?) or Sumbar Valley

Khali; *dyrnak* design
180 × 306 cm (312)/ 70¾ × 120½ in.
First half 19th century

Private collection
Published: (1) Clark 1928: Opp. p. 98; (2) Hali 130, 2003: 100; (3) Rippon Boswell 63, 2004

Comaparable pieces

No directly comparable piece published

– Related Yomut pieces: (1) Bogolyubov 1973 (1908/1909): No. 17; (2) Bausback 1969: 75; Bausback 1978: 459; (3) Lefevre, 3 February 1978: Lot 19; (4) Eskenazi 1983: No. 266; (5) Sotheby's NY, 5 December 1987: Lot 68; (6) Woolley and Wallis Salisbury, 11 February 2004: Lot 377

– "Eagle"*gül khali* with "double cross" borders (in most cases only on the sides): (8) Loges 1978: No. 39; (9) Mackie/Thompson 1980: No. 60; (10–16) Rautenstengel/Azadi 1990: No. 8, 10–15; (17) Eiland 1990: No. 144; Rippon Boswell 35, 1992: Lot 142; (18) Pinner/Eiland 1999: No. 28; (19) Concaro/Levi 1999: No. 112; (20) Rippon Boswell 63, 2004: Lot 74

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 7

Structure

Warp:	Wool, Z_2S, mix of ivory and some brown fibres
Weft:	Wool, Z, 2Z, dark brown; cotton, Z, 2Z, white System of wefting: – Both shots cotton, 2Z, white; mainly – Both shots wool, Z, dark brown, plied with cotton, Z, white, 2Z; 100 cm at the beginning of the piece – Both shots wool, 2Z, dark brown; some wefts at beginning and end only
Pile:	Wool, 2Z, some 3–4Z; height 2 mm 9 colours – Brownish purple, some 3Z; orange-red, some 3Z; violet-red, 2–4Z (Ra 625-1), dark blue; medium blue; yellow, some 3Z; dark blue to grey-green; dark brown; ivory, some 3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Asymmetrical, open right Some rows of stacked knots in brownish purple (Mallett 1998, 2.29) Horiz. 42–47 × 52–58 vert. = 2184–2726 knots/dm²; 1:1.2
Selvages:	Original not extant
Ends:	Upper and lower end: 3 cm weft faced tabby with stripes in brownish purple and medium blue wool, 2Z, and white cotton, 2Z
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 625-1 violet-red, w, 2–4Z:	Mexican cochineal, madder and young fustic
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

116

Turkmen

Workshop in Astarabad (or Khorasan?)

Khali; multiple *gül* design (including compound *gül*)
168 × 227 cm / 66 × 89½ in.
17th or 18th century

Fine Arts Museums of San Francisco, 2000.186.16
Gift of Marie and George Hecksher
Published: (1) Sotheby's London, 26 April 1995: Lot 89; (2) Hali 80, 1995: 20; (3) Dodds/Eiland 1996: No. 180; (4) Hali 156, 2008: 55

Comparable pieces

No comparable piece published

- Other multiple *gül khali* with compound *gül* design: (1) Mackie/Thompson 1980: Plate 62 (Sy knotted); Hali 47, 1989: 31, no. 3; (2) Herrmann II, 1980: No. 93; Rautenstengel/Azadi 1990: No. 59

- Pieces with compound *gül* and *dyrnak gül* design:(3) Hali 5/2, 1982: 183; Jourdan 1989: 161; (4) Christie's South Kensington, 20 March 2002: Lot 57; Hali 125, 2002: 129; Hali 126, 2003: 119; (5) Skinner Boston, 10 April 1999: Lot 20; Skinner Boston, 29 April 2000: Lot 15; (6) Rippon Boswell 62, 2004: Lot 70

- Pieces with compound *gül* design only: (7) Milhofer 1968: No. 59; (8) Auction Schloss Ahlden 1997: Lot 1777 (Sy knotted); (9) Cat. no. 159 (dated 1911)

- Non-Turkmen pieces with compound *gül* design: (10) Stanzer 1988: 73, Kordi rug

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Cotton, 2Z, white
Pile:	Wool, 3Z; height 4–5 mm 7 colours – Brownish purple, medium orange, light orange, dark blue, dark green, brown, ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Asymmetrical, open left Horiz. 36–40 × 47–50 vert. = 1692–2000 knots/dm²; 1:1.3
Selvages/Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, December 2001

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-16763
Radiocarbon age:	245 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1530–1546 (3.5%) AD 1635–1673 (73.7%) AD 1777–1800 (21.7%) AD 1941–1946 (1.2%)

117

“P-Chowdur” Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gorgan/Atrek Plain, (Astarabad), Sumbar valley

Aq yüp; all-pile, 2 fragments, sewn together
29–36 × 490 cm/520 cm, totally 1010 cm/11½–14¼ × 397½ in., shortened by approximately 2 m, cut after 4.90 m from the beginning (see complete image of the band fragment in Vol. 2)
17th century

Private collection
Published: (1) Cassin/Hoffmeister 1988: Plate 1; (2) Andrews et al. 1993: No. 8

Comparable pieces

- Asymmetrically open right knotted all-pile *aq yüp*: (1) part 1: Sotheby’s NY, 3 December 1988: Lot 11b; part 2: Hali 74: 117; ORR 12/6, 1992: Back cover; part 3: Hali 91: 168

- For symmetrically knotted all-pile tent bands, see cat. no. 98

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 8
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory,
Weft:	Cotton, Z, 2Z, ivory (unbleached); silk, Z, white System of wefting: – Both shots cotton, Z, ivory, plied with silk, Z, white, 2Z; mainly – Both shots cotton, 2Z, white; 100 cm from the beginning and 220–200 cm before the end of the pile area
Pile:	Wool, 2Z, some 3–6Z; height 3 mm 14 colours – Brownish purple, some 3Z; light brownish purple, some 3Z; reddish brown, (only in small quantities); orange-red, 4–6Z (Ra 668-2); light orange; crimson, 4–6Z, appears in nearly every design element (Ra 668-1); dark blue; medium blue; pale yellow; greenish blue; medium blue-green; light blue-green; green; brown; ivory, 2–3Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps slightly depressed in some areas
Knot:	Asymmetrical, open right Horiz. 47–59 × 57–64 vert. = 2679–3776 knots/dm²: 1:1.14
Salvages:	Original not extant
Ends:	Remains of 5–6 cm weft faced tabby at beginning and end, wefts in ivory (unbleached) cotton, 2Z
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 668-1 crimson, w, 4–6Z:	Mexican or Armenian cochineal and traces of madder and young fustic (tin)
Ra 668-2 orange-red, w, 4–6Z:	Madder and a trace of tannin
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-17361
Radiocarbon age:	310 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1492–1601 (77.4%) AD 1613–1646 (22.6%)

118

"P-Chowdur" Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gorgan/Atrek Plain, (Astarabad), Sumbar valley

Kapunuk; *kejebe* and *kochanak* design
117 × 109 cm / 46 × 43 in.
19th century

Private collection
Published: (1) Loges 1978: No. 69; (2) Andrews et al. 1993: No. 82; (3) Pazyryk Gesellschaft 1998: Plate 30, no. 2

Comparable pieces

No comparable piece published

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Goat (?) hair, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; height 3 mm 8 colours – Purple; orange-red; light orange; dark blue; blue-green; yellow; black-brown; ivory Additional colours for fringe: Medium blue (horizontal panel), light orange red (vertical panels)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 37 × 67 vert. = 2479 knots/dm^2; 1:1.8
Selvages:	2 warp units (2,2) overcast with wool, 2Z, purple (Mallett 1998, 15.67)
Ends:	– Left side vertical panel: 2.5 cm tabby, folded to the back and sewn; attached fringe (as right side panel). – Top horizontal panel: bottom; remnants of attached fringe in wool, 4Z–5Z, purple, medium blue, blue-green, light orange red top: 3 cm tabby, wefts in wool, 2Z, purple, medium brown; folded to the back and sewn down – Right side vertical panel: 2.5 cm tabby, wefts in wool, 2Z, light orange; folded to the back and sewn; attached fringe in wool, 4Z, light orange-red, purple, ivory, blue-green
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Visual inspection dos not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17870
Radiocarbon age:	130 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1670–1780 (41.1%) AD 1797–1951 (58.9%)

119

"P-Chowdur" Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gorgan/Atrek Plain, (Astarabad), Sumbar valley

Mafrash; "compartment and pole" design
64.5 × 42 cm/25½ × 16½ in.
End of 17th or 18th century

Private collection
Unpublished

Comparable pieces

(1) Bausback 1978: 468, sy knotted; (2) Hali 4/1, 1981: 17, no. 22, knot type unknown; (3) Sotheby's NY, 30 October 1981: Lot 198, knot type unknown; (4) Hali 4/3, 1982: 309, knot type unknown; (5) Jourdan 1989: No. 174; Elmby 1990: No. 5A, as knotted; (6) O'Bannon et al 1990: No. 21, sy knotted; (7) Elmby 1990: No. 5, as knotted; (8) Dodds/Eiland 1996: No. 239, knot type unknown; (9) Hodenhagen 1997: No. 24, as2 knotted; (10) Nagel, 6 November 2001: Lot 221, knot type unknown; (11) Rippon Boswell 57, 2001: Lot 172, as2 knotted?; (12) Nagel Auction 55 T, 7 September 2010: Lot 310; (13) plate 113 as knotted

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 8
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool 2Z, light to medium brown
Pile:	Wool, 2Z, some 3–4Z; height 1 mm, worn 8 colours – Ivory; brownish purple; orange-red; pale purple, 2–3Z (Ra 494-1); dark blue; medium greenish blue; dark blue green; yellow
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Asymmetrical, open right Pile upside down in relation to object orientation Horiz. 38 × 65–70 vert. = 2470–2660/dm²; 1:1.8
Salvages/Ends:	Original not extant
Notes:	All contour lines in blue
Examined by:	Jürg Rageth; Riehen, February 2005

Dyes

Ra 494-1 pale purple, w, 2Z:	Mexican cochineal, a trace of madder and young fustic
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-27820
Radiocarbon age:	75 ± 45 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1678–1742 (27.3%) AD 1751–1757 (0.9%) AD 1804–1936 (67.4%) AD 1946–1956 (4.3%)

120

"P-Chowdur" Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gorgan/Atrek Plain, (Astarabad), Sumbar valley

Mafrash; "compartment and pole" design
74 × 33 (66) cm / 29 × 13 (26) in
Post 1880

Private Collection
Published: (1) Rippon Boswell 44, 1996: Lot 142; (2) Hodenhagen 1997: No. 28

Comparable pieces
See plate 119

– For "Eagle" *gül* group II *torba* with the same type of wrapped blue fringes, see cat. no. 114

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 8

Structure

Warp:	Wool, Z_2S, ivory with some brown fibres
Weft:	Wool, 2Z, gray-brown to brown
Pile:	Wool, 2Z, some 3–4Z; height 2–3 mm 8 colours (+ medium blue for fringe) – Brownish red; orange, some 3Z (Ra 500-2), violet-red 2–3Z (Ra 500-1); dark blue; yellow (synthetic?); blue-green; dark brown; ivory, some 4Z, (stacked knots?, Mallett 1998: 2.29)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Some stacked knots (Mallett 1998: 2.29), Horiz. 35 × 78 vert. = 2730 knots/dm²; 1:2.2
Selvages:	2 warp units (2,2) reinforced with orange wool, Z (Mallett 1998, 15.10)
Ends:	Top: 2.5 cm weft faced tabby in brownish purple wool, 2Z, ; folded and sewn. Bottom: Back side in weft faced tabby, wefts in ivory wool, 2Z; upper end of back side folded and sewn Attached fringe: Wool, 2 × 8Z, medium blue, up to 35 cm long: area of 10 cm wrapped in: (1) brownish purple/orange, (2) brownish purple/yellow, (3) brownish purple/ivory, (4) orange/green, (5) orange/medium blue, (6) orange/black-blue. The colours brownish purple (madder?), orange (madder?), black-blue (dark brown overdyed with indigo?) and blue-green (Z_2S) differ from correspondoing pile colours.
Note:	Contour lines partly in blue
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 500-1 violet-red, w, 2–3Z:	Synthetic, tannin and madder
Ra 500-2 orange, w, 3Z:	Synthetic, and a trace of madder
Ra 500-3 brownish red, w, 2Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

Dated post 1880 by synthetic dystuffs

121

“P-Chowdur” Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gorgan/Atrek Plain, (Astarabad), Sumbar valley

Khali; 5 × 17 *tauk nuska* design
275 × 191 cm/108¼ × 75¼ in.
17th/18th century

Collection of Marion and Hans König, Minusio
Published: (1) Hali 3/2, 1980: 92; (2) Andrews et al. 1993: No. 79

Comparable pieces

(1) Loges 1978: No. 111; (2) Lefevre, 25 April 1980: Lot 58; (3, 4) Hoffmeister 1980: No. 6 and 7; (5) Benardout 1983: No. 58; (6) Elmby III, 1996: No. 28; (7) Reuben 2001: No. 34; (8, 9) d’Heurle/Munkacsi/Saunders 2003: No. 20, 21

– For Qaradashlï and Yomut *khali* with *tauk nuska* field design, see plates 89–92

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 8
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, ivory, camel hair, Z, brown System of wefting: – Both shots wool, Z, ivory, plied with camel hair, Z, brown, 2Z – Both shots wool, 2Z, ivory – Both shots camel hair, 2Z, brown
Pile:	Wool, 2Z, some 3Z; height 3 mm 8 colours – Medium purple, some 3Z (Ra 236-1); red/orange-red, some 3Z (Ra 236-2); dark blue; medium blue; green-blue; pale yellow; ivory, some 3Z; corroded black-brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps depressed in some areas
Knot:	Asymmetrical, open right Horiz. 31–33 × 58–66 vert. = 1798–2178 knots/dm²; 1:1.9
Selvages:	Original not extant
Ends:	Bottom and top: 2.5 cm weft faced tabby, wefts in violet wool with a row of inlaid brocading with discontinuous areas of patterning
Examined by:	Elena Tsareva; Riehen, June 2002

Dyes

Ra 236-1 med. purple, w, 2–3Z:	Madder
Ra 236-2 orange-red, w, 2–3Z:	Madder
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-25304
Radiocarbon age:	235 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1525–1557 (6.1%) AD 1630–1682 (49.1%) AD 1734–1806 (38.9%) AD 1931–1947 (5.9%)

122

Chowdur
Mangïshlaq, Üst-Yurt, or Khorezm

Trapping; *ertmen gül* design
180 × 66 cm/71 × 26 in.
18th or early 19th century

Fine Arts Museum of San Francisco, 2000.186.11
Gift of Marie and George Hecksher
Published: (1) Hali 5/3, 1983: 251; (2) Eskenazi 1983: No. 274; (3) Dodds/Eiland 1996: No. 226

Comparable pieces
(1) Mulder-Erkelens 1977: No. 58; (2) Loges 1978: No. 70; (3) Denny 1979: No. 22; (4, 5) Mackie/Thompson 1980: No. 49, no. 50 variation; (6) Andrews et al. 1993: No. 87, variation; (7) Sotheby's NY, 16 December 1993: Lot 37

– Other Chowdur pieces with comparable design and of comparable quality: (8) Volkmann 1985: No. 98, *chuval*; (9) Sotheby's NY, 16 December 1993: Lot 36, *torba*; (10) Hali 105, 1999: *Chuval*

For a discussion, see vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool (?), Z_2S, mix of brown fibres
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; height 3 mm
Colours:	7 colours – Brownish purple; medium orange-red; dark blue; medium green; brown; yellow; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots
Knot:	Asymmetrical, open right Horiz. 42–44 × 52–56 vert. = 2184–2464 knots/dm^2; 1:1.2
Selvages/Ends:	Original not extant
Examined by:	Diane Mott; San Francisco, December 2001

Dyes

Visual inspection dos not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22409
Radiocarbon age:	170 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1656–1709 (19.2%) AD 1718–1823 (49.3%) AD 1826–1885 (14.4%) AD 1912–1950 (17.1%)

123

Chowdur
Mangïshlaq, Üst-Yurt, or Khorezm

Khali; 5 × 12 *tauk nuska* design
197–203 × 227 cm / 80 × 89½ in.
18th century

Private collection
Unpublished

Comparable pieces
No comparable piece published

For a discussion, see vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool or camel hair (?), Z_2S, mix of light brown and some some brown fibres
Weft:	Wool or camel hair (?), 2Z, light brown, some brown fibres
Pile:	Wool, 2Z, 3Z; height up to 5 mm 6 colours – Purple; orange-red; dark blue; shades of green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open right Horiz. 37 × 45–55 vert. = 1665–2035 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Note:	Uneven structure
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Visual inspection dos not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-17364
Radiocarbon age:	165 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1661–1703 (17.3%) AD 1721–1816 (52.9%) AD 1830–1881 (10.9%) AD 1914–1950 (18.9%)

124

Arabachi

Mangïshlaq, Üst-Yurt or Khorezm

Ensi; diagonal cross field desgin
130 × 136 cm / 51 × 53½ in.
19th century

Collection of Marion and Hans König, Minusio
Published: (1) Grote-Hasenbalg 1922: Tafel 92; (2) Schürmann 1969: no. 26; (3) Andrews et al. 1993: no. 90; (4) Hali 96, 1998: 97; (5) Eiland 2003: 186; (6) Hali 132, 2004: 100

Comparable pieces

(1) Lefevre, 16 May 1975: Lot 51; Eiland 1976: 164; Neff/Maggs 1977: Plate 115 (2) Hali 1/1, 1978: 89; (3) Bausback 1979: 149; Hali 2/2, 1979: 70 and 168; Nagel, Stuttgart, 25 May 1979: Lot 44; Jourdan 1989: No. 208; (4) Sotheby's NY, 1 December 1984: Lot 113; Sotheby's NY, 14 December 2006: Lot 137; (5) Sotheby's NY, 31 January 2014: Lot 67

– With "classic" *ensi* design: (6) Bausback 1982: 147; (5) Hali 2/2, 1979: 168; Sotheby's London 19 May 1979: Lot 51; Hali 41, 1988: 89; Jourdan 1989: No. 205; (7) Bausback 1982: 147; (8) Hali 37, 1988: 91; (9) Christie's East, N.Y., 7 June 1988: Lot 67; Hali 41, 1988: 89 (10) Eiland 1990: No. 130; Pinner/Eiland 1999: No. 54; Hali 96, 1998: 96, fig. 10; (11) Rippon Boswell 49, 1998: Lot 134

– With additional *kejebe* panel at the top: (12) Bausback 1972 (Heft 4): 111; Carola van Ham, Köln, 28 November 1998: Lot 745; (13, 14) Bausback 1978: 496 and 497; Rippon Boswell 57, 2001: Lot 143; (15) Nagel 11. März 1987: Lot 3335, Farbtafel 31; Jourdan 1989: No. 206; (16) Hali 94, 1997: 112; (17) Rippon Boswell 66, 2005: Lot 58

– See also: (18) Eiland 2003: 187, fig. 20; (19) Bogolyubov/Thompson 1973: No. 24; Tzareva 1984: No. 109; Dodds/Eiland 1996: No. 164

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 9
For mordant (tin) analysis, see appendix III, table 11
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool or goat hair, Z_2S, mix of grey, brown, and ivory fibres
Weft:	Cotton, 2Z, white, blue; camel hair (?), Z, light brown system of wefting: – Cotton, 2Z, white, some blue; – Camel hair (?), Z, loosely plied with cotton, Z, white, 2Z
Pile:	Wool, 2Z, some 3–4Z; silk, I; height up to 3 mm 10 colours – Wool: brownish-purple, some 3–4Z; bright red, some 3–4Z (Ra 238-1); light purple (Ra 238-2); black blue; blue, some 3–4Z; blue-green; pale yellow; brown; ivory Silk: Magenta (Ra 238-5)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Horiz. 32–38 × 50–56 vertical = 1600–2128 knots/dm²; 1:1.5
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva; Riehen, June 2002

Dyes

Ra 238-1 bright red, w, 2Z:	Madder (tin excluded)
Ra 238-2 light purple, w, 2Z:	Mexican cochineal and traces of madder (tin excluded)
Ra 238-5 magenta, s, I:	Mexican or Armenian cochineal, madder
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-25306
Radiocarbon age:	220 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1641–1680 (41.4%) AD 1736–1805 (50.7%) AD 1933–1947 (7.9%)

125

Arabachi (?)
Mangïshlaq, Üst-Yurt or Khorezm

Aq yüp; mixed technique
31–36 × 1270 cm / 12¼–14¼ × 500 in.
18th or early 19th century

Private collection
Unpublished

Comparable pieces
No directly comparable piece published

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 10
For mordant (tin) analysis, see appendix III, table 12

Structure

Warp:	Wool, Z_2S, dark ivory and medium brown; wavy
Weft:	Cotton, 2Z, white
Pile:	Wool, 2–9Z; cotton, 2Z; silk, 4Z; height 2 mm 15 colours (13 on wool, 1 on cotton, 1 on silk) Wool: Red, 2–3Z; scarlet, 5–9Z (Ra 463-4); rose red, 3–6Z (Ra 463-3); ruby red, 3[Z_2S] (Ra 463-2); light orange, Z–2Z; dark purple, 2Z; medium purple, 2Z; dark blue, 2Z; medium blue, 2Z; yellow, Z–2Z; medium blue-green, 2Z; light blue green, 2Z; dark brown, 2Z; Cotton: White, 2Z; Silk: Magenta, 4Z (Ra 463-1)
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 164–184 warps by 57–59 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1-3.4); Horiz. 41–46 × 57–59 vert. = 2337–2714 knots/dm^2
Selvages:	3 warps, Z_2S, overcast with wool, Z, in red and blue (Mallett 1998, 15.21/23, but 3 warps instead of 2 warp units)
End panels:	Beginning: Panel of 95 cm length decorated with horizontal bands in inlaid brocading (Mallett 1998: 8.31/32), 4 span counter twining (Mallett 1998: similar as 4.3) and 2/1 diagonal wrapping (latter for vertical borders only), all on top layer of warps. Remains of up to 15 cm plaited fringe. End: Panel of 105 cm length, otherwise very similar to the panel at the beginning, except for plaited fringe, which are all cut.
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 463-1 magenta, s, 4Z:	Mexican or Armenian cochineal and madder
Ra 463-2 ruby red, w, 3(Z_2S):	Lac dye, Mexican or Armenian cochineal, madder
Ra 463-3 rose red, w, 3–6Z:	Lac dye, madder
Ra 463-4 scarlet, w, 5–9Z:	Mexican cochineal, traces of madder and young fustic
Examined by :	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

126

Arabachi

Mangïshlaq, Üst-Yurt or Khorezm

Chuval; 4 × 5 *chuval gül* design
140–145 × 79 cm / 55–57 × 31 in.
19th century

Private collection
Published: Hodenhagen 1997: No. 19

Comparable pieces

(1) Loges 1978: No. 109; Hali 96, 1998: 95, Nr. 7; Rippon Boswell 62, 2004: Lot 51; (2) Hali 1/3, 1978: 308; Rippon Boswell 62, 2004: Lot 74; (3) Herrmann III, 1981: No. 97; (4) Nagel, Auction 276, 18 November 1978: Lot 73, colour plate 12; Jourdan 1989: No. 211; (5) Nagel, Auction 333, 13 October 1990: Lot 419; (6) Andrews et al. 1993: No. 93; (7) Moshkova 1970 (1996): No. 134; (8) Rippon Boswell 49, 1998: Lot 41; (9) Reuben I, 1998: No. 57; (10) Hali 96, 1998: 95, no. 8

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 10

Structure

Warp:	Wool, Z_2S, mix of brown and some ivory fibres
Weft:	Cotton, Z, white, plied with camel hair (?), Z, light brown, 2Z
Pile:	Wool, 2Z, some 6Z; silk, 3–4Z; height up to 4 mm 9 colours (7 on wool, 2 on silk) – Wool: Reddish brown; orange; bright red, 6Z (Ra 480-1), black-blue; dark (greenish?) blue; brown; ivory Silk: Magenta, 4Z (Ra 480-2); yellow
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 35–36 × 45–47 vert. = 1575–1692 knots/dm²; 1:1.3
Salvages:	2 warp units (2,2) reinforced with an extra selvage yarn, now missing
Ends:	Upper end; 4 cm of tabby, wefts in wool, ivory and reddish brown 2Z; ivory part folded to the back and sewn Lower end: Original not extant
Examined by:	Jürg Rageth; Riehen, July 2005

Dyes

Ra 480-1 bright red, w, 6Z:	Mexican cochineal
Ra 480-2 magenta, s, 4Z:	Mexican or Armenian cochineal and madder
Examined by:	KIK-IRPA Brussels

Dating

No radiocarbon dating performed

127

Arabachi
Mangïshlaq, Üst-Yurt or Khorezm

Khali; *chuval gül* design
186 × 286 cm / 73¼ × 112½ in.
17th century

Private collection
Published: (1) Nagel, 6 November 2001: Lot 208; (2) Nagel 7 May 2002: Lot 163

Comparable pieces
No comparable piece published

For a discussion, see Vol. 2
For dye analysis, see appendix II, table 10
For mordant (tin) analysis, see appendix III, table 12
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of brown and some ivory fibres
Weft:	Camel (?) hair, Z, light brown, plied with cotton, Z, white, Z_2S
Pile:	Wool, 2Z, some 4Z; height 4–5 mm 9 colours – Purplish brown; orange-red; scarlet, 4Z (Ra 251-1, some knots only) dark blue; blue; yellow; blue-green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Horiz. 38–39 × 48–55 vert. = 1824–2145 knots/dm²; 1:1.3
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth, Riehen; September 2003

Dyes

Ra 251-1 scarlet, w, 4Z:	Mexican cochineal, madder, and traces of young fustic (+tin)
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-26221
Radiocarbon age:	295 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1492–1600 (69.9%) AD 1614–1657 (30.1%)

128

Arabachi

Mangïshlaq, Üst-Yurt or Khorezm

Khali; 3 × 14 *tauk nuska* design
296 × 217 cm / 116½ × 85½ in.
Early 18th century

Fine Arts Museum of San Francisco, 2001.143.17
Gift of Marie and George Hecksher
Published: Reuben I, 1998, no. 55

Comparable pieces

(1) Edelmann NY, 15 April 1980: Lot 189; Andrews et al. 1993: No. 88; HALI 96, 1998: 93, fig. 2; (2) Volkmann 1985: No. 88

– With 4 rows of *tauk nuska*: (3) Gombos 1975: No. 22; (4) Lefevre, 25 March 1977: Lot 11; (5) Nagel 261st Auction, 1976: Lot 67; Loges 1978: No. 108; Jourdan 1989: No. 203; (6) Lefevre 25 March 1977: Lot 11; Hoffmeister 1980: No. 4; (7) Elmby 1990: No. 38; (8) Sotheby's London, 19. Oktober 1994: Lot 49; (9) Pinner/Eiland 1999: No. 53; (10) Reuben I, 1998: No. 56; Hali 97, 1998: 34; Christie's London, 17 October 2002: Lot 31

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

Structure

Warp:	Wool, Z_2S, mix of dark brown and ivory fibres
Weft:	Wool (?), Z, light brown, plied with cotton, Z, white, 2Z
Pile:	Wool, 2Z; height 4–5 mm 8 colours – Brownish purple; medium orange-red; dark blue; medium blue; yellow; blue-green; medium brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open left Horiz. 27–29 × 44–51 vert. = 1188–1479 knots/dm²; 1:1.7
Selvages:	Original not extant
Ends:	Weft faced tabby, wefts in wool, 2Z, brownish purple
Examined by:	Diane Mott; San Francisco, November 2001

Dyes

Visual inspection does not suggest the use of insect dyestuffs
No chemical analysis performed

Dating

Lab. no.:	ETH-22406
Radiocarbon age:	85 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1685–1731 (26.3%) AD 1809–1925 (70.4%) AD 1948–1954 (3.3%)

Appendix I: Turkmen Carpets
Black and White Illustrations and Technical Data
Cat. nos. 128 – 168

129 Salor (?)

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter "The Salor" in Vol. 2)
Kapunuk; curled leave meander design
130 × 130 cm / 51¼ × 51¼ in.
18th or first half 19th century

The Russian Museum of Ethnography, St. Petersburg
Dudin Collection, REM 26-94
Published: (1) Tsareva 1984: No. 4; (2) Dodds / Eiland 1996: No. 138
Comparable pieces: Cf. cat. no. 3

Structure

Warp:	Wool, Z_2S, ivory, mixed with brown fibers
Weft:	Wool, 2Z, ivory, mixed with brown fibres
Pile:	Wool, 2–3Z; height 4 mm 8 colours – Ivory; red; brownish red; orange; yellow; dark blue; dark blue-green; dark brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 45 × 88 vert. = ca. 3960 knots/dm²; 1:1.9
Selvages:	3 warps overcast in blue wool
Ends:	Tabby, wefts in red and ivory wool, folded to the back and sewn
Examined by:	Elena Tsareva; St. Petersburg

Dating

Lab. no.:	ETH-28654.1/.2/.3
Radiocarbon age:	90 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1695–1735 (27.1%) AD 1815–1927 (72.6%) AD 1957–1957 (0.3%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

130 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter "The Salor" in Vol. 2)
Hanging; *kejebe / darvaza* field and *kochanak* border design
61 (shortened) × 64 cm / 24 × 25¼ in., fragment
18th or first half 19th century

The Russian Museum of Ethnography, St. Petersburg
Bogolyubov Collection, REM 87-28
Published: Dodds / Eiland 1996: No. 150
Comparable pieces: Cf. cat. no. 5

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z, 2Z, brown, and red
Pile:	Wool, 2Z, some 3Z and 4Z; silk 2–4Z; height 3–4 mm 10 colours – Wool: Red; carmine, 4Z (lac dye?); brownish purple; dark blue; blue; yellow; dark blue-green; brown; ivory Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps completely depressed
Knot:	Asymmetrical, open left
	Horiz. 58 × 68–80 vert. = 3944–4640 knots/dm²; 1:1.3
Selvages/ends:	Original not extant
Examined by:	Elena Tsareva; St. Petersburg

Dating

Lab. no.:	ETH-18916.1/.2
Radiocarbon age:	75 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1695–1735 (25.8%) AD 1815–1927 (72.6%) AD 1955–1959 (1.6%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

131 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter “The Salor” in Vol. 2)
Torba; 6 × 3 mini *chuval gül*
95 × 42 cm / 16½ × 37½ in.
18th or first half 19th century

Hoffmeister Collection
Published: Tsareva 2011: No. 3
Comparable pieces: (1) Loges 1978: No. 19; (2) Dodds / Eiland 1996: No. 217; (3) Hali 86, 1996: 101; (4) Hali 95, 1997: 60; (5) Hodenhagen 1997: No. 4; (6) Concaro / Levi 1999: No. 177; (7) TKF Graz, 1999: No. 217

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown, some red
Pile:	Wool, 2Z, some 4Z; silk, 2Z 10 colours – Wool: Red, some 4Z; scarlet, 4Z (lac dye?); orange-red; brownish purple; dark blue; medium blue; dark blue-green; brown; ivory – Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open right
	Horiz. 54 × 72 – 82 vert. = 3888 – 4528 knots/dm²; 1:1.5
Selvages/ends:	Original not extant
Examined by:	Elena Tsareva; Dörfles Esbach

Dating

Lab. no.:	ETH-17369
Radiocarbon age:	160 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1668 – 1710 (17.5%) AD 1724 – 1827 (49.7%) AD 1837 – 1889 (13.2%) AD 1917 – 1960 (19.6%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

132 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter “The Salor” in Vol. 2)
Chuval; Salor *gül* design
155 × 78 cm / 61 × 30¾ in., fragmented
18th or first half 19th century

The Russian Museum of Ethnography, St. Petersburg
Bogolyubov Collection, REM 87-24
Published: (1) Bogolyubov 1908: No. 39; (2) Tzareva 1984: No. 1; (3) Dodds / Eiland 1996: No. 149
Comparable pieces: Cf. cat. nos. 11 and 12

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown, some red
Pile:	Wool, 2Z, some 4Z; silk, 2Z; some cotton; height 4 mm 10 colours – Wool: Red; light red; scarlet, 4Z (lac dye?); dark blue; medium blue; yellow; green; dark brown; ivory Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 50 – 53 × 56 – 65 vert. = 2650 – 2968 knots/dm²; 1:1.2
Selvages/Ends:	Original not extant
Examined by:	Elena Tzareva; St. Petersburg

Dating

Lab. no.:	ETH-18911
Radiocarbon age:	75 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1691 – 1737 (26.2%) AD 1812 – 1933 (71.8%) AD 1954 – 1960 (1.9%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

133 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter "The Salor" in Vol. 2)
Chuval; 3 × 3 *chuval gül* design
124 × 81 cm/44 × 32¾ in. (pair with KOB-202?)
Mid 19th century

The Russian Museum of Ethnography, St. Petersburg; REM 87-20
Published: (1) Tzareva 1984: No. 7; (2) Hali 108, 2000: 79
Comparable pieces: (1) Hali 165, 2010: 75; (2) Cat. no. 134

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, mix of ivory and brown fibres
Pile:	Wool, 2Z, some 3–4Z, silk 2–3Z; height 2–3 mm 11 colours–Wool: Red, some 4Z; carmine 4Z (lac dye?); orange-red: dark blue; medium blue; yellow; blue-green; brownish purple; dark brown; ivory, some 3Z Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 52–57 × 54–60 vert. = 2912–3420 knots/dm²; 1:1.1
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva; St. Petersburg, June 2001

Dating

Lab. no.:	ETH-19349
Radiocarbon age:	135 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1676–1784 (43.3%) AD 1804–1897 (40.7%) AD 1912–1948 (15.7%) AD 1957–1957 (0.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

134 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter "The Salor" in Vol. 2)
Chuval; 3 × 3 *chuval gül* design
112 × 83 cm/48¾ × 32 in. (pair with REM 87-20?)
Mid 19th century

The State Russian Museum, St. Petersburg; KOB 202
Published: (1) Tzareva 1984: No. 9; (2) Boguslavskaya 2001: No. 21
Comparable pieces: (1) Hali 165, 2010: 75; (2) Cat. no. 133

Structure

Warp:	Wool , Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z some 5Z; silk 2–4Z; height 3 mm 11 colours–Wool: Red; carmine, 5Z (lac dye?); orange-red; dark blue; medium blue; yellow: blue-green; brownish purple; dark brown; ivory. Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Pile upside down in relation to object orientation Horiz. 48 × 70 vert. = 3360 knots/dm²
Selvages:	2 warp units (2,2) reinforced with red wool (Mallett 1998: 15.10)
Ends:	Top: Tabby, wefts in red and ivory wool, folded to the back Bottom: Remains of tabby in red wool, 2Z
Examined by:	Elena Tsareva; St. Petzersburg, 1999

Dating

Lab. no.:	ETH-18908
Radiocarbon age:	90 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1691–1737 (27.1%) AD 1812–1933 (71.8%) AD 1955–1959 (1.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

135 Salor

Balkhan Mountains, middle reaches of the Amu-Darya, or Merv Oasis
(Cf. map in the chapter "The Salor" in Vol. 2)
Khali (detail); 5 × 11 *gülli gül* design
245 × 296 cm / 96½ × 116½ in.
17th or 18th century

Private collection
Published: Baumann 2008: No. 17
Comparable pieces: Cf. cat. no. 16

Dyes

Ra 608-1 violet-red, w, 4Z:	Mexican cochineal and madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-28652
Radiocarbon age:	90 ± 25 y BP
Calibrated age ranges:	AD 1695–1735 (27.1%)
(95.4% confidence limit)	AD 1815–1927 (72.6%)
	AD 1957–1957 (0.3%)

For a discussion, see vol. 2
For dye analyses, see appendix II, table 1
For radiocarbon dating details, see appendix IV, table 15

136 Ersarï

Middle reaches of the Amu-Darya
(Cf. map in the chapter "The Salor" in Vol. 2)
Ensi
116 × 97 cm / 45¾ × 38¼ in., fragment
17th or 18th century

Hoffmeister Collection
Published: (1) Cassin / Hoffmeister 1988: No. 38; (2) Hali 104, 1999: 85:
(3) Tsareva 2011: No. 112
Comparable pieces: Cf. cat. no. 19

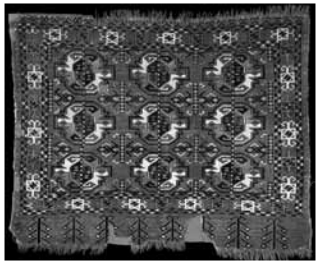
Structure

Warp:	Goat hair (?), Z_2S, ivory
Weft:	Wool, 2Z, some 3Z, brown
Pile:	Wool, 2Z, some 3Z 8 colours – 2 shades of red; orange-red; dark blue, 3Z; dark blue-green; yellow; brown; brownish purple; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps slightly depressed
Knot:	Asymmetrical, open right Horiz. 36 × 64 vert. = 2304 knots/dm²
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva

Dating

Lab. no.:	ETH-17875
Radiocarbon age:	250 ± 35 y BP
Calibrated age ranges:	AD 1523–1598 (21.3%)
(95.4% confidence limit)	AD 1625–1686 (50.6%)
	AD 1744–1757 (1.4%)
	AD 1767–1807 (21.8%)
	AD 1942–1959 (4.8%)

For a discussion, see vol. 2
For radiocarbon dating details, see appendix IV, table 15



137 Ersarï

Middle reaches of the Amu-Darya
(Cf. map in the chapter “The Salor” in Vol. 2)
Chuval; 3 × 3 *chuval gül* design
120 × 90 cm / 47¼ × 35½ in.
18th or early 19th century

Collection of David Reuben, London
Published: (1) Reuben 1998: No. 41; (2) Hali 99, 1998: 135

Structure

Warp:	Wool, Z_2S, brown
Weft:	Wool, 2Z, mix of grey and light brown fibres
Pile:	Wool, 2Z 7 colours – Rred; brownish orange; dark blue; green; yellow; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 31 × 42 vert. = 1302 knots/dm²; 1:1.3
Selvages:	2 warp threads covered in brown wool
Ends:	Top: Weft faced tabby in ivory wool with 2 blue lines Bottom: Original not extant
Examined by:	David Reuben; London, December 2002

Dating

Lab. no.:	ETH-26821
Radiocarbon age:	165 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1666 – 1707 (17.9%) AD 1725 – 1826 (51.7%) AD 1837 – 1887 (10.7%) AD 1918 – 1960 (19.7%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

138 Ersarï

Middle reaches of the Amu-Darya
(Cf. map in the chapter “The Salor” in Vol. 2)
Khali; compartment design
133 × 187 cm / 47¼ × 35½ in., fragment
18th or early 19th century

Collection of Marion and Hans König, Minusio
Published: Spuhler / König / Volkmann 1978: No. 87

Structure

Warp:	Goat (?) hair, Z_2S, mix of ivory and light brown fibres
Weft:	Cotton, Z, white
Pile:	Wool, 2Z, some 1 – 4Z; cotton, 2 – 4Z; height worn, in some ares up to 2 mm 10 colours – Red, some 3Z; orange, some Z; dark blue, some 3Z; yellow, some 3Z; blue-green; light brown, some 4Z; ivory; dark brown Cotton: White (3Z?), light blue, 2-4Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right
	Horiz. 34 – 38 × 40 – 42 vert. = 1360 – 1596 knots/dm²; 1:1.1
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva; Riehen, June 2003

Dating

Lab. no.:	ETH-25308
Radiocarbon age:	80 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1685 – 1744 (27.3%) AD 1760 – 1766 (0.8%) AD 1807 – 1942 (70.1%) AD 1953 – 1961 (1.8%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

139 Ersarï
Middle reaches of the Amu-Darya
(Cf. map in the chapter "The Salor" in Vol. 2)
Khali; *ikat* design
120 × 290 cm / 47¼ × 114¼ in.
19th century

The Russian Museum of Ethnography, St. Petersburg
Dudin Collection, REM 362-13
Published: (1) Tsareva 1993: No. 9; (2) Cat. Antwerp 1997: No. 135
Comparable pieces: See cat. no. 27

Structure

Warp:	Wool, Z_2S, mix of brown, ivory and light grey fibres
Weft:	Wool, 2Z, light-brown; some red, Z
Pile:	Wool, 2Z, some 2–4Z; height 4 mm
	9 colours – Red, 2–4Z; violet-red; orange; dark blue;
	blue; light yellow; green; dark brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots;
	2 wefts per row of knots, first taut, second sinuous;
	alternate warps depressed
Knot:	Asymmetrical, open on the right
	Horiz. 26–30 × 42 vert. = 1092–1260 knots/dm²; 1:1.5
Selvages:	Brown-red plaiting on 5 warps
Ends:	21 cm tabby; wefts in red and blue (3 × 3 stripes), both 2Z
Examined by:	Elena Tsareva; St. Petersburg

Dating

Lab. no.:	ETH-25311
Radiocarbon age:	235 ± 40 y BP
Calibrated age ranges:	AD 1525–1582 (10.5%)
(95.4% confidence limit)	AD 1587–1594 (0.6%)
	AD 1627–1693 (41.4%)
	AD 1735–1815 (37.4%)
	AD 1930–1960 (10.1%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

140 Sarïq
Middle reaches of the Amu-Darya or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Ensi
105/115 × 140/151 cm / 46 × 59¾ in.
18th or early 19th century

Hoffmeister Collection
Published: (1) Cassin/Hoffmeister 1988: No. 34; (2) Tsareva 2011: No. 19
Comparable pieces: See cat. no. 37

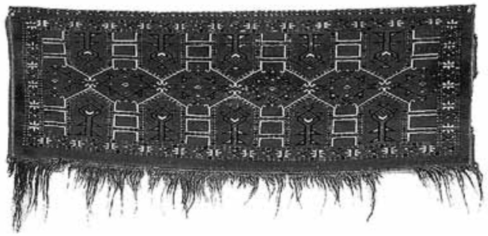
Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, light brown
Pile:	Wool, 2Z; height up to 2 mm
	7 colours – Wool: Red; orange-red; medium blue; yellow; dark
	blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots;
	2 wefts per row of knots, both sinuous
Knot:	Symmetrical
	Rows of overlapping knots mainly in the left side border
	Horiz. 30 × 60 vert. = 1800 knots/dm²
Selvages/Ends:	Original not extant
Examined by:	Hans Christian Sienknecht, March 1988

Dating

Lab. no.:	ETH-17367
Radiocarbon age:	170 ± 30 y BP
Calibrated age ranges:	AD 1663–1705 (18.6%)
(95.4% confidence limit)	AD 1727–1822 (53.1%)
	AD 1838–1886 (8.6%)
	AD 1919–1960 (19.8%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



141 Sarïq

Middle reaches of the Amu-Darya or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Hanging; *kejebe* design
132 × 46 cm / 52 × 18 in.
18th or early 19th century

Formerly Lessley and Robert Pinner Collection, London
Publishhed: (1) Thompson 1983: 9; (2) Rippon Boswell 62, 2004: Lot 69;
Comprable pieces: (1) Mackie / Thompson 1980: No. 23; Dodds/Eiland 1996: No. 256; (2) Tzareva 1984: No. 15; (3) Andrews et al. 1993: No. 112; (4) Pinner 1993: No. 10; (5) Dodds/Eiland 1996: No. 161

Structure

Warp:	Wool, Z_2S, mix of brown and ivory fibres
Weft:	Wool, 2Z, mix of brown and dark brown fibres
Pile:	Wool, 2–3Z; cotton, 2–3Z; silk, 2–3Z 8 colours – Wool: Red; bright red (insect dyed?), orange; dark blue; dark blue-green; brown – Cotton: White – Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Symmetrical Ppile upside down in relation to object orientation Horiz. 40 × 70 vert. = 2800 knots/dm²; 1:1.7
Selvages:	Overcasting on two pairs of warps (2,2) in red wool
Ends:	Top: Tabby, wefts in red and ivory wool, folded and sewn Bottom: 9 cm tabby, wefts in blue-green and ivory wool, folded and sewn; attached medium blue fringe
Examined by:	Elena Tsareva; London

Dating

Lab. no.:	ETH-17866
Radiocarbon age:	135 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1676–1784 (43.3%) AD 1804–1897 (40.7%) AD 1912–1948 (15.7%) AD 1957–1957 (0.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

142 Sarïq

Khiva Oasis, middle reaches of the Amu-Darya or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Hanging; Memling *gül* design
120 × 42 cm / 47¼ × 16½ in.
17th or 18th century

The State Russian Museum, St. Petersburg; Burdukov Collection, KOB-193
Published: (1) Tzareva 1984: No. 26; (2) Concaro/Levi 1999: No. 182; (3) Boguslavskaya 2001: No. 24
Comparable pieces: (1) Hoffmeister 1980: No. 50; (2) Andrews et al. 1993: No. 111; (3) Dodds/Eiland 1996: No. 215

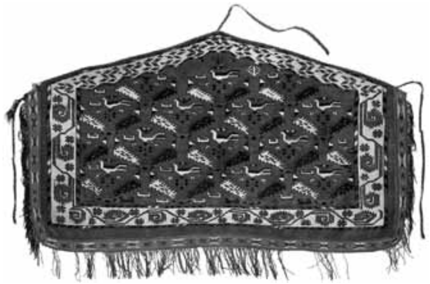
Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, dark brown
Pile:	wool, 2Z, some 3Z; cotton, 2Z; silk, 2Z 8 colours – Wool: Red; orange-red; dark blue; dark blue-green, some 3Z; brown, soem 3Z; ivory Cotton: White – Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Symmetrical Horiz. 40 × 50–80 vert. = 2000–3200 knots/dm²; 1:1.9 Multiple use of offsetknotting in field and *alem*
Selvages/Ends:	Original not extant
Examined by:	Elena Tsareva, St. Petersburg

Dating

Lab. no.:	ETH-24260
Radiocarbon age:	180 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1658–1701 (20.6%) AD 1729–1820 (55.8%) AD 1842–1850 (1.0%) AD 1855–1877 (2.9%) AD 1922–1960 (19.7%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



143 Teke

Balkhan Mountains or Akhal Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Asmalyk; bird design
151 × 88 cm/59½ × 34½ in.
18th century

The Russian Museum of Ethnography, St. Petersburg; Dudin Collection 26-52/2
Published: (1) Pinner/Franses 1980: 115; (2) Tzareva 1984: No. 44; (3) ORR 11/1, 1990: Cover, cat. no. 44; (4) Dodds Eiland 1996: No. 120
Comparable pieces: Cf. cat. no. 54

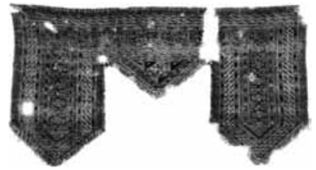
Structure

Warp:	Wool, Z_2S, mix of ivory and brown fibres
Weft:	Wool, 2Z, light brown
Pile:	Wool, Z2, some Z; height 4 mm 6 colours – Red; orange-red; dark blue; blue-green; dark brown; ivory, some Z
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Three rows of symmetrical knots on the right side Horiz. 40–42 × 48–62 vert. = 1920–2604 knots/dm^2; 1:1.3
Selvages:	1 warp unit (2) overcast with red wool (Mallett 1998: 15.21)
Ends:	Bottom: Ivory wool warp faced plain weave folded and sewn Top: Ivory wool warp faced plain weave folded and sewn. Band in warp substitution weave in wool sewn to the edges; 10 cm long blue woollen fringe sewn to the band.
Examined by:	Elena Tsareva; St. Petersburg, November 2002

Dating

Lab. no.:	ETH-18914
Radiocarbon age:	160 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1667–1715 (17.9%) AD 1722–1894 (63.9%) AD 1915–1959 (18.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



144 Teke

Balkhan Mountains, Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Khalik
74 × 40 cm/29 × 15¾ in.
18th or early 19th century

Private collection
Published: Hali 122, 2002: 77

Dating

Lab. no.:	ETH-18899
Radiocarbon age:	120 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1677–1783 (39.2%) AD 1804–1947 (59.8%) AD 1955–1958 (1.0%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

145 Teke
Balkhan Mountains, Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Torba; 3 × 2 *chuval gül* design
106 × 42 cm / 41¾ × 16½ in.
18th or early 19th century

Hoffmeister Collection
Published: Tsareva 2011: No. 52
Comparable pieces: See cat. nos. 55 and 56

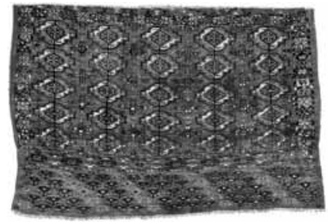
Structure

See Tsareva 2011: No. 52	

Dating

Lab. no.:	ETH-17873
Radiocarbon age:	185 ± 45 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1651 – 1712 (22.6%) AD 1724 – 1830 (48.7%) AD 1835 – 1891 (11.1%) AD 1917 – 1960 (17.7%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



146 Teke
Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Chuval; 5 × 5 small *chuval gül* design
105 × 70 cm / 41¼ × 27½ in.
19th century

Collection of David Reuben, London.
Published: Reuben II, 2001: No. 4
Comparable pieces: (1 – 3) Tzareva 1984: No. 48 – 50

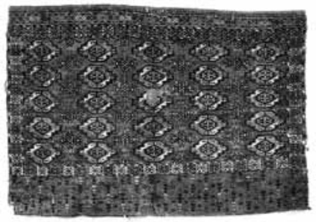
Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, brown
Pile:	Wool, 2Z; silk 2Z; cotton 2Z (few knots only); cotton and wool one ply each 10 colours (+ cotton) – Wool: Red; orange; dark blue; blue; blue green; green; yellow; brown; ivory Silk: Magenta – Cotton: Pink, blue-green
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 45 × 80 vert. = 3600 knots/dm^2; 1:1.8
Selvages:	Original not extant
Ends:	Top: Original not extant Bottom: Traces of weft faced tabby
Examined by:	David Reuben; London, December 2000

Dating

Lab. no.:	ETH-26222
Radiocarbon age:	145 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1673 – 1715 (16.9%) AD 1722 – 1786 (30.0%) AD 1802 – 1894 (34.8%) AD 1915 – 1958 (18.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



147 Teke

Akhal or Merv Oasis
(Cf. map in the chapter “The Sarïq” in Vol. 2)
Chuval; 5 × 5 small *chuval gül* design
120 × 85 cm/47¼ × 33½ in.
19th century

The Russian Ethnographic Museum, St. Petersburg, no. 8762-22681 T
Published: (1) Tzareva 1984: No. 49; (2) Tsareva 1993: No. 60
Comparable pieces: See cat. no. 146

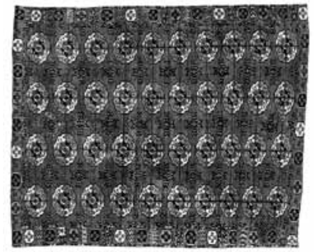
Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z, and camel hair (?), Z, 2Z
Pile:	Wool, 2-3Z; pile height 3-4 mm (olive-brown); pile looks up 10 colours – Violet-red; red, some 3Z; 2 shades of orange; dark blue; medium blue; yellow; bluish green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Symmetrical knots along both edges Horiz. 42–48 × 62–72 vert. = 2604–3456 knots/dm²; 1:1.5
Selvages:	Original not extant
Ends:	Bottom: Weft faced tabby in dark blue, red, ivory; cut Top: Weft faced tabby in bluish green, red, ivory; folded and sewn
Examinde by:	Elena Tsareva; St. Petersburg, November 2002

Dating

Lab. no.:	ETH-18915
Radiocarbon age:	75 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1684–1769 (30.5%) AD 1806–1944 (67.4%) AD 1953–1961 (2.1%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



148 Teke

Balkhan Mountains, Akhal or Merv Oasis
(Cf. map in the chapter “The Sarïq” in Vol. 2)
Khali; with unusal secondary motif
193 × 237 cm/76 × 93¼ in
18th or early 19th century

Formerly Lesley and Robert Pinner Collection, London
Published: (1) Azadi 1975: No. 5; (2) Hali 30, 1986: 9; (3) Rippon Boswell 62, 2004: Lot 8
Comparable pieces: Hali 5/3, 1983: 266; cf. also cat. no. 71

Structure

Warp:	Wool, Z_2S, ivory with some brown fibres
Weft:	Wool, 2Z, light brown with some dark brown fibres
Pile:	Wool, 2Z; height 2.5 mm 6 colours – Red-brown; orange; dark blue; green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 39 × 64 vert. = 2500 knots/dm²; 1:1.6
Selvages/Ends:	Original not extant
Examined by:	Lesley Pinner (Hali 30, 1986: 9)

Dating

Lab. no.:	ETH-18655
Radiocarbon age:	210 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1530–1562 (3.4%) AD 1636–1713 (28.6%) AD 1723–1892 (52.6%) AD 1916–1961 (15.4%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

149 Teke

Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Khali; with piled *alem*
68 × 98 cm / 26¾ × 38½ in., fragment
19th century

The State Russian Museum, St. Petersburg, no. KOB-204
Published: (1) Tzareva 1984: No. 28; (2) Concaro / Levi 1999: No. 184
Comparable pieces: Cf. cat. nos. 71–74

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, 2Z, ivory and red
Pile:	Wool, 2Z; height 2 mm 7 colours – Violet-red; orange; dark blue; medium blue; green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Three rows of symmetrical knots along the edge 1944 knots/dm^2; 1:1.6
Selvages:	2 warp units (2.2) overcast with blue wool (Mallett 1998: 15.21)
Ends:	Original not extant
Examined by:	From Tzareva 1984: No. 28

Dating

Lab. no.:	ETH-19345
Radiocarbon age:	165 ± 55 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1660–1897 (82.6%) AD 1912–1959 (17.4%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

150 Teke

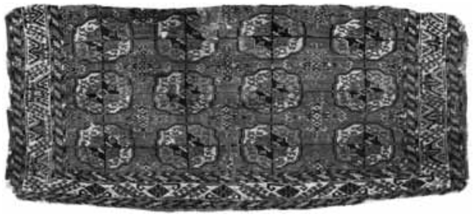
Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Khali; with mini *chuval gül* secondary motif
167 × 76 cm / 65¾ × 30 in., fragment
19th century

Private collection
First publication
Comparable pieces: Cf. cat. no. 72

Dating

Lab. no.:	ETH-17865
Radiocarbon age:	120 ± 55 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1674–1786 (39.6%) AD 1802–1959 (60.4%)

For radiocarbon dating details, see appendix IV, table 15



151 Teke
Akhal or Merv Oasis
(Cf. map in the chapter "The Sarïq" in Vol. 2)
Khali; with white ground lotus (boat) border
167 × 76 cm/65¾ × 30 in., fragment
19th century

The State Russian Museum, St. Petersburg, no. KOB-176
Published: (1) Tzareva 1984: No. 32
Comparable pieces: (1) Rippon Boswell 44, 1996: Lot 80; (2) Rippon Boswell 47, 1997: Lot 65; (3) Herrmann X, 1988: No. 92; (4) Hali 144, 2006: 41

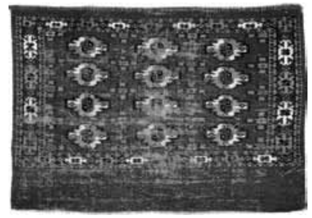
Structure

Warp:	Wool, Z_2S, ivory, slightly brownish red coloured
Weft:	Wool, Z and 2Z; ivory, Z, alternating with red, 2Z
Pile:	Wool, 2–4Z; cotton 6 colours (+ white cotton) – Wool; purpel-red; orange-red; dark blue; blue-green; brown; light brown; ivory Cotton: White (some knots only)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Symmetrical knots along both edges Horiz. 42 × 66 vert. = 2772 knots/dm²
Selvages:	2 warp units (2.2) overcast with blue wool (Mallett 1998: 15.21)
Ends:	Original not extant
Examined by:	Elena Tsareva; St. Petersburg, 1999

Dating

Lab. no.:	ETH-18909
Radiocarbon age:	90 ± 55 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1681–1782 (34.6%) AD 1805–1946 (63.7%) AD 1954–1960 (1.7%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



152 Qaradashlï
Akhal Oasis
(Cf. map in the chapter "The Yazïr-Qaradashlï" in Vol. 2)
Chuval; 3 × 4 small *chuval gül* design
117 × 82 cm/46 × 32¼ in.
End of 17th or 18th century

Private collection
First publication
Comparable pieces: No other piece with 3 × 4 small *chuval gül* design published; for 3 × 3 *chuval gül* design, cf. cat. no. 84

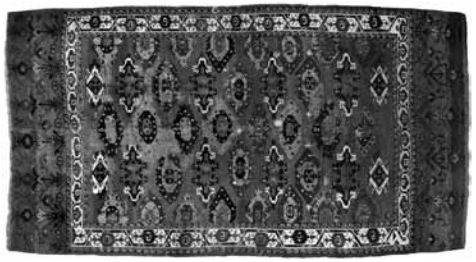
Structure

Warp:	Wool, Z_2S, mix of ivory and brow fibres
Weft:	Wool, brown with some ivory fibres, 2Z
Pile:	Wool, 2Z; height: completely worn 8 colours – Dark brownish purple; orange-red; dark-blue; dark medium blue; brownish yellow; green; dark brown; white
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots; alternate warps originally depressed
Knot:	Symmetrical Multiple use of offset knotting in plain areas only Many rows of overlapping knots in field and border Horiz. 40–41 × 63–69 vert. = 2520–2829 knots/dm²; 1:1.6
Selvages:	Original not extant
Ends:	Upper end: 2.5 cm tabby, wefts in brown wool, 2Z, folded to the back and and sewn Lower end: Cut
Examined by:	Jürg Rageth; Riehen, March 2005

Dating

Lab. no.:	ETH-30793
Radiocarbon age:	100 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1686–1742 (28.2%) AD 1808–1940 (70.6%) AD 1954–1960 (1.2%)

For a discussion, see vol. 2
For radiocarbon dating details, see appendix IV, table 15



153 Qaradashlï (or Yomut?)

Akhal Oasis, or Gorgan/Atrek Plain
(Cf. map in the chapter “The Yazïr-Qaradashlï” in Vol. 2)
Khali; multipl *gül* design
183 × 306 cm / 72 × 120½ in.
17th century

Private collection
First publication
Comparable pieces: See cat. no. 106

Structure

Warp:	Wool, Z_2S; oatmeal (natural)
Weft:	Wool, 2Z; brown (natural)
Pile:	Wolle, 2Z 9 colours – Red-brown; light red; bright red; dark blue; medium blue; yellow (few); dark green; dark brown (contour lines); ivory (natural)
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Symmetrical Frequent use of offset knotting for the design in field, borders and *alem* Some rows of overlapping knots in the plain field (Mallett 1998: 2.32-33) Horiz. 36 × 60 vert. = 2160 knots/dm²; 1:1.7
Selvages:	Original not extant
Begining/End:	Original not extant
Examined by:	Hans Christian Sienknecht; Hamburg, Februar 2014

Datierung

Lab. no.:	ETH-53248
Radiocarbon age:	246 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit) (using OxCal v3.10 for calibr.)	AD 1520 – 1570 (9.6%) AD 1630 – 1680 (51.6%) AD 1760 – 1810 (23.6%) AD 1930 (10.6%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

154 Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Akhal Oasis
(Cf. map in the chapter “The Yazïr-Qaradashlï” in Vol. 2)
Ak yüp; with wedding caravan design
45 × 1235 cm / 17¾ × 486¼ in.
19th century

The Russian Museum of Ethnography, St. Petersburg; REM 5153-1
Published: Cat. Antwerp 1997: No. 42

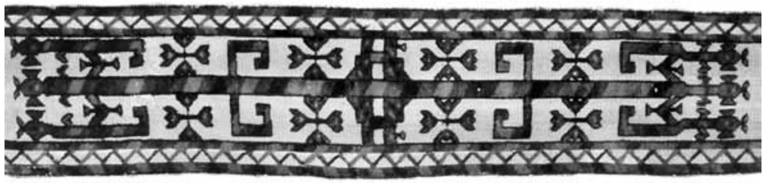
Structure

Warp:	Wool, Z_2S, ivory
Weft:	Cotton, 2Z, white
Pile:	Wool; cotton; camel-hair; silk; all 2Z; height 3 mm 12 colours – Wool: red; orange-red; orange; scarlet (insect dyed?); dark blue; yellow; blue-green; brown; brownish purple; Cotton: white – Camel hair: Light brown – Silk: Magenta
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8) Horiz. 50 × 67 vert. = 3350 knots/dm²
Brocading:	Silk, 2Z and 3Z, floating wefts
Embroidery:	Silk, chain stich, with long step
End:	Lattice made of corded fringe
Examined by:	Elena Tsareva

Dating

Lab. no.:	ETH-18913
Radiocarbon age:	70 ± 50 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1685 – 1746 (27.0%) AD 1752 – 1768 (2.5%) AD 1807 – 1943 (68.3%) AD 1953 – 1961 (2.2%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15



155 Yomut

Balkhan Mountains, Gorgan/Atrek Plain or Akhal Oasis
(Cf. map in the chapter "The Yazïr-Qaradashlï" in Vol. 2)
Aq yüp (detail)
18th century

Private collection
Published: Tsareva 2011: No. 149

Structure

See Tsareva 2011: 167, no. 149

Dating

Lab. no.:	ETH-17874
Radiocarbon age:	95 ± 20 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1696–1735 (27.8%) AD 1815–1927 (72.0%) AD 1957–1957 (0.2%)

For a discussion, see vol. 2
For radiocarbon dating details, see appendix IV, table 15

156 Yomut

Balkhan mountains, Gorgan/Atrek plain or Akhal Oasis
(Cf. map in the chapter "The Yazïr-Qaradashlï" in Vol. 2)
Asmalyk; white ground with tree of life design
81 × 138 cm / 32 × 54¼ in.
Around 1700, or early 19th century

The State Russian Museum, St. Petersburg, no. KOB-191
Published: Concaro/Levi 1999: No. 198
Comparable pieces: (1) Mackie/Thompson 1980: No. 77; (2) Jourdan 1989: No. 198

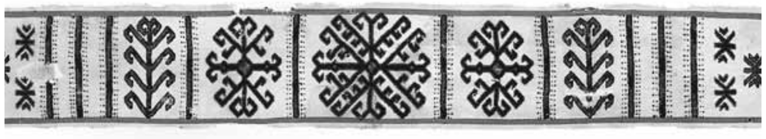
Structure

Warp:	Goat (?) hair, Z_2S, ivory
Weft:	Wool, Z, ivory, and cotton, Z, white, plied 2Z
Pile:	Wool, 2Z; height 5 mm 5 colours – Ivory; orange-red; dark blue-green; brownish purple; dark brown
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Symmetrical Some offset knotting Horiz. 38 × 66 vert. = 2508 knots/dm²
Selvages:	Original not extant
Ends:	Bottom: Weft faced tabby, wefts in ivory wool, folded to the back and sewn Top: Weft faced tabby, wefts in red wool, folded to the back and sewn
Examined by:	Elena Tsareva (from Concaro/Levi 1999: No. 198)

Dating

Lab. no.:	ETH-18907
Radiocarbon age:	110 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1685–1745 (28.6%) AD 1758–1767 (1.6%) AD 1807–1943 (68.9%) AD 1955 – 1959 (0.9%)

For radiocarbon dating details see, appendix IV, table 15



157 "Eagle" *gül* groups

Related to, or "Eagle" *gül* group I
Presumably from a workshop in Astarabad
(Cf. map to the chapter "The Eagle *gül* groups" in Vol. 2)
Aq yüp
17 × 1275 cm / 6¾ × 502 in.
17th century

Hoffmeister Collection
Published: (1) Cassin / Hoffmeister 1988: No. 40; (2) Rautenstengel/Azadi 1990: No. 23; (3) Andrews et al. 1993: No. 33; (4) Tzareva 2011: No. 140
Comparable pieces: See cat. no. 110

Structure

See Rautenstengel/Azadi 1990: Structure tables, 8/28;
Tsareva 2011: 166, no. 140

Dyes

Ho 1-1, bright red, w, ?Z:	Mexican cochineal (most probably on tin)
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-17365
Radiocarbon age:	270 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1497 – 1607 (48.4%) AD 1618 – 1676 (43.4%) AD 1784 – 1805 (7.3%) AD 1949 – 1955 (0.8%)

For a discussion see Vol. 2
For dye analyses, see appendix II, table 7
For radiocarbon dating details, see appendix IV, table 15

158 "Eagle" *gül* groups

"Eagle" *gül* group I
Presumably from a workshop in Astarabad
(Cf. map to the chapter "The Eagle *gül* groups" in Vol. 2)
Khali; palmette and *dyrnak* design
239 (with both *alem* 261.7) × 183 cm / 94 (with both *alem* 103) × 72 in.
17th or early 18th cenruty

Hoffmeister Collection
Published: (1) Rautenstengel/Azadi 1990: Fig. 6; (2) Andrews et al. 1993: No. 32; Tsareva 2011: 166, no. 140
Comaparable pieces: See cat. no. 113

Structure

See Rautenstengel/Azadi 1990: Structure tables, 6/6;
Tsareva 2011: 161, no. 88

Dating

Lab. no.:	ETH-19254
Radiocarbon age:	225 ± 40 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1527 – 1577 (5.5%) AD 1633 – 1699 (37.4%) AD 1732 – 1818 (44.0%) AD 1924 – 1961 (13.1%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

159 "Eagle" *gül* groups

"Eagle" *gül* group I
Presumably from a workshop in Astarabad
(Cf. map to the chapter "The Eagle *gül* groups" in Vol. 2)
Khali; palmette and *dyrnak* design
238.7 (279.4) × 199.3 cm / 94 (110) × 78½ in.
late 17th or early 18th century

The Metropolitan Museum of Art, 22.100.44
Gift of Joseph V. McMullan
Published: (1) McMullan 1965: No. 123; (2) Rautenstengel/Azadi 1990: Abb. 5.
Comaparable pieces: See cat. no. 113

Structure

See Rautenstengel/Azadi 1990: Structure tables, 5/5

Dating

Lab. no.:	ETH-39776.1/.2
Radiocarbon age:	100 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1690–1737 (27.9%) AD 1812–1933 (71.5%) AD 1956–1958 (0.6%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

160 "Eagle" gül Groups (?)

Eventually related to *khali* of "Eagle" *gül* group III
Presumably from a workshop in Astarabad
(Cf. map to the chapter "The Eagle *gül* groups" in Vol. 2)
Khali; compound *gül* design, with inscription and date in upper left corner
199 × 339 cm / 78¼ × 133½ in.
Dated 1911

Private collection
Published: Hali 156: 58

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, Z; silk, Z, 2Z; cotton 2Z 3 irregularly applied variations of weft material combinations have been observed throughout the piece: (1) wool, Z, brown, plied with silk, Z, ivory, 2Z; (2) silk, 2Z, ivory; (3) cotton, 2Z, white
Pile:	Wool, 2Z; height 4 mm, full pile all over the piece 6 colours – Red-brown; red; black-blue; dark blue-green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	information lost Offset knotting (for inscription and star of David only) Horiz. 33–36 × 64–67 vert. = 2112–2412 knots/dm²
Ends:	Weft faced tabby in ivory wool
Examined by:	Information by Hans Christian Sienknecht

Dating

Lab. no.:	ETH-19263
Radiocarbon age:	150 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1672–1713 (17.0%) AD 1724–1788 (32.8%) AD 1800–1831 (12.0%) AD 1833–1892 (19.8%) AD 1917–1958 (18.4%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

161 "P-Chowdur" Group

Yomut, Göklen, Yemreli, Oqlï, Sayinkhani, or other group
Balkhan Mountains, Gurgan/Atrek Plain, (Astarabad), Sumbar valley
(See map in the chapter "The "Eagle" *gül* groups in Vol. 2)
Khali; *dyrnak* field design
187 × 289 cm / 73½ × 113¾ in.
ca. 1700 or early 19th century
Collection of David Reuben London
Published: Hali 155, 2008: 59

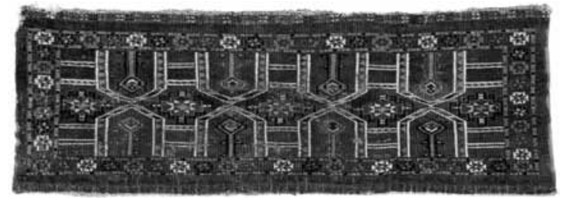
Structure

Warp:	Wool, Z_2S; ivory
Weft:	Wool, 2Z; grey or brown
Pile:	Wool, 2Z 7 colours – Brownish purple; brownish orange; dark blue; greenish blue; pale yellow; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 34 × 66 vert. = 2244 knots/dm²; 1:1.9
Selvages/Ends:	Original not extant
Examined by:	David Reuben; London, September 2007

Dating

Lab. no.:	ETH-27821
Radiocarbon age:	65 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1698 – 1733 (24.2%) AD 1817 – 1925 (73.1%) AD 1954 – 1960 (2.7%)

For radiocarbon dating details, see appendix IV, table 15



162 Chowdur

Mangïshlaq, Üst-Yurt or Khiva Oasis
(Cf. map in the chapter "The Chowdur" in Vol. 2)
Hanging; *kejebe* design
134 × 48 cm / 52¾ × 19 in.
19th century
Formerly Collection of Nancy Jeffries and Kurt Munkacsi
Published: (1) Eiland 1990: No. 151; (2) Austria Auction Company, 9. Mai 2015: Lot 204

Structure

Warp:	Wool and goat hair (?), Z_2S, mixed of brown and grey fibres
Weft:	Wool and camel hair (?), 2Z, natural tan
Pile:	Wool, 2Z; height worn 7 colours – Purple (Ra 220-1); red; pale orange; dark blue; green; brown; ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Horiz. 35 × 67 vert. = 2345 knots/dm²; 1:1.9
Selvages:	1 warp unit (2) overcast with purple wool (Mallet, 1998, 15.21)
Ends:	Top and bottom: Up to 3,8 cm balanced plain weave, tan goat hair and wool (or camel hair?), 2Z, folded and sewn
Examined by:	Peter Saunders; New York

Dyes

Ra 220-1 purple, w, 2Z:	Madder
Examined by:	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-22413
Radiocarbon age:	35 ± 35 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1698 – 1732 (20.8%) AD 1817 – 1925 (70.6%) AD 1953 – 1965 (8.5%)

For a discussion, see Vol. 2
For dye analyses, see appendix II, table 8
For radiocarbon dating details, see appendix IV, table 15

163 Arabachi

Mangïshlaq, Üst-Yurt or Khiva Oasis
(Cf. map in the chapter "The Chowdur" in Vol. 2)
Hanging; *ertmen gül* design
135 × 48.5 cm / 53 × 19 in.
18th or early 19th century

The State Russian Museum, St. Petersburg, no. KOB-224
Published: (1) Tsareva 1984: No. 113; (2) Concaro/Levi 1999: No. 202

Structure

Warp:	Goat hair (?), Z_2S, grey
Weft:	Cotton, Z, white, plied with camel hair (?), Z, light brown, 2Z
Pile:	Wool, 2Z, some 6Z; silk 4–6Z; height: 4 mm 11 colours – Wool: brownish purple; crimson, 6Z (insect dyed?); orange-red; dark blue; medium blue; dark blue-green; yellow; dark brown; ivory Silk: Magenta
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, first taut, second sinuous; alternate warps depressed
Knot:	Asymmetrical, open left Horiz. 38 × 60 vert. = 2280 knots/dm²; 1:1.6
Selvages:	1 warp unit (2) overcats with red wool (Mallett 1998: 15.21)
Ends:	Top: Weft faced tabby in ivory, red and blue-green stripes; folded and sewn; red and blue plaited cord sewn to the upper end
Examined by:	Elena Tsareva

Dating

Lab. no.:	ETH-24261
Radiocarbon age:	185 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1655–1700 (22.1%) AD 1730–1819 (56.8%) AD 1847–1847 (0.1%) AD 1859–1872 (1.5%) AD 1923–1960 (19.5%)

For a discussion, see Vol. 2
For radiocarbon dating details, see appendix IV, table 15

164 Turkmen

Southwest Turkmenistan
Aq yüp (detail)
30 × 695 cm / 11¾ × 273½ in., fragment
17th or 18th century
Published: Elmby 1996: No. 27
Comparaple pieces: Hali 6/1 1983: 12

Structure

Warp:	Wool, Z_2S, ivory; 2 dark blue warps on the right side
Weft:	Cotton, 2Z, white
Pile:	Wool, 2Z, some Z–4Z; cotton, 2Z; height 2 mm 10 colours – Wool: red, some 3Z (Ra 491-2); brownish purple, some Z; crimson, 4Z (Ra 491-1); black-blue; dark blue; medium blue; turquoise, 3Z; blue-green; brown – Cotton: white, 2Z
Ground weave:	Warp faced tabby with inserted rows of knots in pile area; 1 taut weft; 220 warps by 80 wefts/dm
Knot:	Symmetrical tent band knot tied on alternate warps (Mallett 1998: 3.1–3.4, 3.8); some offset knotting Horiz. 100 × 80–85 vert. = 8000–8500 knots/dm²
Salvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, September 2003

Dyes

Ra 491-1 crimson, w, 4Z:	Mexican cochineal and madder
Ra 491-2 red, w, 2–3Z:	Madder
Examined by :	KIK-IRPA Brussels

Dating

Lab. no.:	ETH-17360
Radiocarbon age:	235 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1534–1552 (2.6%) AD 1639–1687 (51.6%) AD 1742–1761 (2.8%) AD 1763–1809 (34.8%) AD 1940–1960 (8.2%)

For dye analyses, see appendix II, table 7
For radiocarbon dating details, see appendix IV, table 15

165 Turkmen
Teke (?)
Southwest Turkmenistan
Torba fragment; *ayna gül* design
46 × 40 cm/18 × 15¾ in.
17th or 18th century

Hoffmeister Collection
Published: Tsareva 2011: No. 66
Comparable pieces: No directly comparable piece published

Structure

See Tsareva 2011: 159, no. 66

Dating

Lab. no.:	ETH-22401
Radiocarbon age:	230 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1642–1688 (48.1%) AD 1741–1809 (42.1%) AD 1939–1960 (9.8%)

For dye analyses, see appendix II, table 7

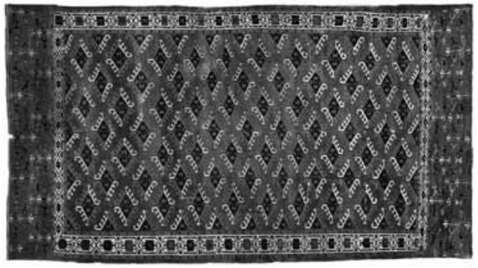
166 Turkmen
Southwest Turkmenistan
Torba fragment (symmetrically knotted); *chuval gül* design
17th or 18th century

Formerly Lesley and Robert Pinner Collection, London
First publication
Comparable pieces: Cat. no. 96 (?)

Dating

Lab. no.:	ETH-22402
Radiocarbon age:	140 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)

For radiocarbon dating details, see appendix IV, table 15



167 Turkmen

"P-Chowdur" group ?
Southwest Turkmenistan
Khali; *dyrnak* design
247 × 142 cm / 97¼ × 56 in.
18th or early 19th century

Structure

Warp:	Wool, Z_2S, ivory
Weft:	Wool, brown, and cotton, white; (1) wool, dark brown, 2Z; (2) wool, Z, brown, plied with cotton, Z, white, 2Z;
Pile:	Wool, 2Z, some 3Z; height 1–3 mm 7 colours – Brownish purple, some 3Z; orange-red, some 3Z; brownish yellow, in *alem* only (Ra 227-1); dark blue; dark blue green; brown; dark ivory
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Asymmetrical, open right Asymmetrical offset knotting; one short row of symmetrical over-lapping knots; many rows of symmetrical knots; 4–8 symmetrical knots along both edges Horiz. 32–34 × 50–60 vert. = 1600–2040 knots/dm²
Selvages/Ends:	Original not extant
Examined by:	Jürg Rageth; Riehen, Febraury 2005

Dyes

Ra 227-1 brownish yellow, w, 2Z:	Persian larkspur
Examined by:	Marmara University Istanbul

Dating

Lab. no.:	ETH-23837
Radiocarbon age:	155 ± 30 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)

For radiocarbon dating details, see appendix IV, table 15

168 Turkmen (?)

Southwest Turkmenistan
khali fragment; *multiple gül* design
239 × 140 cm / 94 × 55 in.
Second half 17th or 18th century

The Metropolitan Museum of Art, 22.100.44
Gift of James F. Ballard
Published: Mackie/Thompson 1980: No. 62; Gilles et al. 2004: No. 56
Comparable pieces: No compareble piece known

Structure

Warp:	Animal hair, Z_2S; undyed light brown
Weft:	Animal hair, Z_2S; undyed light brown
Pile:	Animal hair, Z_2S 7 colours – Dark red; red; dark blue; dark blue-green; light ochre; dyed brown; undyed white
Ground weave:	Weft faced tabby with taut warps and inserted rows of knots; 2 wefts per row of knots, both sinuous
Knot:	Symmetrical Horiz. 29.5 × 51 vert. = 1500 knots/dm²
Selvages/Ends:	No original selvedges or ends
Examined by:	Nobuko Kajitani, The Metropolitan Museum of Art, New York (from Mackie/Thompson 1980)

Dating

Lab. no.:	ETH-39775.1/.2
Radiocarbon age:	215 ± 25 y BP
Calibrated age ranges: (95.4% confidence limit)	AD 1649–1687 (37.0%) AD 1742–1761 (5.2%) AD 1763–1809 (44.8%) AD 1940–1959 (13.0%)

For a discussion, see the chapter "From Safavid Palmettes to the Turkmen *kepse gül*" in Vol. 2.
For radiocarbon dating details, see appendix IV, table 15

Dyestuffs in Turkmen Weavings

Dye Analysis: A Generator of Knowledge Beyond Science Alone

Jan Wouters[1]

1. Introduction

Colour has always been an important element in the culture of peoples all over the world. Not only should it be considered one of the most widely used elements to embellish an object or an individual, but also a means to signify importance and hierarchy. Some colourants have been used to pay taxes and tributes.[2] The painstaking interventions required to select, to grow, to harvest, and to process animal and vegetable sources of colourants justified their high commercial value. Therefore, it is not surprising that the discovery and industrial mass-production of synthetic dyes since the last quarter of the 19th century has led to a fast and complete replacement of natural colourants by synthetics. This change contributed to the disappearance of mysticism and hierarchical appreciation associated with natural colourants.

Colour is given to objects by colourants in the form of dyes or pigments. The difference between the two is that the former are soluble in the medium in which they are applied to give colour to the object, whereas the latter are not soluble in that medium. In paint, pigments suspended in oil are used in most cases. Dyes colour substrates such as yarns in aqueous dyebaths. Yarns may belong to the chemical group of carbohydrates, such as cotton and flax, or to the group of proteins, such as wool and silk. The selection of the substrate to be dyed may influence the choices of colourants. This is a consequence of what is called the affinity of a colouring matter for a substrate to give colour to. Affinity between colourant and substrate can be improved by the use of a mordant. The historically most important mordant is alum, but iron and tin salts have also been used.

Both wool and silk occur in Turkmen weavings. Red colours are omnipresent in a variety of hues. The main analytical objective of the dye analysis project was to look for correlations between observed hues and the yarn substrate on the one hand, colourant and mordant used on the other.

Although dye analysis as such may be exciting from a scientific point of view, its usefulness for the study of historic objects research will depend greatly on its complementarity to results from other studies and on the way all data is compiled and interpreted. The study of Turkmen weavings presented in this book is a good example of how dye analysis can be usefully integrated in a total study. This project is a seldomly encountered opportunity of having so many samples so generously provided with the clear objective to collect as much as possible data on the production technology of Turkmen weavings. And

1 Independent Conservation Scientist – Consultant, Belgium.
2 Born 1936/1938.

thanks to this policy dye and mordant analyses have much contributed to historical, geographical and cultural observations of the weavings studied, as clearly outlined in the book as a whole.

This paper aims to explain important parameters to be considered for accurate and useful dye analysis.

2. General observations on dye analysis

In most natural dyes, several components contribute to the formation of colour. Moreover, the chemical nature of the components may be very similar, even when from highly different sources. For example, anthraquinones and indigoids do occur in plants and also in animals. The total number of natural sources used for dyeing is very high and is a function of geographical conditions and historic evolutions. Furthermore, the way a biological source and preparations made from it are treated before the actual dye is used may introduce variables that are not known when analyzing a particular object. Such procedures are often described in old literature sources but are not always easily interpretable. Natural organic dye components are vulnerable to ageing processes, caused by the atmospheric environment and by substances accompanying them. Procedures developed for the recovery of dyes from their matrix and for their analysis do alter the composition of the dye as such.[3] Last but not least are analytical problems caused by limitations of the performance of instruments in terms of sensitivity and resolution, as well as by the absence of many adequate reference products.

Following these observations on the complexity of all technology that has played a role before the dye on a yarn produced from an earlier living plant or animal can be analyzed and identified, it is clear what should be aimed for in natural dye analysis to identify the biological sources at the species level used for dyeing:

(1) the separation of all the components that are recovered from the dyed fibre;
(2) the characterization of each of these that, according to its spectral data, may contribute to colour;
(3) the calculation of the relative proportions of the different dye components in the sample;
(4) the statistical evaluation of the results obtained as a function of information contained in a database on reference products and dyeings.

In some rare cases, specific degradation products or components present in a dye that do not contribute to colour but show high affinity for a fibre and good resistance to ageing may be used for source identifications.[4]

Attribution or provenance of studied fabrics to a specific geographical area necessitates surveying the biological sources of that particular area which have been known, cited, or supposed to have been used for dyeing. However, any such study should always involve the consideration of possible influences caused by commerce with neighbouring and/or other areas.

3. Sampling and analysis

Invasiveness is the term associated with the removal of a sample from an object for analysis. Destructiveness can mean either the loss of the sample through the analytical process or the damage caused by the process as a whole. Even the most sophisticated techniques available today, which may be expected to deliver sufficient analytical detail, involve invasive sampling of the object at a level observable by the naked eye and subsequent loss of the sample. Non-invasive approaches, such as those measuring the reflectance or fluorescence spectrum directly on the dyed fabric, may cause changes at the molecular level, which are not even observable with an electron microscope. However, more detail and useful information from the sample can normally be obtained by using invasive approaches. If visible alteration of the object is not permissible, then the application of a non-invasive analytical technique may be suggested but, alternatively, the usefulness of such analysis should then be brought into question. This will be the case when the analytical detail to be expected will be estimated too low to give a plausible answer to a formulated request.

For the analysis of dyes and mordants used in Turkmen weavings, all parties involved have selected invasive sampling and high resolution analysis because this approach was the only one that could produce analytical detail good enough to be useful for the multifaceted study of the weavings.

3 Wouters et al. 2011.

4 Quye/Wouters 1992; Wouters et al. 2010.

4. Analytical protocols for dye analysis

An analytical approach is called a protocol when executed in an at least internally controlled and systematic way. The first dye analysis protocol, involving observations of extraction behaviour and discolouration, was developed and applied by Pfister in the 1930s to –50s.[5] The first chromatographic protocol was based on thin layer chromatography.[6] This was followed later on by high performance liquid chromatography (HPLC), combined with single- or multiple-wavelength UV-Vis detection[7] , later combined with photodiode array (PDA) detection[8]. The first non-invasive protocol showing appreciable component resolution was based on three-dimensional fluorescence spectrophotometry.[9] New developments, yet to be translated into systematic approaches and protocols, involve the application of direct mass spectrometric techniques , micro-Raman spectroscopy,[10] and microspectrofluorimetry.[11] The analytical technique selected for dye analysis of the Turkmen weavings was high performance liquid chromatography, coupled with photodiode array detection (HPLC-PDA).

4.1 Chromatography and HPLC-PDA Protocol

The term "chromatography" is derived from the Greek words *chroma* (χρωυα), colour and *graphein* (γραφξιν), to write. Invented and named by Mikhail Tswett in 1901, it has become a general term for a prominent group of laboratory separation techniques.

A chromatography experiment aims to separate mixtures into individual chemical components by introducing the mixture into a system in which a solid stationary phase, normally sitting in a column, is in continuous contact with a mobile phase which is forced through that column. According to the affinity of a component for either the mobile or the stationary phase, it will leave the separation system sooner or later, respectively. When two different components display different affinities, they will pass through the separation system at different speeds and will be separated.

In liquid chromatography, the mobile phase is a liquid. In high-performance liquid chromatography, the quality of all elements of the whole separation system is such that very efficient separation (high resolution) of complex mixtures can be achieved in a short amount of time (often not more than a few minutes).

A major aspect of the versatility of HPLC chromatographic systems is the possible coupling to the separation system of any detector that can handle fluids. Most popular are photodiode array detectors (PDA), fluorimeters, and mass spectrometers (MS).

From the nature of these detectors it may already be concluded that HPLC will be applied mostly for the separation and identification of organic materials in objects of art, such as dyes, amino acids, proteins, carbohydrates, oils-fats-waxes, tannins, acids. When considering applications of HPLC for analyzing art, it must be realised that the technique is destructive in all of its aspects; it requires the removal of a sample from the object and the sample is destroyed in the analytical process, but separated components may be recovered with a fraction collector for further study. Alternatively, analytical parameters such as sensitivity, reproducibility, resolution, quantification and identification potential are all of very high quality and make HPLC a technique representing a high ratio of detail and quality of information to degree of invasiveness/destructiveness. Nowadays, natural dye analyses can be performed by HPLC-PDA on not more than a few hundred micrograms of dyed yarn. More information on HPLC analysis and PDA detection of dyes can be found elsewhere.[12]

5. Red dyes in Central Asia

Central Asia occupies a large central geographical position that not only implies the use of dyes according to region-specific biotopes, but will also have been influenced by surrounding areas (China, the Indian subcontinent, the Near East and, further away, the Mediterranean basin) through commercial activities and changing political circumstances. As a consequence, the red dyes used on Turkmen weavings may reflect a diversity that stretches beyond Turkmenistan. The short description of red dyes given here represents a range of biological sources likely to have been produced locally or imported.

5 Pfister 1935.
6 Masschelein-Kleiner 1967.
7 Wouters 1985.
8 Wouters/Verhecken 1989a.
9 Shimoyama/Noda 1994.
10 Brosseau et al. 2009.
11 Claro et al. 2008.
12 Wouters 2010a, b.

5.1 Scale Insects

Female scale insects of the order *Homoptera*, suborder *Sternorhyncha*, superfamily *Coccoidea*, have been used since early times for the production of red dyes for textiles or for red pigments for paint, usually to be applied on objects of high quality. The value of insect dyes was so high that they were used for paying tributes and taxes.

Several species are known to have been processed to produce such reds. The most important of them are documented in historical literature sources, and their presence in objects of art and culture can be evidenced by present day analysis. However, the possibility of the use of still other species than those documented, probably in a more specific geographic or cultural context, should not be excluded. More information on the historical, geographical, and technical data of scale insects and their dyes can be found in Verhecken/Wouters 1988/89, but some essential data is given below.

The red insect dyes that can be unequivocally identified today are those produced by Mexican cochineal (*Dactylopius coccus* Costa), Polish cochineal (*Porphyrophora polonica* L.), Armenian or Ararat cochineal (*Porphyrophora hamelii* Brandt), kermes (*Kermes vermilio* Planchon), and Indian lac (*Laccifer lacca* Kerr).

5.1.1 Mexican Cochineal (*Dactylopius coccus* Costa)

This insect lives on some cactus species of the genera *Opuntia* and *Nopalea*.[13] There were two commercial grades available: wild insects, of which eight different species are known (*grana sylvestra*), and cultivated ones (*grana fina*). The cultivated insect was twice the size of the wild variety.[14] As much as 20% of its dry body mass is active dyestuff.[15] Cochineal biotopes originally occurred in Central America, Peru, Brazil and Argentina.[16] At present, this cochineal is cultivated on the Canary islands.

13 Donkin 1977a: 12
14 De Lotto 1974: 173.
15 Wouters/Verhecken 1989b.
16 Donkin 1977a: 34; Brunello 1973: 80.

Cochineal has been reported on precolumbian Peruvian textiles, as early as the Huari civilization (500 AD).[17] The first European reports date from the second quarter of the 16th century. It was commercially imported in Antwerp since 1540, but in the early 17th century its use was not yet widespread.[18] The dyestuff was also marketed in Asia by 1580. In 1700 it was known in China (Donkin 1977c).[19] Cochineal became the most highly valued natural dyestuff of the post-medieval period. It was only displaced by the advent of the synthetic azo dyes in the last quarter of the 19th century and, as a consequence, the cochineal cultures almost completely vanished.

5.1.2 Polish Cochineal (*Porphyrophora polonica* L.)

This species lives mainly on the roots of Scleranthus perennis L., in dry warm sandy places in Central and South-Eastern Europe. For the purpose of mating with winged males, the females climb the plant. The eggs are deposited underground in a cocoon of waxy filaments. Larvae feed on the sap of the roots, change to immobile cysts and then to mature insects. Collecting the cysts must have been a painstaking activity, implying lifting the plant with a special trowel, picking the tiny cysts and replacing the plant. One person could collect some 80 g per day, not more![20]

A red dye reflecting the dyestuff composition of present-day Polish cochineal was found on a permafrost-conserved carpet at Pazyryk in Central Asia, radiocarbon dated 383-200 BCE.[21, 22] The consideration of Polish cochineal is justified by this fact as well as by its detection on 4th – 6th centuries silk ribbons of Egyptian or Persian origin.[23] Any still unidentified scale insect species taxonomically different from *Por-*

17 Wouters/Rosario-Chirinos 1992.
18 Scholz 1929: 118.
19 Donkin 1977a: 39.
20 Bancroft 1817: 562.
21 For the result of radiocarbon dating of the Pazyryk carpet, see chapter “From Visual Guesstimate to Scientific Estimate”, fig. 7 in this volume.
22 HPLC-PDA analyses were executed on samples from the Pazyryk carpet, donated by Valery Golikov; essentially, around 20 % of flavokermesic and kermesic acids were found, relative to carminic acid, when integrated at 275 nm; this result indicates Polish cochineal.
23 Wouters et al. 2010

phyrophora polonica but with a similar dye composition, such as *Porphyrophora crithmi* Goux for instance,[24] should also be considered.

5.1.3 Armenian Cochineal (*Porphyrophora hameli* Brandt)

This species lives in the valleys of the region of Mount Ararat and the Caucasus, on salt marshes and on sandy and clayey soil, mostly on the plants *Aeluropus littoralis* and *Phragmites communis*. Emerging red females may have caused cattle to be seen with red legs, as if they had been dyed. Their life cycle is similar to Polish cochineal, but the dye was probably prepared from the adult females.

In ancient literature sources, kermes and Ararat cochineal may have been confused. More recently there are citations of the use of cochineal on wool from the Bar-Cochba caves on the Western shore of the Dead Sea, dated in the first century CE. This is consistent with the detection by infrared spectroscopy of carminic acid, which is the main component of several red insect dyes, including Ararat cochineal. Ararat cochineal may also have been an important dyestuff in Asia Minor in the Middle Ages. A red insect dye used by Phoenicians and Jews in Antiquity was referred to as karmil or as tola' at shani, meaning scarlet worm,[25] possibly referring to Armenian cochineal or a related species. There is still a breeding station for Ararat cochineal in Yerevan, Armenia.

5.1.4 Indian Lac (*Laccifer lacca* Kerr)

Sometimes this species is also included in the genera *Laccifer*, *Lakshadia*, *Tachardia,* or *Carteria*. The insects live in close colonies on branches of the tree *Schleichera trijuga* in Southern and Eastern Asia. They produce a secretion that covers them and ultimately forms a thick layer of lac over the twigs of the host tree, with the insects living in the cells in the lac. Since the dye is concentrated in the eggs and the young larvae, Indian lac was harvested twice a year by cutting the twigs before the complete development of the eggs. This material is called stick-lac. It is still produced, for the collection of the resinous component, shellac.

24 Wouters/Verhecken 1991
25 Sternlicht 1980.

Lac has been used since early times in India and China. But India also imported lac from Burma and Cambodia because of its higher dye content. In Medieval times, Persia and Arabia imported lac from Indonesia and Indochina.[26] Despite its widespread use in Asia, and although it has been identified in textiles from Coptic Egypt after the Arab conquest (8th century CE),[27] it does not seem to have been of regular use in European textiles before the end of the 18th century.[28] This is radically different from the rapid development of the trade in Mexican cochineal. However, lac has been identified in 16th century European polychrome paint.[29]

5.1.5 Kermes (*Kermes vermilio* Planchon)

The exact identity of this red producing insect species has been controversial for a long time. Early authors cite *Kermes ilicis* L. or use the incorrectly spelled *Kermes vermilis*. Modern analyses have revealed *Kermes vermilio* as the red producing insect, since the active dye content of Kermes ilicis was far too low to yield any useful colouration.[30]

Kermes vermilio lives only on the kermes oak *Quercus coccifera* L. in several circum-mediterranean countries. Adult females appear like spherical scales, fixed on the thin branches of the kermes oak, and contain several thousand eggs. The larvae hatch in May-June, disperse over the plants, suck its sap, and develop into adult insects one year after hatching. Winged males fertilize many females which, while depositing their eggs, change into the spherical scale.

Kermes was a highly esteemed dye in Classical Greece and Rome. It was abundantly found on early medieval silk weaves in Europe.[31] After the discovery of America, kermes was gradually replaced by Mexican cochineal. One of the most probable reasons is the much higher dye content of the latter, as compared to the 1% by weight for kermes.

26 Mahdihassan 1954
27 Wouters 1993a
28 Hofenk de Graaff 2004.
29 Wouters 2000.
30 Wouters/Verhecken 1991.
31 Wouters 1993b.

5.2 Madder (*Rubiaceae* Juss.)

Madder is the general trivial name given to the red dye found in the roots of plants of the *Rubiaceae* family. This family comprises the genera *Rubia* L., *Relbunium* (Endl.) Hook. f., *Galium* L., *Morinda* L. and *Oldenlandia* L. to name only the most important for natural dye studies. In each genus there are several species. *Rubia tinctorum* is the most universally growing and has been used all over the world, from Europe to China and in the Americas. *Rubia cordifolia* L., *Rubia munjista* L., and *Rubia sikkimensis* Kurz show similar chemical compositions among them but different from that of *Rubia tinctorum,* and they bear trivial names such as Indian and Chinese madder. On historical and geographical grounds, it is logical to expect to find red dyes prepared from the latter sources in Central Asian textiles, but that does not seem to have been the case with the Turkmen weavings studied.

5.3 Redwood (*Caesalpinia* L. species)

The main colouring matter of redwoods occurs in the wood of many species. Historically *Caesalpinia sappan* L., native to South-East Asia, must be considered the most important source for the Asian continent. It has been imported into Europe from the early Middle Ages onwards.[32] One of the Latin American species, *Caesalpinia brasiliensis* L., is commonly called brazilwood. Interestingly, it is the colour of those trees that gave the name to the country Brazil.

6. The chemistry of red dyes

6.1 Scale Insects

The colouring principles of red insect dyes are anthraquinones. Differentiation between species is possible if, in addition to the presence of specific components, their relative proportions calculated from analysis are also considered. The most challenging in this context is the differentiation between Mexican and Armenian cochineal. Until the 1980s, such a differentiation was not possible because of the lack of an analytical technique with high enough analytical resolution and identification potential. Only after extensive research and analytical work involving HPLC-PDA instrumentation and the availability of scale insects of different provenances, a graphical system could be put forward that displayed probability areas for each Mexican, Armenian, and Polish cochineal. The graphical system involved the identification and relative quantification of three minor components in these dyes: flavokermesic and kermesic acids and a yellow dye component encoded dcII.[33] The determination of the graphical probability areas resulted from laboratory-made samples as well as from experiments on easily interpretable unknowns.

However, more recent experiments have shown that the graphical system is not universally applicable to dyes recovered from wool and silk substrates. Whereas dyes recovered from wool conform well to the identification system, this seems to be less the case with dyes recovered from silk. Regarding the latter yarn type, dcII seems to be less abundant so that the probability areas for Mexican and Armenian cochineal tend to overlap at least partially.[34] This may lead to uncertainties regarding the identification of that red insect dye where carminic acid is the main component and flavokermesic and kermesic acids show relative quantities below 4%, when integrations occur at 275 nm.

Yet, the identification of Polish cochineal or an equivalent is not dependent of the nature of the substrate, wool or silk, because the sum of relative quantities of flavokermesic and kermesic acids should be over 10 %.

6.2 Plants and Trees

In a number of cases, *Rubiaceae* red dyes show quite similar chemical compositions at the species level when measured as water-soluble dye components;[35] in other cases, compositional differences are more substantial.[36] The identification of anthraquinones present in an acid-treated sample, derived from a dyed yarn, and calculation of their relative abundances may help to identify the biological source used at the

32 Hofenk de Graaff 2004.

33 Wouters & Verhecken 1989a.

34 Ina Vanden Berghe, personal communication.

35 Dutra Moresi/Wouters 1997.

36 Wouters 1985.

genus level in most cases, at the species level sometimes.[37] Recently, relationships between species and genera of the *Rubiaceae* family were studied with the help of DNA sequencing. From this study it appears that *Rubia tinctorum* L. and *Rubia peregrina* L. do represent two distinct species, yet they are more closely related to each other than to, for example, *Rubia cordifolia* L..[38] Whereas the identification of either *Rubia tinctorum* or *Rubia peregrina* based on dye compositions may still be considered controversial,[39] those of the group *Rubia cordifolia*, *Rubia munjista,* and *Rubia sikkimensis* is easiy distinguishable from the former by a relative abundance of munjistin considerably higher than that of alizarin.[40]

The red colour produced from redwood is brazilein, a neoflavonoid, that is formed from the lighter-coloured brazilin by oxidation. Redwood dyeings are fugitive to light. Their easy fading through ageing may result in hues that range from pink to beige. The redwood dye is one of the few examples where the dyestuff can still be recognized even when the original colour has completely disappeared. This is the result of the detection of a degradation product that remained unidentified until now.[41]

7. Conclusion

Colours and, hence, dyes are prominent components of objects of art and culture. When studied in a systematic way on a large enough number of samples, results from dye analyses offer a set of technical data, complementary to other studies on the same objects. However, the usefulness of the data depend strongly on the level of analytical detail and on the availability of botanical, geographical, historical, and technical information on the dyes. The best analytical approach available today for the analysis of natural organic dyes and pigments is a combination of high performance liquid chromatography, combined with photodiode array detection (HPLC-PDA) and eventually further complemented with serial mass spectrometric detection (MS). This approach involves the removal of a small sample from the object (a few hundred micrograms) and the destruction of the sample during the analytical protocol. The level of invasiveness/destructiveness is justified by the quality of information obtained, as is clearly demonstrated in conjunction with the other contributions to this study of Turkmen weavings.

37 Wouters 1998.
38 Natali et al. 1996.
39 Wouters 2001.
40 Wouters 1985.
41 Quye/Wouters 1992.

The Identification of Cochineal Species in Turkmen Weavings; A Special Challenge in the Field of Dye Analysis

Ina Vanden Berghe, KIK-IRPA Brussels

1. Introduction

The fascinating rich palette of reddish shades is a very prominent characteristic of Turkmen weavings. In 2003 the question of the source of these fascinating reds led to a multi-year collaboration between Jürg Rageth and the KIK/IRPA textile laboratory in Brussels. The aims of this study are to identify the range of the organic colorants and to specify as closely as possible the related applied biological sources.

1.1 Dye Compounds (see also Appendix II)

Up to the last quarter of the 19th century, various kinds of biological sources were used for dyeing. Characteristic of these natural sources is the fact that they all contain multiple colorants or colorant precursors. One of the principal and at the same time most complex dye sources for red dyeing is madder. In the roots of this dye source, not less then twenty eight anthraquinone derivatives – either in free form (aglycone) or as glycosidic compounds - have been identified so far, although (only) fifteen of them contribute to the dyeing.[1] The best known dye compound is alizarin, present in the roots in the free form but mainly as the primveroside called ruberythric acid. Other compounds found in the madder roots are the aglycones pseudopurpurin, rubiadin, and munjistin together with their glycosides, as well as the glycosides lucidin and rubianin. In dried roots also purpurin, and xanthopurpurin, nordamnacanthal, and anthragallol are found. In fact, these dye compounds are present not only in madder but also in the roots of many other plants belonging to the Rubiaceae family, in very different or non-distinct relative ratios.[2] Not only for vegetable red sources, but even more so for the scale insect reds - the other major source for red colours in the Turkmen weavings - the relative composition of the dye compound mixture is of major importance for the specification of the applied insects. In this context, high performance liquid chromatography (HPLC-DAD) with photo diode array detection was applied for the identification of the organic colorants. The ability to determine a very wide range of colorants, and the very high sensitivity of this method, which allows detection of major and minor dye components in historical fibre samples, are among the principal advantages over thin layer chromatography (TLC). Also for very degraded and faded textiles, or for archaeological textile remains even in heavily mineralized condition, this technique has proven its usefulness many times.

1 Cardon 2003: 104.

2 Wouters, in this volume.

In the case of red scale insect dyeing, it allowed new insights in the use and the differentiation between different insects from the Coccoideae family.[3]

A complete overview of all dye compounds detected in wool and silk sampled from Turkmen weavings for this study is given in appendix II, tables 1 – 10. Object and sample information are listed in the first columns. Detected dye compound composition is shown in the fifth column. Semi-quantitative composition is determined by calculation of the relative ratios of the different compounds after integration of the peak areas at the given wavelength(s) given in the sixth column (expressed in nm). Interpretation indicating the possible vegetal or animal dye sources is suggested in the last column. If the sum of all compounds of one dye source is less than five percent compared to other dye sources, the dye source is considered to be used as a minor source indicated by the expression "trace of" in the table. Unknown compounds with spectral data identical to a known compound though found at a different elution time are coded as the known compound' (e.g. lu'). Information about the applied abbreviations of the compounds is listed at the end of appendix II.

1.2 Mordants (see also Appendix III)

The actual colour of the fibres is not determined only by the dyes used. Most natural dyes are able to attach directly to textile fibres. To overcome this, people used to work with organic and inorganic mordants with which they treated the fibres before or, eventually, at the same time as the dyes in the dye bath. Since early history, a wide range of tannin-containing plants and vegetable aluminium-containing sources were applied, as well as metal salts containing aluminium, iron, or copper. Other mordants were only used at a much later stage, e.g. tin salt mordants since the 17th and chromium salts only since the 19th century.[4] In addition to fixing the dye into the fibres, mordants play a crucial role in the final coloration. The lowest modification of the colour is obtained by using alum mordanted fibres. Applying iron salts give much darker shades; in combination with tannin, it was used to produce greenish, bluish to brownish black colours. Copper-based mordants seems to have been used generally to change yellow colours into more olive-green or bronze shades, while tin mordanting gives more brilliant colours, mainly applied to obtain red and orange shades although it is known to be harmful for the wool fibres.[5]

The use of organic (hydrolysable or not) tannin-rich material as mordant, can be evidenced with HPLC-DAD analysis, mainly based on the detection of ellagic acid (ea). Investigation on inorganic mordants was done by means of scanning electron microscopy (SEM) coupled with energy and/or wavelength dispersive X-ray detection (EDX and/or WDX). The aim of the mordant analyses done for the present dye study on wool and silk samples from Turkmen weavings was initially undertaken to look for tin as a mordant. Beyond that, samples have also been examined to prove the absence of tin, to exclude the use of tin mordant.[6] These latter samples were mainly mordanted with alum, occasionally also in the presence of some iron. The presence of iron is most likely to be considered as an impurity from alum or a contamination during usage of the textiles rather than that it would have been used deliberately for mordanting.

It has to be noted that also in the tin mordanted samples, many other elements are found in small amounts, among them aluminium, magnesium, and sulphur. Since sulphur is also part of the wool fibres itself, this could lead to misinterpretation of the results. Although we can not exclude that they would refer to the use of alum together with tin salts, it is much more likely that the small amounts of these elements, the same as for silicium, sodium, and calcium, are to be considered as overall impurities present on the fibres.

The results are given in appendix III, tables 11 – 14.

2. Cochineal Species Identification on Turkmen Samples

2.1. Red Dye Compounds from Scale Insects

Among the wide range of red shades found in Turkmen weavings, the use of insect red plays a prominent role. As early as the 1970's, it became clear by the tests done by Mark Whiting that these insect reds

3 Wouters/Verheken 1989a.

4 Cardon 2003: 20 – 53.

5 See figs. 14 and 15 in chapter "Scarlet and Purple" in this volume.

6 The reasons for this are explained in chapter "Scarlet and Purple", section 3.6 "Insect dyes on tin mordant" in this volume.

Dye source: Latin nomenclature	Dye source: Common name	Analysis method	Carminic acid (ca)	Kermesic acid (ka)	Flavokermesic acid (fk)	Glucoside of fk (fk-glu)	Laccaic acids
Kerria lacca Kerr	Lac dye	HPLC		+	+		++
Kermes vermilio Planchon	Kermes	HPLC		++	+		
Porphyrophora hamelii Brandt	Armenian or Ararat cochineal	HPLC	++	+	+	+	
Porphyrophora polonica L.	Polish cochineal	HPLC	++	+	+		
Porphyrophora tritici L.	Ekin cochineal	TLC	++				
Dactylopius coccus Costa	Mexican cochineal	HPLC	++	+	+	+	

Table 1: Dye constituents of red insect dyes (ca: carminic acid: fk: flavokermesic acid; ka: kermesic acid, fk-glu: fk-glucoside; laccaic acids)

included both lac and cochineal. However, concerning cochineal, the precise species remained unspecified.[7] Identifying the cochineal species was one of the chief aims of this study with the KIK initiated by Jürg Rageth.

The female scale insects producing the red dyes all belong to the order *Homoptera*, suborder *Sternorhyncha*, superfamily *Coccoidea*.[8] Old world scale insects known as Mediterranean kermes (*Kermes vermilio* Planchon), Polish kermes (*Porphyrophora polonica* L.), Armenian or Ararat kermes (*Porphyrophora hamelii* Brandt), and lac dye (*Kerria lacca* Kerr) have been studied by multiple authors and were evidenced multiple times in early historic textiles.[9] The species called grain kermes or Ekin cochineal (*Porphyrophora tritici* Bod.) is another known Asian scale insect, indigenuous to Central Turkey, though it is not known whether it has been used for dyeing. It was known rather as a parasite, and has actually completely vanished.[10] The import of a 'new' species after the discovery of the Americas caused a complete collapse of the red insect dye market in Europe and Asia, as this American species named Mexican cochineal (*Dactylopius coccus* Costa) had much more dyeing power and brightness than the other species known at that time.

The main colouring compounds present in the female scale insects of kermes and cochineal species as well as in the secretion of lac dye were shown in the late 1980s by Wouters using liquid chromatography with diode array detection.[11] An overview of the characteristic compounds in each of them is given in table 1. Differentiation between these type of insects is not problematic as they have distinct major characteristic dye constituents: kermesic acid in kermes, laccaic acids in lac dye, and carminic acid in cochineal. Among the cochineal insects however, distinction is less straightforward. Besides the principal anthraquinone compound carminic acid, which they have in common, Ararat, Polish, and Mexican insects also share minor dye constituents like kermesic and flavokermesic acid, and to a less extent the 'dcII' compound, recently characterised as the 7-C glucoside of flavokermesic acid.[12] Despite the fact that Böhmer also identified carminic acid as the principal compound from Ekin cochineal, more detailed research on that species has not been possible due to the lack of fresh species nowadays.

2.2. Cochineal Species Identification Procedure

In the course of this study, cochineal species identification was performed primarily according to the procedure developed by Wouters in 1989. The procedure was slightly optimised in order to improve the accuracy of the calculations. Integration was done at different wavelengths (275, 290, 420, and 500 nm) and recalculated to 275 nm, and instead of peak heights, the whole peak areas were considered. Preliminary evaluation of the first group of 90 samples, both wool and silk, in finding that carminic acid, indicative of cochineal dyeing, was the principal dye compound identified in 35 of 90 samples.

7 See chapter "Scarlet and Purple" in this volume.
8 Kosztarab/Kozar 1988; Verhecken/Wouters 1988/89.
9 Wouters/Verhecken 1989a; Böhmer 2002: 203-214; Vanden Berghe et al. 2004.
10 Böhmer 2002: 210.
11 Wouters/Verhecken 1989a.
12 Peggie et al. 2007.

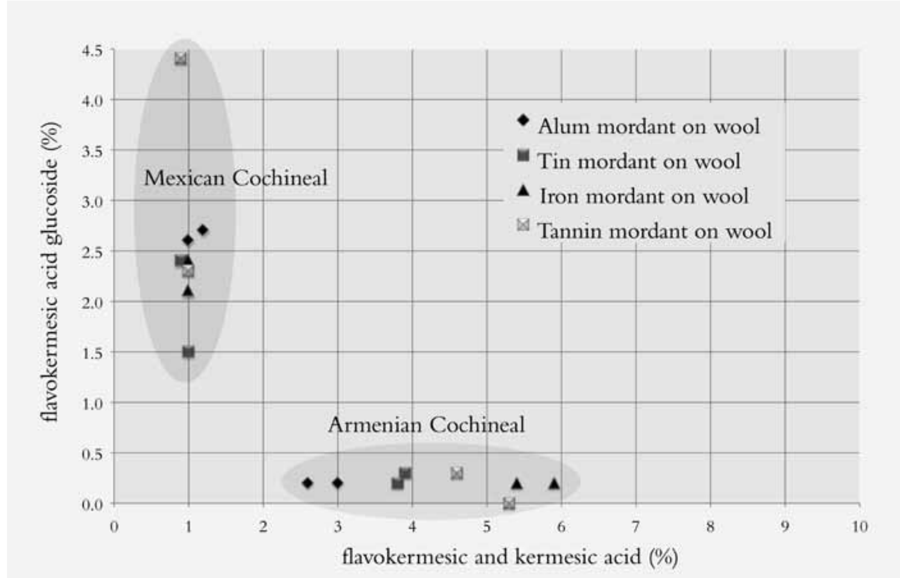
Among the 25 cochineal dyed wool samples, 15 were dyed with Mexican cochineal (*Dactylopius coccus* Costa) and 5 with Armenian cochineal (*Porphyrophora hamelii*, Brandt), while for 10 cochineal dyed silk samples only 2 could be identified as Armenian cochineal (*Porphyrophora hamelii* Brandt).

At that stage, species identification of the cochineal type applied in 10 samples – all characterised by the lack of flavokermesic acid glucoside and extreme low amounts of both flavokermesic and kermesic acids (less than 2.8%) – was not possible. More study about the amount of minor compounds in Mexican and Armenian cochineal will be needed to improve the identification system, while on the other hand, the use of another cochineal species can not be excluded.

At this stage of the work, it was decided to perform new dye experiments with Mexican and Armenian cochineal species. In the previous work from 1989, the focus was on the characterisation of the composition of Mexican, Ararat, and Polish cochineal by the analysis of multiple air dried insects, both adult females and larvae, from different provenances and dates.[13] Where possible, tests were also done with extracts from specific parts of the insects or larvae. Adapted extraction protocols were used for each species and the composition of all extracts was evaluated against the composition obtained after hydrolysis, after all the necessary treatment to recover organic dyes from textiles.

In the new dye experiments, we want to shed more light on the possible influence of parameters related to the dyeing process. The experiments are limited to only Mexican and Ararat cochineal. Dried female insects from Mexican cochineal were bought at Kremer Pigmente, and those from the Ararat species were received from E. M. Danzig, coming from the Zoological Institute of the Academy of Sciences in St. Petersburg (USSR). Parameters tested were the extraction time, the fibres, and mordants.

13 Wouters/Verhecken 1989b.



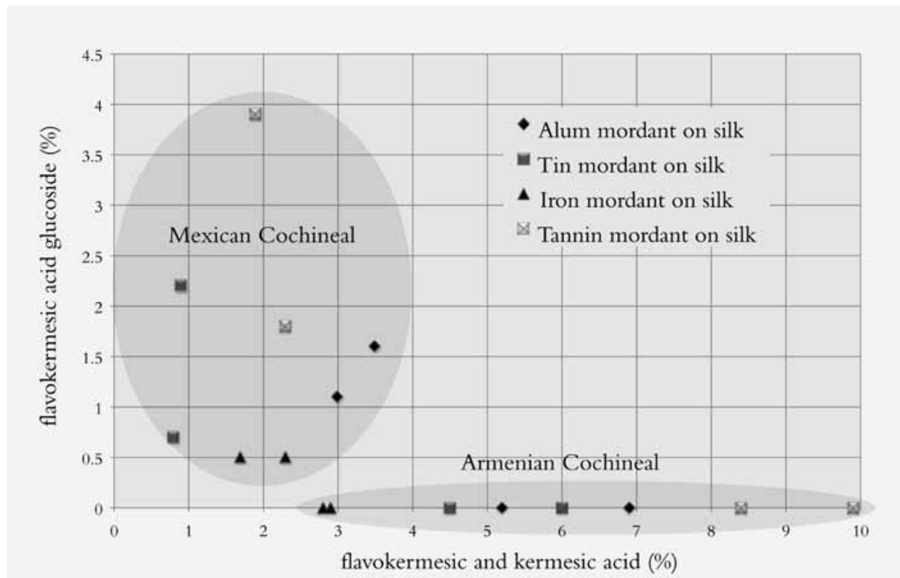
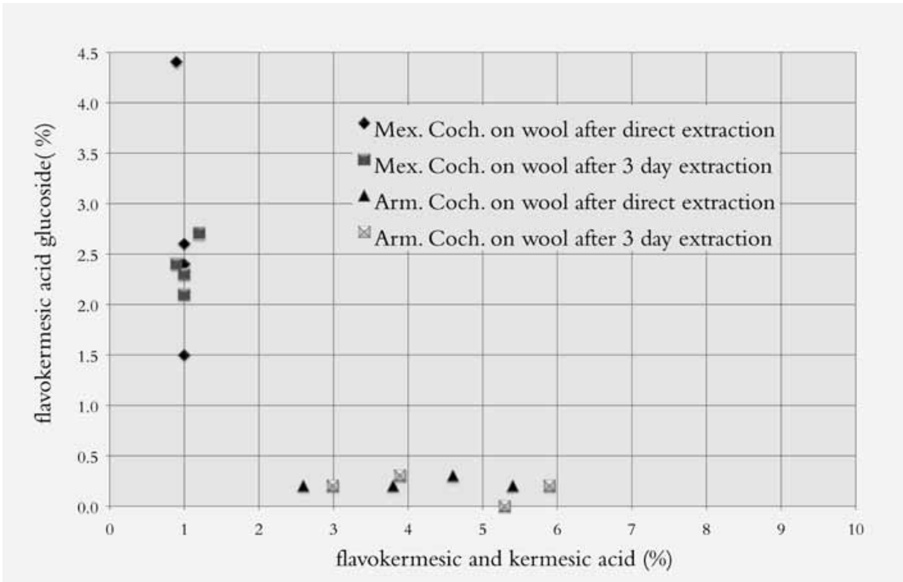


Fig. 1 (top) and 2 (bottom): Influence of the mordant on the detection of the minor compounds (flavokermesic acid glucoside, and flavokermesic and kermesic acid) found on wool (fig. 1) and silk (fig. 2) dyed with Mexican and Armenian cochineal species.



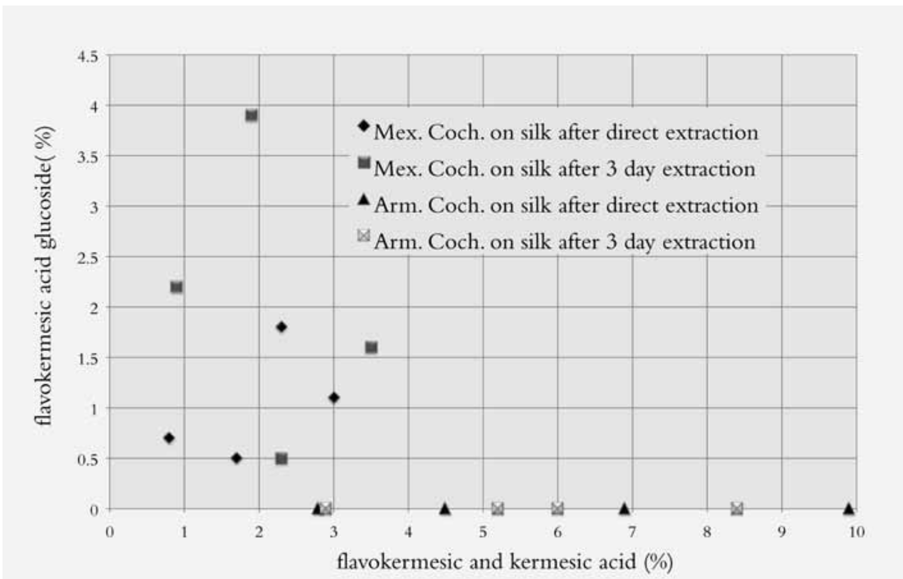


Fig. 3 (top) and 4 (bottom): Influence of the time of extraction of the dyes out of the dried cochineal insects on the detection of the minor compounds (flavokermesic acid glucoside and flavokermesic and kermesic acid) found on wool (fig. 3) and silk (fig. 4) dyed with Mexican and Armenian cochineal species.

2.3. Cochineal Dyeing Experiments

Experiments were carried out both on silk and wool fibres, using untreated silk and wool washed with neutral soap. The threads were premordanted with either alum, iron sulphate, or stannous chloride (inorganic mordants) as well as with tannin (organic mordants). Cream of tartar was added to all mordanting baths. Lab recipes were used for dyeing based on earlier experimental investigations of the dyeing technology of cochineal.[14] For all steps, purified water was used (MilliQ. Water). Dye baths were prepared using crushed dried scale insects from the Mexican and the Armenian cochineal, either by dyeing immediately after addition of the scale insects into the dye bath (direct dyeing) or by dyeing after three days of extraction at ambient temperature (3 day extraction). After addition of pre-wetted mordanted threads to the dye bath at 40°C, the bath was slowly heated up to 80°C. Dyeing was continued for one hour at that temperature. Thereafter, the threads were taken out, rinsed in cold water, and dried by air in the lab.

The influence of the mordant on the detection of the minor compounds in all extracts (direct as well as three day extraction) from wool and silk dyed with Mexican and Armenian cochineal is shown in figs. 1 and 2. While the difference between the applied mordants is rather limited in dyeings of wool, much more significant deviation is found in silk dyeing. Of note in figs. 1 and 2 is also the very large increase of flavokermesic acid glucoside on wool and silk mordanted with tannin. In wool, 'fk-glu' is present in both types of cochineal, however, in clearly distinguishable relative amounts (max. of 0.5% in Armenian- and 1.5% – 4.5% in Mexican Cochineal). No flavokermesic acid glucoside (fk-glu) was detected at all in silk dyed with Armenian cochineal, while with Mexican cochineal between 0.5 and 4% of the glucoside is found. Another interesting point is the wide range of values found for 'fk+ka' going from 2.8 % up to 10 % in silk samples. For wool, the minimum values are about the same, though the maximum amounts do not exceed 6 %.

14 Golikov 1990, 1998a and b; Wouters/Verhecken 1989a; Schweppe 1992 and Sandberg 1997.

The experiments show that the manner of extracting definitely influences the amount of minor compounds on the textile (cf. figs. 3 and 4). Longer extraction of the dyes before dyeing resulted in a higher uptake of the minor compounds. This was noticed for dyeings with wool as well as with silk and for both types of cochineal. In the case of Mexican cochineal, the higher uptake was more pronounced for the flavokermesic acid glucoside (fk-glu) than for both kermesic and flavokermesic acids (fk+ka) together, while for silk dyeings, having no or very small amount of fk-glu, most variation was noticed in the result for the aglycones (fk+ka). An observation of note here is the lower value of fk-glu from the tannin mordanted wool after dyeing with the 3 day extract from Mexican cochineal (fk-glu from 4.4 % to 2.3 %).

So far, the experiments have proven that both the extraction procedure and the applied mordant have an influence on the relative composition of the characteristic dye components found after analysis. Despite this, the results did not resolve the issue of identification of the cochineal species. The major outcome of this study was the deviation in the uptake of the minor compounds found with respect to the type of fibre being dyed, which had not been considered before in the identification procedure earlier developed.[15] Graphical interpretation is shown in fig. 5. A significant difference in the amount of the minor compounds depending on the fibre type was encountered for both types of cochineal, however greater distinction was found when dyeing with Mexican cochineal. The dyeing of silk fibres seems to be much more dependent on the applied process parameters, as clearly the greatest variation in the composition of the minor dye compounds for the same applied insect species is encountered in the silk fibres. Although both types of fibres are proteinaceous fibres, they have a completely different physical character. Wool is mainly amorphous, which makes it easy for mordants and dyes to be absorbed in large quantities inside the fibres. Silk, on the contrary, is highly crystalline and easily saturated by dyes and mordants. In such dyeing conditions, more competition can be expected between the different dye molecules resulting in a higher vulnerability as to changes of the process parameters. On the other hand, one has to consider that in this study, only one insect

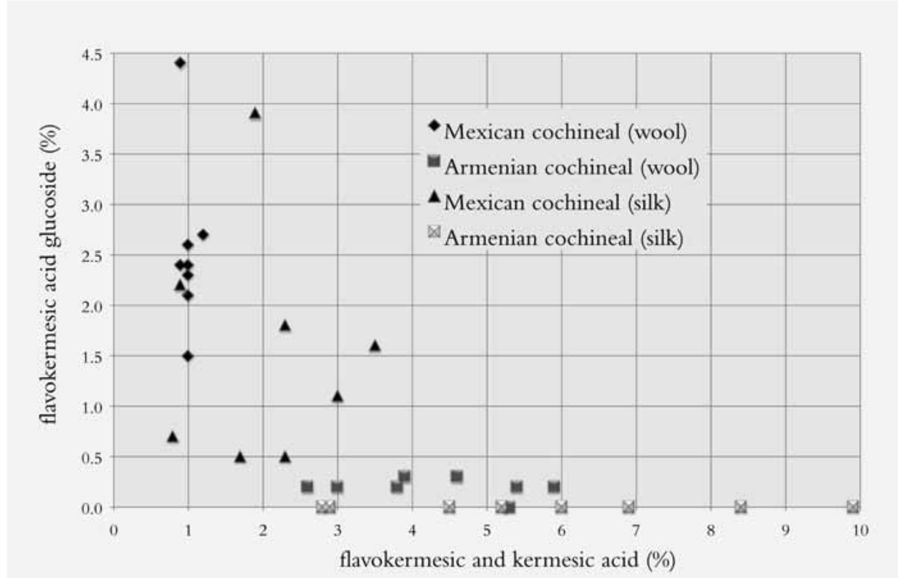


Fig. 5: Influence of the type of fibre on the detection of the minor compounds (flavokermesic acid glucoside and flavokermesic and kermesic acid) after dyeing with Mexican and Armenian cochineal species.

reference was used, so no investigation was done on the biological variation within the same species, which would probably result in a greater spread for both species.

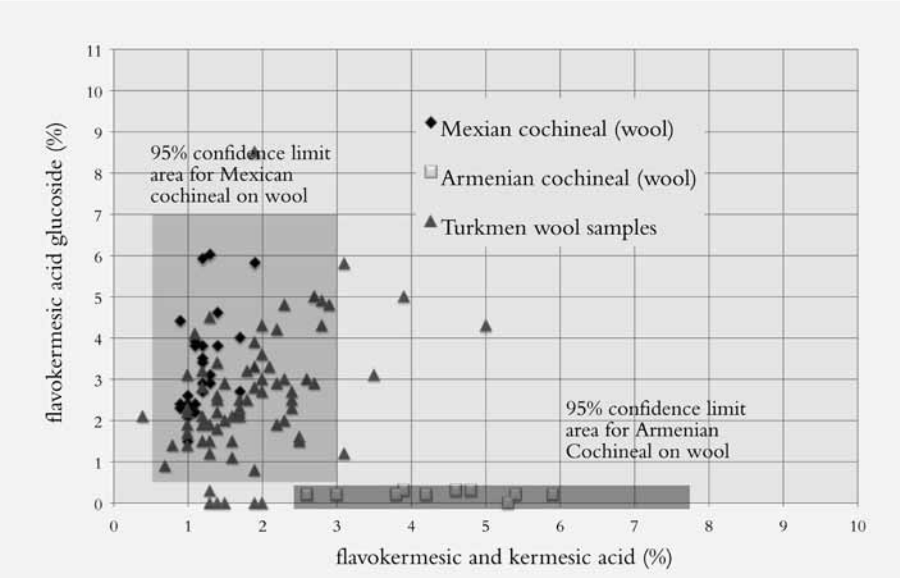
The main conclusion is the lack of any flavokermesic acid glucoside in silk dyed with Armenian cochineal, in contrary to wool where small amounts, up to 0.3 % were found. Higher amounts of 'fk-glu' are detected when Mexican cochineal is applied. These clusters tend to overlap but for wool as well as for silk distinction between Mexican and Armenian cochineal stays clear.

2.4. Evaluation of the Cochineal Species in Turkmen Weaving

As a result of the study, the dye composition of all 126 Turkmen wool and silk samples dyed with cochineal were interpreted, also considering the type of fibre.[16] This made it possible to identify the type of cochineal for the majority of the samples. In the case of wool (fig. 6),

15 Wouters/Verhecken 1989a.

16 See appendix II, tables 1–10, or fig. 4 in chapter "Scarlet and Purple" in this volume.



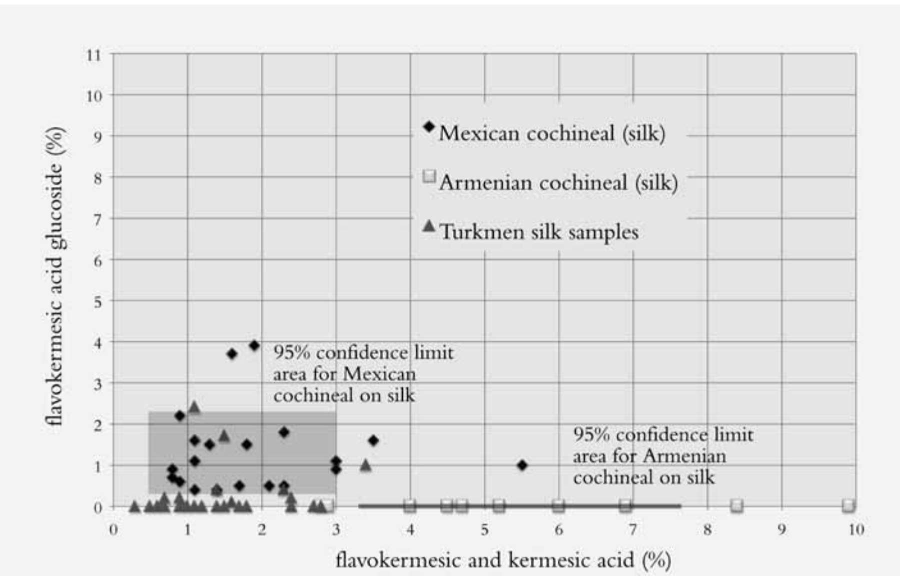


Fig. 6 (top) and 7 (bottom): Results of the wool (fig. 6) and silk (fig. 7) samples from Turkmen weavings in comparison with the results of the reference samples of on wool and on silk.

the cochineal species was revealed in almost all samples except from a few having very low or almost no fk-glu (%) combined with very small amounts of fk+ka (%). In those cases both possibilities remained, as shown in the tables from appendix II.

For silk, interpretation of the specific insect species remained less straightforward. Fig. 7 shows the position of the Turkmen silk samples in comparison with the data from Mexican and Armenian cochineal references. Turkmen silk samples in which the 'fk-glu' compound was present, were most probably dyed with Mexican cochineal, but for the other samples without any 'fk-glu', the match with either one of the two considered species stays poor, therefore both species are indicated as possible sources in appendix II.

The dye experiments improved the understanding of the major external influences on dyeing with cochineal species. For the majority of the Turkmen wool samples, it resulted in the identification of the applied cochineal source. For the silk samples, it is still not possible to specify what insect has been used among the Turkmen to dye their silk for the pile of their carpets. But by proving carminic acid as a main dyestuff component in all these samples, it is at least clear that silk was dyed with a type of cochineal (cf. figs. 4 and 5)

3. Semi-synthetic and Synthetic Dyestuffs in Turkmen Weavings

As described by Jürg Rageth[17] in his chapter on this study in this volume, in the late 19th century early synthetic dyestuffs quasi-replaced the role insect dyes played in earlier weavings of the Turkmen, in having been used as highlights or for important parts of the design.

The identified synthetic dyestuffs belong to the group of Acid dyes, a dyestuff group applicable for dyeing of wool and silk. More precisely, it concerns all acid red and orange dyes. Also chemically, it closely resembles related dyestuffs, all monoazo dyes. In several cases the precise dyestuff could be identified,[18] often two dyestuffs were used together,[19]

17 See chapter "Scarlet & Purple", section 5. The first synthetic dyestuffs in this volume.
18 E.g. in the Ersarï *chuval* cat. no. 24 (appendix II, table 2, Ra 403-2 07915/116), or in the Teke *chuval* cat. no. 63 (appendix II, table 3, Ra 270-2 07915/32).
19 E.g. in the Salor trapping cat. no. 7 (appendix II, table 1, Ra 280-2 07915/23), or in a fragment of a late Salor-trapping (Fig. 79 in the chapter "The Salor"; appendix II, table 1, Ra 659-2 07915/192').

though in other samples, high similarity was found with one or more Acid Red or Acid Orange dyestuffs. [20] Information about the possible synthetic dyestuffs, according to the Colour Index Classification (2nd edition, 1977) with the CI name and number, as well as the name and year of discovery, is given in a table at the end of appendix II.

Besides these man-made azo dyes, in some Turkmen weavings evidence was found of so-called semi-synthetic dyes, derived from natural dyes much earlier than the first synthetic dyes. In 4 samples, indication was found of a semi-synthetic dye, called ammoniacal cochineal,[21] obtained by treatment (refluxing) of cochineal with ammonia for several hours.[22] In one other sample, in a Yomut tent band, indigo carmine was identified, also known as Saxon blue or Indigosulphonic Acid.[23] This is a semi-synthetic dye produced by the treatment of indigo with sulfuric acid, a procedure which was already known in 1740. [24] Finally, in a single case, synthetic Alizarin was found in the pale-red silken wefts of a pile-woven saddle cover of the early 20th century. [25]

---

20 E.g. in the Salor(?) *kapunuk* in Andrews et al. 1993: No. 91 (appendix II, table 1, Ra 667-1 07915/207), or in the "P-Chowdur" *mafrash* cat. no. 112 (appendix II, table 7, Ra 500-1 07915/153)

21 E.g. in cat. no. 25, cat. no. 68, cat. no. 70 and an unpublished Teke *mafrash* (sample no. 651-1 07915/199, appendix II, table 4). Interestingly all 4 pieces are Teke-products (Ed).

22 Wouters/Verhecken 1989a: 192.

23 See appendix II, table 6, Yomut *aq yüp* (Fig. 12 in the chapter "Scarlet and Purple") sample no. 623-3 07915/183.

24 Hofenk de Graaff 2004: 258 – 261.

25 See appendix II, table 7, sample no. Ra 620-3 17915/174.

Scarlet and Purple

Special Red Dyes in Turkmen Weavings

1. Introduction

The preference for the colour red among the Turkmen is beyond any doubt. Reds in many varying shades are present in all their weavings. Most of these reds are dyed with madder, a vegetable dyestuff which, depending on the dyeing method, can produce a colour range from light orange to bright red to a deep purple.

In addition to madder, other colorants were used to produce reds on both silk and wool for the pile. Extremely bright reds were achieved by applying special dyeing methods with insect dyestuffs. Since the early 1880's they have been replaced by synthetic dyes, producing comparably bright reds. These special insect reds, in earlier times always used as highlights in addition to madder reds, are not only significant for the aesthetics of a weaving, but can also provide valuable information on provenance and age. Earlier pieces often show such special reds – some of unusual brightness, some with unusual hues – suggesting either the use of an insect dyestuff and/or a special dyeing method. It therefore made sense to complement the insights from radiocarbon dating by examining carefully selected fibre samples for their unusual reds.

An unusual scarlet, observed in small quantities in a tent band radiocarbon dated to the 16th/17th century (Fig. 1, cat. no. 157) was the "trigger" of the present dye study. On the occasion of the 1999 Liestal symposium,[1] Harald Böhmer of Marmara University in Istanbul collected a sample from this band for TLC (Thin Layer Chromatography) analysis. Surprisingly, carminic acid, the main dyestuff component of cochineal, was the result of this first test. A second TLC analysis confirmed this first, unexpected result. Cochineal dyed wool has so far been visually associated with a more bluish shade of purple or even violet. Later HPLC (High Performance Liquid Chromatography) analyses of two more "Eagle" *gül* group tent bands which produced the same result[2] supported the accuracy of the first two tests.

In the course of the ongoing dye examinations it turned out that the TLC method did not enable differentiation between different types of cochineal with different places of origin. In 1988/89 Verhecken and

1 26.–28. February 1999, Symposium and exhibition "Dating Turkmen Carpets" in the Cantonal Museum Baselland, Liestal, Switzerland. See Hali 104, 1999: 82–85, "Turkomania meets Science".

2 Cat. no. 109 and 110.

Wouters demonstrated the superiority of HPLC over TLC for identifying insect dyestuffs.[3] Based on that, in June 2003, a collaboration started with Jan Wouters from the Royal Institute for Cultural Heritage (KIK–IRPA) in Brussels. After examining a first small group of 15 samples, we defined a project with the aim of examining between 100 and 200 samples of unusual red dyes taken from Turkmen weaving. The aim was to include as many of the pieces previously radiocarbon dated by Georges Bonani at the ETH in Zurich as possible, which gave the project a historical frame from about 1500 to 1900.[4] Between 2003 and 2007, 221 samples taken from 118 Turkmen piled weavings were analysed (see table fig. 2).

The majority of the samples were taken on the basis of visually suspected insect dyestuffs, a smaller group to identify suspected synthetic colorants.

In this context, a hint by Amy Butler Greenfield turned out to be very helpful. In her book "A Perfect Red" she describes the amplifying effect of tin in connection with dyeing red with insect colorants, especially cochineal.[5] On the basis of her observation, 60 samples of striking bright shades of red were tested for possible content of tin. In the course of our investigations it became clear that the presence or absence of tin turned out to be helpful in regard to the dating of the objects.

Not all the tests resulted in the expected insect dyestuffs; in some cases the visually unusual red was found to be madder.

Fig. 2 shows the origin, function, and number of the tested pieces. To keep the results from getting too complicated, all types of bags and decorative hangings were combined under the category of *chuval*; as a result, more than half of the objects tested are listed under this category. As candidates for sampling, more than 700 objects were visually examined in search of suspected insect dyestuffs. In the end, 300 fibre samples were chosen from some 200 Turkmen weavings, from which 221 have been chemically analysed for their dyestuffs.

3 Verhecken/Wouters 1988/89: 208.
4 For more information, see the chapter "From Visual Guesstimate to Scientific Estimate".
5 Butler Greenfield 2004: 136. My thanks to Dr. Richard Isaacson for referring me to this book.

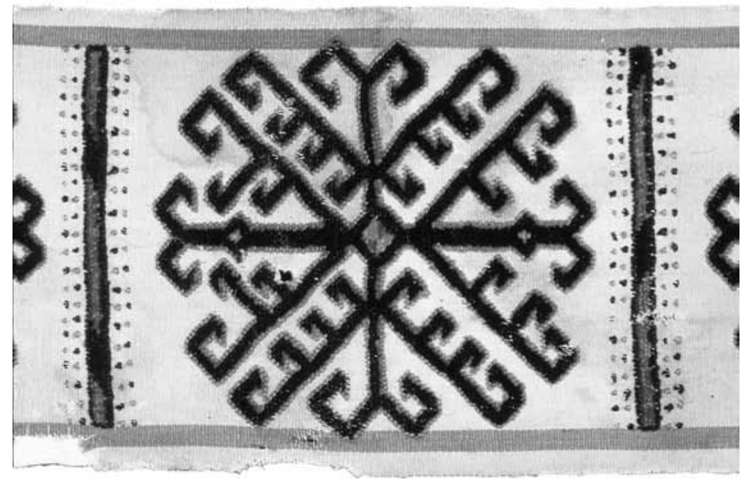


Fig. 1: Detail of cat. no. 157, "eagle" *gül* group I *aq yüp*, 17th century. The small rhombuses in the centres of the hooked rosettes consist of two hourglass-like confronted pairs of triangles, alternately dyed scarlet with Mexican cochineal, or dark red with madder.

Since the early 20th century, dyestuffs and dyeing methods in Turkmen carpets have been addressed by various authors. In 1911, Semjonov[6] in his seminal essay *Carpets from Russian Turkestan* devoted a complete chapter to dyes and dyeing methods. In 1914/15 Felkersam[7] followed with similar explanations, as did Dudin[8] in his essay *Carpets from Central Asia* in 1928. Also Moshkova's[9] field work, carried out between 1929 and 1945 and published in 1970 by her colleague Morosova, nearly 20 years after Moshkova's early death, includes information on dyestuffs and dyeing methods.

From some of these Russian scholars we obtained curious and, as we now know, maybe even misleading, information. For example, according to Felkersam, the insect dyestuff Kermes is "the most impor-

6 Semjonov 1911 (1979): 45–51.
7 Felkersam 1914/15 (1979): 30–33.
8 Dudin 1928 (1998): 50–52.
9 Moshkova 1970 (1996): 35–40.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor	1	7	6	38	6	58
Ersarï, Kizil Ayak	1			10	3	14
Sarïq	1		17	6	1	25
Teke		2	11	28	2	43
Yomut, Qaradashlï	1		12	11	2	26
"Eagle" *gül* groups			3	18	5	26
"P-Chowdur" group			7	3		10
Chowdur						
Arabachi	5		7	2	5	19
	9	9	63	116	24	221

Fig. 2: The dye study includes 221 fibre samples collected from 120 Turkmen piled weavings, analysed at the KIK-IRPA in Brussels by using the HPLC-PDA method. Several samples contain mixtures of cochineal, lac dye and madder, so the total number of samples shown in Fig. 4, 8, 13, 17 and 18 is higher than 221.

tant dyestuff to dye red" among the Turkmen.[10] His precise description of the dyeing insect leaves no doubt that he really meant *kermes vermillio*. Reading all these Russian authors of the first half of the 20th century one needs to be aware that, when these scholars collected their information, the decline of the weaving tradition was already in full progress or even concluded, and much of the old knowledge was already lost. Nevertheless these reports are still of interest today, as they were collected in the field, and reflect the situation in the first half of the 20th century.

This branch of research has seen a fundamental change with the introduction of chemical analysis. Marc Whiting provided pioneering work in this field. His work, specifically on insect dyes in Turkmen weavings, was seminal. He made many essential findings, despite having to work without equipment and supporting information available today. In the course of this study we will repeatedly refer to Whiting's work. Our investigation should be viewed as a continuation and refinement of Whiting's, though it should be noted that we not only had improved technical equipment at our disposal, but also a much larger and more differentiated historical background with dated objects as early as from the 16th/17th centuries.

2. Visual recognition of insect dyed woollen yarn

Is there a way to differentiate material dyed red with insect dyes from material dyed with madder? Certainly it can be done by chemical analysis, which is the only definitive way to an unambiguous result. This was the impetus for this study, which was further encouraged by the results of some early tests.

Nevertheless, there are some visual clues which lead one to suspect the presence of insect dyes. Insect dyed yarn tends to have a more bluish shade of red than madder dyed yarn. In addition, especially in Turkmen weavings, a finer quality/spin of the material is also of significance. Insect dyed woollen yarn, especially in pieces predating 1850, is always finer than the rest of the pile yarn. For madder-dyed pile, usually 2 yarn threads (2Z) were used, one knot consisting of two pieces of yarn, both spun in Z-direction and only loosely plied to form the knot. Mallett calls this a "working unit".[11] The loose plying of the pile material helps to create a smooth, velvety surface of the pile woven object. To make knotting material of the correct thickness out of the more finely spun insect dyed yarn requires the use of more than 2 pieces of yarn. 4-, 6-, 8-, or in one case, even 18-plied yarn [9(Z2S)] has been found. The single case mentioned, the *torba* cat. no. 112, shows 18-plied [9(Z2S)] lac dyed woollen yarn of unusual fineness in very small areas only. It seems likely that such extremely fine insect dyed woollen materials were purchased rather than being produced by the weavers themselves. Probably made in professional ateliers, they may well have been intended for textiles, clothing, or other purposes, rather than specifically for carpets. Turkmen weavers used such woollen yarns with the exotic and expensive insect dyestuffs to highlight small de-

10 Felkersam 1914/15 (1979): 31. Felkersam's misleading remark might possibly have bee based on an anomalous late 19th century group of weavings in which cochineal replaced madder as the ground colour (see section "3.1.3 Mexican Cochineal in Turkmen Weavings: 1875 – 1900").

11 Mallett 1988: 22, Fig. 1.6.

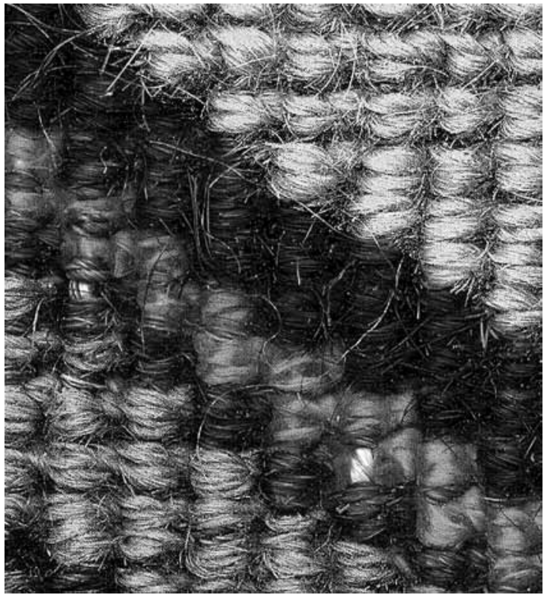


Fig. 3: Detail of Salor *chuval* cat. no. 13 (back side). The upper right corner shows 2 plied, madder dyed woollen pile yarns, while the lower left corner shows 4–6 plied lac dyed woollen pile yarns.

tails in their most valuable pieces. Cat. no. 38, an early Sarïq tent band with some beautiful scarlet highlights illustrates this perfectly. Only a few specific knots of 4-plied woollen yarn dyed with Mexican cochineal are used to emphasize the centre of the blossoms at the beginning and end of the flower-tree design in the centre of the band.

The lower left corner of Fig. 3 plainly illustrates how the finer insect dyed wool yarn can be distinguished clearly even in a black and white picture. The detail shows the back of Salor *chuval* cat. no. 13 with lac dyed wool in the red parts of the *chuval gul*.

It became clear in the course of this study, though, that a fine yarn alone as an indicator can be misleading. We also find synthetically dyed woollen yarns, which show more than the usual 2 plies.[12] But synthetic dyes never show the cool, bluish reds of insect dyes – more likely orange, or at least more yellowish shades of red. In addition, synthetic-dyed yarns with more than 2 plies do not occur often, and the experienced eye can also recognize them by their usually faded pile tips. Furthermore, not all insect-dyed yarn demonstrates the additional fineness. For example, cochineal-dyed yarn in post-1850 pieces is not as fine as in the older ones, rather 2-plied like the rest of the pile yarn. Parallel with this coarser, cochineal dyed yarn is a change in colour; a purple, or a purplish red replaces the unusual shade of scarlet.[13]

All of the above pertains specifically only to wool. Insect-dyed silk yielded different results. All tested silk samples were dyed with cochineal, though it is not clear which type.[14]

In conclusion: chemical analysis is the only way to an unambiguous identification of insect dyestuffs on wool. But in pile weavings predating 1850, the likelihood of insect-dyed wool can be indicated by its cooler, slightly bluish shades of red (madder-dyed material as a rule shows a warmer, more yellowish shade) and more finely spun woollen yarns (more than 2-ply). Though one may be able to suspect the presence of an insect dye by visual inspection, it is impossible to distinguish between lac and cochineal by naked eye alone[15].

3. Insect dyestuffs in Turkmen weavings

The choice of the applied insect dyestuffs depends on the material to be dyed: wool or silk. As already mentioned, the magenta dyed silk for the pile in Turkmen weavings has always been dyed with an insect dyestuff.[16] In Central Asia, dyeing silk with insect dyestuffs reaches far back into pre-Islamic times, at least to the Iranian speaking Sogdians and their neighbours. By the 7th/8th century they were dyeing a similar, cool light red on silk. Based on chemical analyses it is known today that most of these early silks were dyed with lac.[17] Even with the technical progress and experience regarding the analytical methods, there are still limits to the specificity to which we can identify the insect dyestuffs on silk in the field of Turkmen weavings. Though they

12 E.g. cat. no. 112.

13 See section "3.1.3 Mexican Cochineal in Turkmen Weavings: 1875–1900".
14 See section "3.5 Insect Dyestuffs on Silk".
15 See Whiting 1980: 220.
16 In exceptional cases, madder as an admixture was proven in small quantities .
17 See Schorta 1998: 86–94; Verhecken-Lammens et al. 2006: 244; Hofenk de Graaff/Roelofs 2006; Oepen et al. 2011: 215 et seq. Madder was found in a few instances (Oepen et al. 2011: 328).

can be identified as a type of cochineal, a more precise identification is currently not possible.

The use of insect dyestuffs on wool among the Turkmen has been assumed for quite some time, but had not previously been proved by chemical analysis. As early as 1973, Thompson pointed out a presumed insect dyestuff in pieces of the Salor, then still described by him as S-Group. Describing the characteristic features of his S-Group, he wrote: "use of wool of a special pinkish-red in which the dye is corrosive, causing increased wear on the wool."[18] Commenting on Bogolyubov's cat. no. 8, Thompson even goes one step further in connection with the just mentioned "pinkish red": "It is interesting to speculate what this dye could be – Kermes perhaps? We await the results of dye testing which is now in progress."

Three years later, in 1976 at the Ist ICOC (International Conference on Oriental Carpets) in London, Mark Whiting introduced the results of his first dye test on Turkmen carpets. The corrosive pinkish red on wool turned out to be dyed with lac, and not with Kermes, as suggested by Thompson. In the publication of his talk, Whiting writes: "Lac has been found only on Salor pieces, and only on wool."[19] We will come back later to this revealing remark. Whiting was the first who chemically identified the insect dyestuffs cochineal and lac in Turkmen weavings, although largely only in pieces of the 19th century. In his publications, he repeatedly referred to technical problems analysing not only these two dyestuffs, but also distinguishing between different species of cochineal.[20] These difficulties were most likely a result of the method he was using. It was only many years later that a solution to these difficulties began to emerge. First steps to identify the different types of cochineal were made and published in the late 1980s by Jan Wouters and André Verhecken in Belgium.[21]

Today the HPLC (High Performance Liquid Chromatography) method is able to distinguish between different species - Mexican cochineal (*Dactylopius coccus* Costa), Armenian cochineal (*Porphyrophora hameli* Brandt) and Polish cochineal (*Porphyrophora polonica*), as long as we are dealing with the testing of wool samples.[22] Beyond this, Dominique Cardon's fieldwork in Kazakhstan has brought to light a number of additional species of so called "root cochineal" belonging to the *Porphyrophora* family, which may eventually turn out to have been used for dyeing. This could bring us another step further regarding the identification problem of cochineal dyed silk among the Turkmen. However, Cardon's research is still in progress, and does not yet include any dyeing experiments with subsequent chemical analyses.[23]

Our own tests show that, when dyeing with insect dyestuffs on wool, Turkmen weavers used both cochineal, to be precise cochineal from Mexico, and lac dye, most probably from India. While in some cases Armenian cochineal can not be excluded with certainty, its use by the Turkmen is rather unlikely.[24]

3.1 Mexican Cochineal

From the second half of the 16th to the end of the 19th centuries, Mexican cochineal (*Dactylopius coccus* Costa) was the most frequently used insect dyestuff among all Turkmen. In many languages the word is very similar (English "cochineal", German "cochenille", French "cochenille", Italian "cocciniglia"); all driven from the Spanish "cochinilla". According to Schweppe "Nopal Schildlaus" is the German name of the insect.[25] There is still uncertainty about the origin of the Spanish name. Generally the word is driven from Latin *coccinus* (scarlet) or *coccum*, the latter being the name for Kermes used by Pliny the elder in his Naturalis Historiae.[26] Donkin points out that the Aztek name for cochineal "*nochetzli*" means "Blood of the Nopal cactus" (*etzli* = blood, *nochtli* = fruit of the Nopal cactus).[27] Cardon also us the Maya name, "tzotzil", which sounds somewhat similar to the Spanish "cochinilla". Cardon herself does not suggest this connection, only cit-

18 Bogolyubov 1908/09 (1973): Plate 6.
19 Whiting 1978b: 282.
20 Whiting 1978b: 281.
21 Wouters/Verhecken 1989a: 195; 1989b: 406.

22 See the chapter "A Speciel Challenge in the Field of Dye Analysis: The Identification of Cochineal Species in Turkmen Weavings ".
23 Cardon 2003, 2007.
24 See appendix II, table 4, Ra 405-2; table 5, Ra 624-1, Ra 296-1; table 8, Ra 492-1, Ra 668-1 (cat. no. 118).
25 Schweppe 1992: 263.
26 Schweppe 1992: 262; Cardon 2007: 608 and 619.
27 Donkin 1977a: 12.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor				4	2	6
Ersarï, Kizil Ayak	1			7	2	10
Sarïq	1		11	3		15
Teke			7	19	1	27
Yomut, Qaradashlï			6	4		10
"Eagle" *gül* groups			2	4	3	9
"P-Chowdur" group			3	1		4
Chowdur						
Arabachi	2		3	1	3	9
	4		32	43	11	90

Fig. 4: Number of samples analysed by HPLC-PDA method containing Mexican cochineal on wool. Several samples contain mixtures of Mexican cochineal, lac dye, and madder. For detailed dyestuff compositions, see appendix II, tables 1–10.

ing Pliny and the Latin name for Kermes as a possible source. Greenfield mentions another option. She writes: "In February 1543, an enterprising silk merchant and a distinguished citizen presented three samples of cochineal to the Venetian silk guild. Each sample had a different name – *uchimillia*, *cochimeia* and *panucho* – possibly indicating slight variations in the place of origin. It was also true, however, that in 1543 cochineal was too new a commodity in Europe to have a settled name. Only later in the century would the term for the dyestuff be firmly established as *grana cochinilla*, or cochineal".[28] But in a footnote, she mentions: "The exact origins of the term cochinilla remain a mystery". In any case, all names in different languages go back to the 16th century and the Spanish "cochinilla".

There are two species of Mexican cochineal, one wild and one domesticated.[29] Both were unknown in the old world before 1520. The domesticated species is the one which came to dominate the market. Columbus' discovery of America not only brought sweet corn (maize), potatoes, tomatoes, cocoa (chocolate), and large quantities of gold and silver to Europe, but also caused a revolution in the field of textile dyes.

The commercial export of cochineal to Spain started in 1523.[30] As a result of the high demand, the production in Mexico increased significantly in the first half of the 16th century. European dyeing centres like Genoa and Venice tried to forbid the exotic dyestuff, though only briefly and with little success. By the mid-16th century the demand for cochineal from the New World was so great and the distribution so well organized, that it is reasonable to assume a first appearance in the markets of Central Asia at about that time.[31]

Particularly in Europe, the efficient colorant from Mexico became a big seller from the mid-16th century on, attaining by 1736 an annual volume of 400 tons.[32] Hardly anyone would have thought that by the 1870s this enormous amount would increase by a multiple of 10![33] The valuable cargo was brought from Mexico to Seville by large ship convoys. In the 18th century, this flourishing trade across the Atlantic led to adventurous piracy, which was encouraged, even supported by the English crown.[34] Surprisingly, 18th century Europe hardly knew what cochineal actually was, although the French naturalist Plumier in 1666 did describe its zoological origin.[35] Likely, the reason for this mystery mongering was the protection of the Spaniards' worldwide monopoly, which was held by them for over 250 years. They kept the secret as long as they could, going even as far as to punish the export of living lice with death.[36]

A primary basis for the success of this new dyestuff was its high efficiency; Mexican cochineal dyes 10 times more effectively than kermes,[37] and as much as 20 to 30 times its Armenian relative.[38] Therefore the rapid adoption of this new dyestuff in the dyers' workshops all over the Old World is not surprising.

28 Butler Greenfield 2004: 73.
29 Donkin 1977a: 14.

30 Born 1936: 231.
31 Donkin 1977b: 847.
32 35'000 arrobas, Donkin 1977a: 37.
33 Butler Greenfield 2004: 230.
34 Butler Greenfield 2004: 110–124.
35 Born 1936: 232.
36 Butler Greenfield 2004: 108.
37 Butler Greenfield 2004: 76.
38 Harald Böhmer, personal communication.

In the 16th century Mexican cochineal was 10 times as expensive as madder,[39] but the price structure changed radically in the course of the always growing world-wide production. In the 19th century, when cochineal was produced in Spain, Algeria, the Canary Islands, and even Java, prices dropped tremendously, and what had formerly been a luxury was attainable by the average consumer.

At the beginning of the 19th century there was even an attempt to increase the efficiency of the dyestuff using an ammonia treatment.[40] But even this could not halt the decline in the market position of cochineal. At the end of the 19th century, the fatal competition of the early synthetic dyes effectively drove Mexican cochineal out of the market.[41]

In our study, for the first time, cochineal from Mexico could clearly be identified, while Armenian cochineal, except in a few instances, could be excluded as a possible dye source. This distinction was not possible at the time of Whiting's research. He had to content himself with knowing that he was dealing with a type of cochineal; the specific species was not identifiable then. He did know about the unavailability of Mexican cochineal in Central Asia before the mid 16th century, but he could not know of the existence of Turkmen weavings from that period, let alone pieces of that period containing Mexican cochineal.[42]

3.1.1 Mexican Cochineal in Turkmen Weavings; 1550–1900 (Table fig. 4) It is unusual to find wool dyed with Mexican cochineal in Turkmen carpets dating from as early as the the 16th century. There is no doubt that this occurs by the first half of the 17th century. In our study, six Turkmen weavings[43] radiocarbon dated to before 1650 contain Mexican cochineal on wool. Whether we are dealing with already dyed imported wool or with imported cochineal from Mexico as a raw material is still not clear, although the latter appears to be more likely. The six pre-1650 radiocarbon dated weavings containing Mexican cochineal will be addressed later in detail. The chemical proof of Mexican cochineal delivers a *terminus post quem* of 1550, the earliest assumed possible date for the use of this dyestuff in Central Asia, and therefore allows us to shorten the range obtained by radiocarbon dating from, for example, 1490–1660 to 1550–1660. [44]

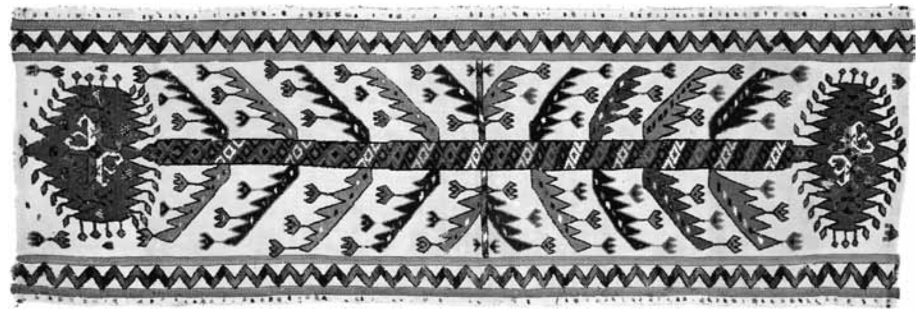


Fig. 5: Sarïq tent band fragment, ca. 1850, 38 x 112 cm/15 x 44 in., private collection.
The cochineal dyed yarns in the heads at either end of the flower are of scarlet colour, on tin mordant, and 4 plied (4Z), while those in the leaves along the stem are violet-red, without tin mordant, and 2 plied. The two types of dyed yarns correspond to Whiting's Cochineal-I and Cochineal-II. For a related example, see cat. no. 61. For analytical results, see appendix II, table 3, Ra 273-1/-2 and appendix III.

Our results show that, in 17th and 18th century pieces, the insect dyestuff, which at that time would still have been extremely expensive, was always found in shades of scarlet on fine to very fine woollen yarns from 6–8Z up to [9(Z2S)] (18 singles!) and sometimes in small quantities of a few knots only. Around the middle of the 19th century, a very significant change takes place. In contrast to the scarlet shades of the earlier pieces, we now find purplish or even violet shades replacing them. The scarlet of the older pieces with 4-, 6-, or 8-plied woollen pile yarns has been replaced by a 2-plied purple or violet. In weavings of the 2nd half of the 19th century, the cochineal dyed woollen yarns no longer differ from the rest of the pile of the piece. This suggests that weavers now dyed their yarns themselves. No longer was cochineal dyed wool purchased, rather the dyestuff itself.

39 Butler Greenfeld 2004.
40 Verhecken/Wouters 1988/89: 211–212.
41 Hofenk de Graaff 2004: 76.
42 E.g. the Salor *khali* cat. no. 16, and the Teke *germech* cat. no. 51
43 Cat. nos. 16, 36, 110, 117, 127 and 157.
44 E.g. the Salor *khali*, cat. no. 16.

3.1.2 Whitings Cochineal-I & II

Most probably it was exactly this same change that was observed and described by Mark Whiting, leading him to propose two different kinds of cochineal: the older cochineal-I dyed wool of finer quality and often slightly corroded, and the newer cochineal-II dyed on coarser, conventional pile yarn of the late 19th century.[45] But it was clear beyond question in the course of our study that in both cases we are dealing with the same species of cochineal, namely *Dactylopius coccus* Costa. In the 19th century, the dyestuff need not have been imported from Mexico, but could have come from the Canary Islands or even Indonesia. Nevertheless, the species remains the same.

Whiting observed and described another interesting detail: the simultaneous use of his so-called cochineal-I and cochineal-II in one and the same piece, a Teke *mafrash*.[46] The same finding was confirmed in our study. In three pieces, 4-plied scarlet dyed woollen pile yarn was found (Whitings cochineal-I), as well as 2-plied purple dyed woollen pile yarn (Whitings cochineal-II). In all three pieces (the two Sarïq tent bands cat. no. 39 and fig. 5, and the Teke *chuval* with Salor *gül* cat. no. 61), the dyestuff determined was always Mexican cochineal. In the tent band fig. 5, a small quantity of cochineal dyed scarlet on 4-plied woollen pile yarn was found in the two hooked crosses within the flower-heads on the left and right hand side of the flower-tree, while much more cochineal dyed purple on 2-plied woollen pile yarn was used for 5 of 20 serrated leaves of the flower-tree. The Teke *chuval* cat. no. 61 only contains 14 knots of cochineal dyed scarlet on 4-plied pile yarn in the centre of the Salor *gül* in the lower row on the right hand side, while the remaining cochineal dyed wool of the pieces is 2-plied and purplish or violet-red. This leads to the conclusion that all three examples likely date from the mid-19th century, when the enormous drop in the price of the dyestuff resulted in the shift from the purchase of pre-dyed wool to the local dyeing on local wool.

In conclusion: in pre-1850 pieces, cochineal dyed pile yarns mostly show a scarlet shade on 4- (4Z) or 6-plied (6Z) wool, as in the tent band cat. no. 39 or the *khali* cat. no. 127. In later pieces of the mid to second half of the 19th century, these cochineal dyed shades on wool are purplish, or violet, and only 2-plied. The Ersarï *chuval* cat. no. 23, as well as the Teke *chuval* cat. nos. 61 and 63 are good examples of this second type.

3.1.3 Mexican Cochineal in Turkmen Weavings: 1875 – 1900

In the last quarter of the 19th century, change accelerated even more. Two phenomena exemplify the inexorable decline of an old tradition. On the one hand, Mexican cochineal became so inexpensive that it was fully competitive with madder, the long-time traditional dyestuff for red. On the other hand, the first synthetic reds from Europe came on the market. In the early period of their availability, these new exotics from England and Germany replaced the old insect dyestuffs, and were used for highlights in the same way as their 17th/18th century predecessors, lac dye from India and cochineal from Mexico.

It is unclear whether the absence of madder in some Turkmen weavings of Central Asia at the end of the 19th century is related to a similar phenomenon in Europe, where madder was replaced by synthetic alizarin, a replica of the dyestuff component alizarin in natural madder (*Rubia tinctorum* L.). In contrast to what happened in Central Asia, madder has never been used since then in Europe. This period in which Mexican cochineal can be found in place of madder even as a ground colour did not last for a long time in Central Asia, probably from about 1880 to 1900. Was this caused by the low price of cochineal alone, or was there a temporary shortage of madder in the Central Asian market? The former seems more reasonable, as this particular phenomenon seems to disappear after a short time.[47] A general lack of madder in conjunction with the use of Mexican cochineal as a ground colour can be observed in cat. nos. 23, 62, 67, 69 and 70.

In conclusion, Mexican cochineal played an outstanding and changeable role in the history of Turkmen carpets from the 16th to the 20th centuries. Until the 18th century, the dyestuff was used very care-

45 Whiting 1980: 220.
46 Whiting 1980: 220.
47 Moshkova 1970 (1996): 36. This probably is a note made by Morosova, the editor of Moshkova's "Carpets of the people of Central Asia". In Moshkova's notes, there is no information on dyeing with synthetic alizarin. See also Moshkova 1970 (1996): viii.

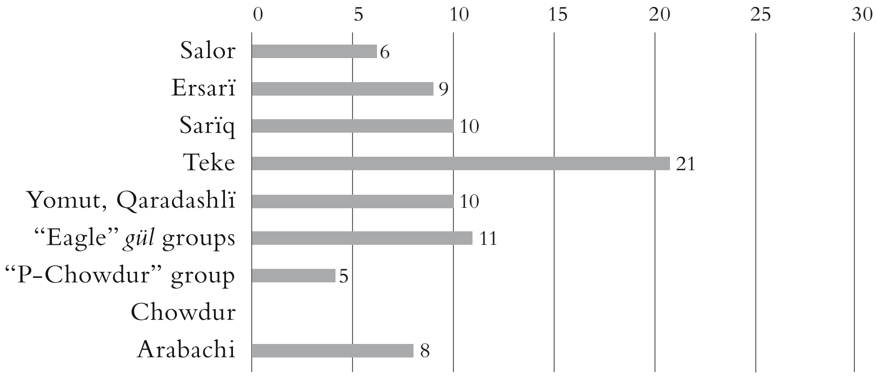


Fig. 6: Number of samples analysed by HPLC-PDA method dyed with Mexican cochineal on wool.

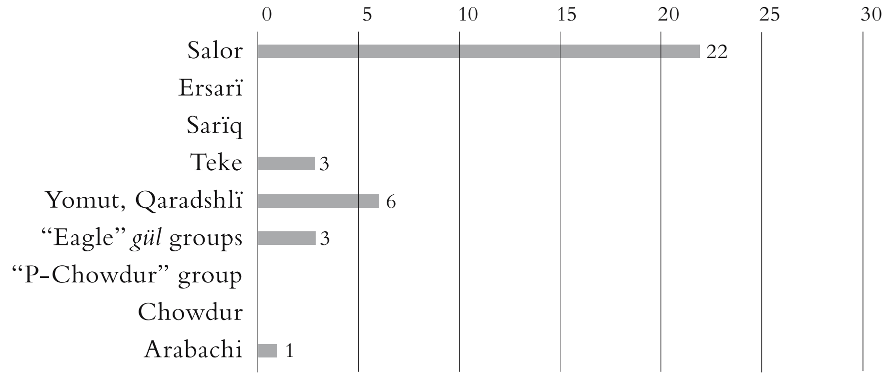


Fig. 7: Number of samples analysed by HPLC-PDA method dyed with lac dye on wool.

fully and in small amounts, sometimes even in only a few knots (e.g. cat. nos. 23 und 127), whereas in the late 19th century it has been used as ground colour for *chuval* (cat. nos. 24, 63, 68, 69, 70) and even for *khali*. [48] Up to the early 19th century, the shade of cochineal dyed wool was mostly scarlet (e.g. in the flower heads of the Sarïq tent band cat. no. 138), but since the mid-19th century it is found as a somewhat dull violet or purple (e.g. the ground colour of the Ersarï *chuval* cat. no. 24). Until the early 19th century, cochineal dyed woollen pile yarns were always 4- or 6-plied, and were probably acquired on the market as trade products, whereas from the mid-19th century on, the wool was only 2-plied, like the rest of the pile. In early 20th century production, Mexican cochineal was used only very sparingly, or not at all. Compared with lac, the other insect dyestuff used by the Turkmen, the dyestuff from Mexico played a significant, though from a historical perspective a comparatively short role.

3.2 Armenian Cochineal

It is somewhat surprising that Armenian cochineal (*Porphyrophora hameli* Brandt) has not been found in Turkmen weavings from Central Asia from the 16th to 19th century, although this dyestuff is native to a much closer place than its Mexican relative, and allegedly has been traded and used since antiquity.[49] The most likely explanation for this, at least for the period from the 16th to 19th centuries, is the much higher efficiency of cochineal from Mexico. The high content of fat combined with the low content of dyestuff of the Armenian species, and the resulting problems for the dyeing process, are key factors why cochineal from Mexico displaced Armenian cochineal within a short time in Europe and Asia. As already emphasized, cochineal from Mexico contains 20 to 30 times more dyestuff per weight than its Armenian relative.

3.3 Kermes

Most probably for similar reasons the insect dyestuff kermes (*Kermes vermillio* Planchon) also disappeared from the European market and the dyers workshops as early as the second half of the 16th century. Kermes, indigenous to the Mediterranean, but, according to Donkin, also to the near East, has also been used for dyeing since antiquity.[50] Before

48 E.g. in many late Teke *khali* with Salor *gül* field design.

49 Donkin 1977b: 851.

50 Donkin 1977b: 848.

the arrival of cochineal from Mexico, kermes was *the* insect dyestuff in Europe and the Mediterranean area.

As already pointed out by Whiting, kermes until now has not been found in Oriental carpets, including Turkmen carpets.[51] To our knowledge, there is still no chemical analysis known proving kermes as a dyestuff in any kind of oriental carpet. The classical pre-cochineal insect dyestuff of the Orient and Central Asia was lac dye.

3.4 Lac dye

In Central Asia, lac (*Kerria lacca* Kerr) as a dyestuff for textiles has been used for a very long time. The local markets there probably imported it from India. Because of climatic conditions, the insects (*Kerria lacca* Kerr) are exclusively found in South Asia and Southeast Asia, living as parasites on various species of trees. According to Schweppe, the quality of the dyestuff depends to a large extent on the host plant.[52] The insect draws up the sap of the host tree, expels it as a resin like excrement, completely encrusts the twigs of the tree and itself with it and dies. The encrusted twigs with the enclosed insects form the raw material (sticklack), from which the dyestuff is extracted.[53]

Lac dye was the preferred red colorant used in the Central Asian silks in the early Middle Ages. The red ground colour of most of the known Sogdian silks of the 7th to 9th centuries is, as already mentioned, dyed with lac. In only a few instances, madder and/or redwood were found. Silk dyed with madder is much less lightfast than the insect dyed equivalent; it fades to a unattractive pale shade.[54] Silk dyed with redwood can be recognised and identified easily, as, exposed to light, the initial bright red fades to a kind of beige or unattractive brownish yellow.[55]

51 Whiting 1978a: 41.
52 Schweppe 1992: 272.
53 Schweppe 1992: 272.
54 This at least applies to late medieval silks. An example is a silk textile with guinea fowls from the 7th or early 8th centuries, recently discovered in the shrine of St. Severin in Colon. The ground colour, now faded to a pale brownish red, is dyed with madder (see Oepen et al. 2011: 226-240, and 326-332).
55 Schorta 1998: 86–94; Verhecken-Lammens et al. 2006; Hofenk de Graaff/Roelofs 2006.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor	1	3	4	15	2	25
Ersarï, Kizil Ayak						
Sarïq						
Teke		1	1	1		3
Yomut, Qaradashlï	1		3	2		6
“Eagle” *gül* groups				4		4
“P-Chowdur” group						
Chowdur						
Arabachi			1			1
	2	4	9	22	2	39

Fig. 8: Number of samples analysed by HPLC-PDA method containing lac dye on wool. Several samples can come from the same piece. Some of the samples contain mixtures of lac dye, Mexican cochineal, and madder. For detailed dyestuff compositions, see appendix II, tables 2 – 10.

3.4.1 The use of Lac Dye among the Salor

From the 17th to the 19th century lac dye was used among the Turkmen on wool only. Marc Whiting’s investigations have already proved the existence of lac dye among the Turkmen, particularly among the Salor. Harald Böhmer also found lac dye in several pieces of the Salor. Whiting wrote that “Lac has been found only in Salor pieces and only on wool”; our study found that only the Salor used lac systematically and consistently, though we did find random occasional occurences in other weavings. All the classical Salor pieces we tested, with only the exception of two *khali* from the time before ca. 1850 (compare fig. 6 and 7), contained lac dye, but exclusively on wool. The Salor’s adherence to the use of lac, when using an insect dyestuff on wool, is extremely consistent. At the same time, our study shows that the abundant silk, a typical feature of early Salor work, is in no instance dyed with lac, rather with a cochineal of yet to be determined origin. In later Salor work of the second half of the 19th century, when the power and economic fortunes of the Salor were in decline, silk is generally not found.

Another feature, distinctive to the Salor, is how they used insect dyed yarn and in what quantities. It is quite remarkable that in classical Salor work all reds inside patterned areas are dyed with an insect dyestuff: wool with lac dye and silk with cochineal. [56] This unusual systematic use of insect dyestuffs on wool and silk is a unique feature of Salor work. It is seen in no other Turkmen group of weavings. Salor examples showing this are the *kapunuk* ca. no. 3, the *aq yüp* no. 4, the hanging no. 5 and 6, the *torba* no. 8, 9, and 10 as well as the *chuval* no. 11, 12, 13, and 15.[57] In some Salor pieces we even find lac dye instead of the usual madder as a ground colour. One is the *torba* fragment cat. no. 10. The ground colour of the field is dyed with lac, on which the squares with eight pointed stars are placed. Here, one could describe it as a lac dye grid, but in a strict sense it is the ground colour. The same is true for *torba* cat. no. 6, where the whole grid is dyed with lac, arguably forming the ground colour, with the regular arrangement of hexagonally framed *shemle gül*.

In two cases, Mexican cochineal was mixed with lac, in different amounts. The Salor *aq yüp* cat. no. 4 and the *khali* fragment no. 18 contain such mixtures.[58] Madder as an ingredient was found in very few cases and in traces only. In most cases, we are dealing with pure lac dye.[59]

In contrast to all other types of objects, the large format *khali* generally contain no insect dyes, on wool nor silk. This applies to all Turkmen *khali*, not only the Salor.[60] But not surprisingly, there are exceptions among the Salor. As in *chuval*, a group of *khali* shows the same kind of lavish use of silk and lac dyed wool. Examples of this group are the fragment cat. no. 18, the *khali* formerly in the Wiedersperg collection,[61] and the carpet formerly in the Leifer Collection.[62] All demonstrate the above mentioned criteria, having lac dye on wool and cochineal on silk. In *khali*, this phenomenon is only seen among the Salor.

56 There are exceptions here as well, e.g. Salor A-typ *ensi* cat. no. 1.
57 Cat. no. 14 has not been tested.
58 For the results, see appendix II, table 1, Ra 267-4 and Ra 260-2.
59 See appendix II, table 1, e.g. Ra 266-1, Ra 619-1, Ra 267-3 a.o.
60 E.g. *khali* cat. no. 16, without any silk, and *khali* cat. no. 17 with only 20 knots of cochineal dyed silk in the main border
61 See Pinner/Eiland 1999: Plate 1.
62 See Mackie/Thompson 1980: No. 4; Austria Auction Company, 16 September 2014: Lot 125.

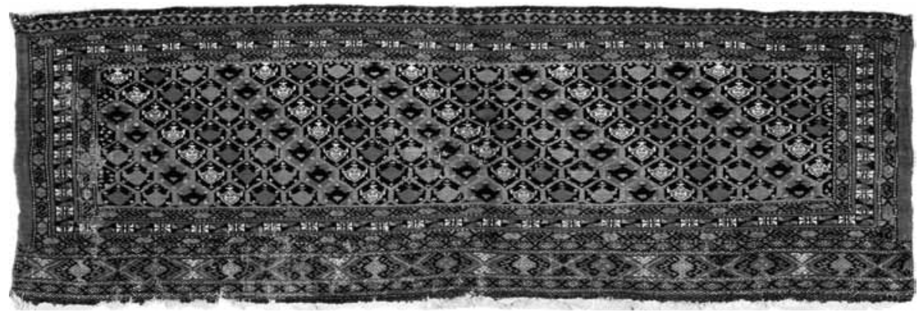


Fig. 9: Salor trapping with *shemle gul* design, 150 x 48 cm, post 1880, presumably from Serakhs. Asymmetric open right knotted on depressed warps, h 38 x 67 v = 2564 knots/dm2, private collection. The weaving still shows a classic version of the design seen in older Salor work (cf. cat. no. 6). The typical monochrome blue fringes seen in all early Salor trappings at the bottom end are still present, although as remnants only. Chemically proven synthetic dyestuffs of the Ponceau group date this piece post 1880. The purple shade of natural cochineal usually seen in pieces of this age has been imitated by a synthetic dyestuff. For the analytical results, see appendix II, table 1, Ra 621.

3.4.2 Lac Dye and Cochineal among the Salor in the late 19th century.

In the late 19th century, dyeing habits changed among the Turkmen, including the Salor. Like most other Turkmen groups, they started to use Mexican cochineal together with the first synthetic dyes, though less frequently and more sparsely than the Teke, the Sarïq, or the Ersarï. The early Salor *khali,* cat. no. 16, is one of the few exceptions containing Mexican cochineal.

In the late 19th century, Salor weavers sometimes even tried to imitate the purple shade of cochineal by using a synthetic dyestuff. In our study, two late Salor hangings tested showed exactly this phenomenon.[63] In a late Salor *kapunuk*, a truly unusual mixture of lac dye, Mexican cochineal, and a synthetic dyestuff was detected.[64] This, among other things, shows that lac as a dyestuff was used up to the

63 Fig. 9 as well as a fragment with *kejebe* design. Results of the tests, see appendix II, table 1, Ra 621-2 (Abb. 9) and Ra 613-1.
64 The piece is published in Andrews et al. 1993: No. 91. Results of the tests, see appendix II, table 1, Ra 667-1.

late 19th century. Whether or not we are really dealing with a Salor piece here is not absolutely clear, but based on its design, colouring, and technique (depressed warps, asymmetric knot open left), the piece very much compares to other late Salor work, e.g. the hanging cat. no. 7. Convincing evidence for the previous Arabachi attribution is sparse. For one thing, until today no other comparable Arabachi *kapunuk* is known whereas in addition to the late example discussed here, 6 other Salor *kapunuk* are known, all comparable in design, colour, and technique. [65] Only the shortened "arms" with 4 instead of the usual 6 curled leaves in the meander of the piece discussed here differ from the Salor relatives, though it should be noted that this piece is clearly late 19th century work with early synthetic dyes. One of the 6 Salor examples listed above is probably also not very old, but still in the old Salor tradition regarding its use of materials, dyes, and weaving technique, though it only shows 5 curled leaves.[66]

Our investigations proved the systematic use of lac dye in considerable quantities exclusively on wool among the Salor. As distinguishing between lac and cochineal dyed wool is not possible by the naked eye, one has to assume that the Salor were very clear about the source of their dyestuff or the lac dyed wool. Whether this special use of lac dye represents a local tradition and can be traced back to the pre 10th century Sogdians[67] or reflects some influence from 16th/17th century Safavid Persia, or both, has not been examined thoroughly yet. For the moment, it has to suffice that the Salor played a unique role regarding the use of lac dye among the Turkmen.

Our chemical tests proved the usual bright red ground colour of all Salor pieces to be dyed with madder. But the shade of this madder red ground colour stands out in quality from madder red ground colours in most other Turkmen weavings. Only after the decline of the Salor in the early 19th century, similar bright reds can be observed as a ground colour e.g. in Teke work.[68] The distinctive Salor madder red

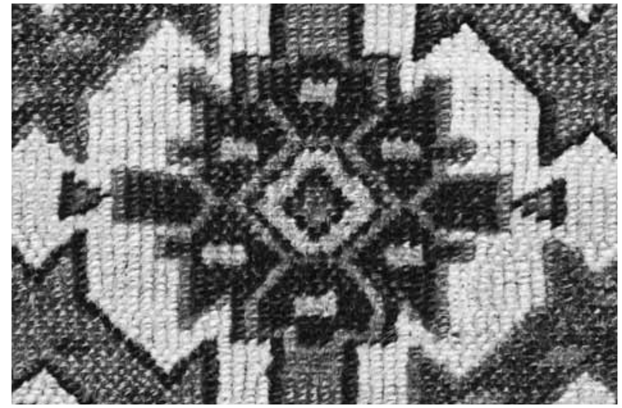


Fig. 10: Detail of cat. no. 77, a Qaradashlï asmalyk showing lac dye in 6 small squares within all *erre gül* with dark blue ground colour. For the analytical results see appendix II, table 7, Ra 629-1. Apart from the Salor, lac dye has only been used selectively, in small quantities, and mostly unsystematically among the Turkmen.

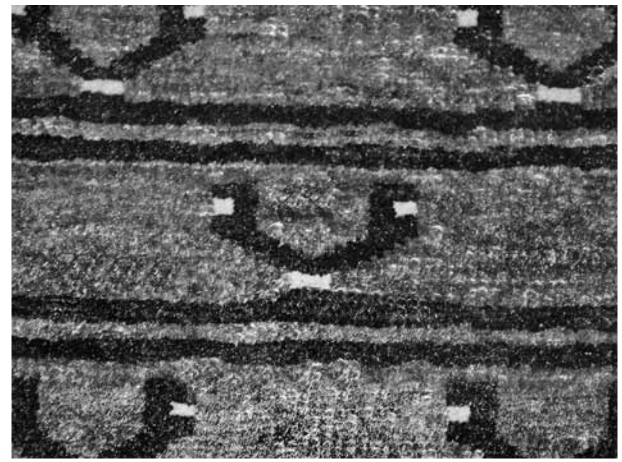


Fig. 11: Detail of a Qaradashlï *ensi*, containing lac dye in the little, light squares of the *gush* motives in the registers of the field. The *ensi* is published in Rippon Boswell 40, 1994: Lot 95. For the analytical result, see appendix II, table 7, Ra 466-1.

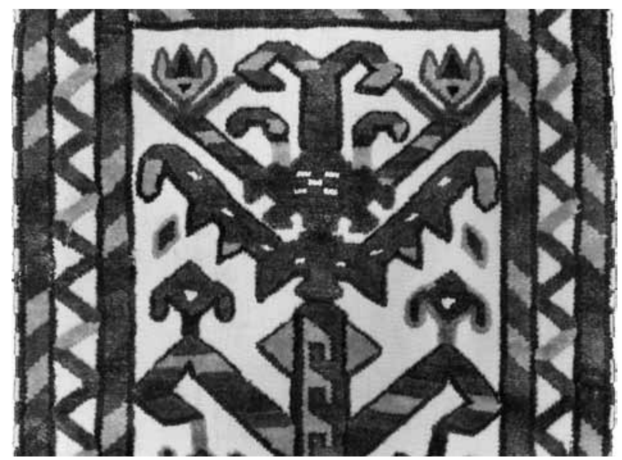


Fig. 12: Detail of a Yomut *ak yüp* showing lac dyed wool in the 5 (4+1) little squares within the flower head and the serrated leaves underneath. The half synthetic dyestuff indigo carmine, also known as Saxon Blue or indigosulphonic acid, has been detected in the same band. For the analytical results, see appendix II, table 7, p. ?, Ra 623-2/-3.

65 Cf. cat. no. 3, and the description of the piece in Vol. 2.
66 Rippon Boswell 64, 2004: Lot 169. Results of the tests, see appendix II, table 1, Ra 619-1.
67 For a possible origin of the Salor *gül*, see the chapter "The Salor".
68 E.g. among the Sarïq and the Teke. Cf. also cat. nos. 44, 45 and 62.

might be explained by a special and costly (professional?) dyeing procedure, which was unknown to other Turkmen groups or at least used only occasionally. We come back to this again under the heading of "bright red dyed with madder".

3.4.3 The use of Lac Dye among the other Turkmen

In contrast to the Salor, whose weavings mostly show a rigorously consistent use of lac dyed wool, the remaining Turkmen used this dyestuff, if at all, unsystematically as highlights only, and even then very sparingly. The diagram fig. 7 illustrates this. For example, our tests proved lac dye in the Qaradashlï *asmalyk* cat. no. 3 (fig. 10), in which the dark blue *erre gül* show small spots of lac dyed wool. A similar use of lac dyed wool can be seen in a second Qaradashlï piece, an *ensi*, showing spots of lac dyed wool in the *gush* motives of the field (fig. 11). A Yomut *aq yüp*, our third example, shows very small quantities of lac dyed wool in the form of small quincunx (4+1) motifs, used only in a few places in the band (fig. 12). In this tent band, the lac dyed woollen yarn is of particular interest, as it is really 2-plied (Z_2S), rather than a very loosely plied working unit (2Z), which is standard for pile yarn. This type of insect dyed pile material has already been mentioned under the heading "Visual recognition features for insect dyed woollen yarn". In the case of this Yomut *aq yüp* (fig. 12), 6 such 2-plied lac dyed woollen yarns were used for a single knot [6(Z_2S)]. In other words, the yarn is extremely fine. A comparable 2-plied lac dyed woollen yarn can be observed in the *torba* cat. no. 112, belonging to one of the so called "Eagle" *gül* groups, and in the Arabachi *aq yüp* cat. no. 125. Over the several years of our study, only in these three objects have we found real 2-plied (Z_2S) pile yarns.

3.5 Insect Dyestuffs on Silk

Examining insect dyed silk samples, one problem turned up again and again: Although carminic acid could be detected as a main dyestuff component, a clear attribution to one of the known species of cochineal was not possible. Either Armenian- or Mexican cochineal is possible.[69]

69 See the chapter "The Identification of Cochineal Species in Turkmen Weavings".

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor		2	2	7	1	12
Ersarï, Kizil Ayak				4		4
Sarïq			5		1	6
Teke		1	2	1		4
Yomut, Qaradashlï						
"Eagle" *gül* groups				5		5
"P-Chowdur" group						
Chowdur						
Arabachi	2		3	1	1	7
	2	3	12	18	3	38

Fig. 13: Number of HPLC-PDA analysed silk samples. 34 are dyed with Mexican or Armenian cochineal (pile samples), 3 with madder and 1 with synthetic alizarin (weft samples). For dyestuff compositions, see appendix II, tables 1–10.

Furthermore, in nearly all cochineal dyed silk samples examined, madder has been added in a quantity of up to 30% proportional to all dyestuff components. Possibly for economic reasons, the expensive insect dyestuff was mixed. In two cases, silk was even dyed exclusively with madder, without any content of insect dyestuff. However, this was weft material, unseen in the finished carpet, and not material for the pile. This unusual kind of madder dyed silk weft is found in cat. nos. 111 and 115, a *torba* and a *khali*, both belonging to the so called "Eagle" *gül* group 1.[70] Though we have no explanation for why the silk wefts, which would not be seen, are dyed red at all, perhaps economics drove the decision to use madder rather than the more expensive insect colorant.

Lac dyed silk with an admixture of madder has also been described by Verhecken-Lammens et al. in Sogdian silks of the 7th/8th centuries.[71] This seems, already by this early period, to have been a standard practice in this area. Obviously, dyers must have treated these expen-

70 For the test results, see appendix II, table 7, Ra 414-4 und Ra 626-3.
71 Verhecken-Lammens et al. 2006: 244–45.

sive dyestuffs (or their purses?) economically. In addition, in these early silks the unseen warps are dyed brownish red, and also here with madder! [72]

The table fig 13 shows number and origin of the 38 silk samples examined for this study. We did not find tin as a mordant on silk on any examples from any period.[73] We do not know the reason for the lack of tin in connection with silk in Central Asia. In Europe, tin as a mordant to obtain bright reds was already used extensively in the 17th century, on both silk and wool.

In addition to the 38 silk samples tested from Turkmen weavings, two more samples from radiocarbon dated Sogdian silks from the 7th/8th centuries were tested for both lac dye and tin.[74] The intent of these tests was to settle the question of whether the insect dyestuff used was, as suspected, really lac dye. At that time, lac dye was the classical insect dyestuff of Central Asia, while kermes was the classical insect dyestuff of the West: Islamic Spain, the Mediterranean, and Byzantium. The finding of lac dye therefore supports a Central Asian origin for the two silks. Further the idea was to confirm the absence of tin in one sample in support of the notion that tin as a mordant was not used before the 17th century.

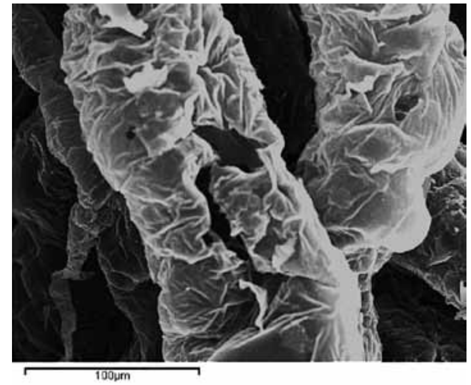


Fig. 14: Woollen fibres of a Sarïq *aq yüp*, dyed with Mexican cochineal on tin mordant. For the analytical result, see appendix III, table 12, Ra 299-1.
Clearly visible is the damage caused to the fibres by the tin treatment. Fig. 15 in comparison shows woollen fibres without tin treatment.

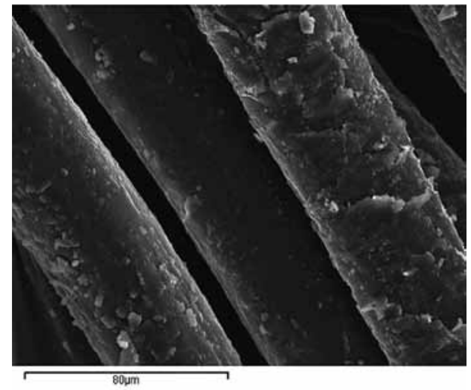


Fig. 15: Woolen fibres of the Salor *chuval* cat. no. 13 without tin mordant. For the analytical result, see appendix III, table 13, Ra 259-2.
The fibres are dyed with lac dye on alum instead of tin mordant. They do not show any damage, just the usual scaled surface structure of the woolen fibre.

3.6 Insect Dyestuffs on Tin Mordant

The impetus for this study was, as mentioned earlier, a conspicuously fiery red in a tent band (cat. no. 156), which against all my expectations turned out to be dyed with Mexican cochineal. It was a mystery to me, at least for a while, how this bright scarlet could have been dyed with cochineal. The unexpected answer eventually became clear: tin mordant. In the dyeing process, metal salts are responsible for a stable connection between dyestuffs and textile fibres; they build a kind of bridge. Depending on which metal salt, whether alum, iron, copper, or tin, has been used, the very same dyestuff produces completely different shades. Radically different shades from violet to ruby to bright scarlet can be achieved with cochineal, depending on the pre-treatment (mordanting) of the wool with one of these metal salts before dyeing.[75]

Amy Butler Greenfield provided the clue to the answer. She describes how in the early 17th century while doing experiments with Mexican cochineal, Cornelius Drebbel accidentally discovered the affinity between tin and cochineal. "Drebbel's recipe produced an even brighter red, a shade of scarlet cloth so brilliant that no one had ever seen its like before".[76] While reading these lines, I remembered the unusual bright cochineal dyed scarlet in our tent band, and the hitherto unsolved mystery of the relevant dyeing process. This could be the explanation!

72 Verhecken-Lammens et al. 2006: 245.
73 See appendix II, table 14.
74 See appendix II, table 10, and appendix III, table 14.

75 Hofenk de Graaff 2004: 79, a.o.
76 Butler Greenfield 2004: 138.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor	1	1	4	4	1	11
Ersarï, Kizil Ayak				1		1
Sarïq			7			7
Teke			5	1		6
Yomut, Qaradashlï			3	2		5
"Eagle" *gül* groups			2	2	1	5
"P-Chowdur" group			1			1
Chowdur						
Arabachi					1	1
	1	1	22	10	3	37

Fig. 16: Number of SEM analysed samples dyed with Mexican cochineal or lac dye on tin mordant. For more details, see appendix III, tables 11 and 12, in this vol.

For all we know about Drebbel (1572 – 1633), he remains an intriguing yet enigmatic character. Born in the Netherlands, he spent most of his life in England. He served the English King Jacob I and was esteemed as an inventor and physicist, notably, inventor of the submarine. The discovery of tin as a mordant for bright scarlet was supposedly a fluke.[77]

When I asked Jan Wouters and Ina Vanden Berghe about the possibility of identifying tin in some of our samples that had previously been tested for dyestuffs, they both confirmed that indeed it was possible. The identification of tin in a textile fibre by the SEM-EDX Method (Scanning Electronic Microscopy) is facilitated by its being the heaviest of all metallic mordants. Further, it can be excluded as being present due to contamination, which is not the case with aluminium and iron.

Consequently, two samples each of madder dyed, cochineal dyed and lac dyed wool were chosen for testing by SEM-EDX analysis. All six samples had already been tested for their dyestuffs in the course of the study, and this first selection was based exclusively on a visual assessment of the quality of their bright reds. From the selected madder samples, in the laboratory in Brussels only one stil had enough material, the one from the Arabachi *ensi* cat. no. 124 showing an extremely bright red. The cochineal dyed samples came from two Sarïq tent bands,[78] the lac dyed samples from a Yomut[79] and a Teke[80] tent band. The results, even for me, came as a surprising direct hit: All four insect dyed samples contained tin,[81] the bright madder dyed red of the Arabachi *ensi* alone was dyed with a different mordant.[82] This made it completely clear: tin was the magic formula for the bright scarlet dyed with insects.

The next challenge was to find out more about the cochineal dyed violets in 19th century pieces. My suspicion was that here we are dealing with cochineal dyed wool with a mordant different from tin; this was confirmed by our tests. Essential for the selection of samples was the visual impression alone: scarlet or violet. In this connection it is also interesting that the pictures, taken by the Scanning Electronic Microscope showed a clear difference between woollen fibres treated with tin or without. The treatment with tin has caused visible damage to the woollen fibres. Fig. 14 shows this clearly. Thompson noted the following as a typical characteristic of his S-group: "use of wool of a special pinkish-red in which the dye is corrosive, causing increased wear on the wool". This is probably due to the combination of an insect dyestuff and tin mordant.

The use of tin as a "colour amplifier" in connection with insect dyestuffs apparently was not known before the 17th century in Central Asia and appears to have been abandoned around the mid 19th century. This is clearly the conclusion we are led to by our test results. The early dated Salor *khali* ca. no. 16 still does not contain tin, while the majority of all pieces dated somewhat later to the 17th and 18th century do. The two pieces described above, fig. 5 and cat. no. 62, containing both scarlet as well as violet cochineal dyed wool, seem to

77 Butler Greenfield 2004: 138.

78 Cat. no. 38 and Neugebauer/Oriendi 1909: 210.

79 Cat. no. 99.

80 Andrews et al. 1993: No. 21.

81 For the test results, see appendix III, tables 11 and 12.

82 A second analysis of the cochineal dyed wool of the same ensi provided the same result: No tin. For the result, see appendix III, table 12, Ra 438-1.

be from the mid-19th century,[83] likely illustrating the end of this method of dyeing.

The table fig. 6 presents an overview of positive results for tin, while tables 12–15 in appendix III show the complete results of all tested samples in connection with tin, including those on silk and those with a negative result. These insect dyed scarlet wools, always 4-, 6- or 8-plied, are probably products of professional workshops, while the 2-plied cochineal dyed woollen yarns may represent traditionally produced products made by the weavers themselves. Finally it should be noted that Felkersam also mentions the use of tin among the Turkmen,[84] though leaving us in the dark about the source and meaning of this information. So it is not clear whether this reflects real appraisal from his fieldwork or only theoretical knowledge out of books. Should the first be the case, it would be surprising to find such information among the Turkmen at the beginning of the 20th century, although this method had not been practiced for more than 50 years.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor		1		7	1	9
Ersarï, Kizil Ayak						
Sarïq			1	2		3
Teke			1	4		5
Yomut, Qaradashlï				3	2	5
"Eagle" *gül* groups			1	3	1	5
"P-Chowdur" group			4	2		6
Chowdur						
Arabachi	1					1
	1	1	7	21	4	34

Fig. 17: Number of HPLC-PDA analysed samples dyed with madder on wool, cotton, and silk. For detailed dyestuff compositions, see appendix II, tables 1–10.

4. Bright red dyed with madder (*Rubia tinctorum* L.)

Madder is the primary red dyestuff in Turkmen weavings. Conservatively, at least 80% of the color in Turkmen weaving is the result of madder dyeing. Using madder, not only can many different shades of red be achieved, but also a wide range of hues ranging from violet (purple) to brown.

We do not intend to go into detail regarding the certainly interesting and complex subject of "madder" in all its abundance, but rather to focus on the rare bright reds, standard from the Salor as a ground colour, but only seen among the other Turkmen as highlights. The question is, how were these bright madder dyed reds produced?

From the beginning, the bright red of the Arabachi *ensi* cat. no. 124 attracted my interest. To be sure, and to absolutely exclude the possibility of synthetic dyes, a first TLC (Thin Layer Chromatography) analysis was done by Harald Böhmer in Istanbul. The result was madder, but the test could not determine with certainty whether it was pure madder or madder with some additional dyestuff components. A later HPLC analysis done by the KIK in Brussels confirmed madder and excluded other dye components. The question about the dyeing method to get this bright red from madder remains unsolved, and as Wouters tended to consider tin as a possible reason, the bright red of this *ensi* was one of the first candidates for a SEM-EDX mordant analysis. To achieve bright reds, the special role of tin in the dyeing procedure has already been discussed. The result of the examination of the bright red in the Arabachi *ensi* was negative; tin was not detected.

In all, seven bright reds, all dyed with madder, were examined for tin. The low number of samples examined is a function of the rarity of this shade in Turkmen weavings. In all seven samples tin was absent in connection with madder. Apparently tin as a mordant in connection with madder was not used among the Turkmen.

These bright reds seem to represent a specialty, which again leads us back to the Salor, as it was used by them often for the ground colour of their weavings.[85] Occasionally, an Ersarï piece may also show a

83 Cf. section "2.2 Whiting's Cochineal-I & II" in this chapter.
84 Felkersam 1914/15 (1979): 33.
85 E.g. cat. nos. 11, 13, and 18.

comparable red as a ground colour,[86] but generally this kind of intense shade was used by the Turkmen only in small quantities, perhaps as a kind of insect dyestuff replacement, an example being the bright red parts of the *chuval gül* in *khali* cat. no. 104. I also suspected the bright red in a Qaradashlï *chuval* to have been dyed with an insect dyestuff, although it was only 2-plied, but according to chemical analysis it was pure madder.[87]

Only after the decline of the Salor in the second quarter of the 19th century, when other groups like the Teke and the Sarïq increasingly used Salor designs, both groups also took over the bright red as a ground colour for their weavings.[88]

The riddle of the bright red madder dyed shades on wool is not yet resolved and demands further studies. Dyeing methods with madder can be extremely complex; obtaining bright reds with this dyestuff definitely requires specialised knowledge, and in addition may possibly be very costly as a result of requiring large quantities of madder. There has also never been a study of why among the Yomut and Qaradashlï more brownish to purplish shades of red are the rule, so that answer remains, for now, a mystery as well.[89] Perhaps there were aesthetic reasons, perhaps varying techniques in traditional dyeing. We do not know. But one thing is certain: this is a highly promising area for future studies in the field of dyes in Turkmen weavings![90]

5. The first synthetic dyes

In this study, early synthetic dyestuffs are not of the same interest as insect dyestuffs, but deserve some attention as their "successors". They were the late exotics among the dyestuffs used by the Turkmen, and at first were used in a similar way as their predecessors, the insect dyestuffs: sparingly and as highlights only. Whiting also observed and described this phenomenon, but compared their use rather with the bright orange-red in Teke pieces. [91]

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor		2		6		8
Ersarï, Kizil Ayak				1		1
Sarïq				1		1
Teke				4	1	5
Yomut, Qaradashlï			1	2		3
"Eagle" *gül* groups				2		2
"P-Chowdur" group						
Chowdur						
Arabachi					1	1
		2	1	16	2	21

Fig. 18: Number of HPLC-PDA analysed samples dyed with synthetic dyestuffs on wool. For detailed dyestuff compositions, see appendix II, tables 1–10.

According to Whiting,[92] the Turkmen only made occasional use of the earliest synthetic Aniline dyestuffs like Mauveine and Fuchsine.[93] Our results were consistent with his findings; not any of the 21 samples examined for synthetic dyes contained either Mauveine or Fuchsine. The same is true for synthetic alizarin, which Whiting said has not been found in any Oriental carpet.[94] This has not really changed; in a single case we found synthetic alizarin, but only in a pale red silk weft from an early 20th century saddle cover possibly related to the "Eagle"-*gül* groups.[95] A completely different story is found with the group of the so called azo dyes, the generation succeeding the aniline dyestuffs. Whiting's results show that Ponceau RR, a classic azo dyestuff, was used by nearly all the Turkmen of Central Asia.[96] Whiting

86 E.g. cat. no. 22.
87 For the result see appendix II, table 5, Ra 481-1.
88 E.g. the Sarïq *chuval* with Salor *gül* cat. nos. 43 and 44, and the Teke *chuval* with Salor *gül* cat. no. 62.
89 Cat. nos. 83–107.
90 Barbara Bigler has conducted experiments with varying dyeing methods. Her first findings regarding how to obtain bright reds with madder point to a repeated boiling of the wool in the same dye bath, having dried the powdered madder after each dyeing process, also evaluating hot vs. cold dye baths. Definitve results are not yet published.

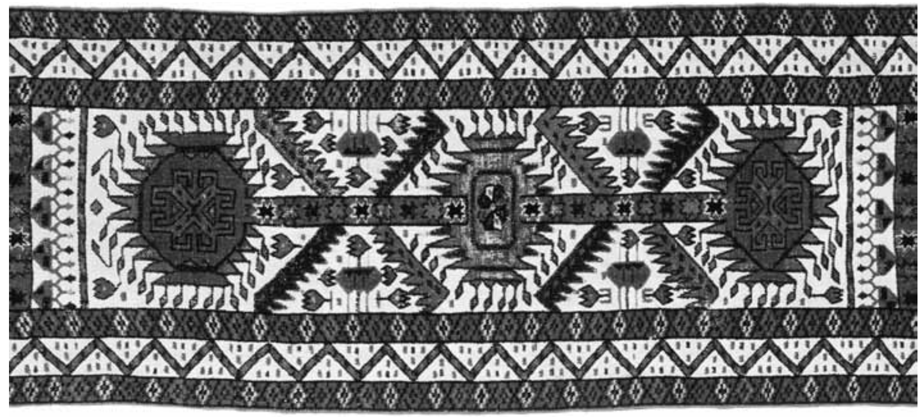
91 Whiting 1987b: 28.
92 Whiting 1978b: 282; 1980: 221.
93 von Nagel 1970: Mauveine discovered 1856 by William Henry Perkin. Fuchsine discovered 1859 by Emanuel Verguin.
94 Whiting 1980: 221.
95 See appendix II, table 7, Ra 620-3.
96 Whiting 1978b: 282; 1980: 221–22.

published a detailed description of his findings on synthetic dyestuffs.[97] Already in his early publications he indicated that synthetic dyestuffs were used among the Turkmen more widely than previously supposed.[98]

We now follow his example, even though in less detail, trying to extract something positive from this rather unpopular chapter in the history of Turkmen weavings; it can certainly contribute to our understanding of dating.

Examining Turkmen carpets by radiocarbon dating was the beginning of this substantial new study on Turkmen weavings. The goal was to clarify how far back in history the earliest survived examples date. The limits and benefits of radiocarbon dating in the field of oriental carpets generally, and Turkmen carpets in particular, are discussed in the chapter on dating.[99] As shown above, the introduction of Mexican cochineal to the old world has provided a *terminus post quem* of ca. 1550 for results between 1450 and 1650 achieved by radiocarbon dating. An additional *terminus post quem* of ca. 1610 has been provided by the invention of dyeing on tin mordant by Drebbel, explained in detail in the corresponding chapter. The first synthetic dyestuffs in Turkmen weavings now provide us a third *terminus post quem*, 1880, the time of the invention of the Ponceau dyestuffs.

97 Whiting 1980: 221 – 23.
98 Whiting 1978b: 283.
99 See chapter "From Visual Guesstimate to Scientific Estimate".



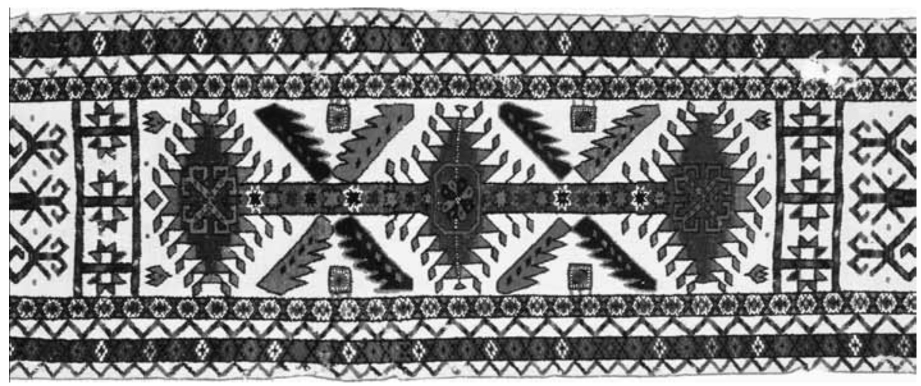


Fig. 19: Detail of Salor *aq yüp* cat. no. 4. On the basis of its systematic use of lac dye on wool, and other typical features like colour palette, colour sequence, and sophisticated drawing of the design, this tent band can be attributed to the Salor.

Fig. 20: Detail of the Sarïq *aq yüp* of the Textile Museum Washington DC (1983.55.1). Published in Isaacson 2007: Plate 12.

Fig. 21: Detail of Sarïq *aq yüp*, cat. no. 39.
Although the tent bands figs. 20 and 21 show a similar design to fig. 19 (cat. no. 4), they clearly differ in several details. Instead of lac dye on wool, Mexican cochineal was used. Furthermore the colour palette is different, and the drawing of the design is already clearly simplified, especially in fig. 21. All these criteria point to an early 19th century Sarïq (or Teke) production, reproducing Salor design.

Figs.. 19 – 21

As already mentioned, the introduction of Mexican cochineal to Europe and Asia caused a small revolution in the field of textile dyestuffs. A second such revolution was caused by the invention of the first synthetic dyestuffs. Names like William Henry Perkin, inventor of Mauveine, suddenly emerged in the world of textile dyes. It did not take long for this new development to manifest its first presence in Central Asia. In many pieces, colour shades started to appear that had rarely or never been seen in earlier examples. They are too bright or too pale, sometimes irregularly faded or only present in small quantities.[100] The question remained whether in such cases this resulted from a change of palette reflecting a decline of tradition in the course of the 19th century, or rather from early synthetic dyestuffs. Judging by overall appearance such pieces do not convey the impression of containing synthetic dyestuffs.[101] This was reason enough to examine a number of such curious objects more precisely.

Running colours frequently indicate the presence of synthetic colorants, but in some instances we wanted to know exactly what kind of dye had been used.[102] Of particular interest were the orange dyed woollen yarns, sometimes more than 2-plied, which often appeared as highlights in conjunction with Mexican cochineal as a ground colour.[103]

Based on these criteria, 21 woollen samples were tested for synthetic dyestuffs (cf. table fig. 18). 19 tests produced results clearly indicating the presence of a synthetic dyestuff. For reasons that are not clear, two examples did not yield results. In one case, the Teke all pile *kizil chuval* cat. no. 68, the orange examined is running, which generally speaks for a synthetic dyestuff. The other piece is the previously mentioned Salor *kapunuk* published by Andrews et al. 1993 with a mixture of lac dye, Mexican cochineal, and a synthetic dyestuff. The analysis of the more-than-2-plied orange woollen yarn in this piece, yielded no result, but probably is synthetic as well; madder would have given a clear result.[104] Of primary interest for us in connection with synthetic dyestuffs is the additional *terminus post quem* of ca. 1880. In other words, we are able more specifically to define the possible period of pieces with Mexican cochineal as a ground color by the presence of synthetic dyes.

100 E.g. in the Yomut *asmalyk* cat. no. 81.
101 E.g. cat. no. 77.
102 E.g. in Salor hanging cat. no. 7.
103 E.g. the late Salor *kapunuk*, published in Andrews et al. 1993: No. 91. For the test results, see appendix II, table 3, Ra 667-2.
104 Appendix II, table 1, Ra 667-2.

Fig. 22: Teke (?) chuval cat. no. 64 with extremely "Salor like" design. Teke or Salor? That is the question. The piece lacks typical Salor features like a systematic use of lac dyed wool or a lavish use of cochineal dyed silk for the pattern. In addition it shows a colour palette completely unfamiliar for Salor work. All this, and the asymmetric open right knotting, point more to Teke than Salor work.

6. Tribal attribution by means of dye analysis

The new scientific findings on the use of lac dye on wool among the Turkmen gained through this study can be helpful in connection with a tribal attribution. This is particularly the case in regard to differentiation between the Salor, Sarïq, and Teke. In most cases, a differentiation of objects like *khali* and *chuval* of these three groups is not too difficult, but looking at tent bands, things become less clear. Two particular cases from our study illustrate this. In the first case, of a group of nine tent bands distinguished by a particular stylized "compound palmette-tree" design (figs. 19–21),[105] an unambiguous tribal attribu-

105 See also comparable pieces to cat. nos. 4 and 39.

tion was not possible. It was unclear whether Teke, Sarïq, or even Salor people made them. The results of the dye tests in our study add considerable clarity and insight to the attribution process. Based on the frequent and systematic use of lac dye on wool and cochineal dyed silk, in conjunction with its general appearance, one of these tent bands (fig. 19, cat. no. 4) can now in all probability be attributed to the Salor.[106] This tent band's colour sequence - dark blue, lac dyed red on wool, dark blue, cochineal dyed red on silk etc. - very much resembles the Salor *kapunuk* cat. no. 3, which shows the same sequence in the upper horizontal panel's curled leaves, and also in the vertical drooping panels to the left and right. In addition, the tent band uses this sequence in what seems to be the most characteristic Salor tent band design: the stylized "compound palmette-tree" (figs. 19 – 21).[107] All these facts speak for a Salor attribution for this specific object.

So, at least one of this group is a Salor weaving. But what are the others? Until now only two of them have been tested for their insect dyestuffs (figs. 20 and 21). One of them is a tent band from the Textile Museum in Washington, D.C. (fig. 20); the other is cat. no. 39 (fig. 21), the tent band from the collection of Francois Ang in Paris. Several samples examined for insect dyestuffs from both bands turned out to be dyed with Mexican cochineal, and no lac dye was detected.[108] Comparing the stylized "compound palmette-tree" designs (fig. 19 – 21) of the three tent bands, clear differences can be observed; in the band now recognised as Salor (fig. 19), not only the design, but also the palette is more sophisticated than in the two other objects (fig. 20 and 21). Although the first two meters of the Ang band (cat. no. 39) indeed show what one could call "Salor quality" colours, this is not the case for the rest of the band; the palette changes to darker, more sombre shades. Instead of the bright red, we now find a brownish purple. This colour change is even clearly visible in the lower left corner of the colour illustration (cat. no. 39). All this speaks more strongly for an attribution to the Sarïq or the Teke. Much the same applies to the band from the Textile Museum (fig. 20). In the 19th century, it was not unusual for the Sarïq and Teke to copy Salor designs.[109] More tent bands with this design await further dye analysis.

The second example with a "tribal" attribution supported by dye analysis is the *chuval* cat. no. 64 (fig. 22). A Salor attribution has been proposed based on the drawing, but structure, palette, and the lack of an insect dyestuff on wool calls such an attribution into question. Every older Salor *chuval* we tested contained a relatively high quantity of lac dyed wool. Here, this is not the case. Two woollen samples from the area of the *chuval gül* both turned out to be dyed with madder.[110] Here we are certainly not dealing with what could be considered classical Teke work, but based on its palette and on the absence of lac dye, the piece is much closer to Teke than to Salor work. Furthermore, the brownish red ground colour is unusual if not unknown among the Salor, but not so among the Teke, as the early dated *khali* cat. no. 71 clearly demonstrates.

It is perhaps appropriate here to revisit the issue of the late Salor *kapunuk*, plate no. 91 in Andrews et al. 1993. Though the design shows clear similarity to the other known Salor *kapunuk*, it was extremely surprising to find lac, much less in combination with cochineal and synthetics; no other late Salor piece tested showed even traces of lac dye. In this "outlier" case, the dye evidence is much less compelling for the purpose of attribution than it is with the tent band fig. 19 (cat no. 4).

Our dye analysis study not only tells us what dyestuffs are present, but can also assist with attribution of a specific piece to a specific tribe; our findings regarding the presence and use of lac have been particularly illuminative.

106 For the results of the analyses, see appendix II, table 1, Ra 267-3, 267-4.
107 For a description and a possible derivation of the "compound palmette-tree" design see Vol. 2, description of cat. no. 4, and Figs. 52–66, in the chapter "The Salor".
108 For the test results, see appendix II, table 5, Ra 710-1 (Fig. 13); Ra 618-1 to 618-4 (Fig. 14).
109 E.g. the Sarïq *chuval* cat. nos. 43 and 44, and the Teke *chuval* cat. nos. 61 and 62.
110 For the test results, see appendix II, table 6, Ra 709-1/-2.

7. Summary

For this study 183 woollen and 38 silk samples from Turkmen weavings were tested for their dyestuffs. 61 samples were tested for tin mordant. The aim was to get an explanation for the bright reds, especially in earlier pieces. Providing a historical frame of ca. 1500 to 1900, the radiocarbon dating results of the preceding dating study turned out to be of great help.

We are aware of the limitations of our study presented here. For example, in the study of tin mordant more analyses would have been helpful. The same is true for the synthetic dyestuffs. Further research into madder is another area of significant opportunity, not only on the analytical but also on the experimental side (dyeing experiments). In this area Barbara Bigler has provided some very interesting initiatives. Finally more results on the special use of lac dye among the Salor would have been welcome to confirm the results obtained. In spite of these realities, our chemical tests of Turkmen weavings provided revealing results, particularly regarding dating and attribution, and are at least a stimulus for further research. It turned out that the extremely bright reds were produced using three insect dyestuffs: Mexican cochineal (*Dactylopius coccus* Costa), lac dye (*Kerria lacca* Kerr), and in a few cases Armenian cochineal (*Porphyrophora hameli* Brandt).

For a first time, the use of Mexican cochineal as an insect dyestuff on wool among the Turkmen has been identified and proved with certainty. Until now a differentiation between Mexican and Armenian cochineal in this field had not been possible. In Turkmen weavings, lac dye has been proved on wool only, and cochineal on both wool and silk, though it has not yet been possible to distinguish between the species of cochineal on silk.

In addition our study has determined that all Turkmen groups, except the Salor, have used Mexican cochineal on wool regularly. Lac dye on the other hand has been used systematically and in larger quantities by the Salor only. Naturally, there are exceptions, which, as they say, "prove the rules". In both earlier and later pieces, the Yomut used insect dyes much less than other Turkmen groups, hardly at all, in fact. The same is true regarding the use of silk. In sharp contrast to the Yomut, the Salor made a "lavish" use of both silk and insect dyestuffs, – particularly in what I call "classical" Salor – in early pieces before their defeat by the Persians, Sarïq, and the Teke between 1820 and 1830.

As chemical analyses showed, Mexican cochineal was used in Turkmen weavings with a 16th/17th century radiocarbon dating. This clearly proves the early use of this dyestuff as far East as Central Asia. Donkin writes that the dyestuff from the New World was exported to Central Asia as early as about 1550.[111] In the 17th century, tin as a brightener for insect dyed reds came into use. Around 1850, there was a tremendous change regarding the use of insect dyestuffs. The use of tin as a colour brightener was abandoned, and prices for Mexican cochineal dropped precipitously, leading, in the 1870s, to a breakdown of the market because of excessive production. In addition, the appearance of the early synthetics was the final death-blow for Mexican cochineal. The market collapsed completely, and in Central Asia Mexican cochineal was lower in price than madder. Among the Turkmen this led to the use of Mexican cochineal instead of madder as a ground colour in some cases. The newly arrived early synthetics took the place of the old insect dyestuffs, being used in much the same way as their predecessors.[112]

Finally, our study has demonstrated the value of the dye analysis findings in constructing better supported attributions of specific pieces to specific weaving groups.

111 Donkin 1977b: 847.
112 E.g. cat. no. 24, 63, 68, 69, 70.

Appendix II: Tables 1 – 10
HPLC-DAD Dye Analysis
Dyestuffs in Turkmen Weavings: Composition and Sources

Ordered by tribes and objects
Legend of abbreviations of dye compounds at the end

Ina Vanden Berghe
Institut Royal du Patrimoine Artistique, KIK-IRPA, Brussels

Table 1: The Salor

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Salor *ensi*, type B Cat. no. 2	Ra 707-1 07915/222	w, 3 – 4Z	bluish red	2 ca, 63 laA, 1.5 fk, 26.5 laE, 7 ery	255	Lac dye and a trace of cochineal
Salor *kapunuk* Cat. no. 3	Ra 266-1 07915/53	w, 2–6Z	deep red	57 laA, 38.5 laE, 4.5 fk	255	Lac dye
	Ra 266-2 07915/54	s, 2Z	magenta	4.5 fk-glu, 87.5 ca, 3.5 ea, 0.5 fk, 1,5 ka, 2.5 al 0.4 fk-glu, 97.3 ca, 2.3 (fk+ka)	255 275R	Mexican cochineal, tannin, and a trace of madder
	Ra 266-3 07915/163	w, 2Z (wefts)	pale red	0.5 ag, 1 ru, 73 al, 1.5 xp, 20.5 pu+, 3.5 ru	255	Madder
Salor *kapunuk* Rippon Boswell 64, 2004: Lot 169	Ra 619-1 07915/165	w, 2–4Z	bright orange-red	55 laA, 34 laE, 3 fk, 8 ery	255	Lac dye
	Ra 619-2 07915/166	s, 2–3Z	magenta	74 ca, 2.5 ka, 23 al, 0.5 ru 97.1 ca, 2.7 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
Salor (?) *kapunuk* Andrews et al. 1993: No. 91	Ra 667-1 07915/207	w, 2Z	violet-red	14 ca, 34 ea, 3 laA, 14 laE, 4 fk, 24 al, 11 pu, + Acid Red 13 (Fast Red E) or Acid Red 25 (Ponceau 3RO)	255	Cochineal, Lac dye, madder, + synthetic dyes
	Ra 667-2 07915/209	w, 4Z	orange	no dyes detected		-
Salor *ak yüp* Cat. no. 4	Ra 267-2 07915/55	s, 2Z	magenta	89 ca, 9 ea, 0.5 fk, 1 ka, 0.5 al 97.6 ca, 2.4 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin, and a trace of madder
	Ra 267-3 07915/56	w, Z	deep red	63 laA 35.5 laE, 1.5 fk	255	Lac dye
	Ra 267-4 07915/57	w, 3Z	violet-red	0.5 fk-glu, 49.5 ca, 23 laA, 15.5 laE, 2 fk, 0.5 ka, 9 al 1.2 fk-glu, 93 ca, 5.8 (fk+ka)	255 275R	Lac dye, Mexican cochineal and madder
Salor(?) *ak yüp* Unpublished (HCS 1608)	Ra 285-1 07915/58	s, 2Z	magenta	93.5 ca, 5.5 ea, 1 ka 97.6 ca, 2.4 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin, and a trace of madder
	Ra 285-2 07915/59	w, 3–4Z	deep red	59 laA, 39 laE, 2 fk	255	Lac dye
	Ra 285-3 07915/175	w, 3–4Z	deep red	59 laA, 9.5 sul, 27 laE, 1.5 fk, 0.5 laX, 2.5 al	255	Lac dye, young fustic, and a trace of madder

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Salor hanging Cat. no. 5	Ra 614-1 07915/134	w, 4–7Z	rose-red	61 laA, 32 laE, 5 ery	255	Lac dye
	Ra 614-2 07915/135	s, 2Z	magenta	59.5 ca, 5 ea, 2 laA, 2,5 laE, 1 fk, 2.5 ka, 20 al, 6.5 pu, 1 ru 95.6 ca, 4.4 (fk+ka)	255 275R	Mexican or Armenian cochineal, Lac dye, madder, and tannin
	Ra 614-3 07915/160	w, 2Z (wefts)	pale red	70.5 al, 1 xp, 27 pu, 1.5 ru	255	Madder
Salor hanging Cat. no. 6	Ra 615-1 07915/136	w, 4–7Z	deep red	53.5 laA, 38laE, 3 fk, 3,5 ery	255	Lac dye
	Ra 615-2 07915/137	s, 2Z	magenta	5.5 fk-glu, 76 ca, 2 ea, 1 laA, 2.5 laE, 1 fk, 2 ka, 5.5 al, 4.5 pu 0.5 fk-glu, 96.6 ca, 2.9 (fk+ka)	255 275R	Mexican cochineal, Lac dye, madder, and a trace of tannin
	Ra 615-3 07915/161	w, 2Z (wefts)	pale red	+ag, 70.5 al, 1 xp, 27.5 pu, 1 ru	255	Madder
Salor hanging Cat. no. 7	Ra 280-1 07915/22	w, 2Z	violet-red	3 fk-glu, 92 ca, 4 ea, 0.5 fk, 0.5 ka 1.9 fk-glu, 96.6 ca, 1.2 (fk+ka)	255 275R	Mexican cochineal and tannin
	Ra 280-2 07915/23	w, 2Z	bright red	Acid Orange 14 (Ponceau G) and Acid Red 26 (Ponceau RR)	255	Synthetic dyes
Salor hanging *shemle gül* Fig. 9, chapter "Scarlet and Purple"	Ra 621-1 07915/178	w, 2Z	orange	Acid Orange and Acid Red	255	Synthetic dyes
	Ra 621-2 07915/179	w, 1–2Z	bluish red	Acid Red 88 (Fast Red AV) and unknown synthetic	255	Synthetic dyes
Salor hanging *kejeb* design Fig. 77, chapter "The Salor",	Ra 659-1 07915/191'	w, 2Z	violet-red	5 fk-glu, 72.5 ca, 1.5 fk, 1.5 ka, 8.5 al, 11 pu, +ru 5.9 fk-glu, 91.5 ca, 2.6 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 659-2 07915/192'	w, 2Z	orange-red	5 ca, 68 orh, 11 al, 12 pu, +Acid Red 26 (Ponceau RR) and Acid Orange 14 (Ponceau G)	255	Brasil wood, madder, a trace of cochineal, + synthetic dyes
Salor hanging, *kejeb* design Fragment, Unpublished (Tischer)	Ra 613-1 07915/132	w, 2Z	violet-red	Acid Red 13 (Fast red E), or Acid Red 25 (Ponceau 3RO)	275R	Synthetic dyes
	Ra 613-2 07915/133	w, 2Z	orange	Acid Orange 14 (Ponceau G), or Acid Red 26 (Ponceau RR)	500	Synthetic dyes
	Ra 613-3 07915/176	w, 2Z	red with bluish tinge	+ law, + ag, 1 mu, 53 al, 0.5 xp, 45 pu, 0.5 ru	255	Madder
	Ra 613-4 07915 177	w, Z (wefts)	pale red	+ law, + ag, 2 mu, 55.5 al, +xp, 42 pu, 0.5 ru	255	Madder
Salor *torba* Cat. no. 8	Ra 221-1 07915/10	w, 4Z	ruby red	58 laA, 38 laE, 2 fk, 2 ery	255	Lac dye
Salor *torba* Cat. no. 10	Ra 279-1 07915/36	s, 2Z	light magenta	97 ca, 1.5 ka, 1.5 al 98.6 ca, 1.4 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 279-2 07915/37	w, 4Z	bluish red	54.5 laA, 41.4 laE, 4.5 ery	255	Lac dye
	Ra 279-3 07915/164	w, 2Z (wefts)	pale red	+ag, 59 al, 0.5 xp, 40 pu, 0.5 ru	255	Madder
Salor *torba* (?) *shemle gül* Baumann 2008: Nr. 2	Ra 606-1 07915/128	w, 4Z	deep red	53 laA, 40 laE, 2.5 fk, 0.5 al, 3.5 ery	255	Lac dye and a trace of madder
Salor *chuval* Cat. no. 11	Ra 258-2A 07915/48	w, 3–5Z	rose-red	57.5 laA, 37.5 laE, 2 ery	255	Lac dye
	Ra 258-3A 07915/49	s, 3Z	light magenta	61 ca, 11 ea, 2 ka, 13.5 al, 12.5 pu 97.2 ca, 2.8 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin, and madder
Salor *chuval* Cat. no. 12	Ra 259-2A 07915/50	w, 3–5Z	violet-red	57.5 laA, 1.5 sul, 35.5 laE, 5.5 ery	255	Lac dye and a trace of young fustic
	Ra 259-3A 07915/51	s, 2Z	magenta	68 ca, 1.5 ka, 15 al, 15.5 pu 98.5 ca, 1.5 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 259-4 07915/162	w, 2Z (wefts)	red	+ag, +mu, 57 al, 0.5 xp, 42 pu, 0.5 ru	255	Madder

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Salor *chuval* Unpublished	Ra 701-1 07915/210	w, 3Z	rose-red	56 laA, 0.5 sul, 29.5 laE, 5 al, 9 ery	255	Lac dye, traces of madder, and traces of young fustic
	Ra 701-2 07915/211	w, 5Z	violet-red	2 fk-glu, 30.5 ca, 32.5 laA, 0.5 sul, 23.5 laE, + fk, 2 ka, 5 al, 0.5 pu, 3.5 ery 1.2 fk-glu, 95.7 ca, 3.1 (fk+ka)	255 275R	Mexican cochineal, Lac dye, traces of madder, and traces of young fustic
Salor *chuval* Jourdan 1989: No. 6	Ra 605-1 07915/127	w, 4Z	deep red	57 laA, 37.5 laE, 2 fk, 1.5 al, 2 ery	255	Lac dye and a trace of madder
Salor *chuval* Cat. no. 13	Si 15-2 07915/04	w, 6Z	deep red	54 laA, 35 laE, 6 al, 2 pu, 3 ery	255	Lac dye and madder
	Si 15-3 07915/05	s, 2Z	magenta	62 ca, 2 (fk+ka), 19 al, 16 pu, 1 ru 98.2 ca, 1.8 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Si 15-4 07915/159	w, Z weft	pale red	+ag, 49 al, 0.5 xp, 49.5 pu, 1 ru	255	Madder
Salor *chuval* TKF Graz 1999: No. 69	Ra 604-1 07915/126	s, 3–4Z	violet-red	1.5 fk-glu, 69 ca, 9 ea, 1 fk, 1 ka, 11 al, 7 pu, 0.5 ru 0.2 fk-glu, 97.4 ca, 2.4 (fk+ka)	255 275R	Mexican cochineal, madder and tannin
Salor *chuval* Cat. no. 15	Ra 228-1 07915/11	w, 4Z	deep red	52 laA, 31 laE, 2 fk, 10 al, 1 xp, 3 ery, 1 ru	255	Lac dye and madder
	Ra 228-2 07915/12	w, 2Z	yellow	11 ea, 15 qu, 23 kf, 19 isorht, 32 al	255	Persian larkspur, madder and tannin
Salor *chuval*, 4 × 4 *chuval gül* Unpublished , (KM 1187)	Ra 293-1 07915/33	w, 4Z	deep red	59.5 laA, 35 laE, 5.5 ery	255	Lac dye
Salor *chuval* Hodenhagen 1997: No. 2	Ra 607-1 07915/129	w, 4Z	deep red	49.5 laA, 34.5 laE, 3 fk, 6 al, 1 pu, 6 ery	255	Lac dye and madder
Salor *chuval*, 4 × 4 *chuval gül* Unpublished (Ladewig)	Ra 650-1 07915/190'	w, 2–4Z	violet-red	8 ca, 58 laA, 29.5 laE, + fk, 2.5 al, 0.5 pu, 1.5 ery	255	Lac dye, traces of cochineal, and traces of madder
Salor *khali* Cat. no. 16	Ra 214-1 07915/27	w, 2–4Z	light violet-red	1.5 fk-glu, 76 ca, 1.5 sul, 10 al, 11 pu 2.3 fk-glu, 96.7 ca, 1 (fk+ka)	255 275R	Mexican cochineal, madder, and a trace of young fustic
	Ra 214-2 07915/28	w, 2Z	dark purple	45 al, 54.5 pu, 0.5 ru	255	Madder
Salor *khali*, fragment Cat. no. 18	Ra 260-1A 07915/34	s, 2Z	magenta	79.5 ca, 5.5 ea, 1 ka, 8 al, 6 pu 98.3 ca, 1.7 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin, and madder
	07915/34'			87.5 ca, 8.5 ea, 1.5 ka, 2,5 al 99.4 ca, 0.6 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin, and madder
	Ra 260-2A 07915/35	w, 3Z	dark magenta	12 ca, 48 laA, 32.5 laE, 0.5 fk, 0.5 ka, 3.5 al, 1 pu, 2 ery 83.4 ca, 16.6 (fk+ka)	255 275R	Lac dye, madder, and cochineal
Salor *khali* Cat. no. 135	Ra 608-1 07915/130	w, 4Z	light violet (animals)	1 fk-glu, 79 ca, 1 fk, 1.5 ka, 7.5 al, 10 pu, + ru 1.6 fk-glu, 96 ca, 2.5 (fk+ka)	255 275R	Mexican cochineal and madder
Salor *khali* Bausback 1983: 143	Ra 609-1 07915/131	w, 4Z	deep red (animals)	45.5 laA, 32.5 laE, 2.5 fk, 3.5 laX, 7 al, 9 ery	255	Lac dye and madder

Tabel 2: The Ersarï

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Ersarï *ensi* Hali 111, 2000: 8	Ra 288-1 07915/43	w, 6Z	violet-red	3.5 fk-glu, 94 ca, 0.5 fk, 0.5 ka, 1,5 al 3.2 fk-glu, 95.0 ca, 1.8 (fk+ka)	255 275R	Mexican cochineal and madder
Kizil Ayak (?) hanging Unpublished	Ra 402-1 07915/114	s, 2–3Z	magenta	95 ca, 0.5 fk, 0.5 ka, 2 al, 2 pu 99.1 ca, 0.9 (fk+ka)	255 275R	Mexican or Armenian cochineal and a trace of madder
	Ra 402-2 07915/115	w, 4Z	deep red	2.5 fk-glu, 96 ca, 0.5 fk, 1 ka 1.9 fk-glu, 96.8 ca, 1.3 (fk+ka)	255 275R	Mexican cochineal

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Ersarï *chuval* Cat. no. 23	Ra 281-1 07915/38	s, 2Z	magenta	65 ca, 0.5 ka, 22.5 al, 11.5 pu, 0.5 ru 99.4 ca, 0.6 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 281-2 07915/39	w, 3–4Z	deep red	5 fk-glu, 94 ca, 0.5 fk, 0.5 ka	255	Mexican cochineal
Ersarï *chuval* Cat. no. 24	Ra 403-1 07915/44	w, 2Z	bluish red	5.5 fk-glu, 93 ca, 1 fk, 0.5 ka 4.1 fk-glu, 94.8 ca, 1.1 (fk+ka)	255 275R	Mexican cochineal
	Ra 403-2 07915/116	w, ?Z	orange	Acid Red 26 (Ponceau RR)	255	synthetic dye
Ersarï *chuval* Cat. no. 25	Ra 616-1 07915/206'	w, 2Z	violet-red	dcIII', 4.5 fk-glu, 72.5 ca, 1 fk, 1.5 ka, 8.5 al, 12 pu 4.2 fk-glu, 94.7 ca, 1.2 (fk+ka)	255 275R	cochineal, probaly ammoniacal cochineal, and madder
Ersarï *chuval*, 3 × 4 *gül* Unpublished	Ra 282-1 07915/111	s, 2Z	magenta	71.5 ca, +ag, +fk, 1 ka, 19 al, 8 pu, 0.5 ru 99 ca, 1 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 282-2 07915/112	w, 4–6Z	deep red	2.5 fk-glu, 95 ca, 0.5 fk, 0.5 ka, 1 al, 0.5 pu 2.2 fk-glu, 96.8 ca, 1 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
Ersarï *chuval*, 3 × 4 *gül* Unpublished (HCS 1443)	Ra 300-1 07915/113	w, 6Z	bluish red	2 fk-glu, 96.5 ca, 0.5 fk, 1 ka 1.5 fk-glu, 97.3 ca, 1.2 (fk+ka)	255 275R	Mexican cochineal
Ersarï *khali* (small rug) Unpublished	Ra 470-1 07915/109	w, 2–3Z	violet-red	5.5 fk-glu, 70 ca, 4 ea, + ag, 1 fk, 1 ka, 10 al, 8 pu, 0.5 ru 3.9 fk-glu, 94.3 ca, 1.9 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of tannin
	Ra 470-2 07915/110	s, 2Z	magenta	70 ca, 2.5 ea, +fk, 1 ka, 19.5 al, 7 pu, +ru 0.2 fk-glu, 99.1 ca, 0.7 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of tannin
Kïzïl Ayak (?) *khali*, fragm. Cat. no. 36	Ra 462-1 07915/189	w, ?Z	bluish red	2 fk-glu, 90.5 ca, 1 fk, 1.5 ka, 1.5 al, 3.5 pu 2.2 fk-glu, 96.1 ca, 1.7 (fk+ka)	255 275R	Mexican cochineal and a trace of madder

Table 3: The Sarïq

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Sarïq *ensi* Unpublished (HCS 1001)	Ra 469-1 07915/108	w, 2Z	violet-red	2 fk-glu, 97 ca, 0.5 fk, 0.5 ka 0.9 fk-glu 98.4 ca, 0.7 (fk+ka)	255 275R	Mexican cochineal
Sarïq (?) *ak yüp*, fragment Unpublished	Ra 415-1 07915/106	s, 2Z	magenta	93 ca, 4.5 ea, 0.5 fk, 1.5 ka, 0.5 al 0.1 fk-glu, 98.2 ca, 1.6 (fk+ka)	255 275R	Mexican cochineal, tannin and a trace of madder
	Ra 415-2 07915/107	w, 3Z	deep red	3 fk-glu, 94.5 ca, 1.5 fk, 1 ka 2.8 fk-glu, 95.3 ca, 1.9 (fk+ka)	255 275R	Mexican cochineal
Sarïq (?) *ak yüp* Cat. no. 38	Ra 294-1 07915/14	w, 3Z	scarlet	3.5 fk-glu, 79 ca, 1 fk, 1 ka, 8.5 al, 7 pu 3.0 fk-glu, 95.0 ca, 2.0 fk ka	255 275R	Mexican cochineal and madder
	Ra 294-2 07915/17	w, 3Z	scarlet	5 fk-glu, 81 ca, 2 sul?, 1 fk, 1 ka, 4 al, 6 pu 3.3 fk-glu, 94.6 ca, 2.1 (fk+ka)	255 275R	Mexican cochineal madder and young fustic
	Ra 294-3 07915/18	s, 2Z	magenta	92.5 ca, 0.5 ka, 6 al, 1 pu 99.7 ca, 0.3 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 294-4 07915/124	w, 3Z	orange	0.5 qu, 0.5 kf, 0.5 rht, 54 al, 44 pu, 0.5 ru	255	madder and berries as e.g. yellow or Persian berries
	Ra 294-5 07915/125	s, 2Z	green	27 lu, 4 lu', 1.5 ap, 12.5 al, 36 in, 19 pu	255	madder, weld and an indigoid dye source (indigo or woad)
Sarïq (?) *ak yüp* Cat. no. 39	Ra 618-1 07915/154	w, 3–4Z	scarlet	2.5 fk-glu, 95.9 ca, 1.7 (fk+ka)	275R	Mexican cochineal
	Ra 618-2 07915/155	w, 3–4Z	scarlet	2 fk-glu, 96.5 ca, 1.5 (fk+ka)	275R	Mexican cochineal
	Ra 618-3 07915/156	w, 3–4Z	scarlet	4.8 fk-glu, 92.9 ca, 2.3 (fk+ka)	275R	Mexican cochineal
continues on next page	Ra 618-4 07915/157	w, 2Z	scarlet	2 fk-glu, 95.7 ca, 2.3 (fk+ka)	275R	Mexican cochineal

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
	Ra 618-5 07915/158	s, 2–3Z	magenta	4 fk-glu, 85.5 ca, 1.5 ea, 0.5 fk, 1 ka, 4.5 al, 3 pu 0.4 fk-glu, 98.2 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal and madder
Sarïq (?) *ak yüp* "Scarlet and Purple", fig. 20	Ra 710-1 07915/226	w, 3–4Z	leuchtend rot	2 dc II, 90 ca, 1 fi, 4.5 sul, 1.5 fk, 1 ka 2.7 fk-glu, 94.9 ca, 2.4 (fk+ka)	255 275R	Mexican cochineal and young fustic
Sarïq (?) *ak yüp*, fragment "Scarlet and Purple", fig. 5	Ra 273-1 07915/30	w, 2Z	violett-rot	1.5 fk-glu, 86 ca, 0.5 fk, 0.5 ka, 4.5 al, 7 pu 1.4 fk-glu, 97.8 ca, 0.8 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 273-2 07915/99	w, 3–4Z	scharlach	5 fk-glu, 92 ca, 2 fk, 1 ka 4.2 fk-glu, 93.6 ca, 2.2 (fk+ka)	255 275R	Mexican cochineal
Sarïq (?) *ak yüp* Unpublished	Ra 299-1 07915/104	w, 3Z	scharlach	2 fk-glu, 87 ca, 2 sul, 1 fk, 1 ka, 5 al, 2 pu, +ru 2.3 fk-glu, 96 ca, 1.7 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
	Ra 299-2 07915/105	s, 2Z	magenta	86 ca, 0.5 fk, 0.5 ka, 8.5 al, 4.5 pu 0.2 fk-glu, 98.9 ca, 0.9 (fk+ka)	255 275R	Mexican cochineal and madder
Sarïq hanging Herrmann 1986: No.102b	Ra 412-1 07915/151	w, 3Z	violet-rot	1.5 fk-glu, 94.5 ca, 1.5 ea, 1 fk, 1.5 ka 1.5 fk-glu, 96.8 ca, 1.6 (fk+ka)	255 275R	Mexican cochineal and a trace of tannin
	Ra 412-2 07915/152	w, 3Z	brownish violet-red	2 fk-glu, 94 ca, 2 fk, 2 ka 1.5 fk-glu, 96 ca, 2.5 (fk+ka)	255 275R	Mexican cochineal
Sarïq *torba* *ak su* design Unpublished	Ra 419-1 07915/102	w, 2Z	bluish red	5 fk-glu, 93.5 ca, 0.5 fk, 1 ka 1.9 fk-glu, 96.9 ca, 1,2 (fk+ka)	255 275R	Mexican cochineal
	Ra 419-2 07915/103	w, 4Z	orange	Acid Red 26 (Ponceau RR)	255	synthetic dye
Sarïq *chuval* 4×7 *chuval gül* Unpublished	Ra 286-1 07915/46	w, 2Z	dark violet	0.5 ag, 62.5 al, +xp, 37 pu	255	madder
	Ra 286-2 07915/47	w, 2Z	brownish yellow	33.5 al, 66.5 pu	255	madder
Sarïq *khali* Cat. no. 47	HCS 1103-1 07915/26	s, 2Z	magenta	73.5 ca, 23 ea, 1 ka, 2 al, 0.5 pu 99.4 ca, 0.6 (fk+ka)	255 275R	Mexican or Armenian cochineal, tannin and madder

Table 4: The Teke

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Teke *kapunuk* Cat. no. 52	Ra 453-1 07915/71	s, 2Z	magenta	1 fk-glu, 87 ca, 10.5 ea, 0.5 fk 1 ka 1.7 fk-glu, 96.8 ca, 1.5 (fk+ka)	255 275R	Mexican cochineal and tannin
	Ra 453-2 07915/72	w, 2–5Z	deep red	58 laA, 39 laE, 3 fk	255	Lac dye
Teke (?) *ak yüp*, fragment Cat. no. 53	Ra 467-1 07915/73	w, 4Z	violet-red	2 fk-glu, 88 ca, 4.5 sul, 1.5 fk, 1.5 ka, 2.5 al 3 fk-glu, 94.7 ca, 2.3 (fk+ka)	255 275R	Mexican cochineal and traces of madder and young fustic
	Ra 467-2 07915/74	w, 4Z	pale orange	2 fk-glu, 81.5 ca, 3 sul, 2 fk, 1.5 ka, 9 al, 1 ru 2.3 fk-glu, 95.4 ca, 2.4 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
	Ra 467-3 07915/218	w, ?Z	bright orange-red	0.5 ca, +ag, 2.5 mu, 44.5 al, 1 xp, 51 pu, 0.5 ru	255	madder
Teke (?) *ak yüp* Andrews et al. 1993: No. 21	Ra 292-1 07915/66	s, 2Z	dark magenta	97.5 ca, 0.5 fk, 1 ka, 0.5 al, 0.5 pu 98.8 ca, 1.2 (fk+ka)	255 275R	Mexican or Armenian cochineal and a trace of madder
	Ra 292-2 07915/67	w, 4(Z_2S)	rose-red	43 laA, 36.5 laE, 1.5 fk, 15.5 al, 3.5 pu	255	Lac dye and madder
	Ra 292-3 07915/68	w, 3Z	bright red	4.5 fk-glu, 78 ca, 2.5 sul, 1 fk, 1.5 ka, 12.5 al 5 fk-glu, 92.3 ca, 2.7 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
Teke (?) *ak yüp* Neugeb/Orendi: Fig. 136	Ra 408-1 07915/70	w, 3–4Z	bright red	2.5 fk-glu, 72 ca, 2.5 sul, 1 fk, 1 ka, 7 al, 14 pu 2.7 fk-glu, 95.3 ca, 2 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
Teke (?) *ak yüp* Unpublished	Ra 287-1 07915/60	w, 3Z	scarlet	2.5 fk-glu, 82.5 ca, 2.5 sul, 1 fk, 1.5 ka, 10 al 3.1 fk-glu, 93.4 ca, 3.5 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Teke (?) *ak yüp* fragment Unpublished	Ra 428-1 07915/77	s, 2Z	magenta	87 ca, 1 ka, 7 al, 5 pu 98.9 ca, 1.1 ka	255 275R	Mexican or Armenian cochineal and madder
	Ra 428-2 07915/78	w, 3–4Z	rose-red	3 fk-glu, 79.5 ca, 3 sul, 1 fk, 1.5 ka, 5.5 al, 6.5 pu 3 fk-glu, 94.4 ca, 2.6 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
Teke (?) *ak yüp* fragment TKF Wien 1986, 124 left	Ra 276-1 07915/62	w, 3Z	light red	3.5 fk-glu, 73 ca, 4 sul, 3.5 fk, 2 ka, 9 al, 5 pu 4.3 fk-glu, 90.7 ca, 5 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
Teke *mafrash* Unpublished	Ra 289-1 07915/63	s, 2Z	light magenta	10.5 fk-glu, 81.5 ca, 2 fk, 1.5 ka, 2.5 al, 2 pu 1 fk-glu, 95.6 ca, 3.4 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 289-2 07915/64	w, 3–4Z	deep red	5 fk-glu, 92 ca, 2 fk, 1 ka 4.8 fk-glu, 92.3 ca, 2.9 (fk+ka)	255 275R	Mexican cochineal
	Ra 289-3 07915/65	w, 2Z	lighter red	2 fk-glu, 66.5 ca, 1 fk, 1 ka, 12 al, 16.5 pu, 1 ru 2.5 fk-glu, 95.1 ca, 2.4 (fk+ka)	255 275R	Mexican cochineal and madder
Teke *torba* Unpublished (HCS 805)	Ra 295-1 07915/69	w, 3Z	rose-red	2 fk-glu, 81 ca, 8 laA, 6 laE, 1.5 fk, 1.5 ka 2 fk-glu, 95.6 ca, 2.4 (fk+ka)	255 275R	Mexican cochineal and lac dye
Teke *torba* Unpublished	Ra 405-1 07915/148	w, 2–3Z	bluish red 1	2.5 fk-glu, 95 ca, 1 fk, 1 ka, 0.5 al, + pu 1.1 fk-glu, 97.3 ca, 1.6 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
	Ra 405-2 07915/149	w, 3Z	bluish red 2	96.5 ca, 1.5 fk, 1 ka, 0.5 al, 0.5 pu 98 ca, 2 (fk+ka)	255 275R	Mexican or Armenian cochineal and a trace of madder
Teke *chuval* Cat. no. 61	Ra 265-1 07915/21	w, 2Z	bluish red	4 fk-glu, 91 ca, 0.5 fk, 0.5 ka, 1.5 al, 2.5 pu 3.2 fk-glu, 95.6 ca, 1.2 (fk+ka)	255 275R	Mexican cochineal and madder
Teke *chuval* Cat. no. 62	Ra 290-1 07915/146	w, 2Z	violet-red	4 fk-glu, 79 ca, 14 ea, 1.5 fk, 1.5 ka 2.9 fk-glu, 94.4 ca, 2.7 (fk+ka)	255 275R	Mexican cochineal and tannin
	Ra 290-2 07915/147	w, 3Z	light scarlet	4 fk-glu, 92 ca, 2 fk, 2 ka 4.3 fk-glu, 92.8 ca, 2.8 (fk+ka)	255 275R	Mexican cochineal
	Ra 290-3 07915/187	w, 3Z	bluish red	2.5 fk-glu, 79.5 ca, 16 ea, 1 fk, 1 ka 2.9 fk-glu, 95 ca, 2.2 (fk+ka)	255 275R	Mexican cochineal and tannin
Teke *chuval* Cat. no. 63	Ra 270-1 07915/31	w, 2Z	bluish red	9 fk-glu, 85.5 ca, 1.5 fk, 1 ka, 1.5 al, 1.5 pu 8.5 fk-glu, 89.5 ca, 1.9 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 270-2 07915/32	w, ?Z	bright red	Acid Red 26 (Ponceau RR)	255	Synthetic dye
Turkmen (Teke?) ***chuval*** Cat. no. 64	Ra 709-1 07915/224	w, 2Z	brownish red (*chuval gül*)	37.5 al, 0.5 xp, 62 pu, +ru	255	Madder
	Ra 709-2 07915/225	w, 2Z	orange-red (*chuval gül*)	+ag, 43 al, +xp, 56.5 pu, 0.5 ru	255	Madder
Teke *kizil chuval*, all pile Cat. no. 66	Ra 434-1 07915/212	w, 2Z	rose-red	1.5 fk-glu, 81 ca, 0.5 fk, 1.5 ka, 8.5 al, 6 pu, 1 ru 2 fk-glu, 96.5 ca, 1.5 (fk+ka)	255 275R	Mexican cochineal and madder
Teke *kizil chuval* Cat. no. 67	Ra 643-1 07915/202'	w, 1–3Z (pile)	rose-red	4.5 fk-glu, 78.5 ca, 6 sul, 2.5 fk, 1 ka, 7.5 al 5 fk-glu, 91.2 ca, 3.9 (fk+ka)	255 275R	Mexican cochineal, madder, and young fustic
	Ra 643-2 07915/203'	w, 2Z (flatweave)	red	+law, +ag, 3 mu, 52.5 al, 1.5 xp, 42.5 pu, 0.5 ru	255	Madder
Teke *kizil chuval* Cat. no. 68	Ra 661-1 07915/204'	w, 1–3Z (flatweave)	violet-red	dcIII', 3.5 fk-glu, 91 ca, 3 ea, 1 fk, 0.5 ka, 0.5 al, 0.5 pu 3.3 fk-glu, 95.3 ca, 1.4 (fk+ka)	255 275R	Cochineal, probaly ammoniacal cochineal, and traces of madder, and tannin
	Ra 661-2 07915/205'	w, 2Z (pile)	orange	Acid Orange 14 (Ponceau G) and Acid Red 25 (Ponceau 3RO)	255	Synthetic dyes
Teke *ak mafrash* Unpublished (Gersbach)	Ra 651-1 07915/199	w, 2Z	violet-red	4.5 fk-glu, 94 ca, 1 fk, 0.5 ka 3.6 fk-glu, 94.3 ca, 2 (fk+ka)	255 275R	Mexican cochineal
Teke *ak torba* Unpublished	Ra 656-1 07915/200'	w, 2Z (flatweave)	violet-red	dcIII', 3.5 fk-glu, 67.5 ca, 18 ea, 0.5 fk, 1 ka, 5.5 al, 4 pu, +ru 4.9 fk-glu, 93.6 ca, 1.5 (fk+ka)	255 275R	Cochineal, probaly ammoniacal cochineal, madder, and tannin
	Ra 656-2 07915/201'	w, 2Z (pile)	orange-red	4 fk-glu. 36.5 ca, 29 al, 31 pu, +Acid Orange 7 (Orange II) and an unspecified type of acid red	255	Mexican cochineal, madder and synthetic dyes

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Teke *ak chuval*, all pile Cat. no. 69	Ra 464-1 07915/193'	w, 2Z	dark violet-red	5 fk-glu, 85 ca, 7 ea, 1 fk, 1 ka, 0.5 al, 0.5 pu 4.5 fk-glu, 94.1 ca, 1.3 (fk+ka)	255 275R	Mexican cochineal, tannin, and a trace of madder
	Ra 464-2 07915/194'	w, 2Z	orange	no dyes detected	255	-
Teke *ak chuval* Cat. no. 70	Ra 648-1 07915/197'	w, 2Z (flatweave)	violet-red	dcIII', 6 fk-glu, 48.5 ca, 2.5 ea, 1.5 fk, 1.5 ka, 17.5 al, 22.5 pu 10.1 fk-glu, 86 ca, 3.9 (fk+ka)	255 275R	Cochineal, probaly ammoniacal cochineal, madder, and a tarce of tannin
	Ra 648-2 07915/198'	w, 2Z (pile)	orange-red	Acid Orange 7 (Orange II) and Acid Orange 14 (Ponceau G)	255	Synthetic dyes
Teke *ak chuval* Unpublished	Ra 644-1 07915/195'	w, 2Z	brownish orange-red	0.5 ag, 3.5 mu, 65 al, 0.5 xp, 30 pu, 0.5 ru	255	Madder
	Ra 644-2 07915/196'	w, 2Z (flatweave)	violet-red	2.5 fk-glu, 96 ca, 0.5 fk, 1 ka 2.5 fk-glu, 96.1 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal
Teke *khali* Nagel, 18 May 2004: Lot 48	Ra 484-1 07915/100	w, 2Z	violet-red	3.5 fk-glu, 94 ca, 1 fk, 0.5 ka, 0.5 al, 0.5 pu 3.4 fk-glu, 95.3 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
	Ra 484-2 07915/101	w, 2Z	orange	synthetic (not Acid Red 26, Ponceau RR)	500	Synthetic dye

Table 5: The Qaradashlï

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Qaradashlï (?) *ensi* Rippon Boswell 40: Lot 95	Ra 466-1 07915/83	w, 6Z	light violet	60.5 laA, 36.5 laE, 1 laX, 2 al	255	Lac dye and a trace of madder
Qaradashlï (?) *aq yüp* Unpublished	Ra 446-1 07915/217	w, 6–8Z	scarlet	1.5 fk-glu, 94.5 ca, +fk, 1 ka, 3 al, 2.1 fk-glu, 96.8 ca, 1.2 (fk+ka)	255 275	Mexican cochineal and a trace of madder
Qaradashlï *asmalyk* Cat. no. 76	Ra 460-1 07915/81	w, 4Z	violet-red	59.5 laA, 38.5 laE, 0.5 fk, 1.5 laX	255	Lac dye
	Ra 460-2 07915/82	w, 2Z	light-red	76 al, 24 pu	255	Madder
Qaradashlï *asmalyk* Cat. no. 77	Ra 629-1 07915/188	w, 2Z	pale orange	25.5 al, 3.5 ru, +71 Acid Orange 14 (Ponceau G)	255	Synthetic dye and madder
Qaradashlï hanging Unpublished (HCS 11668)	Ra 624-1 07915/180	w, 4Z	violet-red	0.5 fk-glu, 96 ca, +fk, 1 ka, 2.5 al 0.3 fk-glu, 98.4 ca, 1.3 (fk+ka)	255 275R	Mexican or Armenian cochineal
Qaradashlï hanging Hodenhagen 1997, no. 57	Ra 422-1 07915/141	w, 3Z	rose-red	1.5 fk-glu, 92 ca, 1.5 fk, 1.5 ka, 3 al, 0.5 pu 1.9 fk-glu, 95.9 ca, 2.2 (fk+ka)	255 275	Mexican cochineal and madder
Qaradashlï *chuval* Nagel, May 1999, lot 143	Ra 472-1 07915/97	w, 4Z	violet-red	54.5 laA, 36.5 laE, 0.5 fk, 2 laX, 3 al, 3.5 pu	255	Lac dye and madder
Qaradashlï *chuval* fragm. Unpublished (HCS 887)	Ra 481-1 07915/84	w, 2Z	deep red	51 al, 48 pu, 1 ru	255	Madder
Qaradashlï *chuval* Unpublished (HCS 1644)	Ra 602-1 07915/96	w, 2–3Z	bright red	+ag, 52.5 al, 47.5 pu	255	Madder
Qaradashlï *khali* Cat. no. 87	Ra 677-1 07915/232	w, 2Z	purple	4 ea, +ag, 52 al, +xp, 43 pu, o.5 ru	255	Madder, a trace of tannin

Table 6: The Yomut

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Yomut (?) *aq yüp*, all pile Cat. no. 97	Ra 708-1 07915/223	w, 2–3Z	light violet	81 ca, 0.5 fk, 5 al, 13.5 pu 2.5 fk-glu, 95.7 ca, 1.8 (fk+ka)	255 275R	Mexican cochineal and madder
Yomut (?) *aq yüp*, all pile Cat. no. 98	Ra 247-1 07915/140	w, 4Z	scarlet	5 fk-glu, 66 ca, 2 fk, 2 ka, 18 al, 6 pu, 1 ru 5.8 fk-glu, 91 ca, 3.1 (fk+ka)	255 275R	Mexican cochineal and madder
Yomut (?) *aq yüp* Unpublished	Ra 622-1 07915/215	w, 8Z	violet-red	1.5 fk-glu, 92 ca, 0.5 fi, 5.5 sul, 0.5 fk 1.7 fk-glu, 97.3 ca, 1 fk	255 275	Mexican cochineal and traces of madder and young fustic
	07915/215'			1.5 fk-glu, 92 ca, 0.5 fi, 3 sul, 0.5 fk, 0.5 ka, 1.5 al, 0.5 pu 1.9 fk-glu, 96.7 ca, 1.4 (fk+ka)	255 275	
Yomut (?) *aq yüp* Fig. 12, "Scarlet and Purple"	Ra 623-1 09715/181	c, 7Z	rose-red	90 al, 10 pu	255	Madder
	Ra 623-2 07915/182	w, 6(Z_2S)	bluish red	55.5 laA, 36.5 laE, 1.5 fk, 1 laX, 3.5 al, 2 ery	255	Lac dye and a trace of madder
	Ra 623-3 07915/183	w, 6Z	green	93 al, 7 pu + indigo carmine	255	Madder + indigo carmine (Saxon blue, or indigo sulphonic acid, semi-synthetic)
Yomut (?) *aq yüp*, fragment Cat. no. 99	Ra 283-1 07915/40	w, 4–6Z	deep red	48 laA, 2 sul?, 28 laE, 16 al, 1 pu, 5 ery	255	Lac dye, madder and young fustic
Yomut (?) *aq yüp* Andrews et al. 1993: No. 2	Ra 291-1 07915/41	w, 4Z	deep red	2 fk-glu, 45.5 ca, 29 laA, 15 laE, 0.5 fk, 2 ka, 2.5 al, 3.5 ery 3.6 fk-glu, 90.2 ca, 6.2 (fk+ka)	255 275R	Mexican cochineal, Lac dye and madder
	Ra 291-2 07915/42	w, 4–6Z	rose-red	3.5 fk-glu, 91.5 ca, 1 fk, 1 ka, 3 al 3.3 fk-glu, 94.8 ca, 1.9 (fk+ka)	255 275R	Mexican cochineal and madder
Yomut (?) *aq yüp* Unpublished	Ra 298-1 07915/61	w, 3Z	deep red	5 fk-glu, 76 ca, 1.5 fk, 1 ka, 5.5 al, 11 pu 5 fk-glu, 92.2 ca, 2.7 (fk+ka)	255 275R	Mexican cochineal and madder
Yomut (?) *aq yüp* Unpublished	Ra 432-1 07915/150	w, ?Z	red	Acid Red 26 (Ponceau RR) and Acid Orange 14 (Ponceau G)	500	Synthetic dyes
Yomut *torba*, *kepse gül* Unpublished	Ra 436-1 07915/79	w, 2Z	violet-red	2 fk-glu, 94.5 ca, 0.5 fk, 1 ka, 1.5 al, 0.5 pu 1.5 fk-glu, 98.3 ca, 1.2 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
	Ra 436-2 07915/80	w, 3Z	orange	Acid Red 26 (Ponceau RR)	255	Synthetic dye
Yomut *chuval* Unpublished	Ra 296-1 07915/45	w, 2Z	violet-red	91 ca, 1 ka, 7 al, 1 in 98.5 ca, 1.5 (fk+ka)	255 275R	Mexican or Armenian cochineal madder and an indigoid dye source
Yomut *khali* Cat. no. 103	Ra 250-1 07915/216	w, 2Z	bright red	0.5 ea, +ag, 43 al, 0.5 xp, 55 pu, 1 ru	255	Madder

Table 7: The "Eagle"-*gül* Groups

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
"Eagle"-*gül* group *aq yüp* Cat. no. 110	Ra 264-1 07915/13	w, 3–4Z	scarlet	2.5 fk-glu, 85 ca, 1.5 fk, 1 ka, 7 al, 3 pu 4.3 fk-glu, 93.7 ca, 2.0 (fk+ka)	255 275R	Mexican cochineal and madder
"Eagle"-*gül* group *aq yüp* Cat. no. 111	Ra 694-1 07915/19	w, 3–4Z	scarlet	1 fk-glu, 76 ca, 6 qu, 0.5 fk, 0.5 ka, 12.5 al, 0.5 xp, 1.5 pu, 1.5 ru 1.2 fk-glu, 97.5 ca, 1.3 (fk+ka)	255 275R	Mexican cochineal, madder and a quercetin containing dye source
	Ra 694-2 07915/20	w, 2Z	bright red	0.5 ea, 0.5 lu, 0.5 ag, 3 mu, 46 al, 1 xp, 48 pu, 0.5 ru	255	Madder, a trace of tannin and weld
"Eagle"-*gül* group II *germech* Unpublished, Collction of	Ra 454-1 07915/120	w, 2Z	light red	46 al, 53 pu, 1 ru	255	Madder
Rob van Wieringen (comparable to Hali 4/1:	Ra 454-2 07915/121	w, 3–4Z	scarlet	54 laA, 39 laE, 2.5 laX, 4.5 al	255	Lac dye and madder
Nr. 15)	Ra 454-3 07915/122	s, 2Z	magenta	96.5 ca, 1 ka, 2.5 al 99 ca, 1 ka	255 275R	Mexican or Armenian cochineal and a trace of madder

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
"Eagle"-*gül* group *torba* Cat. no. 112, *ak su* design,	Ra 414-1 07915/142	w, 3Z	scarlet	50.5 laA, 34 laE, 3 laX, 9 al, 2.5 ery, 1 ru	255	Lac dye and madder
	Ra 414-2 07915/143	w, 9(Z_2S)	scarlet	3.5 ea, 50 laA, 36 laE, 2 fk, 2.5 laX, 3 al, 3 ery	255	Lac dye, traces of tannin, and traces of madder
	Ra 414-3 07915/167	w, Z	pale red (wefts)	+law, 1 ea, 0.5 lu, 0.5 ag, 2.5 mu, 40 al, 0.5 xp, 54 pu, 1 ru	255	Madder and traces of tannin and a luteolin containing yellow dye source
	Ra 414-4 07915/168	s, Z	pale red (wefts)	+law, 1 ea, 1 ag, 1 mu, 62 al, 2.5 xp, 31.5 pu, 1 ru	255	Madder and a trace of tannin
"Eagle"-*gül* group (?) saddle cover Unpublished	Ra 620-1 07915/172	w, 2Z	orange	100 Acid Orange 14 (Ponceau G)	255	Synthetic dye
	Ra 620-2 07915/173	s, Z	red (wefts)	59.5 ca, +ag, +fk, 0.5 ka, 27 al, 12.5 pu, 0.5 ru 99.3 ca, 0.7 (fk+ka)	255 R275	(Mexican or Armenian) cochineal and madder
	Ra 620-3 07915/174	s, Z	pale red (wefts)	synthetic alizarine	255	Synthetic alizarine
"Eagle"-*gül* group hanging Hodenhagen 1997: No. 50	Ra 411-1 07915/118	w, 3Z	scarlet	2.5 fk-glu, 77 ca, 2.5 sul, 1 fk, 1 ka, 10.5 al, 0.5 xp, 4.5 pu, 0.5 ru 2.9 fk-glu, 95.6 ca, 1.5 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
"Eagle"-*gül* group *torba* Hodenhagen 1997: No. 54	Ra 409-1 07915/119	w, 3–4Z	violet-red	1 fk-glu, 89 ca, 4 sul, 1 fk, 0.5 ka, 3.5 al, 1 pu 1.5 fk-glu, 97.2 ca, 1.3 (fk+ka)	255 275R	Mexican cochineal, traces of madder and young fustic
"Eagle"-*gül* group II *torba* Andrews et al. 1993: No. 41	Ra 601-1 07915/123	w, 2–3Z	scarlet	2.5 fk-glu, 84 ca, 2 sul, 1 fk, 1 ka, 8 al, 1.5 pu 2.9 fk-glu, 95.6 ca, 1.5 (fk+ka)	255 275R	Mexican cochineal and traces of madder
"Eagle"-*gül* group *torba* Unpublished	Ra 430-1 07915/144	w, 4Z	violet-red	91 ca, 1.5 ka, 5 al, 2.5 pu 98.6 ca, 1.4 ka	255 275R	Mexican or Armenian cochineal and madder
"Eagle"-*gül* group *chuval* Hodenhagen 1997: No. 46	Ra 450-1 07915/145	w, ?Z	violet-red	50.5 laA, 39 laE, 1.5 laX, 7 al, 2 ery	255	Lac dye and madder
"Eagle"-*gül* group I *khali* Cat. no. 113	Ra 626-1 07915/184	w, 4Z	violet-red	2 fk-glu, 81.5 ca, 0.5 fk, 0.5 ka, 11.5 al, 3 pu, 1 ru 2.6 fk-glu, 96.1 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 626-2 07915/185	w, Z	pale red (wefts)	+law, 10 ea, 0.5 ag, 3 mu, 35.5 al, 0.5 xp, 49.5 pu, 1 ru	255	Madder and tannin
	Ra 626-3 07915/186	s, Z	pale red (wefts)	+law, 3.5 ea, 0.5 ag, 2.5 mu, 52 al, 0.5 xp, 38.5 pu, 2.5 ru	255	Madder and a trace of tannin
"Eagle"-*gül* group II (?) *khali* Cat. no. 115	Ra 625-1 07915/171	w, 3–4Z	violet-red	4.5 fk-glu, 73 ca, 5.5 sul, 1.5 fk, 0.5 ka, 8 al, 7 pu 4.9 fk-glu, 92.3 ca, 2.8 (fk+ka)	255 275R	Mexican cochineal, madder and young fustic
'Eagle'-*gül* II *khali* Rautenstengel 1990: No. 15	Ra 476-1 07915/117	w , 3–4Z	light scarlet	2 fk-glu, 86.5 ca, 1.5 sul, 1 fk, 1 ka, 7.5 al, 0.5 ru 2.5 fk-glu, 96.1 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal, madder and a trace of young fustic
"P-Chowdur group" *mafrash* Cat. no. 120	Ra 500-1 07915/153	w, 2–3Z	violet-red	42.5 ea, 9 al, 48.5 Acid Red 88 (Fast Red AV) or 13 (Fast Red E), or 25 (Ponceau 3RO)		Tannin, madder and synthetic dye
	Ra 500-2 07915/169	w, 3Z	orange	4 al, 96 Acid Orange 14 (Ponceau G)	255	Synthetic dye and a trace of madder
	Ra 500-3 07915/170	w, 2Z	brown-red	0.5 ag, 8.5 mu, 58 al, 1 xp, 30.5 pu, 1.5 ru	255	Madder

Table 8: The "P-Chowdur" Group

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
"P-Chowdur"-group *aq yüp*, all pile, Cat. no. 117	Ra 668-1 07915/24	w, 4Z	violet-red	89.5 ca, 2.5 sul, 1 ka, 6 al, 1 pu 98.7 ca, 1.3 (fk+ka)	255 275R	Mexican or Armenian cochineal, madder, and young fustic
	Ra 668-2 07915/25	w, 4Z	bright red	0.5 ea, 0.5 ag, 52 al, 47 pu	255	Madder and a trace of tannin
	Ra 668-2A 07915/220	w, 4–6Z	bright orange-red	0.5 ea, 0.5 lu, +ag, 54.5 al, 0.5 xp, 43.5 pu, 0.5 ru	255	Madder
	Ra 668-3A 07915/221	w, 2–3Z	light orange-red	+ag, 50 al, 49.5 pu, 0.5 ru	255	Madder
"P-Chowdur"-group *aq yüp* Rippon Boswell 33, lot 122	Ra 492-1 07915/16	w, 3Z	bluish red	70 ca, 1 fk, 1.5 ka, 9 al, 18.5 pu, 98.1 ca, 1.9 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
"P-Chowdur"-group *mafrash* Cat. no. 119	Ra 494-1 07915/98	w, 3Z	violet-red	2.5 fk-glu, 89.5 ca, 3 sul, 1 fk, 1 ka, 1.5 al, 1.5 pu 2.2 fk-glu, 96.3 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal, a trace of madder, and young fustic
	Ra 494-2 07915/219	w, 2Z	bright red	0.5 ea, +ag, 29 al, 0.5 xp, 69.5 pu, 0.5 ru	255	Madder
Chowdur hanging Cat. no. 162	Ra 220-1 07915/09	w, 2Z	dark purple	+ag, 58 al, +xp, 42pu, +ru	255	Madder
Turkmen *aq yüp* Cat. no. 164	Ra 491-1 07915/75	w, 3Z	violet-red	1.5 fk-glu, 93 ca, 1.5 sul, 0.5 fk, 1 ka, 2.5 al 0.8 fk-glu, 97.4 ca, 1.9 (fk+ka)	255 275R	Mexican cochineal, a trace of madder, and young fustic
	Ra 491-2 07915/76	w, 3Z	red	60 al, 40 pu	255	Madder

Table 9: The Arabachi

Object	Sample	Material	Colour	Comopsition	[nm]	Source(s)
Arabachi *ensi* Cat. no. 124	Ra 238-1 07915/06	w, Z?	bright red	1 qu, +kf, 4 mu, 63 al, 1 xp, 31 pu, +ru	255	Madder
	Ra 238-2 07915/07	w, 2Z	light violet-red	2 fk-glu, 95 ca, +fk, 1 ka, 1 al, 1 pu 1.4 fk-glu, 97.5 ca, 1.0 (fk+ka)	255 275	Mexican cochineal and madder
	Ra 238-5 07915/08	s, 2Z	magenta	62 ca, 1 ea, 22 al, 15 pu 99.7 ca, 0.3 (fk+ka)	255 275R	Mexican or Armenian cochineal, madder, and tannin
	Ra 438-1 07915/85	w, Z2	violet-red	3 fk-glu, 95 ca, 0.5 fk, 1 ka, 2.4 fk-glu, 96.5 ca, 1.1 (fk+ka)	255 275R	Mexican cochineal
	Ra 438-2 07915/86	s, 2Z	dark magenta	72 ca, 1 ka, 13 al, 13 pu, 1 ru 99.7 ca, 0.3 ka	255 275R	Mexican or Armenian cochineal and madder
Arabachi (?) *aq yüp* Cat. no. 125	Ra 463-1 07915/87	s, 2–3Z	magenta	76 ca, +ag, 0.5 ka, 9.5 al, 13.5 pu, 0.5 ru 99.3 ca, 0.7 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
	Ra 463-2 07915/88	w, 3(Z_2S)	bright ruby red	43.5 ca, 25.5 laA, 21.5 laE, 1 fk, 1 ka, 7 al, 0.5 pu 95.3 ca, 4.7 (fk+ka)	255 275R	Lac dye, Mexican or Armenian cochineal, and madder
	Ra 463-3 07915/213 07915/213'	w, 4–6Z	light rose-red	1.5 fk-glu, 81 ca, 0.5 fk, 13.5 al, 3.5 pu 2.1 fk-glu, 97.5 ca, 0.4 fk 0.5 fk-glu, 85 ca, 2 ka, 12.5 al 1.3 fk-glu, 97.6 ca, 1 (fk+ka)	255 275 255 275	Mexican cochineal and a trace of madder
	Ra 463-4 07915/214 07915/214'	w, 4–9Z	bright ruby- red	61 laA, 14.5 laE, 21.5 al, 3 ery 30.5 laA, 18.5 laE, 30 al, 20 pu, 1 ery	255 255	Lac dye and madder
Arabachi (?) *aq yüp* Elmby II, 1994: No. 34	Ra 433-1 07915/52	s, 2Z	light magenta	54.5 ca, 4 ea, +ag, 0.5 ka, 23 al, 18 pu 99.3 ca, 0.7 ka	255 275R	Mexican or Armenian cochineal, madder, and a trace of tannin

Object	Sample	Material	Colour	Comopsition	[nm]	Source(s)
Arabachi (?) *aq yüp* Unpublished	Ra 471-1 07915/89	w, 2Z	violet-red	2 fk-glu, 94.5 ca, 1 fk, 1 ka, 1.5 al 2.1 fk-glu, 96.2 ca, 1.7 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
	Ra 471-2 07915/90	s, 2–3Z	magenta	69 ca, 2 ea, +ag, 1 ka, 17.5 al, 10 pu, 0.5 ru 98.6 ca, 1.4 ka	255 275R	Mexican or Armenian cochineal, madder, and a trace of tannin
Arabachi *chuval* Cat. no. 126	Ra 480-1 07915/94	w, 3–6Z	rose-red	2 fk-glu, 95 ca, 1 fk, 1 ka, 1 al 1.8 fk-glu, 96.8 ca, 1.4 (fk+ka)	255 275R	Mexican cochineal and a trace of madder
	Ra 480-2 07915/95	s, 2–3Z	magenta	59.5 ca, 0.5 ag, +fk, 1 ka, 19.5 al, 19.5 pu 98.9 ca, 1.1 (fk+ka)	255 275R	Mexican or Armenian cochineal and madder
Arabachi *khali* Cat. no. 127	Ra 251-1 07915/29	w, 4Z	scarlet	3 fk-glu, 82 ca, 2.5 sul?, 0.5 fk, 1 ka, 11 al 2.8 fk-glu, 96.0 ca, 1.2 (fk+ka)	255 275R	Mexican cochineal, madder, and young fustic
Arabachi *khali* Andrews et al. 1993: No. 88	Ra 706-1 07915/15	s, 2Z	light magenta	74 ca, 3 ea, 0.5 ka, 14.5 al, 8 pu 99.5 ca, 0.5 (fk+ka)	255 275R	Mexican or Armenian cochineal, madder, and tannin
Arabachi *khali* *tauk nuska gül* Unpublished	Ra 479-1 07915/91	w, 2Z	dark violet-red	3 fk-glu, 86.5 ca, 0.5 ea, 0.5 fk, 0.5 ka, 4 al, 5 pu 3.1 fk-glu, 95.9 ca, 1 (fk+ka)	255 275R	Mexican cochineal and madder
	Ra 479-2 07915/92	w, 3Z	light violet-red	+fk-glu, 89 ca, 1 ea, 0.5 fk, 0.5 ka, 3 al, 6 pu 1.9 fk-glu, 97.1 ca, 1 (fk+ka)	255 275R	Mexican cochineal, madder, and a trace of tannin
	Ra 479-3 07915/93	w, 3Z	orange	Acid Red 26 (Ponceau RR)	255	Synthetic dye

Table 10: Textiles of Central Asia

Object	Sample	Material	Colour	Composition	[nm]	Source(s)
Suaire dit de Saint Lambert Fig. 124, Vol. 2, chapter “The Salor”	Ra 680-1 07915/208’	s, I	light magenta	3.5 orh, 69 laA, 1 fk, 22 laE, 1 in, 3 ery	255	Lac dye and traces of brasil wood and an indigoid dye source
Chasse de Saint Simètre, Fig. 222, Vol. 2, chapter “The Salor”	Ra 714-1 07915/233	s, I	light magenta	59 laA, 1.5 fk, 24 laE, 15.5 ery	255	Lac dye

Abbreviations in Tables 1–10:

Natural Dyestuff Compounds

ca	carminic acid
ka	kermesic acid
fk	flavokermesic acid
fk-glu	flavokermesic acid glucoside (formerly dcII)
in	indigotin
laA	laccain acid A
laE	laccain acid E
laX	laccain acid X
ery	erythrolaccin
al	alizarin
pu	purpurin
ag	anthragallol
dcIII’	unknown compound in ammoniacal cochineal
ru	rubiadin
xp	xanthopurpurin
mun	munjistin
law	lawson
ea	eallgic acid
sul	sulfuretin
fi	fisetin
kf	kaempferol
isorht	isorhammetin
rht	rhammetin
lu	luteolin
ap	apigenin
qu	quercetin
orh	degradation product of any soluble redwood

Synthetic Dyestuffs

Colour Index Name	Colour Index Number	Commercial Name	Name and Year of Descovery
Acid Orange 7	15510	Orange II	Z. Roussin, 1876
Acid Orange 14	16100	Ponceau G	H. Baum, 1878
Acid Red 13	16045	Fast Red E	H. Caro, 1878
Acid Red 25	16050	Ponceau 3RQ	C. Rumpff, 1882
Acid Red 26	16150	Ponceau RR	H. Baum, 1878
Acid Red 88	15620	Fast Red AV	H. Caro and C. Roussin, 1877
Alizarin Red	58000	Synthetic Alizarin	Robiquet and Colin, 1826

Appendix III: Tables 11 – 14
Organic and Inorganic Mordant Analysis (HPLC- and SEM-Element Analysis)
Tin Mordant in Turkmen Weavings

Ordered by tribes and objects

Ina Vanden Berghe
Institut Royal du Patrimoine Artistique, KIK-IRPA, Brussels

Table 11: Mexican Cochineal on Wool

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)
Salor hanging Cat. no. 7	post 1880	Ra 280-1 07915/22	w, 2Z	crimson	Mexican cochineal	+	O, Si, S, Al, Ca, Na	Tannin, alum
Salor *khali* Cat. no. 16	ca. 1550 – 1650	Ra 214-1 07915/27	w, 4Z	purple	Mexican cochineal	-	O, Si, S, Al, Ca, Na	Alum
Ersarï *chuval* Cat. no. 22	18th century	Ra 281-2 07915/39	w, 3 – 4Z	scarlet	Mexican cochineal	-	O, S, Si, Sn, Al, P, Mg, Na	Tin
Ersarï *chuval* Cat. no. 23	post 1880	Ra 403-1 07915/44	w, 2Z	purple	Mexican cochineal	-	O, S, Ca, Al, Si	Alum
Sarïq *aq yüp* Cat. no. 38	17th/18th century	Ra 294-1 07915/14	w, 4Z	scarlet	Mexican cochineal	-	O, Si, Al, S, Sn, Fe, K, Mg, P	Tin (iron)
		Ra 294-2 07915/17	w, 4Z	scarlet	Mexican cochineal	-	O, Si, Sn, Al, Mg, P, S	Tin
Sarïq (?) *aq yüp* Cat. no. 39	first half 19th century	Ra 618-1 07915/154	w, 4Z	scarlet	Mexican cochineal	-	O, Sn, S, Si, Mg	Tin
Sarïq (?) *aq yüp* Orendi 1909: 209	18th century	Ra 408-1 07915/70	w, 3 – 4Z	scarlet	Mexican cochineal	-	O, Sn, Si, Al, S, P, Mg	Tin
Sarïq (?) *aq yüp* Vol. 2, fig. 5, chapter "Scarlet and Purple"	mid 19th century	Ra 273-1 07915/30	w, 2Z	purple	Mexican cochineal	-	O, Na, S, Si, Al, Mg, Ca, P	Alum
		Ra 273-2 07915/99	w, 4Z	scarlet	Mexican cochineal	-	O, S, Si, Sn, Al, Na	Tin
Sarïq (?) *aq yüp* HCS 1314	pre 1850	Ra 299-1 07915/104	w, 3Z	scarlet	Mexican cochineal	-	O, Sn, Si, Mg, Al, S, P	Tin
Sarïq (?) *aq yüp* HCS 1122	pre 1825	Ra 415-2 07915/107	w, 3Z	scarlet	Mexican cochineal	-	O, Sn, Na, Si, S, Al	Tin
Teke (?) *aq yüp* Cat. no. 53	17th/18th century	Ra 467-1 07915/73	w, 4Z	scarlet	Mexican cochineal	-	O, Si, S, Sn, Al, Mg, P, Fe	Tin (iron)

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)
Teke (?) *aq yüp* Unpublished	18th century	Ra 276-1 07915/62	w, 3Z	light scarlet	Mexican cochineal	-	O, Si, Al, Sn, S, Mg, Fe	Tin (iron)
Teke (?) *aq yüp* Unpublished	18th century	Ra 428-2 07915/78	w, 4Z	scarlet	Mexican cochineal	-	O, S, Sn, Al, Si, Ca, Mg	Tin
Teke (?) *aq yüp* Unpublished HCS 659	17th/18th century	Ra 287-1A 07915/231	w, 3Z	scarlet	Mexican cochineal	-	O, Sn, S, A	Tin
Teke *torba* Unpublished	1875–1900	Ra 405-1 07915/148	w, 2Z	purple	Mexican cochineal	-	O, Si, S, Al, Ca	Alum
Teke *torba* Unpublished	1875–1900	Ra 265-1 07915/21	w, 2Z	purple	Mexican cochineal	-	O, Si, Al, Ca, S, Mg, K, P	Alum
Teke *chuval* Cat. no. 62	mid 19th century	Ra 290-1 07915/146	w, 2Z	light purple	Mexican cochineal	+	O, S, Si, Ca, Al	Tannin
		Ra 290-2 07915/147	w, 3Z	light scarlet	Mexican cochineal	-	O, S, Sn, Al, Si	Tin
Teke *chuval* Cat. no. 63	post 1880	Ra 270-1 07915/31	w, 2Z	purple	Mexican cochineal	-	O, Si, Al, Ca, S, P, Mg, Na, K, Fe	Alum (iron)
Qaradashlï *aq yüp* Fragment, unpublished	pre 1850	Ra 446-1 07915/217	w, 6Z	scarlet	Mexican cochineal	-	O, Sn, Si, S, Mg, Al	Tin
Qaradashlï hanging Hodenhagen 1997: 57	pre 1850	Ra 422-1 07915/141	w, 3Z	light scarlet	Mexican cochineal	-	O, S, Si, Al, Sn	Tin
Yomut (?) *aq yüp* Cat. no. 98	17th/18th century	Ra 708-1 07915/223	w, 3Z	purple	Mexican cochineal	-	O, S, Sn, Si, Na, Mg, (Fe)	Tin (iron)
Yomut (?) *aq yüp* Cat. no. 99	end of 17th century	Ra 247-1 07915/140	w, 4Z	scarlet	Mexican cochineal	-	O, Sn, S, Na, Si, Al, Mg, P, K	Tin
"Eagle" *gül aq yüp* Cat. no. 110	17th century	Ra 264-1 07915/13	w, 4Z	scarlet	Mexican cochineal	-	O, Sn, Si, S, Mg, Al, P	Tin
"Eagle" *gül aq yüp* Cat. no. 111	17th/18th century	Ra 694-1 07915/19	w, 4Z	scarlet	Mexican cochineal	-	O, Sn, Si, S, Mg, Al, (Fe)	Tin (iron)
"Eagle" *gül* hanging Hodenhagen 1997: 50	18th century	Ra 411-1 07915/118	w, 4Z	light scarlet	Mexican cochineal	-	O, S, Sn, Si, Al, P	Tin
"Eagle" *gül* group I *khali* Cat. no. 113	17th century	Ra 626-1 07915/184	w, 4Z	purple	Mexican cochineal	-	Si, O, Sn, Al, Mg, S, P	Tin
"P-Chowdur" *aq yüp* Cat. no. 117	17th century	Ra 668-1 07915/24	w, 4–6Z	purple	Mexican cochineal	-	O, Sn, Si, S, Mg, Al	Tin
Arabachi *ensi* Cat. no. 124	mid 19th century	Ra 438-1 07915/85	w, 2Z	light purple	Mexican cochineal	-	O, Si, Al, S, Ca, Mg, K, Fe	Alum (iron)
Arabachi *khali* Cat. no. 127	17th century	Ra 251-1 07915/29	w, 3Z	light scarlet	Mexican cochineal	-	O, S, Si, Sn, P, Mg, Na, Al	Tin

Table 12: Lac Dye on Wool

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)
Salor *ensi* Cat. no. 2	pre 1825	Ra 707-1 07915/222	w, 3–4Z	purple	Lac dye		O, Sn, S, Al, Si, Na, Mg, P	Tin
Salor *kapunuk* Cat. no. 3	18th century	Ra 266-1 07915/53	w, 6Z	scarlet	Lac dye	-	O, Sn, S, Si, Al, Mg	Tin

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)
Salor *aq yüp* Cat. no. 4	17th/18th century	Ra 267-3 07915/56	w, 3Z	scarlet	Lac dye	-	O, S, Si, Sn, Al, P, Mg, Na	Tin
		Ra 267-4 07915/57	w, 3Z	crimson	Lac dye	-	O, Sn, Si, S, Al, Mg, P	Tin
Salor (?) *aq yüp* Unpublished	18th century	Ra 285-2 07915/59	w, 3–4Z	crimson	Lac dye	-	O, Sn, S, Si, Al	Tin
Salor hanging Cat. no. 6	first half 19th century	Ra 615-1 07915/136	w, 4–7Z	scarlet	Lac dye	-	O, S, Sn, Al, Si, Mg	Tin
Salor *chuval* Cat. no. 11	17th/18th century	Ra 258-2A 07915/48	w, 4–6Z	scarlet	Lac dye	-	O, Si, Sn, Al, Mg, P, S	Tin
Salor *chuval* Cat. no. 12	17th/18th century	Ra 259-2A 07915/50	w, 4–6Z	purple	Lac dye	-	O, Sn, Si, S, Al, Mg	Tin
Salor *chuval* Cat. no. 13	17th/18th century	Si 15-2 07915/04	w, 4–6Z	crimson	Lac dye	-	O, S, Si, Ca, Al	Alum
Salor *khali*, fragment Cat. no. 19	18th/early 19th century	Ra 260-2A 07915/35	w, 3Z	crimson	Lac dye	-	O, Si, Sn, Al, P, S, Mg	Tin
Teke (?) *aq yüp* Andrews et al. 1993: 21	early 19th century	Ra 292-2 07915/67	w, 4(Z_2S)	scarlet	Lac dye	-	O, S, Sn, Si, Al, Mg, P, Fe	Tin (iron)
Yomut (?) *aq yüp* Cat. no. 100	18th century	Ra 283-1 07915/40	w, 4–6Z	scarlet	Lac dye	-	O, S, Sn, P, Si, Mg, Al	Tin
"Eagle" *gül torba* Cat. no. 112	pre 1850	Ra 414-2 07915/143	w, 9(Z_2S)	scarlet	Lac dye	+	O, S, Ca, Fe, Si, Mg	Tannin (iron)

Table 13: Madder on Wool

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)
Teke (?) *aq yüp* Cat. no. 53	17th/18th century	Ra 467-3 07915/218	w, ?Z	bright orange-red	Madder	-	O, Al, S, Sn	Alum
Qaradshlï *chuval* Unpublished	pre 1850	Ra 602-1 07915/96	w, 2–3Z	bright red	Madder	-	O, Si, Ca, Al, S,	Alum
Yomut *khali* Cat. no. 104	18th century	Ra 250-1 07915/216	w, 2Z	bright red	Madder	-	O, S, Ca, Na, Al, Si, Mg	Alum
"Eagle" *gül aq yüp* Cat. no. 111	17th/18th century	Ra 694-1 07915/59	w, 3Z	red	Cochineal + madder	-	O, S, Al, Si, Sn, (Fe)	Tin (iron)
"P-Chowdur" *aq yüp* Cat. no. 117	17th century	Ra 668-2A 07915/220	w, 4–6Z	bright red	Madder	-	O, Ca, Al, Si, S	Alum
		Ra 668-3A 07915/221	w, 2–3Z	bright red	Madder	-	O, S, Ca, Si, Mg, Al, P	Alum
"P-Chowdur" *mafrasch* Cat. no. 119	17th/18th century	Ra 494-2 07915/219	w, 2Z	bright red	Madder	-	O, S, Ca, Si, Al	Alum
Arabachi *ensi* Cat. no. 124	mid 19th century	Ra 238-1 07915/06	w, 2Z	bright red	Madder	-	Si, Al, Mg, O, Fe, S, Ca, K	Alum (iron)

Table 14: Mexican or Armenian Cochineal on Silk

Object	DaTin g	Sample	Material	Colour	Main Dye Source	HPLC-Analysis tannin (ellagic acid)	SEM-Element Analysis	Probable Mordant(s)*
Salor *kapunuk* Cat. no. 3	17th/18th century	Ra 266-2 07915/54	s, 2Z	light crimson	Mexican or Armenian cochineal	+	Si, Al, O, Ca, Mg, S, K, (Fe)	Alum/tannin
Salor *chuval* Cat. no. 11	17th/18th century	Ra 258-3A 07915/49	s, 3Z	light crimson	Mexican or Armenian cochineal	+	O, Al, P, Si, Ca, Mg, S, (Fe)	Alum/tannin
Salor *chuval* Cat. no. 13	17th/18th century	Si 15-3 07915/05	s, 2Z	light crimson	Mexican or Armenian cochineal	-	Si, Al, O, Ca, P, S, Mg, Na, Fe	Alum
Saryk (?) *aq yüp* Cat. no. 38	17th/18th century	Ra 294-3 07915/18	s, 2Z	light crimson	Mexican or Armenian cochineal	-	O, Si, Al, Ca, S, Mg	Alum
Arabachi (?) *aq yüp* Elmby II, 1994: no. 34	ca. 1900	Ra 433-1 07915/52	s, 2Z	light crimson	Mexican or Armenian cochineal	+	O, Ca, Si, Al, Mg, S	Alum/tannin
Suaire dit de St. Lambert, fig. 124, chapter "The Salor"	7th/9th century	Ra 680-1 07915/208	s, Z	light crimson	Lac dye	-	O, Si, Al, Ca, P, Mg, S, K	Alum

Use of tannin on silk is most probably as weighting agent

Dating Turkmen Weavings

Radiocarbon Dating of Milligram Samples by Accelerator Mass Spectrometry

Georges Bonani, ETH Zurich

1. Introduction

Accelerator mass spectrometry (AMS) has become a powerful tool for the detection of the long-lived cosmogenic radioisotope ^{14}C, which occurs in concentrations of 10^{-12} to 10^{-16} relative to the stable carbon isotopes (^{12}C (99% abundance) and ^{13}C (1%)). AMS has got many applications in several areas of science, and the ^{14}C isotope is usually used for dating. Due to the long half-life of radiocarbon ($t_{1/2}$ = 5 730 years) and the low natural concentration, conventional decay counting requires relatively large samples (several grams) and long measuring times (several days) in order to count enough decays of ^{14}C atoms to obtain the required precision. With the AMS technique, which directly counts the number of ^{14}C isotopes in a sample, the sample size is reduced by about three orders of magnitude and the measuring time by more than two orders of magnitude. This enables to date valuable art objects with only insignificant damage.

2. Radiocarbon Dating Method

The radiocarbon or ^{14}C method was developed during 1946/47 by W. F. Libby and his co-workers.[1] This long-lived radiocarbon isotope is continuously produced in the atmosphere (fig. 1). From the interstellar space, a continuous flux of cosmic particles, mostly high- energetic protons, enter into the atmosphere. Through collisions with the atmospheric gas molecules a broad spectrum of secondary particles is produced. These particles take part in further reactions or are slowed down by elastic and inelastic collisions. The thermal neutrons of this spectrum react with the atmospheric nitrogen to produce radioactive ^{14}C. This ^{14}C is oxidized to the radioactive $^{14}CO_2$, which mixes with the stable $^{12}CO_2$ and $^{13}CO_2$ in the atmosphere. The continuous production and decay of ^{14}C leads to an equilibrium in the atmospheric CO_2 reservoir between the radioactive and stable carbon isotopes. Before the beginning of the atmospheric nuclear weapons tests, the $^{14}C/^{12}C$ ratio was about $1.2 \cdot 10^{-12}$. The ^{14}C enters into the biosphere through photosynthesis and is transported into any living organism over the food chain. Any ^{14}C lost in a living organism due to decay is continuously replaced. This means that all living organisms have, except for possible biological isotopic fractionation processes, the same ^{14}C concentration as the atmosphere. After the death of an organism, the $^{14}C/^{12}C$ isotopic ratio decreases exponentially in time according to the radioactive decay law. A decrease of 1% in the

1 Anderson et al. 1947.

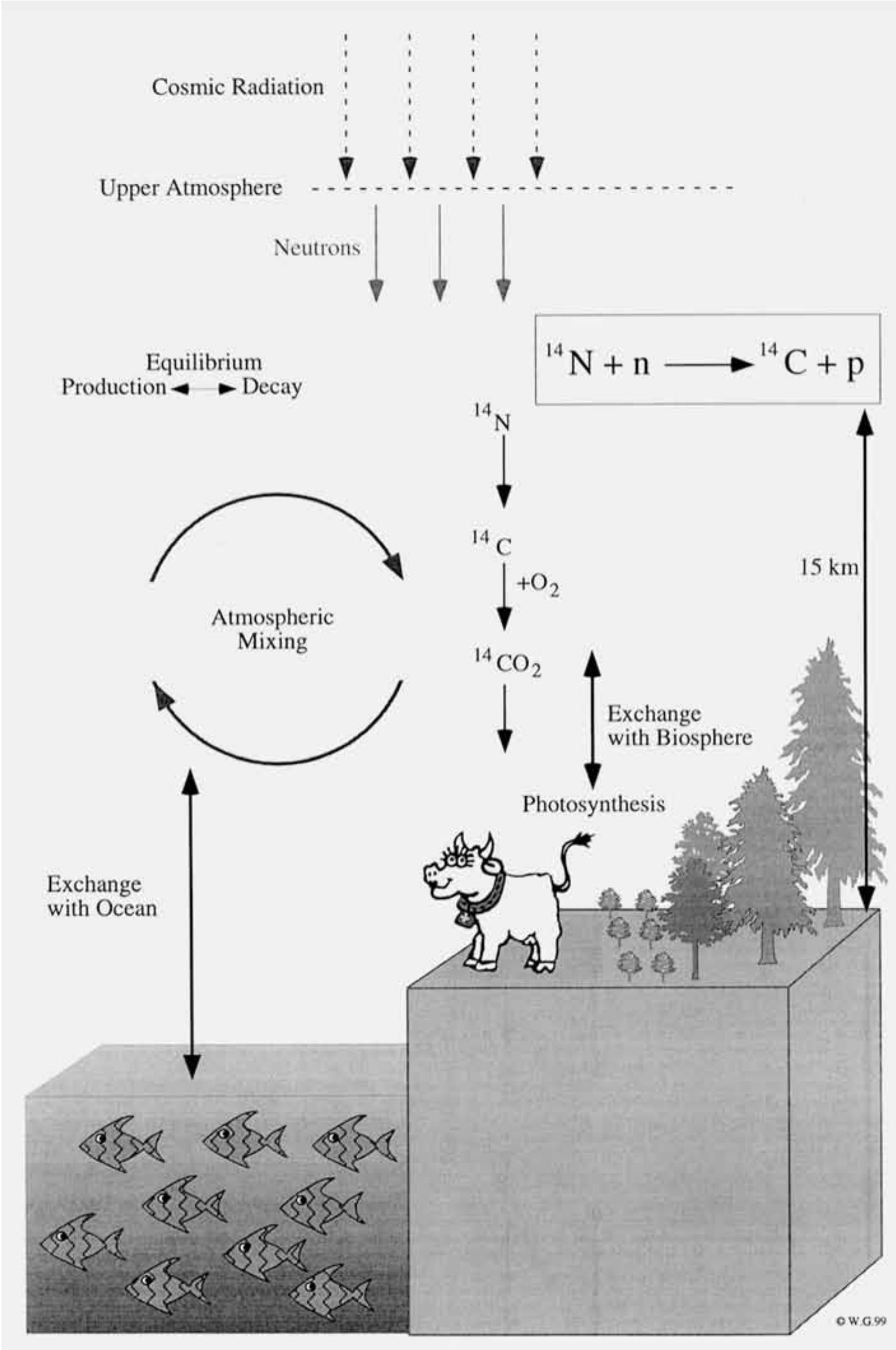


Fig. 1: Principle of the radiocarbon dating method. ^{14}C atoms are produced in the atmosphere by secondary cosmic particles. The radioactive ^{14}C is oxidized to radioactive $^{14}CO_2$ which mixes with the stable $^{12}CO_2$ and $^{13}CO_2$ in the atmosphere. Through photosynthesis ^{14}C enters into the biosphere and is transported to any living organism through the food chain. Losses of ^{14}C in a living organism due to decay are continuously compensated. Thus, apart from possible biological isotopic fractionation, all living organisms have the same ^{14}C concentration as the atmosphere. In dead organic matter, the ^{14}C concentration decreases exponentially according to the nuclear decay law. Based on the remaining ^{14}C concentration an age can be determined.

ratio corresponds to an age difference of 83 years. Thus, the measurement of the ratio in a sample enables to determine the time span (age), since the organism was separated from the global CO_2 cycle, provided the initial ratio is known. The atmospheric CO_2, and thus ^{14}C, exchanges with the oceans, with lakes and the biosphere and is finally stored in archives, in tree rings and in marine and continental sediments.

3. Accelerator Mass Spectrometry

The basic idea of AMS is to first accelerate the ^{14}C ions produced in a negative sputter ion source to high energies (several MeV/nucleon) and then to eliminate the isobaric (isotopes of same mass but from different elements) and molecular interferences with a combination of appropriate filters. A schematic layout of the ETH/PSI AMS facility is shown in fig. 2. The pre-treated and graphitized samples to be investigated are loaded into the ion source and bombarded with a positively charged caesium ion beam. The sputtered and negatively charged carbon atoms are extracted from the ion source. The isobar nitrogen-14 (^{14}N) does not form stable negative ions. Thus, possibly interfering ^{14}N ions are already eliminated in this 1st filter. The extracted ions then enter a first magnetic mass analyzer (2nd filter). In the magnetic field the ions are deflected according to their mass. This mass analyzer only selects ions with mass 14 ($^{14}C^-$ and molecules like $^{13}CH^-$ and $^{12}CH_2^-$) and focussed then into the accelerator. In the electric field of the tandem Van de Graaff accelerator the negative ions are

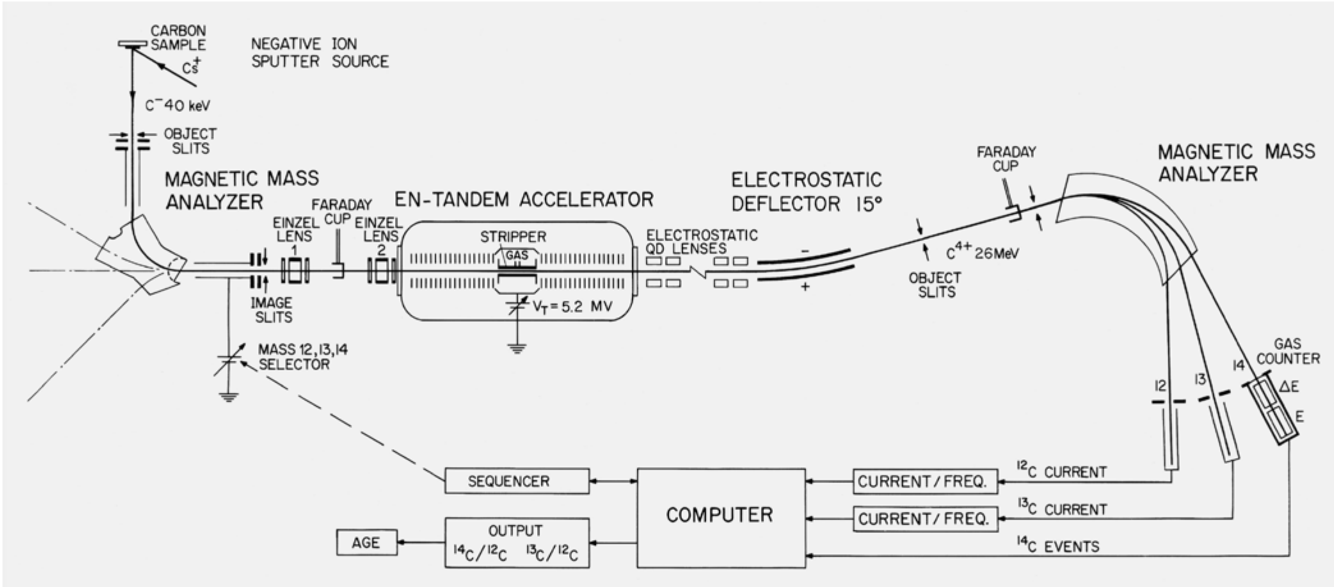


Fig. 2: Schematic diagram of the AMS principle. The prepared samples are loaded into the ion source and bombarded with a positive ceasium ion beam. The sputtered negative carbon ions are extracted from the ion source and analyzed in a first magnetic mass analyzer. They are then accelerated in the tandem accelerator to high energies. During the charge changing process in the striper in the centre of the accelerator, the interfering hydrocarbon molecules are destroyed. The positive ions are accelerated further and analyzed with an electrostatic and magnetic analyzer. The ions of mass 14 are identified in a gas ionisation detector and individually counted. An electrostatic mass selector on the low energy side is used to inject the abundant stable isotopes into the accelerator in short pulses. The stable isotopes are measured as currents. From these currents and the number of ^{14}C atoms the isotopic ratios ^{14}C/^{12}C and ^{13}C/^{12}C can be calculated.

accelerated to the positive high-voltage terminal (V_T). There, they pass through a tube filled with a low pressured gas. Through collisions with the gas atoms some electrons of the incoming ions are stripped away, and the ions end up in a positive charge state. In this process, molecules are destroyed (3rd filter). The positive ^{14}C ions and the molecular fragments are then accelerated back to ground potential. The 4th filter consists of an electrostatic and magnetic analyzer set to pass the ^{12}C, ^{13}C and ^{14}C ions in the selected charge state. Most fragments from molecules destroyed in the stripper are removed at this stage. Finally, the ^{14}C ions are slowed down, identified and counted in a so-called $\Delta E/E$ gas ionization detector (5th filter). In this stage, the last interferences for ^{14}C counting are removed.

An electrostatic mass selector on the low energy side is used to sequentially inject the stable isotopes ^{12}C and ^{13}C and the radioisotope ^{14}C into the accelerator. The stable isotopes are measured only in short pulses and in form of currents with so-called Faraday cups. From these currents and the number of ^{14}C atoms counted in the detector the isotopic ratios ^{14}C/^{12}C and ^{13}C/^{12}C can be calculated.

4. Sample Preparation

First the textile samples were examined microscopically to identify and to remove any obvious foreign material. The chemical pre-treatment of the samples is an acid-base-acid treatment (0.5 M HCl at 60°C for one hour, 0.1 M KOH at 60°C for one hour and 0.5 M HCl at 60°C for one hour). Between the steps the material is rinsed to pH 7 with ultrapure, distilled water. In addition, some of the samples are cleaned with organic solvents in a Soxhlet extraction apparatus. Following the chemical treatment, the samples are dried in an oven at 60°C. The samples are then combusted to CO_2 for two hours at 950°C in evacuated and sealed quartz tubes together with copper oxide and silver wire. In the presence of hydrogen, the purified carbon dioxide gas is reduced to filamentous graphite over a cobalt catalyst using Vogel's method.[2, 3] The resulting graphite-cobalt mixtures are pressed into copper discs to be used as targets in the ion source.

2 Vogel et al. 1984.
3 Vogel et al. 1987.

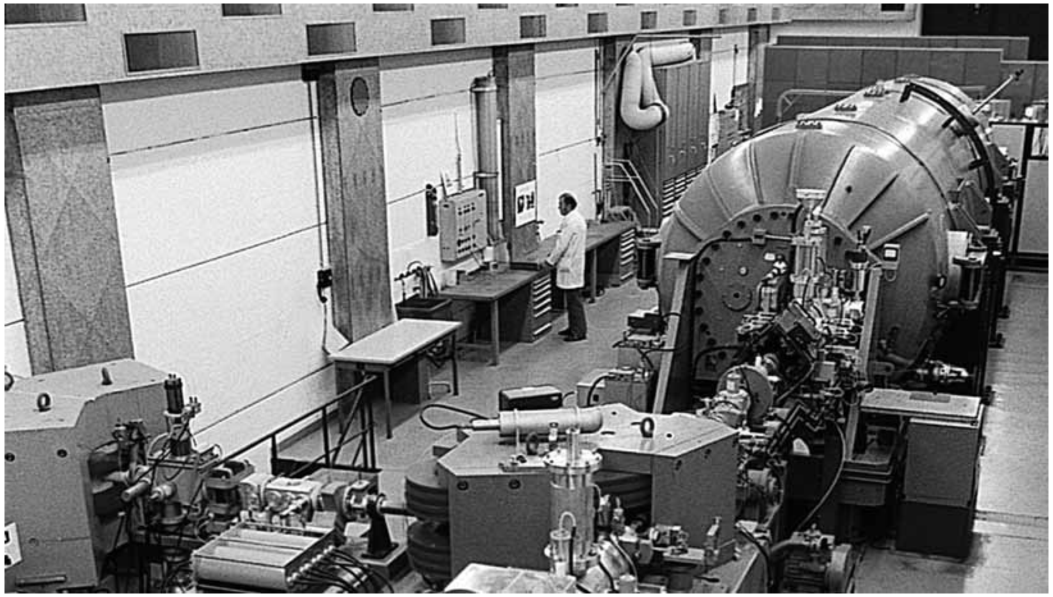


Fig. 3: View of the ETH/PSI AMS facility, ETH Hönggerberg, Zurich, Switzerland.

Fig. 4: (opp. page left) Natural variations in the ^{14}C production rate relative to the reference year AD 1950 corrected for the decay of ^{14}C ($\Delta^{14}C$).[7] The ^{14}C concentration in the atmosphere has been reconstructed on the basis of the ^{14}C concentration measured in wood samples from dendrochronologically dated tree rings. The curve clearly shows that the ^{14}C concentration was not constant in the past. 10000 years ago, the concentration was about 10% higher than in AD 1950. A deviation of 1% corresponds to a change of 83 years in the age.

Fig. 5: (opp. page right) Long-term observation of $\Delta^{14}C$ in atmospheric CO_2 on the northern hemispher.[8] Shortly after the atmospheric nuclear weapons tests began in 1962, the $^{14}CO_2$ level on the northern hemisphere rose to twice the value of natural equilibrium. $\Delta^{14}C$ decreases thereafter due to exchange with the world's oceans and the terrestrial biosphere.

5. Normalization and Calibration of ^{14}C Dates

The procedure for calculating and reporting the so-called radiocarbon age is described by Stuiver and Polach.[4] This procedure includes the following steps:

1. A historical half-life ($t_{1/2}$ = 5568 years) as derived by Libby is used.
2. The atmospheric ^{14}C level in the past is assumed to be constant.
3. The measured $^{14}C/^{12}C$ concentration of the sample is normalized either directly to the concentration of the NBS oxalic acid standard[5] or indirectly by using a secondary standard that is directly related to the NBS oxalic acid standard. The $^{14}C/^{12}C$ concentration of the NBS oxalic acid standard, as distributed by the US National Bureau of Standards, is about 5% higher than the $^{14}C/^{12}C$ concentration in the atmosphere in the year AD 1950. Thus, 95% of the standard value corresponds to the natural concentration value of the year AD 1950.
4. In the CO_2 cycle an isotopic mass fractionation takes place that has to be considered. The mass fractionation correction of a sample is derived from the measured $^{13}C/^{12}C$ ratio and is normalized to $\delta^{13}C = -25‰$ relative to the reference value of the PDB carbonate standard.[6]
5. Because for all samples the $^{14}C/^{12}C$ ratios are measured relative to the NBS oxalic acid standard value, the year AD 1950 automatically becomes the reference year for all ages which are quoted as y BP (years Before Present = AD 1950).

From the radiocarbon age a so-called true or calendar age can be calculated. For this conversion the following corrections have to be made:

A. For the half-life of ^{14}C, the internationally accepted value of $t_{1/2} = 5730 \pm 30$ y has to be used. This value is about 3% higher than the half-life as measured by Libby.

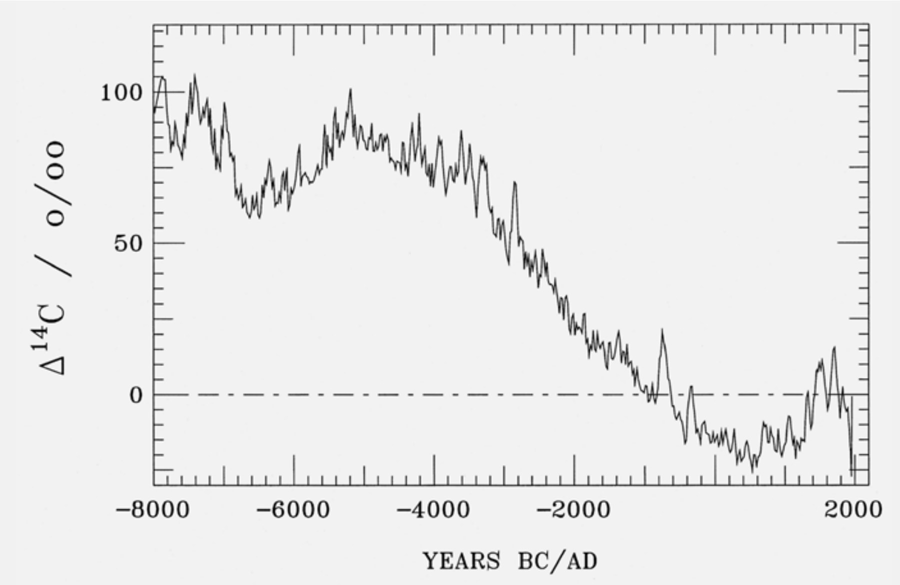
B. For samples in contact with a reservoir other than the atmosphere, an age adjustement is needed. This correction is especially important for marine samples, for which it is of the order of 5% (calculated ages are about 400 years too old).

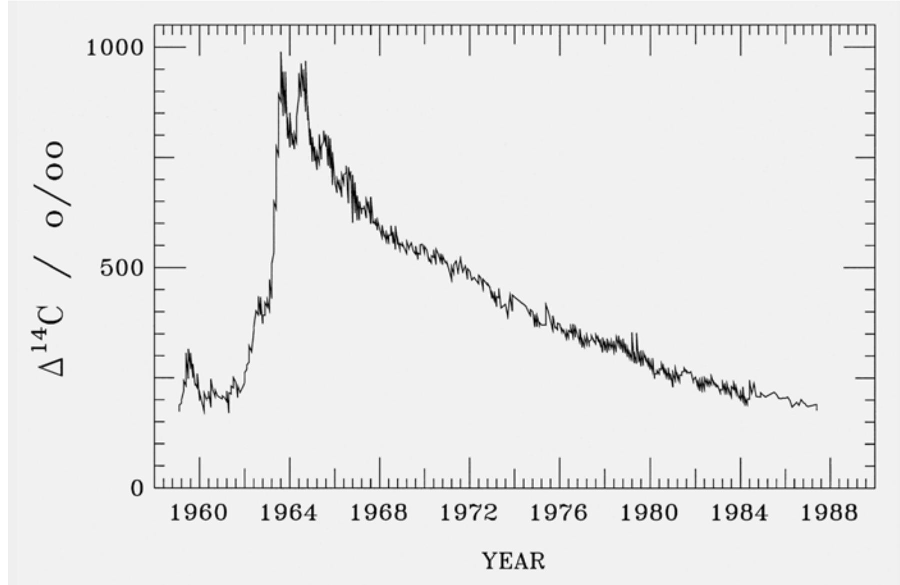
C. The radiocarbon ages are calculated under the assumption of a

4 Stuiver/Polach 1977.

5 US National Bureau of Standards, today NIST (National Institute of Standards and Technology).

6 Pee Dee Belemnitella carbonate standard. Craig 1954.





constant ^{14}C concentration in the past. This assumption has been known to be incorrect since the late 1950's. But only in the recent past, a so-called dendrochronology correction curve could be established for the last 10 000 years. It was determined from high precision ^{14}C measurements of wood samples from tree rings of known age. fig. 4 shows the natural variations in the atmospheric ^{14}C production rate relative to the reference year AD 1950 and corrected for the decay of ^{14}C.[7] They reflect the influence of the slow variations in the geomagnetic field (long term fluctuation) as well as that of the solar activity short term fluctuations on the ^{14}C production rate. In many cases, these strong fluctuations lead to several points of intersection between the radiocarbon age and the calibration curve (see below). These ambiguities can reduce the applicability of the radiocarbon method. Especially the past 300 years are datable only with restrictions due to the strong fluctuations in the ^{14}C production rate during the 17th century. In addition, due to the atmospheric nuclear weapons tests in the early 1960's, the ^{14}C concentration increased dramatically by about a factor of two (so-called bomb peak) (fig. 5).[8] This, however, can be helpful in revealing modern forgeries, because never in the past was the ^{14}C concentration as high or higher than during the bomb peak.

7 Stuiver/Reimer 1993.

6. Measurement Procedure and Statistical Uncertainty of the Age Determination

The $^{14}C/^{12}C$ and $^{13}C/^{12}C$ ratios of the samples to be dated were deter-mined relative to the respective NBS oxalic acid I standard values.[9] So-called chemistry blank samples, which are prepared from anthrazite (dead carbon) were also analyzed in order to determine the background. All samples (unknowns, standards and blanks) of one series were measured several times (typically 3 to 4). The total measuring time per sample is of the order of 30 to 40 minutes depending on the precision required. If further improvement of the precision is required, a second sample is prepared in the same way and measured independently in a later measurement.

8 Levin/Kromer 1997.
9 Bonani et al. 1987.

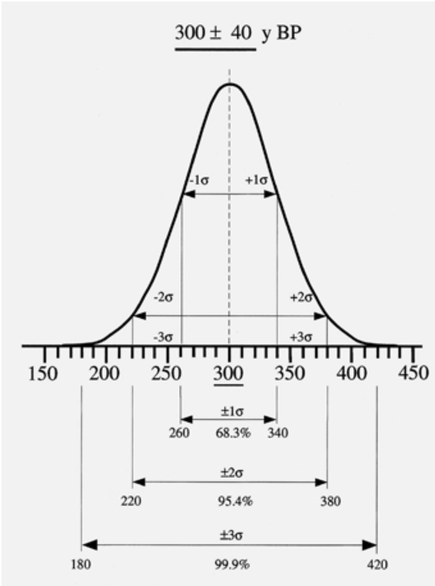


Fig. 6: The Gaussian or bell-shaped curve represents the probability distribution of measuring the true result (300 y BP) and is characterized by the standard deviation sigma (σ, ± 40 y BP).
The probability to find the true value within the 1σ interval (between 260 and 340 years) is 68.3% (confidence limit).
The probability to find it in the 2σ interval (220 to 380 y) is 95.4% (confidence limit) or in the 3σ interval (180 to 420 y) 99.9% (confidence limit).

Fig. 7: (Example 1)
A: The non-linear relation between the ^{14}C age (y BP) and the calendar age (AD) for a ^{14}C age of 480 ± 40 y BP. The three horizontal lines mark the ^{14}C age with the corresponding ±1σ error band.
B: The probability density distribution resulting from the calibration of the ^{14}C age. The probability density is displayed as a histogram with a bar width of 10 years. The black region indicates the 1σ area which corresponds to the interval within which the calendar age lies with a probability of 68.3% (confidence limit). Doubling the error from 1σ to 2σ extends the interval of probable calendar ages, so that with a probability of 95.4% (confidence limit), the actual age lies somewhere within the black and the hatched area.

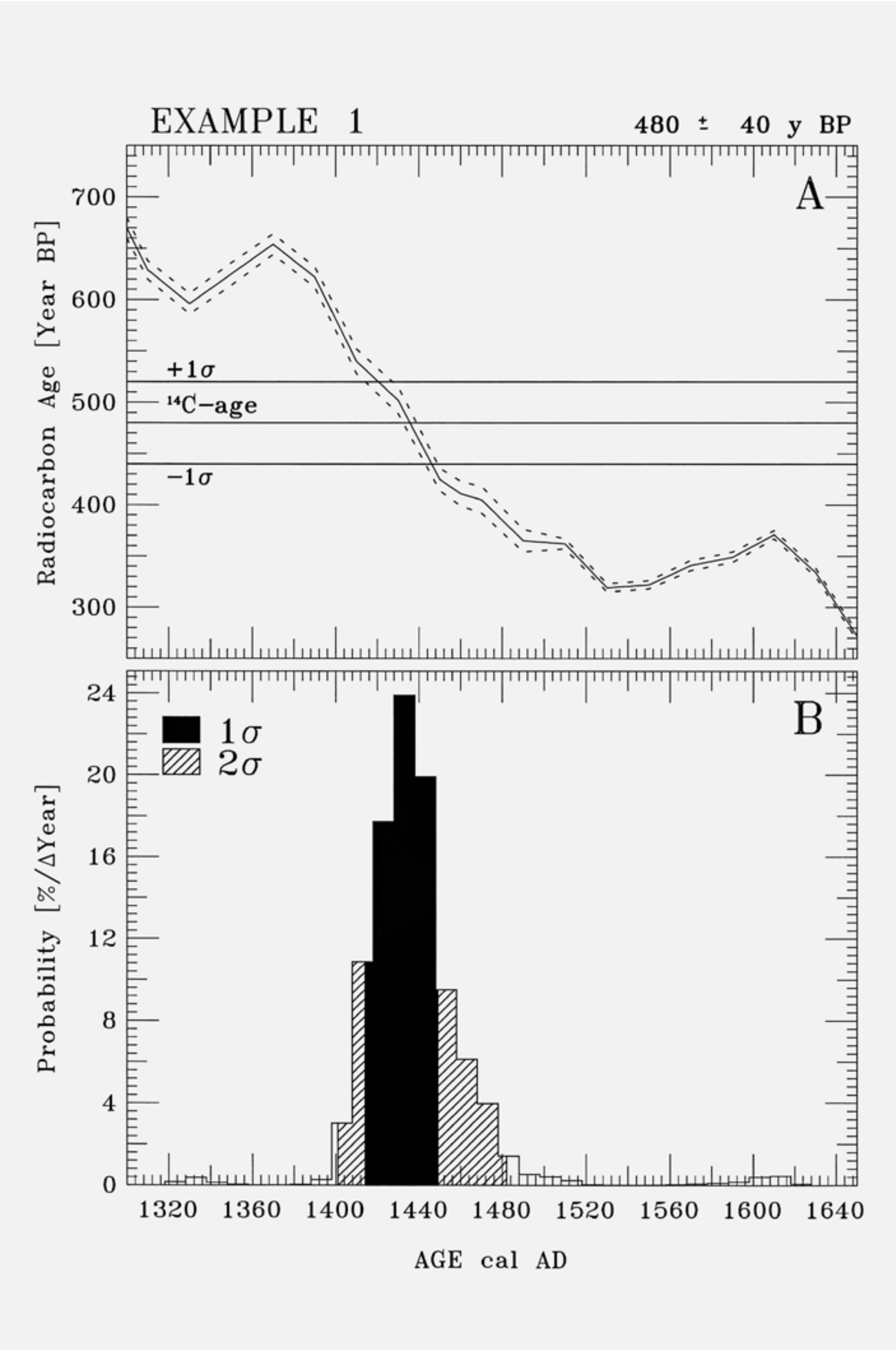
Fig. 8: (Example 2)
A: The non-linear relation between the ^{14}C age (y BP) and the calendar age (AD) for a ^{14}C age of 200 ± 40 y BP. The three horizontal lines mark the ^{14}C age with the corresponding ±1σ error band.
B: The probability density distribution resulting from the calibration of the ^{14}C age. The probability density is displayed as a histogram with a bar width of 10 years. The black regions indicate the 1σ area which corresponds to the interval within which the calendar age lies with a probability of 68.3% (confidence limit).
The combined black and hatched regions indicate the 2σ area and correspond to a probability of 95.4% (confidence limit). The naturally caused temporal variations in the ^{14}C production lead to ambiguities, especially for radiocarbon ages younger than 300 years.

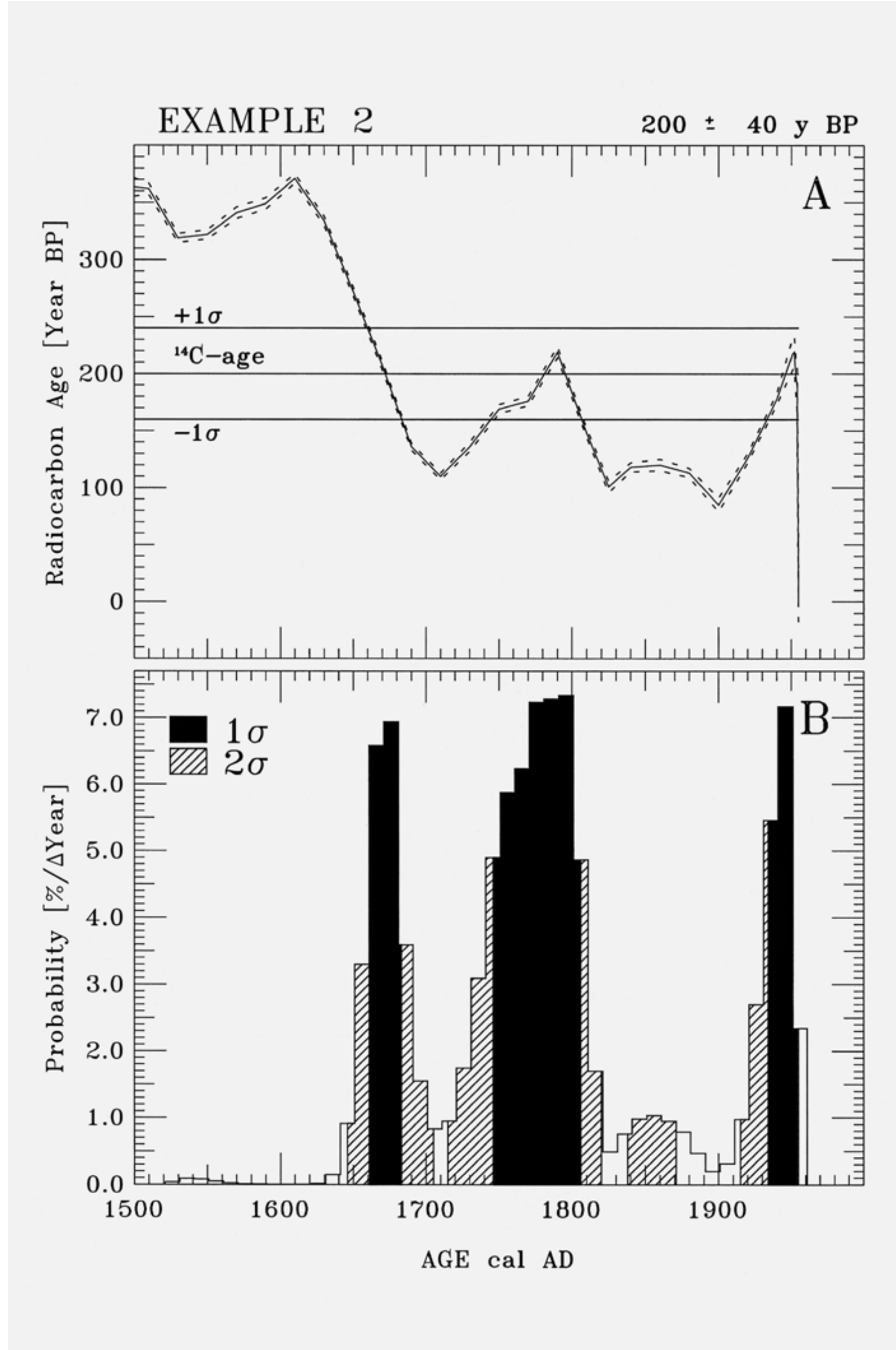
The error of the radiocarbon age (experimental error) is mainly due to the statistical uncertainties of the measurement of the sample to be dated, the standards and the blanks. It also includes the error in the measurement of the $^{13}C/^{12}C$ ratio ($\delta^{13}C$). The statistical uncertainty can be calculated from the number of accumulated ^{14}C events. For a reasonably large counting rate the probability distribution of the true result can be represented by the so-called normal distribution (Gaussian or bell-shaped curve, fig. 6), which can be characterised by the standard deviation sigma (σ). The ±1σ intervall around the measured value corresponds to a probability of 68.3% (confidence limit) to find the true value within this intervall. The ±2σ intervall corresponds to a probability of 95.4% (confidence limit).

A computer program, CalibETH[10], based on statistical theory is used to convert the Gaussian probability distribution of the radiocarbon age to a probability distribution of the historical or calendar time scale. Because of the statistical uncertainties of both the ^{14}C analysis and the calibration curve, it is not possible to quote an exact historical age. Only a time interval can be given, in which the true age lies with a certain probability. fig. 7 illustrates the calibration of a radiocarbon or ^{14}C age of 480 ± 40 y BP. The upper half of the figure shows the non-linear relation between the ^{14}C age (y BP) and the calendar age (AD), which is based on high precision ^{14}C measurements of wood from dendrochronolocically dated tree rings.[11, 12] The three horizontal lines indicate the measured ^{14}C age with the ±1σ error band. The histogram in the lower part of the figure illustrates the probability density distribution for the calibrated age range (in 10 year intervals). The black region indicates the 1 sigma area which corresponds to the interval within which the calendar age lies with a probability of 68.3%. Doubling the error from 1σ to 2σ extends the interval of probable calendar ages, so that with a probability of 95.4%, the actual age lies somewhere within the combined black and the hatched area. It is convention to quote the 2σ intervals (2 sigma). The white area is the 3σ interval and has got a probability of about 5% that the true age lies within it. This means, that on average for every 20 measured objects the true age can actually lie within the 3σ interval instead of the 2σ interval.

10 A. Niklaus et al. 1992.

11 Pearson/Stuiver 1993.
12 Stuiver/Pearson 1993.


EXAMPLE 1
480 ± 40 y BP
A
+1σ
14C−age
−1σ
Radiocarbon Age [Year BP]
700
600
500
400
300
B
1σ
2σ
Probability [%/ΔYear]
24
20
16
12
8
4
0
1320
1360
1400
1440
1480
1520
1560
1600
1640
AGE cal AD


EXAMPLE 2
200 ± 40 y BP
A
+1σ
14C−age
−1σ
Radiocarbon Age [Year BP]
300
200
100
0
B
1σ
2σ
Probability [%/ΔYear]
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1500
1600
1700
1800
1900
AGE cal AD

Naturally caused temporal variations in the ^{14}C production lead to ambiguities in certain historical eras, which can put the true age (with different probabilities) into several time intervals. Especially for objects younger than 300 years, these temporal variations of the ^{14}C production almost always lead to ambiguities (two to five possible true age intervals). An example for a radiocarbon age of 200 ± 40 y BP is shown in fig. 8. ^{14}C analyses alone of samples from this historical era are therefore not too meaningful. Only if additional information or other data is available (e.g., historical or stylistic evidence, etc.), the exclusion of certain time intervals can be considered.

7. Summary Note on the Interpretation of ^{14}C Results

The result of a ^{14}C analysis consists of a so-called radiocarbon or ^{14}C age, which is given in years BP (Before Present – taken as the year AD 1950 according to convention) together with the $\pm 1\sigma$ (1 sigma) uncertainty. However, this age is not the historical or true age.

A calibration curve, determined from high precision ^{14}C measurements of wood samples from tree rings of known age, is used to calculate a historical age from the radiocarbon age (calibration procedure). Because of the statistical uncertainties of both the ^{14}C analysis and the calibration curve, it is not possible to quote an exact historical age. Only a time interval can be given, in which the true age lies with a certain probability. In addition, naturally caused temporal variations in the ^{14}C production lead to ambiguities in certain historical eras, which can put the true age with different probabilities into several time intervals. Conventionally, the 2σ intervals are quoted corresponding to a total probability of 95.4% (confidence limit). This means, that on average for every 20 measured object the true age can actually lie within the 3σ interval instead of the 2σ interval.

Whenever calibrated data is reported, all true time intervals have to be quoted. It is not permissible to only report the interval with the highest probability and to omit the intervals with the smaller probabilities. The omission of information changes the statement and is therefore not allowed.

Especially for objects younger than 300 years, the temporal variations of the ^{14}C production almost always lead to ambiguities (two to five possible true age intervals). ^{14}C analyses alone of samples from this historical era are therefore not too meaningful. Only if additional information or other data is available (e.g., historical or stylistic evidence, etc.), the exclusion of certain time intervals can be considered.

8. Development of the AMS Technique

From its advent more than 30 years ago, accelerator mass spectrometry (AMS) has made tremendous progress. This is true not only for the large variety of possible applications exploiting the unique analytical capabilities of AMS, but also for the measurement technique itself.[13] In the recent past, impressive progress has been made to simplify the AMS measurement technique with commercial high performance spectrometers. The mini radiocarbon dating system MICADAS developed at the institute itself works at much lower high voltage (200 kV) in a tandem configuration. The new system is now fully operational and fulfils the high requirements for radiocarbon dating applications.[14]

13 Synal et al. 2010.
14 Synal et al. 2007.

From Visual Guesstimate to Scientific Estimate

Dating Turkmen Carpets

1. Introduction

Since Westerners started paying attention to Turkmen weavings, their question of the age has aroused a great deal of interest. As much as a hundred years ago researchers were preoccupied with this subject. Both Dudin[1] and Felkersam dared to estimate the age, particularly of early Salor weaving, as far back as the 17th century.[2] Other late 19th century travellers to Central Asia, including their compatriot Bogolyubov and the two German explorers Rickmers and Hummel, assumed an age of more than a hundred years for some of the pieces they collected.

Around 1900, Bogolyubov acquired damaged pieces including the Salor trapping fragment cat. no. 130,[3] as well as considerably newer objects including a completely intact late 19th century Salor *torba*,[4] which already exhibits early synthetic dyestuffs. In addition to newer examples, Rickmers and Hummel also acquired heavily damaged pieces and fragments. Such behaviour indicates that they were aware of age differences of the pieces they collected. A comparable connoisseurship and approach to the subject can also be observed among other authors of the early 20th century. Both Neugebauer and his co-author the Vienna carpet dealer Orendi had a good eye for early Turkmen weavings. In their 1909 "Handbuch der Orientalischen Teppichkunde "they show a number of early Turkmen pieces of outstanding quality, such as the Sarïq *aq yüp* cat. no. 37 and the Sarïq *khali* cat. no. 45,[5] the latter being one of the eighteen pieces radiocarbon dated to the 16th/17th centuries.[6] Like their predecessors Bogulyubov, Rickmers, and Hummel , Neugebauer and Orendi did not hesitate to show fragments. The "Eagle" *gül* group I *khali* fragment cat. no. 113 was first published by them.[7] We now know of a likely 17th century dating of this piece,[8] but looking for age attributions in Neugebauer/Orendi is fruitless. Neugebauer only notes at the very beginning of chapter 1: "…Therefore we have no real reference about how Central Asian carpets looked two hundred years ago, though we know about the fame of Bukhara in

1 About Dudin, see Tzareva 1985 and Tsareva 1990.
2 Felkersam 1914/15 (1979): 53, bottom, chapter on the Salor; Dudin 1928 (1998): 45, 64 and chapter on the Salor, p. 67, 68.
3 In his 1909 folio volume he described the fragment as "antique", probably indicating an age of more than 100 years.
4 Bogolyubov 1909 (1973): Trapping fragment no. 8 and *torba* no. 38; the latter also published in Tzareva 1984: No. 12. A nearly identical late example, though with considerable damage, is our cat. no. 7.

5 Neugebauer/Orendi 1909: Fig. 135 and 147.
6 See section "3.2.1 ^{14}C Results Covering The Period of 1450–1650 AD" and Fig. 13.
7 Neugebauer/Orendi 1909: Fig. 138.
8 See section "3.2.2.2 *Khali* and *aq yüp* of the "Eagle" *gül* Group I".

pre-Islamic times because of its carpets."[9] Rudolf Neugebauer would certainly be delighted about the new findings of early dating results. In the approach of Englishman Hartley Clark, we see the exact opposite of Neugebauer/Orendi's abstention. In his 1922 monograph "Bokhara, Turkmen and Afghan Rugs", all pieces are assigned a date. Like Dudin and Felkersam he even ventures age estimates as far back as the 17th century.[10] Likewise Grote-Hasenbalg gives an age attribution to each of the 27 pieces published in colour in his three-volume book "Der Orientteppich – Seine Geschichte und seine Kultur", published in the same year.[11] Admittedly only with a single Sarïq *khali* does he dare an unambiguous dating to the second half of the 18th century. With three additional pieces, he at least does not exclude the possibility of such an early date.[12] Apart from Moshkova's "Carpets of the People of Central Asia" nearly every monograph of the 20th century deals with the age question.

Moshkova's fieldwork, conducted in the 1930's and 40's, was not published until 1970, 20 years after her death, by Morosova, one of her colleagues. Her ignoring the issue of dating is probably because as an ethnographer she was merely concentrating on facts still tangible among the Turkmen weavers.[13]

In his "Central-Asian Rugs", which became one of the "classics" in Turkmen carpet literature, Schürmann resumes the tradition by giving, with a single exception, an age estimate to every piece. For seven of his 63 Turkmen weavings he gives an 18th century date; for three more a date around 1800.[14] He even dedicates a chapter to age determination, assuming the ability of a connoisseur to approximately determine the age of a Turkmen weaving.[15] Likewise Azadi gives age estimates to all the pieces in both his 1970 and 1975 books. Like Schürmann he devotes a separate chapter to the delicate subject of age determination.[16] In the newer literature, Azadi also remains the only author daring a pre 18th century dating, giving a pre 1700 date to a Chowdur *khali*.[17] He dates nine pieces to the 18th, another fourteen to the 18th or early 19th centuries.

Published three years later, Loges' "Turkmenische Teppiche"[18], illustrated with many excellent examples, shows 117 Turkmen weavings, of which ten are given an 18th century dating.[19] Nine more are suspected to be of the same age.[20] One of these seven early examples is the Sarïq rug cat. no. 46, now radiocarbon dated to the 16th or 17th century. In Mackie and Thompson's "Turkmen – Tribal Carpets and Traditions"[21] – one of the standard works in Turkmen carpet literature – 9 out of 91 illustrated weavings, some of them fragments, are dated to the 18th century.[22] In three additional cases they indicate that the dating is unclear.[23] Most publications since then give 18th and 19th century age estimates.[24]

In summary: since the late 19th century the earliest known examples of Turkmen weavings have been dated to the 18th century by nearly all the authors. Occasionally, even the 17th century has been cautiously considered a possibility.

The introduction of radiocarbon dating in the field of oriental carpets on the occasion of a symposium and exhibition on the dating of Anatolian kilims in January 1997[25] brought an unexpected turn to age determination in the field of Turkmen weavings, based for more than 100 years mainly on guesswork. That same year (1997), the "dat-

9 Neugebauer/Orendi 1909: 2.
10 Clark 1922.
11 Grote-Hasenbalg 1922: 25 Turkmen pieces shown in vol. II, 2 in vol. III.
12 Grote-Hasenbalg 1922: Sarïq *khali* plate 85, as well as plate 82, 90, and 92 as further candidates.
13 Moshkova 1970 (1996).
14 Schürmann 1969: Nos. 1, 15, 18, 26, 44, 46, 58 with a 18th century dating, nos. 6, 22 and 57 around 1800. Tent band no. 5 is without date estimate.
15 Schürmann 1969: 25.
16 Azadi 1970: 57.
17 Azadi 1975: No. 12.
18 Loges 1978. Although never acknowledged by Loges himself, the arbitrative influence of Hans Christian Sienknecht on this publication should not be left unmentioned.
19 Loges 1978: Nos. 19, 20, 24, 34, 36, 43, 57, 76, 80, 102.
20 Loges 1978: Nos. 9, 35, 38, 39, 41, 48, 86, 88, 109.
21 Mackie/Thompson 1980.
22 Mackie/Thompson 1980: 5, 7, 16, 17, 26, 47, 62, 63, 67.
23 Mackie/Thompson 1980: Nos. 8, 24, 57.
24 E.g. Tzareva 1984, Andrews et al. 1993; Pinner 1993; Reuben 1998 and 2001.
25 Symposium 24–26 January 1997 in the Cantonal Museum in Liestal, Switzerland. Papers have been published in November 1999 together with 80 radiocarbon dating results of Anatolian kilims. See Rageth 1999.

ing fever" spilled over into the camp of Turkmen collectors. German collectors Peter Hoffmeister and Hans Christian Sienknecht opened a second "dating round" with a first group of ten Turkmen weavings.[26] These first 10 tested pieces were chosen by the collectors using criteria of age determination based on experience and comparison. All the pieces were suspected to be older than 19th century. The results obtained from this first set of tests, with a "hit rate" of "four out of ten"[27] giving a 16th/17th century dating, were so exciting that they became the starting point of a project. In a second series, another eleven weavings followed in the same year, including pieces from these two and two additional German collections.[28] From this second series another two pieces were dated to the 16th/17th centuries.[29] With the prospect of having another symposium on a group of radiocarbon dated textiles – this time Turkmen carpets – a third group of 21 Turkmen weavings from the The Hermitage Museum, the Russian Museum, and the Museum of Ethnography in St. Petersburg were radiocarbon dated.[30]

On the occasion of our visit to the Hermitage Museum, a sample of the Pazyryk carpet was also submitted for radiocarbon dating. In conjunction with our Turkmen dating project, the oldest carpet in the world has for the first time been radiocarbon dated.[31]

On the 26 to 28 February 1999 the planned symposium and exhibition took place, showing and discussing for the first time Turkmen weavings of the 16th/17th centuries.[32] Now it was I who got excited about the potential of this study, and began intensive study relating to Turkmen carpets with the intention of expanding the scope of the project and publishing the results.

In the following, we shall have a short look at the various approaches to estimating a carpet's age visually, before we address radiocarbon dating with its possibilities and limitations.

2. Conventional dating methods

The conventional dating methods incorporate several components mostly leading to a successful result only when taken together.

2.1 Visual Age Estimate

The method most commonly used among enthusiasts to determine a carpet's age is the visual age estimate. An age estimation of a Turkmen carpet made this way is based on comprehensive knowledge, long standing experience – combined with a sure instinct – and common sense. The connoisseur is often not really able clearly to define his principle of judgement. We are often dealing with a more or less unconscious application of criteria of perception, like the recognition of a pattern or design, and comparisons and correlations to similar or even different examples. By an abundance of impressions a kind of system of decipherment is being developed, which finally can lead to a judgement about the approximate age of an object. The above mentioned "hit rate" of "four out of ten" clearly demonstrates the existence of criteria to estimate a carpets age, or at least to assume what in comparison must be older and less old.

2.1.1 Condition

To estimate the age of a carpet based on its condition is a risky and highly problematic undertaking. There are heavily damaged pieces from the late 19th century like cat. no. 7, and conversely pieces from the 16th/17th centuries in good condition. Unfortunately, bad condition often suggests an exaggerated age estimation. By itself, condition is not a good criterion for a visual age determination.

26 Cat. nos. 17, 56, 72, 84, 117, 123, 131, 140, 156, 164. Sampled by Georges Bonani at the ETH Zurich 28 May 1997. See appendix IV, table 15.

27 Teke *torba* cat. no. 56.

28 Sampling again by Georges Bonani at the ETH Zurich, 6 November 1997.

29 For the two early results, see appendix IV, table 15; first measurement of cat. no. 13, and first measurement of cat. no. 154. Unfortunately both early results could not be confirmed by repeated measurements. For more information, see section "3.2.8 Unconfirmed Re-Testing Results".

30 Robert Pinner and Peter Hoffmeister arranged a meeting in St. Petersburg with Elena Tsareva, who prepared and organized all details. Robert Pinner, Peter Hoffmeister and I travelled to St. Petersburg in June 1998, to collect samples for radiocarbon dating from selected Turkmen weavings of the three Museums.

31 For the result, see Fig. 7 in this chapter and appendix IV, table 16.

32 For a report, see Hali 104: 82–85.

2.1.2 Design and Composition

For a visual age estimate, style, quality of drawing, and the rarity of a design are not without problems, yet they are still more reliable indicators than condition.

Border designs can be particularly revealing. For example, the border with small trifoliate flowers[33] is seen more frequently in early *chuval* and *torba* than in the 19th century, and also drawn in more detail in the earlier pieces. In the 19th century, on the other hand, the so called *kochanak* border[34] is seen much more frequently than the design with the small trifoliate flowers, except for the Salor, where the *kochanak* border is standard for all *chuval*.[35] Further, pieces predating 1800 more frequently show a mixture of designs often referred to as "tribal specific" than can be observed in 19th century weavings. A vivid example of this is the *torba* cat. no. 56, dated to before 1650. For the Teke, this *torba* shows an unusual form of the *chuval gül*, and also the secondary motif, the so called satellite *gül*, is alien to them: it is "borrowed" from *torba* of the "Eagle"-*gül* group II, and is either typical for the region or for a hitherto unidentified group of neighbours of the Teke in Southwest Turkmenistan in the 17th century.[36] Last but not least, the border of this early Teke *torba* is not typical for the Teke. It exhibits some affinities to the *naldag* border often seen in 18th or 19th century Sarïq weaving.[37] Moshkova refers to this border type in her Teke chapter as well, although she may have observed this design on newer pieces, say on small format double bags *khordjin*.[38] In the 19th century, this specific design was also used among the Sarïq, and also here (like among the Teke) for striped *khordjin*.[39]

Another example exhibiting a comparable correlation between type of border and age of the piece is illustrated by two Teke *chuval*, cat. nos. 60 (Fig. 1) and 61 (Fig. 2), with nearly identical design in field and *alem*, but very different in age. The earlier piece is framed by a rather unusual floral border (Fig. 1), while the younger piece shows a border type quite common in 19th century Teke weaving (Fig. 2).

Two Yomut carpets from Southwest Turkmenistan with the so-called "boat" border serve as a third and last example of this comparison method. While cat. no. 113 shows an early version of this type of

Fig. 1: Detail from cat. no. 60, border of an 18th century Teke *chuval*. In the 19th century, this border type is seen only rarely. Designs, colour quality, and materials are of equal importance as indicators for dating.

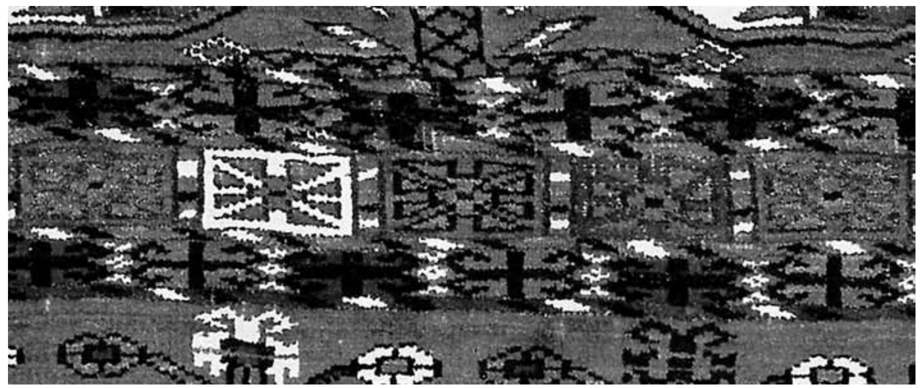


Fig. 2: Detail from cat. no. 61, border of a 19th century Teke *chuval*. This border type has been used by the Teke exclusively in the 19th century. This chuval shows the same *alem* and field design as cat. no. 60, just the borders are different.

33 Cat. nos. 55, 79, 96; Moshkova refers to this design in the Teke chapter, calling it *sakar gishik*, Moshkova 1970 (1996): Plate LIII, no. 10.a
34 Cat. nos. 57, 62.
35 See cat. nos. 11–15, and 132–134.
36 For another *torba* with the same secondary motif, see cat. no. 96.
37 See cat. nos. 43 and 44.
38 Moshkova 1970 (1996): Plate LVII, no. 17.
39 See Moshkova 1970 (1996): Fig. 85 and plate XLIII, no. 9, as well as Sotheby's New York, December 16, 1993: Lot 22.

border, in cat. no. 159 we see a significantly later version of the same border design.[40]

2.1.3 Comparison Series

With these examples of borders, we are entering another realm of visual age determination, the comparison of designs. Particularly helpful in this case are series of the same design type from the same tribe or region, which can provide useful information. Only by comparison, minor differences can be seen clearly. A good example of such a series, even though only three pieces, is the set of Qaradashlï *khali* with *chuval gül* field design, Figs. 3–5 (cat. nos. 84–86). The earliest piece shows, although only at one end, an *alem* design copying the 17th century Safavid/Mughal flower style. This piece not only shows the best drawing of the main border design of this small group, but of this type of border in general. The secondary motifs designed in the form of flower crosses are also of exceptional originality and without comparison examples. Last but not least, the colour quality, especially in the minor borders with the "running dog", is of unequalled beauty. Already by the second piece, the carpet in Fig. 4, all characteristics just described are not quite of the same quality any longer. Although this piece is still of outstanding quality and good age, some highly visible differences can already be made out. The naturalistic flower design in the *alem* is missing, and the borders along the sides are already simplified. Only at the beginning of the piece, the border design shows one single curled leaf as seen in the border of Fig. 3. All in all, the carpet's general impression is already less powerful. The third and clearly most recent piece of this small group (Fig. 5) shows typical features of the late 19th century, in this case even of the early 20th. Though the composition of the design is very similar, the inner drawing of the *chuval gül* even nearly identical, the borders are completely different, and are typical for Yomut pieces of the 19th and early 20th centuries. Next to its two earlier relatives, the piece appears significantly simplified, but fits the standard scheme of late 19th century Yomut pieces, from the time, when this tribe was big and powerful, having annexed a good deal of its neighbourhood. At this time, the Qaradashlï had already been pushed away by the Teke from the Akhal Oasis to Khiva,[41] and had descended into insignificance. Despite all this, the late *khali* is still an interesting contemporary witness, and has been included in this study as a representative of the end of that ancient tradition.

A further example of comparison is the two Ersarï saf carpets with niches in rows, cat. nos. 32 and 33. A third piece closely related to these saf carpets is the rug with a single niche, cat. no. 34. According to a written document, cat. no. 33 was made by Turkmen and Usbek weavers in the 1870's in a workshop in Buchara for the local Bala Hauz Mosque.[42] On the other hand, the saf carpet cat. no. 32 is clearly earlier. Probably woven in the early 18th century, it differs in several aspects – particularly in a more sophisticated design – from the related piece of the late 19th century. It may have been woven for the new Bala Hauz Mosque, finished in 1712. [43] The same may apply to the single niche rug cat no. 34. In many aspects this "prayer rug" comes so close to the older of the two saf carpets that an 18th century dating seems appropriate as well.

Other examples of comparison are the two Ersarï *chuval* cat. nos. 22 and 23 with very similar design but differing in age, the two Teke *chuval* with Salor *gül* cat. nos. 62 and 63, and the two *kizil chuval* cat. no. 66 and 67. We will come back to these last three examples of comparison under the subheading "Dyestuffs and Dyeing Methods as a dating aid".

2.1.4 Silk in The Pile as a Supposed Indicator of Age

The amount of silk in the pile of Turkmen weavings has repeatedly been proposed as an indicator of age. Pieces with a lot of silk in the pile have been considered less old than pieces with little or no silk. But this method of age determination has its peril. For example, the Yomut used silk once in a blue moon, both in early and late pieces. The same holds true for pieces attributed to the Ersarï, the Beshir, or the Kizil Ayak. However, this is not the case with the Sarïq and the Teke. In

40 For illustrations regarding the comparison of the two borders, see discusson of cat. no. 113, as well as Mackie/Thompson 1980: 150/152, plate 62 and Fig. 46.

41 See Bregel 2003: Map 36B.

42 Moshkova 1970 (1996): 292.a

43 For a discussion see Vol. 2, chapter "The Ersarï", cat. nos. 32 and 33.

Fig 3: Cat. no. 84, Qaradashlï *chuval gül khali*,
1st half 17th century

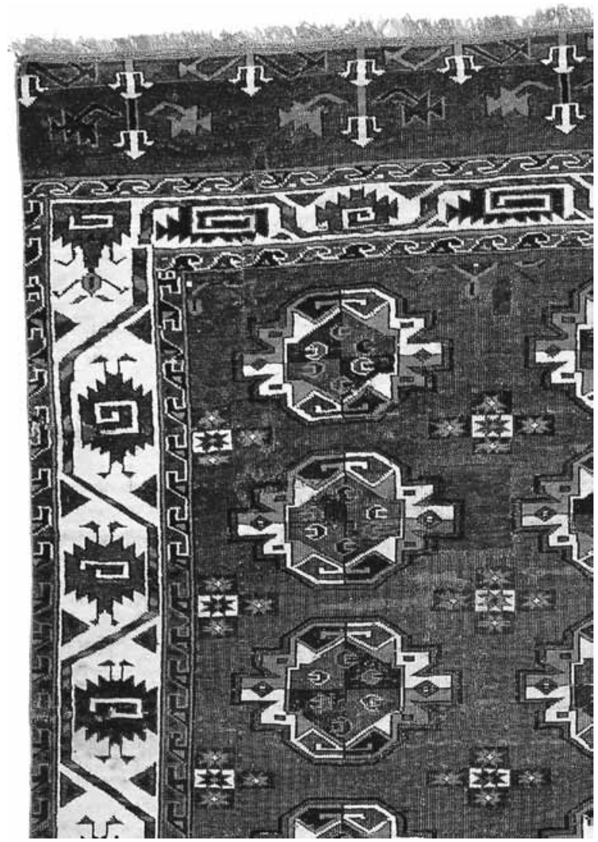


Fig 4: Cat. no. 85, Qaradashlï *chuval gül khali*,
18th century

Fig 5: Cat. No. 86, Yomut/ Qaradashlï *chuval gül khali*,
beginning 20th century

their earlier pieces predating 1850 or even 1825, silk pile can be found only in very small quantities or not at all. In post 1850 pieces, on the contrary, silk pile can appear in large amounts, particularly among the Sarïq, as well as the Chowdur and the Arabachi. Presumably in the 2nd half of the 19th century these tribal groups were very prosperous and were therefore able to afford this kind of luxury. Here once again, the Salor are the exception. In earlier pieces quite large amounts of silk can be found, especially in their small format weavings. The large format *khali*, as a rule, even among the Salor contain no silk (perhaps a few knots sometimes, as in cat. no. 17; in exceptional cases more, as in cat. no. 18).

2.1.5 Dyestuffs and Dyeing Methods as indicators of age

The presence of early synthetic dyes provides some information on the age of a textile. As demonstrated by Mark Whiting's work in the 1970s, and by our own dye study, the first synthetics found are the Ponceau dyestuffs, which presumably were used by the Turkmen living in the Russian area of influence. This group of early synthetic dyestuffs was invented between 1878 and 1880, came quite promptly to the market, from which it disappeared again nearly as promptly as it turned up, being replaced by other, newer synthetic dyes.

For Turkmen weavings, the presence of a Ponceau dyestuff requires a post-1880 dating. The Salor trapping cat. no. 7, the Ersarï *chuval* cat. no. 23, the three Teke *chuval* cat. no. 63, 68, and 70, the Qaradashlï *asmalyk* cat. no. 78, the *mafrash* cat. no. 120 and more pieces not published here are good examples of this,[44] as all these pieces contain Ponceau dyestuffs, mostly in small amounts only. Another phenomenon, often seen in conjunction with the use of these early Ponceau dyestuffs, is Mexican cochineal as a ground colour. As discussed in the chapter on dyes, in the 1870s the global production of Mexican cochineal (*dactylopius coccus* Costa) reached the enormous amount of 4000 tons, resulting in a collapse of the world-wide market price.[45] At that time, in Central Asia Mexican cochineal became cheaper than madder, temporarily leading to a complete displacement of the latter. Pieces with a cochineal dyed ground colour and highlights in synthetic Ponceau within the design were the result. This peculiarity could be established in a significant number of examples,[46] arguably most frequently among the Teke and the Ersarï. Though there are many extant examples of this type, we deemed it sufficient to test only a few. The proof of Mexican cochineal as a ground colour constitutes a further dating aid, as this phenomenon is probably not found before 1870.

Another distinctive feature in regard to the dyeing process is the introduction of tin as a mordant (colour amplifier) at the beginning of the 17th century, as well as its disappearance approximately around the middle of the 19th century.[47] In this case we are dealing with both a *terminus post quem*, namely 1610, as well as a *terminus ante quem* of ca. 1850. In an extreme case the finding of tin can date a piece either to the beginning or to the end of this period. The Arabachi *khali*, cat. no. 127, stands as an example for the beginning and the Teke *chuval*, cat. no. 62, for the end of this period. With the Arabachi *khali* we have a radiocarbon dating result with two possible age ranges: a first between 1492 and 1600, and a second between 1614 and 1657. Therefore, the confirmation of tin mordant is a clear indicator for a date of production of this carpet within the later age range in the 17th century. With the Teke *chuval* cat. no. 62, most of the woollen yarn dyed with Mexican cochineal shows a pale purplish shade, dyed on a mordant other than tin, but a few knots in the lower right Salor *gül* show a bright red indeed dyed on tin mordant.[48]

2.2.1 Acquisition Dates and Documents as a *terminus post quem*

As a possible aid for dating, acquisition dates are generally not very helpful or informative. The earliest acquisition dates of Turkmen weavings in European collections don't go further back than the 1870s and 1880s; they concern objects in the collection of the Victoria & Albert Museum in London.[49]

Furthermore there are several complete collections which were acquired on-site in Central Asia in the late 19th century. One of these is the Rickmers Collection, now housed in the Ethnographic Museum in Berlin.[50] Rickmers' first voyage to Central Asia and his first rug acquisitions date to the years between 1894 and 1898. At about the same time, Wilhelm Hummel, also a German, visited Central Asia. He also assembled a small collection of Turkmen carpets of outstanding quality. Photographs taken in 1898 show Hummel's home in Weimar decorated with Turkmen weavings,[51] among them the *aq yüp* cat. no. 4, attributed

44 For the results, see appendix II, table 3–11.
45 See chapter "Scarlet and Purple", section "3.1.3 Mexican Cochineal to The End of The 19th Century".
46 Cat. nos. 23, 63, 68, and 70.

47 For a detailed discussion of the invention and the use of tin as a colour amplifier in connection with insect dyestuffs see chapter "Scarlet and Purple", section "3.6 Insect Dyestuffs on Tin Mordant".
48 See chapter "Scarlet and Purple", section "3.1.2 Whiting's Cochineal I & II".
49 E.g. the Yomut *khali* 854-1876, the Salor *chuval* 394-1880, and the Salor trapping 143-1884, published in Wearden 2003: Plates 95 and 97.
50 Pinner 1993.
51 Benardout 2002.

to the Salor in this study. The already mentioned collections of Dudin and Bogolyubov were acquired around 1900. Nearly all these dates of acquisition are in the last quarter of the 19th century. Although from a certain point of view already relatively late, such dates of acquisition are not uninteresting, in certain cases even helpful. When acquired in the late 19th or early 20th century, many of these pieces already had a considerable age. At least some of them probably date from the early 19th, if not even the 18th century. Examining a late Salor *torba* from the Bogolyubov collection with apparently synthetic dyes, we will later demonstrate how useful such information can be.

Another source infrequently available is local documents from mosques or religious trusts. The accidental discovery of such a document in Bukhara by the late George O'Bannon provides a date of production for the Ersarï saf carpet cat. no. 34. However, this document only concerns the late 19th century, specifically the year 1876.

2.2.2 Inscriptions and in-woven Dates

We know of no Turkmen weaving with inscriptions or in-woven dates predating 1850. The earliest piece with an in-woven date is the Sarïq tent band Fig. 6, dated ١٢٨١ (AH 1281 = 1865 AD). The Sarïq attribution is mainly based on design details.[52] From right to left, the inscription reads: "The year 1281 …."[53] The word to the left of the date could not be read. At the end of the 19th and in the early 20th century it seems to have been a fashion to decorate Turkmen weavings with inscriptions and in-woven dates. Presumably most of these objects were produced in workshops or at least on commission, and, not surprisingly, made by weavers from the Teke or the Yomut, the two most powerful tribes at that time. Inscriptions and dates appear not only in Arabic, but also in Russian, Armenian, Persian, and Hebrew.[54]

So, inscriptions and in-woven dates are not really of great help regarding the question of dating. The application of radiocarbon dating to the world of Turkmen carpets clearly improved this fairly hopeless seeming situation.

Fig. 6: Sariq *aq yüp* with in-woven inscription and date ١٢٨١ (AH 1281 = 1865 AD). Date and inscription are shown at the lower end of the picture. Private collection.

52 For design features typical for the Sarïq, see Vol. 2, chapter "The Sarïq", discussion of cat. nos. 38 and 39.

53 I thank Dr. Albert Gabbai from Geneva for deciphering the inscription.

54 See Hali 35, 1997: 12 for a Russian example; Hali 60, 1991: 122 for a Armenian example; and cat. no. 159 for an example with an inscription in Hebrew letters and Persian words. For a more detailed discussion, see cat. no. 159 in this Vol.

Fig 7: Woollen pile carpet, so-called Pazyryk carpet, Kurgan V, Pazyryk necropolis, ca. 183 x 200 cm, 4th or 3rd century BC, The Hermitage Museum, St. Petersburg, Inv. No. 1687/94.

^{14}C dating	
Lab. No.:	ETH-18906.1/.2
^{14}C age:	2245 ± 35 y BP
Calibrated age ranges :	BC 383–332 (25.4%)
(95.4% confidence limit)	BC 328–200 (74.6%)

For details, see appendix IV, table 16, H.M.6, ETH-18906.1/.2.

3. Radiocarbon Dating

As radiocarbon dating was essential for this study, representing a foundation for all following investigation, it shall be discussed here appropriately. For dating pre-18th century carpets and textiles, it is the only reliable method. A critical analysis of the results obtained reveals limitations in regard to objects of the 18th and 19th centuries, requiring additional art historical or interdisciplinary examinations. Before a general introduction, the possibilities and limits of the radiocarbon dating method in the field of oriental carpet and textile studies will be shown on the basis of three ^{14}C dated oriental carpets. These three examples and their dating results illustrate the issues pertaining to the testing of all kinds of textiles.

(1) The first example is the oldest known oriental carpet in the world, the so-called Pazyryk carpet (Fig. 7).[55] In 1998 this carpet was examined in connection with our project of radiocarbon dating of Turkmen carpets from the three St. Petersburg Museums, the Hermitage, the Russian, and the Ethnographic Museum. The Pazyryk carpet was dated by the ^{14}C method to the period between 383 and 200 BC.[56] An independent dendrochronological investigation of the Necropolis of Pazyryk published in 1999 gave a date of 240 ± 5 BC for Kurgan V, where the "Pazyryk carpet" had been discovered.[57] Thus it is clear that the carpet itself dates from between 380 and 240 BC, somewhat later than had been thought until now.

(2) In 2000 the European art market saw two almost identical Anatolian carpets, which were attributed to the 17th century on the basis of their design. One of these had been offered in London by the auction house Christie's in the spring of 2000, but had been suspected as

55 Rudenko 1970: 298–302, plates 174 and 175 (first published in Russian, Moscow/Leningrad 1953).
56 The dating result was first published in Rageth 1999: 24.
57 Press information on a Swiss National Foundation Project, 9th March 1999, in the Institute for Particle Physics at the Swiss Federal Institute of Technology, ETH Zurich. Contributions by Dr. Georges Bonani, ETH Zurich, Dr. Erich Ruoff, Director of the National Foundation project, and Dr. Mathias Seifert, archaeologist and specialist in dendrochronology. See also Hajdas et al. 2004, and Seifert 2010.

a forgery and was withdrawn shortly before the auction.[58] The second carpet (Fig. 4) emerged in Switzerland in the summer of the same year. At the wish of a potential purchaser, it was radiocarbon dated. This indicated periods within the 17th, 18th and 20th centuries as possible dates of origin. When it became known that the carpet at Christie's had been suspected of being a forgery and withdrawn from the sale, dye analyses were undertaken on the ^{14}C dated carpet found in Switzerland. These analyses showed that all the dyestuffs in that carpet were synthetic.[59] It was therefore possible to exclude the ^{14}C ranges in the 17th and 18th centuries, leaving only the years between 1928 and 1955 in the 20th century.[60] This led to the conclusion that the carpet was a copy woven in that period and in all probability the work of Theodor Tuduc in Bucharest, Romania.[61]

(3) The third example is an Anatolian carpet fragment in the Orient Stars collection (fig 10). It shows a design very similar to the 20th century copies described above, but was radiocarbon dated to the 15th century. Compared with the Tuduc copies, there are two main differences. The first and clearest difference is in the colours, which are saturated and brilliant in the 15th century fragment and which look very flat in the forgeries. The second is the inclusion of a large eight-pointed star as a centre medallion in the 15th century fragment. This corresponds to the classical oriental design tradition, while the two adjacent small medallions of the forgeries are likely to have been a creation by Tuduc.

3.1 Introduction to Radiocarbon Dating

Results obtained by radiocarbon dating always cover periods of different length. Among other factors, these results depend upon the age of the object and the prevailing ^{14}C concentration in the atmosphere at its time of origin. The variations in ^{14}C concentration over the centuries and millennia are clearly visible in the so-called calibration curve, showing the non-linear relationship between the radiocarbon age and the calendar age.[62] The calibration curve is based on a reconstruction of the ^{14}C concentration in the atmosphere over the centuries, obtained from measurements from dendrochronologically dated wood samples.[63] It is these variations that are responsible for different and often ambiguous ranges, which may extend to between 50 and 300 years. This is also the reason for the particular problems that complicate the results for pieces from the last three hundred years. Without additional "dating aids", such as in our case the knowledge of dyestuffs and/or secure historical data, ^{14}C results obtained from the post-1650 period are ambiguous and unsatisfactory. On the other hand, the second example discussed above clearly shows what accurate information the method can provide even for this "problematic" period in conjunction with additional information.

Another interesting aspect of ^{14}C dating is the application for unmasking "modern" fakes, as it makes it possible to distinguish unambiguously between objects that date from before or after 1950. This too is due to the amount of ^{14}C in the atmosphere, which in the 1950s doubled in concentration as a result of above ground nuclear tests.[64]

---

58 Christie's, London, Oriental Rugs and Carpets, 13th April 2000: Lot 175. Schürmann first published the carpet in 1960. He must have noticed that the carpet was somewhat unusual, since he dated it "presumably 1750", despite the fact that the field design is of the 16th and the borders of the 17th century (See Schürmann 1960: plate 13)

59 The dye analyses were carried out in December 2000 by Dr. Harald Böhmer in the Laboratory for Natural Dyes, Marmara University, Istanbul.

60 Another carpet of the same design type was first sold by auction at Christie's in 1996 (Christie's, London, Important Classical and Turkish Rugs, 17.10.1996, lot 418) and re-emerged in an exhibition at the Textile Museum in Washington, DC, in 2002 (see Denny 2002: plate 37). Later examination of the dyes of this third piece showed that it is another copy by Tuduc; all dyes are synthetic.

61 In the first half of the 20th century Tuduc operated a carpet workshop in Romania in which copies of Anatolian carpets were produced from illustrations of carpets from the 16th to 18th centuries. While at the time, these carpets were sold as "copies", it is known that forgeries reached European museums since the 1930s and that in all probability these too came from the Tuduc workshop. For further information on this subject, see Bennett 1989.

62 See Fig. 4 in the chapter "Radiocarbon Dating of Milligram Samples by Accelerator Mass Spectrometry".

63 Dendrochronology is a dating method which enables determining the period during which a tree has lived and the year that it was felled. The method is based on determining the width of the annual rings of the wood. See Orcel/Orcel/Hurni 1992.

64 See Fig. 5 in the chapter "Radiocarbon Dating of Milligram Samples by Accelerator Mass Spectrometry".

3.1.1 Sampling and Sample Size

The first step in radiocarbon dating is the extraction of a sample from the object to be examined. The quality of the sample is an essential factor and the success of the measurement requires that the sample satisfy a number of criteria. The risks inherent in contaminated samples, and the errors this produces in the results, remain an area of concern, though in recent years the additional cleaning with Soxhlet has almost eliminated the problem.[65] Nevertheless it is advisable carefully to select the location at which a sample is extracted from a textile. Loosely suspended material, for example, should be used only with great care, when nothing else is available. The quantity of the sample is also important. Using the Accelerator Mass Spectrometry Technique (AMS), which was developed 35 years ago, the sample size is only 1/1000 that required for the conventional decay counting method (Low Level Counting or LLC). In practice this means that the mass of the textile sample before cleaning must be at least 15 – 20 mg to achieve a reliable result. However, the ideal sample size is between 50 and 100 mg to ensure that there is enough material in case the measurement has to be repeated.

Despite the small size of the sample now required, the amount of material required for a sample tends to be chronically underestimated. In one case a sample weighing barely 1 mg was received for ^{14}C dating of an oriental carpet 6.5 m^2 in area that had been attributed to the 16th century but whose date of origin was now in doubt. Not surprisingly the sample was too small for ^{14}Cdating.[66]

3.1.2 Replicate Measurements

Why and when should measurements be repeated? When the results of two independent ^{14}C measurements of the same textile contradict one another – most probably due to contamination of the sample - replicate measurements can resolve the discrepancies and bring a greater degree of confidence. Replicate measurements increase the reliability in dating textiles whose ages can not be estimated or estimated only within wide limits. In such cases it is particularly useful, when possible, to date an entire group of textiles all of which were produced within the same limited period of time.

Finally, replicate measurements are especially useful for objects that were produced in the period from the 16th to the 18th centuries. In the following section on the dating of Turkmen carpets such results will be illustrated and discussed on the basis of some concrete examples.

A question always asked in this connection, is: when should two or more measurements be combined? The answer is that the two measurements should lie within the 2 sigma confidence limit (95.4%).

The dating of the Pazyryk carpet serves as an example. A first measurement yielded a radiocarbon age of 2250 ± 55 y BP, where $\pm 55 = 1$ sigma. The results of a second measurement should lie at least within the 2 sigma range. 2 sigma corresponds to ± 110. In fact the second dating result of 2240 ± 40 y BP fell into the 1 sigma range and the mean of the two measurements was 2245 ± 35 y BP with a calibrated calendar age between 383 and 200 BC.

The subsequent dendrochronological investigation and the ^{14}C dating of the wooden structures of the graves in which the carpet was found support the accuracy of the ^{14}C dating method for the Pazyryk carpet. The two results confirmed each other perfectly.[67]

Replicate measurements should be undertaken in the same laboratory to ensure the continuity of the operating conditions. There is no sense in carrying out comparative tests of laboratories against one another; this is done routinely by the different laboratories in regular interlaboratory tests. The ^{14}C dating of the Turin shroud provided an excellent example of this.[68] Reliable and comparable results are best obtained by concentrating on one laboratory and by cooperating with it.

When correctly applied, the radiocarbon dating method is of great assistance and frequently offers an important contribution to solving difficult questions. However, in some instances only an interdisciplinary procedure can solve problems that can not be dealt with by radiocarbon dating alone.

65 See the chapter "Radiocarbon Dating of Milligram Samples by Accelerator Mass Spectrometry".
66 This carpet belongs to the so-called Salting Group. See Franses 1999.
67 Hajdas et al. 2004; Seifert 2010.
68 Damon et al. 1989.

Fig. 8 (left): Woollen pile carpet, copy (or fake?) after an Anatolian original of the 15th/16th century, presumably the work of Teodor Tuduc, Romania, 257 x 186 cm, 1930's or 1940's, collection of Edoardo Concaro, Italy.

^{14}C dating

Lab. no.:	ETH-23014
^{14}C age:	210 ± 30 y BP
Calib. age ranges:	AD 1650 – 1678 (27.1%)
	AD 1737 – 1810 (53.0%)
	AD 1928 – 1955 (19.8%)

For details, see appendix IV, table 16, Ki 67.

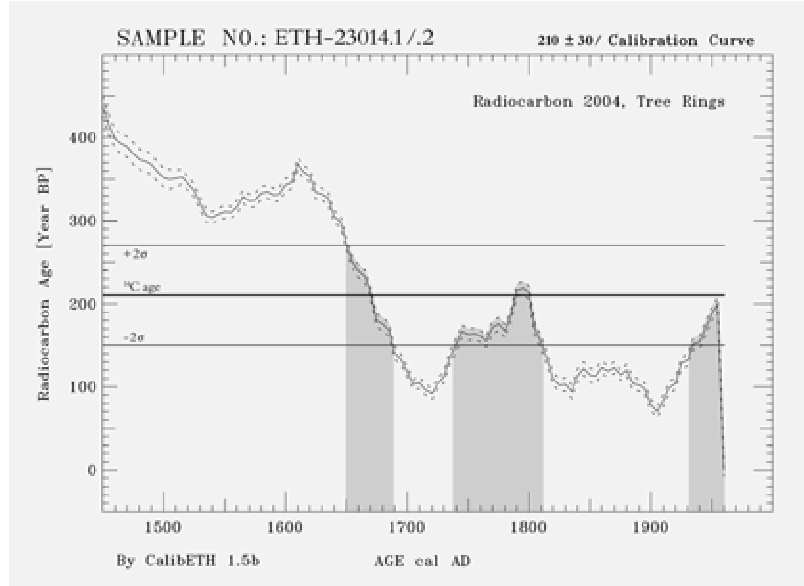


Fig. 9 (right): Graphical representation of the dating of the carpet in Fig. 8.

3.1.3 Interpretation of Results and Statistics

A recurring problem in the interpretation of ^{14}C dating results is confusion between the radiocarbon age and the calendar age. The calendar age is what is of interest to the practical user. The radiocarbon age is a theoretical value that is used to determine the calendar age with the help of a calibration curve. A possible cause of confusion is that the radiocarbon age is always expressed with a confidence limit of 68.3% (± 1σ error [1 sigma error]) and the calendar age with a confidence limit of 95.4% (± 2σ error). A more detailed explanation of the statistical basis for this can be found in the specialist literature.[69]

A further problem for the layman results from the calendar age, its often ambiguous time ranges, and their probabilities. These probabilities are expressed in terms of percentages and often lead to misinterpretations. The probability of an individual time range is often confused with the confidence limit of the measurement, which is also expressed as a percentage. In principle all the ranges of the calendar age determined by calibration must be reported with their probabilities, except when significant factors apply that justify the exclusion of certain ranges. The examples below will help illustrate this.

(1) The first example concerns the dating of a carpet fragment from the Orient Stars collection (Fig. 10). Calibration yielded two possible ranges: a first range in the 15th century (with a probability of 98.1%), and a second range in the 17th century (with a probability of

69 E.g. Bowman 1990.

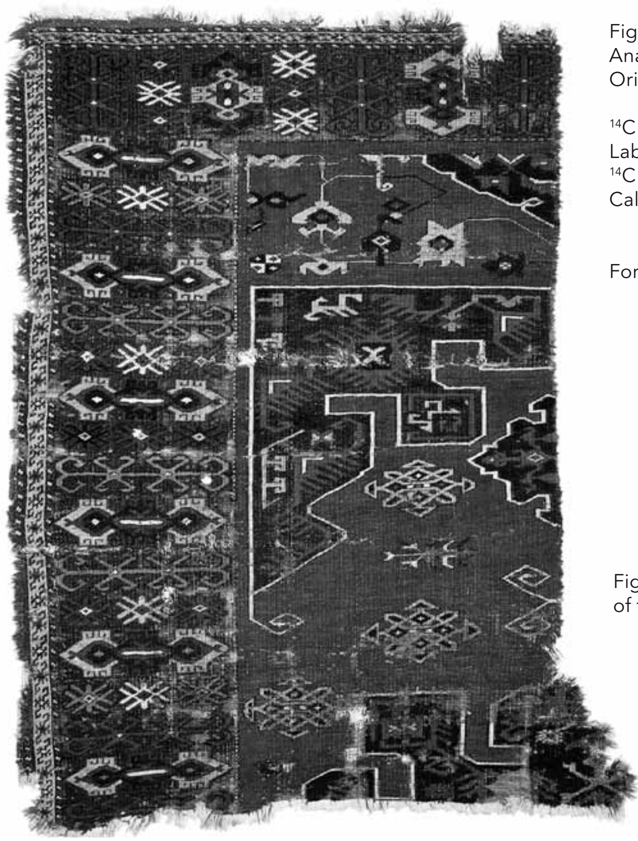


Fig. 10 (left): Woollen pile carpet fragment, Anatolia, ca. 138 x 103 cm, 15th century, Orient Stars Collection.

^{14}C dating	
Lab. no.:	ETH-22195.1/.2
^{14}C age:	440 ± 30 y BP
Calib. age ranges:	AD 1420 – 1502 (98.1%)
	AD 1604 – 1614 (1.9%)

For details, see appendix IV, table 16, Ki 48.

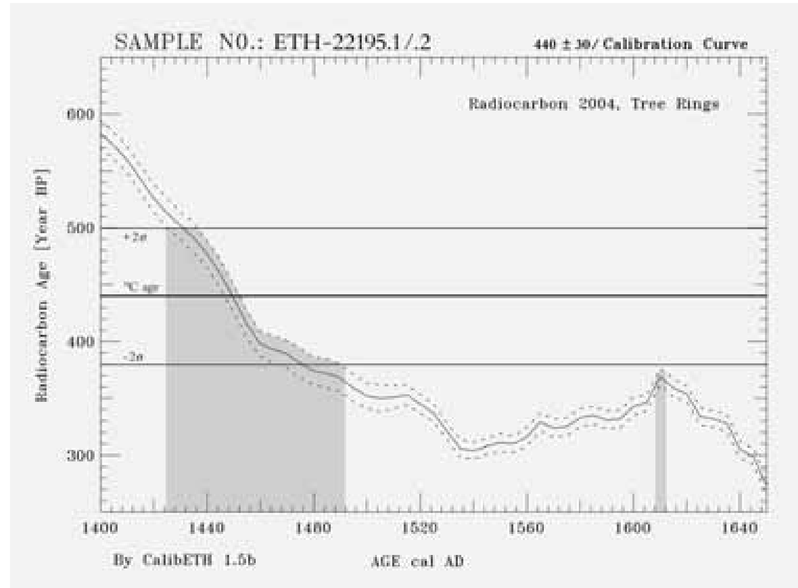


Fig 11 (right): Graphical representation of the dating of the carpet on Fig. 10.

1.9%). The latter together with the measurement error in the minus area only just grazes a peak in the calibration curve and can therefore be neglected (Fig. 11). This is a case in which a second measurement has yielded additional confidence in the result.

(2) As was discovered later, the relevant age range obtained in the dating of the Tuduc carpet (Fig. 8) happens to be the one with the lowest statistical probability. Prior to the discovery of the synthetic dyestuffs, this carpet was believed to be a late variant of the design, perhaps from the 17th century. It was the dye analysis that provided a clear and unmistakable verdict, since the presence of synthetic dyes excluded all but the 20th century. Despite the low probability (19.8%), and in contrast to the previous example, the relevant range clearly intersects the calibration curve Fig. 9 (intersection 1949 AD).

(3) A Turkmen carpet with a Hebrew inscription and date corresponding to 1911 or 1931 (cat. no. 159, Fig. 24) emerged as an additional example of this kind. As with the Tuduc carpet, the relevant age range of the radiocarbon dating result was one with a low probability (18.6%).[70]

From the three cases above it is clear that in radiocarbon dating textiles, the statistical probabilities expressed in percentages must be treated with great caution.

3.2 Dating Turkmen Carpets with the Radiocarbon Method

For this study, 123 Turkmen weavings were radiocarbon dated, nearly all of them with at least two independent measurements (Fig. 12).[71]

70 For a discussion of this piece see section "3.2.6 ^{14}C Results Obtained from 20th Century Pieces"and caption Fig. 24.

71 See also appendix IV, table 15.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor	1	2	1	13	4	21
Ersarï, Kizil Ayak	3			3	9	15
Sarïq	2		1	5	4	12
Teke			1	12	8	21
Yomut, Qaradashlï			4	7	19	30
"Eagle"-*gül* groups			3	2	3	8
"P-Chowdur" group		1	1	2	4	8
Chowdur				1		1
Arabachi	1			1	2	4
Turkmenen			1	2		3
	7	3	12	48	53	**123**

Fig. 12: Radiocarbon dated Turkmen weavings.

	ensi	*kapunuk*	*ak yüp*	*chuval*	*khali*	
Salor					1	1
Ersarï, Kizil Ayak					2	2
Sarïq					1	1
Teke				2	2	4
Yomut, Qaradashlï				1	5	6
"Eagle"-*gül* groups			2			2
"P-Chowdur" group			1			1
Chowdur						
Arabachi					1	1
Turkmenen						
			3	3	12	**18**

Fig. 13: Radiocarbon dated Turkmen weavings pre-dating 1650.

None of the objects examined clearly pre-dated 1450, i.e. all dated pieces cover the period between ca. 1450 and 1950. According to time period, the results can roughly be divided into five groups.

3.2.1 ^{14}C Results Covering The Period of 1450–1650 AD

Eighteen of 123 tested weavings date to the 16th or 17th centuries (Fig. 13).[72] Twelve, i.e. two thirds of these early dated pieces, are large format carpets *khali*.[73] The others are all smaller objects: three tent bands *aq yüp*,[74] two *torba*[75] and a *germech*[76]. A number of factors account for the high percentage of early dated *khali* among the pieces tested. With 53 examples, it is the largest group. Second, *khali* have been a particular focus of the connoisseurship of one of the collectors involved. A contributing factor is that because of their format and size, there was greater demand for these rugs in the European market than for bags and trappings.

72 Cat. nos. 16, 31, 36, 46, 51, 56, 71, 73, 80, 84, 89, 101, 106, 107, 110, 117, 127, 156.
73 Cat. nos. 16, 31, 36, 46, 71, 73, 84, 89, 101, 106, 107, 127.
74 Cat. nos. 110, 117, 156.
75 Cat. nos. 56 and 80.
76 Cat. no. 51.

3.2.2 ^{14}C Results Concerning The "Problematic" 17th Century

In addition to the eighteen Turkmen weavings radiocarbon dated to before 1650, there are a considerable number which can be dated almost certainly to the 17th century. The calibration curve changes radically between the years 1600 and 1700. From 380 radiocarbon years around the year 1600 it drops to about 110 radiocarbon years around the year 1700.[77] This "drop" in the calibration curve reflects the dramatic change of the content of radiocarbon in the atmosphere in the course of the 17th century.[78] Hence to receive suitable radiocarbon dating results from objects of the 17th century at least three independent measurements are required (even more are better).[79] A repeated number of measurements reduces the measurement error so that the "peaks" hanging down in the 16th century and ascending in the 18th century are not being intersected, or just barely. (cf. Fig. 16).

77 Cf. the calibration curve on Fig. 16. The radiocarbon years are shown on the vertical, the calendar years on the horizontal axis of the diagram.
78 Dr. Hans Ritter of the Max Planck Institute in Munich kindly pointed out that this phenomenon has to do with the so called Maunder-Minimum of the frequency of sun spots. During the Maunder-Minimum, i.e. during the whole 17th century, the sun spots were missing and the intensity of cosmic radiation more or less screened by the solar magnetic field was extremely large. The outcome of this is a lot of ^{14}C.
79 Cf. section "3.1.2 Replicate Measurements".

Fig. 14: Cat. no. 101, Yomut *khali*, collection of Edoardo Concaro, 17th century.

Fig. 15: Cat. no. 102, Yomut *khali*, The Textile Museum, Washington, D.C. 17th century.

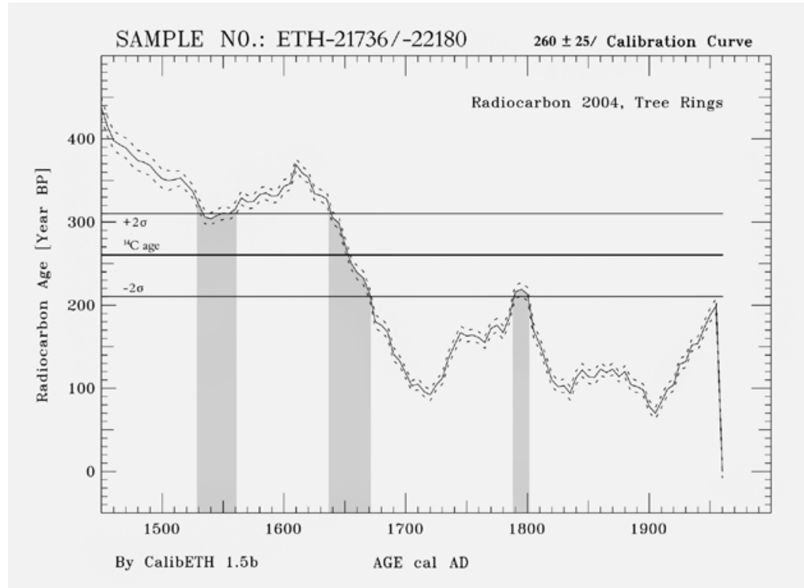


Fig. 16: Graphical representation of the dating of the Yomut *khali* cat. no. 101, Fig. 14.

When dating a textile of that period, let's say around 1650, it could look as follows: a measurement to intersect the year 1650 in the calibration curve should have a radiocarbon age of approximately 260 [y BP]. Let us assume this as a theoretical case. With a radiocarbon age of 260 with a 1σ (sigma) measurement error of ± 50 (2σ would then correspond to ± 100), the minus range of the measurement error would include the 18th century to a large extent, while on the other hand the plus range would include a large part of the 16th century. The calibrated result would then lie with all probability within the 16th to 18th centuries (of course always also including a range in the 20th century). Theoretically a second measurement could fall more into the plus range of the measurement error of the first measurement to result in a dating with a 16th/17th centuries probability. With a third measurement, exactly the opposite could happen. Falling more into the minus range of the first measurement, it could result with a 17th/18th centuries probability. Such results would still lie within the requested tolerance and would therefore be acceptable. A weighted mean of the three results would again bring everything into balance and most probably concern the 17th century with the highest probability. So much for theory; following is a real example.

3.2.2.1 The Yomut *khali* with flower *alem*

The dating result of the Yomut *khali* with flower *alem* from the Concaro Collection (cat. no. 101, Fig. 14) represents a practical example of what has just been described in theory. The weighted mean of three independent measurements has resulted in a 17th century dating range with a statistical probability of 74%. As shown by the graph of the dating in Fig. 16, ranges in the 16th and 18th century are only being touched. With an insignificantly smaller measurement error these ranges could have been omitted. As stated earlier, the measurement error can be reduced by replicate measurement. In addition, art historical facts support a 17th century dating of cat. no. 101 (Fig. 14).[80] The carpet is one of four examples; one of the three comparison pieces is a closer relative than the other two. The close relative is the Yomut *khali* from the collection of the Textile Museum, Washington, D.C. (cat. no. 102, Fig. 15). The other two *khali* are cat. no. 103, the example from the Tabibnia Collection, and the piece published by Goguel in 1927 (Fig. 64 in the chapter "The Yomut").[81] The *khali* of the Textile Museum (Fig. 15) is in many respects so similar to the early dated piece of the Concaro Collection (Fig. 14) that a dating to the 17th century seems a very reasonable assumption. Unfortunately the sample size provided of the Textile Museum piece (Fig. 15) was just enough for a single measurement, and an additional sample was not available. Although this single measurement resulted in a clear 17th century range, on its own it would not allow ignoring the other ranges obtained. The strong over all affinity to the Concaro piece (Fig. 14) adds a great deal of confidence to a 17th century dating of the *khali* of Textile Museum (Fig. 15) as well, in spite of the availability of only one measurement. Despite this, there is an interesting consensus when comparing the results of all these tests. One of the three tests of the Concaro piece (Fig. 14) with a radiocarbon age of 230 ± 40 shows much the same result as the single measurement of the *khali* of the Textile Museum (Fig. 15) with a radiocarbon age of 235 ± 45. An extremely similar result can be seen with another piece very closely related to the two carpets just discussed. One of three measurements of the early dated Qaradashlï *khali* with a single flower *alem* (cat. no. 84) also yielded a radiocarbon age of 240 ± 40.

This can be explained by the fact that we are dealing with pieces dating from the 17th century, and the resulting deviations in their radiocarbon dating results: when radiocarbon dating an object of the 17th century, some results to a greater extent can fall into the area of the minus range of the measurement error, while others can tend more to the plus range. Theoretically, a first measurement could therefore result in a 16th/17th century dating, while a second one indicates the 17th/18th century. There is nothing wrong about this, presupposing that both measurements are within the approved tolerance. A weighted mean would then with highest probability result in a 17th century dating (as shown by the *chuval gül* carpet Fig. 14 (cat. no. 101) with its three measurements). Therefore, the *chuval gül* carpet of the Textile Museum (Fig. 15) with all likelihood dates to the 17th century as well.

80 Cf. also the discussion of this group of rugs in the chapter "The Yomut" in Vol. 2.
81 The whereabouts of the Goguel piece is unknown.

3.2.2.2 *Khali* and *aq yüp* of the "Eagle" *gül* Group I

A second group of Turkmen weavings also probably dating to the 17th century is the carpets of the "Eagle" *gül* group I and the associated tent bands. This group of weavings probably originates from Astarabad in the frontier area between Turkmenistan and Iran, in the 17th century a part of Khorasan, a province of Safavid Persia. Members of this group are the *khali* cat. nos. 113, 158, and 159, as well as the *aq yüp* cat. nos. 110, 111, and 157. All six pieces have been radiocarbon dated, while only the two *aq yüp* cat. nos. 110 and 156 resulted in an unambiguous pre-1650 dating. Radiocarbon dating of the third band cat. no. 111 does indeed not exclude the 17th century, but by its statistical probability ranges is giving more weight to an 18th century date of production. The complexity of statistical probabilities has already been discussed relative to the example of a forgery from the 1930s. In that case as well, the range with the smallest statistical probability was the appropriate one,[82] as was proven by later dye analysis. The *aq yüp* cat no. 111 in every sense is so close to the two early dated examples to make it hard to accept that it is a considerably later piece. Like the early dated band cat. no. 110, cat no. 111 also contains tin as a "colour amplifier". As described in the chapter "Scarlet and Purple", the proof of tin demands a post-1610 dating.[83] The scarlet of the third band is also based on tin, which clearly dates it post-1610. The same applies to the early dated band cat. no. 110, which demands excluding the 16th century range. With great likelihood this can also be assumed for cat. no. 156, the second band with a 16th/17th century radiocarbon dating. The strong similarities regarding quality of both colour and design of

82 See Figs. 8 and 9, and section 3.1.3 Interpretaion of Results and Statistics.
83 The second early dated band cat. no. 156 also contains the same scarlet in the centre of the hooked motifs, but for technical reasons could not be checked for tin.

all these bands leads to the conclusion also to date cat. no. 111 to the 17th century.

The carpets with palmette ("Eagle") and *dyrnak* design (cat. nos. 113, 158, and 159), in all likelihood related to the tent bands just discussed, could also not unambiguously be assigned to the 17th century (like the tent band cat. no. 111), at least not with radiocarbon dating alone. However, it seems probable not only that the carpets are of similar age to the tent bands, but that they also share an origin from the same Astarabad workshop.[84]

The results of radiocarbon dating of these three carpets are further examples of datings to the "problematic" 17th century, comparable to the above discussed *chuval gül* carpet of the Textile Museum (cat. no. 102), where additional measurements would have brought more confidence, i.e. a clearer dating to the 17th century. With the dating of the "Eagle" *gül* carpet cat. no. 113, the situation is similar, but not quite as clear. In conclusion, this small group of so-called "Eagle" *gül* carpets as well as the related tent bands probably dates from the 17th century.

3.2.2.3 Additional Radiocarbon Datings

There are related issues with a number of other pieces, e.g. the well known multiple *gül* carpet of the Hecksher Collection (cat. no. 116). Although in this case we are dealing with a unique piece of presumably great age, a 17th century dating cannot be documented with certainty. However, in addition to radiocarbon dating there are other factors like the design and drawing, in particular that of the border, arguing for such a dating.

The same applies to the *torba* cat. no. 96, a piece most probably from the 17th century as well. Here too, some ambiguity remained due to the lack of comparable examples. The field design is nearly identical to the "Eagle"-*gül* group II *torba*. On the other hand, cat. no. 96 not only has a different border, but is also completely different in its structure. In contrast to the comparable "Eagle"-*gül* group II pieces, which have an asymmetrical knot open to the right, the *torba* cat. no. 96 is symmetrically knotted.[85]

84 For a discussion, see the chapter "The Eagle *gül* Groups" in Vol. 2.

85 For "Eagle" *gül* group II *torba,* see comparable pieces to cat. no. 96.

The Sarïq *khali* cat. no. 47 and the Ersarï *ensi* cat. no. 136 have similar issues in regard to their dating results. Both pieces could date from the 17th century.

Although many other pieces could be listed, the unusual Sarïq *aq yüp* cat. no. 38 will serve as a closing example. Based on a visual inspection, a 16th/17th century dating for this piece was at least a possibility. The band was first published in 1908. It shows not only an outstanding colour quality, but also an excellent and unusual drawing of the design. With a post-1650 result, radiocarbon dating then did not really support the high expectations. A later dye analysis of the scarlet showed Mexican cochineal dyed on tin mordant, suggesting a post-1610 dating. Proving tin has to a certain degree finally confirmed the result of radiocarbon dating. Thus the band can be dated to the second half of the 17th or the early 18th centuries. For stylistic reasons, a dating to the 19th century is hard to imagine.

3.2.3. Results Concerning the Period from 1650–1950

Not surprisingly, a large number of the 123 ^{14}C dated pieces fall into the period between 1650 and 1950, problematic to date with the radiocarbon method, as discussed earlier. The difficulties arising when calibrating radiocarbon dating results from this period have already been described in connection with the dating of Anatolian kilims.[86] In some cases, the age ranges established could not be narrowed by additional dating aids. An exception is the ranges in the 20th century. With only a couple of exceptions the weavings examined for this study all pre-date the 20th century. [87] I will come back to these exceptions later.

3.2.4. Results Excluding the 19th century

Concerning radiocarbon dating results between 1650 and 1950, the fluctuations in the calibration curve proved to be helpful, in that at least part of, or in some cases even the whole 19th century could be excluded. How this looks in practice is as follows. Between 1800 and 1950 the calibration curve has the shape of a wide "valley" with only

86 See Rageth 1999a: 25–26, A New Approach to dating Anatolian Kilims.

87 The exceptions are the early 20th century Qaradashlï *khali* cat. no. 86, and the Yomut *khali* cat. no. 159 with a Hebrew inscription and the inwoven date 1911.

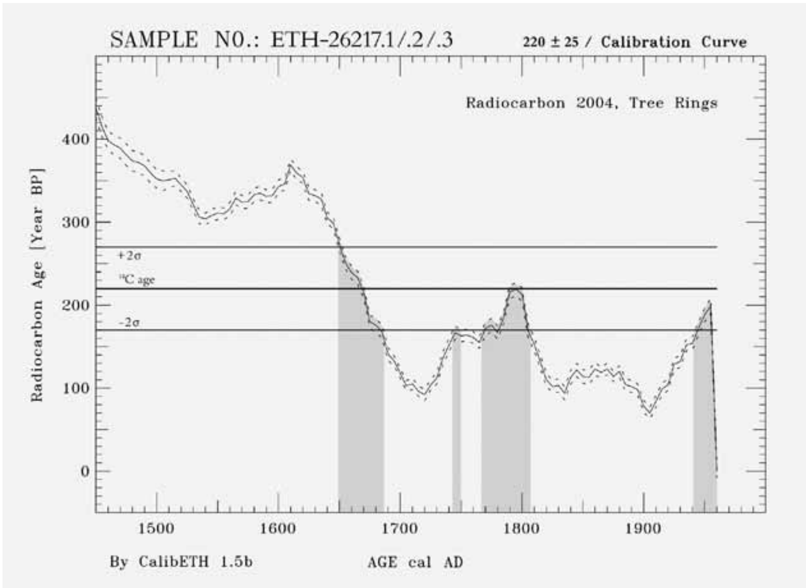


Fig. 17 (top): Graphical representation of the dating of the all pile *ak yüp* cat. no. 99, Fig. 18.

Fig. 18 (right): Detail of the all pile *ak yüp* cat no. 99.

minor peaks in the bottom of the valley (cf. Fig. 17). Falling steeply down from around 1800 to 1820, around 1950 the curve climbs again to a level comparable to that around 1800. This has, in certain instances, a positive side effect: when lying higher than the minor peaks of the valley bottom, the minus range of the measurement error is not affected by them (cf. Fig. 17). We then get a dating result ending between 1800 and 1820, with only a last possible age range in the 20th century. Following are two examples of this.

(1) The first example is the all pile Yomut tent band cat. no. 99. It shows two design sections with, for the Turkmen, unusual "naturalistically" drawn flower shrubs in the Mughal/Safavid flower style. These flower shrubs connect it directly to the already discussed group of 17th century *chuval gül* carpets with flower motives in their *alem* (Fig. 14 and 15).[88] The weighted mean of three measurements of this band resulted in a radiocarbon age of 220 ± 25 y BP, resulting in four possible calibrated age ranges. One of them with a statistical probability of 2.9% is too small to be considered seriously. A second falls into the 20th century and can therefore be ruled out by reasons explained at the beginning of this chapter. From the two remaining ranges, one is during the second half of the 17th century, and the other the second half of the 18th. An art historical analysis of the flower design in common with the group of *chuval gül* carpets suggests a dating to the earlier of the two available date ranges, i.e. to the second half of the 17th century. Considering the design's quality of drawing, and comparing it to the design of the early dated carpets (Fig. 14 and 15) and the corresponding designs in other later tent bands, the 17th century date seems a much more likely conclusion.[89]

(2) The second example is the Salor *torba* fragment cat. no. 10. With a radiocarbon age of 185 ± 30 y BP, five possible age ranges are the result of the calibration into a calendar age. For the same reasons as in the example just discussed, the 20th century range can be excluded. Two ranges are during the second half of the 19th century but with probabilities of 0.1% and 1.5%, too small to be considered seriously. There are also historical reasons speaking for a pre-1850 dating of

88 See section "3.2.2 ^{14}C Results Concerning The Problematic 17th Century".

89 For a discussion see the chapter "Flowering Gardens in the *alem* of Turkmen *khali*", figs. 87–92.

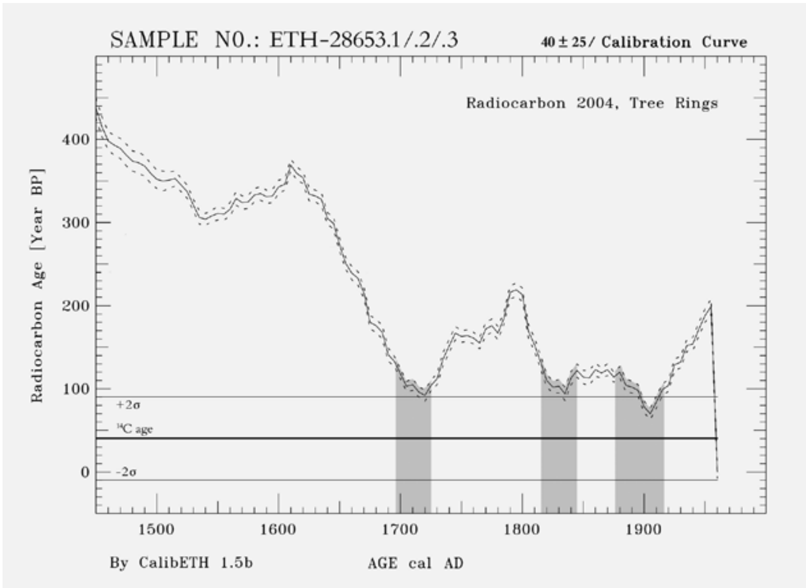


Fig. 19 (top): The dating range around 1900 can be excluded with certainty for this *ensi*, while the range in the first half of the 19th century, although not being completely impossible, given the outstanding quality of the *ensi* is still less likely than the one around 1700.

Fig. 20 (right): Detail of the Salor A Type *ensi* cat. no. 1.

this piece: in 1830 the Salor completely lost their sovereignty, having been defeated by the Persians, the Sarïq, and the Teke. Thus the piece may have been woven in the second half of the 17th or in the 18th century.[90]

3.2.5. Results With a Low Radiocarbon Age

In contrary to the results covering the period 1650–1950 with a relatively high radiocarbon age of 180 to 230 y BP, we also encounter obviously early pieces which show a rather low test result of 25 to 110 radiocarbon years BP. A glance on the calibration curve makes clear that objects made around 1700 exhibit the same result as objects made in the 19th century (as shown on Fig. 19). During these two periods, the content of radiocarbon in the atmosphere was equal, which is reflected in equivalent measurement results. 30 of the 123 examined pieces yielded such a result.[91] First, pieces will be discussed which without doubt do not date from the 19th century. Then we will look at examples with such results but which clearly are from the 19th century.

(1) An excellent example of the first is the Salor *ensi* cat. no. 1. Salor *ensi* Type A like this one are extremely rare. Only two comparison examples to cat. no. 1 are known. One of them is very close to our piece; the other one already differs in some respects, and might well be

90 For comparable dating results, see appendix IV, table 15, results with a radiocarbon age from 180 to 230 y BP.

91 See appendix IV, table 15, results with a radiocarbon age of 25 to 110 y BP.

somewhat younger.[92] Radiocarbon dating of the *ensi* cat. no. 1 yielded four possible age ranges (a fifth with 0.2% is too small to be considered), calibrated from a weighted mean of 40 ± 25 y BP from three independent measurements. The latest range in the 20th century can be excluded without objection (this range is not shown on the graph Fig. 19). The next range covers the last quarter of the 19th and the beginning of the 20th century; this one also can be excluded with certainty. The next one, only very short, covers the period of defeat of the Salor by the Persian Qajars in 1830 this range is rather implausible as well. The remaining range, the first quarter of the 18th century, certainly seems the most appropriate. The supporting argument could be made that, based on its quality of design and the clear differences in quality between it and the younger comparison piece, it could date from the time when the Salor were still an independent tribe, thus before 1830.[93]

(2) Another *ensi* (cat. no. 37) with a low radiocarbon age, this time an example of the Sarïq, is our second example. The *ensi* is of such high quality to be considered without doubt one of the best of its kind.[94] The only "fault" is the missing left side border. Otherwise this piece manifests all one could hope for in an early Sarïq *ensi*.[95] Here again we would expect the piece to pre-date the 19th century. The weighted mean of two tests yielded a radiocarbon age of 105 ± 30 y BP, corresponding precisely to the lowest point of the calibration curve around 1700 (cf. calibration curve Fig. 19). In this case, four age ranges emerged, though two are of such low probability to be discounted. One of them actually concerns the 20th century and can be eliminated on that basis. Of the two ranges under consideration, one covers the entire 19th century, the other the period from 1679 – 1740. We can assume with all likelihood that this is not a 19th century piece, not even from the early 19th century, but rather from around 1700, or the early 18th century.

92 For the first piece, see Hali 60, 1990: 88; for the second, somewhat younger piece, see Eiland 2003: 168, Fig. 1. An additional late example turned up in 2011 in the United States at Grogan. This third piece already differs considerably from the two older examples. For a discussion, see Vol. 2, cat. no. 1, in the chapter "The Salor".

93 For a discussion of the *ensi* cat. no. 1 see Vol. 2, chapter "The Salor".

94 See comparison pieces to cat. no. 37.

95 For a discussion of the *ensi* cat. no. 37 see Vol. 2, chapter "The Sarïq".

(3) This may also apply to the Sarïq *khali* cat. no. 47. It would be hard to imagine a 19th century dating for this carpet, particularly comparing it with the pre-1650 dated example cat. no. 46. An early 18th century dating certainly seems more likely for this carpet.

(4) The Qaradashlï *torba* cat. no. 80 is another interesting piece with such a dating. Especially the comparison with the *chuval* fragment cat. no. 82 is telling. This fragment clearly pre-dated the 19th century. There are convincing arguments against the idea that the *torba* cat. no. 80 is considerably younger. Both pieces speak too much the same language to differ significantly in age.

(5) The Qaradashlï *chuval* cat. no. 156 is also closely related to the two pieces just discussed. What has been said of them is just as true of this piece with its unusual 3 x 4 arrangement of *chuval gül* in the field.

In regard to a number of pieces listed at the beginning of this section, it can not be stated with certainty whether they were made at the beginning of the 19th century or more than a hundred years earlier. Examples are the two Salor *chuval* cat. no. 12 and 132. In comparison with the two obviously later Salor *chuval* cat. No. 133 and 134, they still represent what could be considered "classic" Salor tradition. Cat. nos. 133 and 134, in contrast, seem to represent a development of the 19th century during the time or after the defeat of the Salor.

(6) To show once more how accurate radiocarbon dating results can be, let us take a closer look at another dating result, where, with the help of additional dating aids, radiocarbon dating has been confirmed perfectly. In the Salor hanging, cat. no. 7 (Fig. 21), synthetic dyestuffs of the Ponceau group have been proved, providing a *terminus post quem* for its dating, namely 1880, the date of the appearance of the Ponceau dyestuffs on the international markets. As already mentioned in the chapter "Scarlet and Purple", Ponceau dyestuffs were not used for a long time among the Turkmen. They were soon replaced by newer synthetic dyestuffs, which in later years were used more and more commonly. Therefore Turkmen pieces containing a Ponceau dyestuff can not pre-date 1880 and with all likelihood are not much later than 1900. The Salor hanging cat. No. 7 is a good case in point. Containing

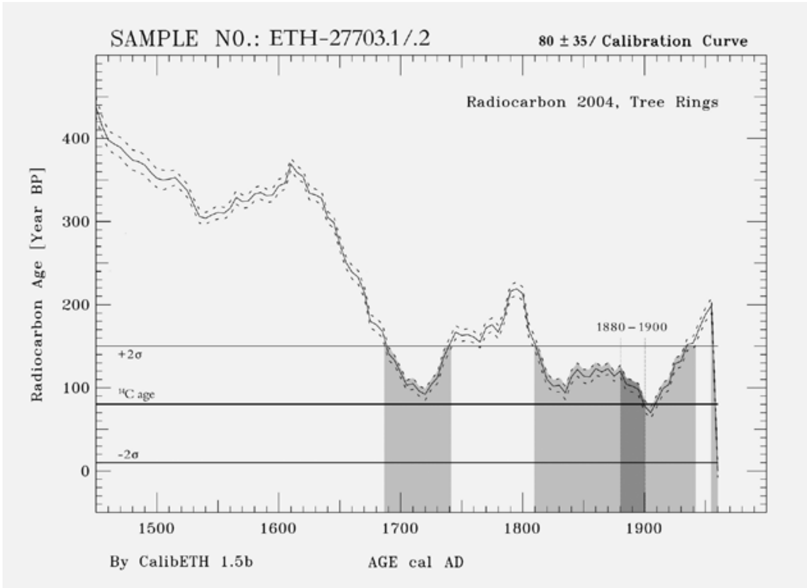


Fig. 21 (right): Graphical representation of the dating of the hanging cat no. 7, Fig. 21. Amazingly the radiocarbon dating with its radiocarbon age of 80 intersects the calibration curve quite precisely around 1900, once more demonstrating the accuracy of the ^{14}C method. This measurement can really be considered a direct hit (for more details, see appendix IV, table 15, Ra 280).

Fig. 22: Salor hanging cat. no. 7. This hanging contains the synthetic dyestuff Ponceau RR, discovered in 1878, and can therefore hardly be dated pre-1880. Beyond 1900 the synthetic dyestuffs of the Ponceau group have hardly been used, which effectively amounts to a *terminus post quem* for this piece. A nearly identical piece in perfect condition was acquired in Central Asia by A.A. Bogolyubov between 1899 and 1901, now belonging to the collection of the Museum for Ethnography in St. Petersburg (Tzareva 1984: No. 12).

two dyestuffs of the Ponceau group, it clearly post-dates 1880. A close relative to cat no. 7 provides a possible *terminus ante quem*: the Salor hanging acquired by Bogolyubov between 1899 and 1901, now in the collection of the Ethnographic Museum in St. Petersburg. Bogolyubov, in his 1908 folio volume, published the piece with a black and white illustration as Teke work, while Thompson in his 1973 translation suggested a Salor attribution.[96] In 1984, Tzareva published the piece in colour and listed an asymmetrical knot open left, and synthetic dyes.[97] If Tzareva is right concerning the synthetic dyestuffs, which with all likelihood must come from the Ponceau group, the Bogolyubov piece can be dated to a relatively short period between 1880 and 1900. This on the other hand allows a similar dating for the hanging cat. no. 7. Calibration of the radiocarbon dating of cat. no. 7 with a radiocarbon age of 80 ± 35 y BP yielded three possible age ranges. Because of the presence of synthetic dyestuffs the 17th/18th century range can be excluded. The type of synthetic dyestuff (Ponceau) excludes the 20th century range, which is even very unlikely with a statistical probability of only 1.3%. What remains is the range between 1813 and 1932. Coming back to the dating of the Bogolyubov piece and assuming that our piece dates from the same period, two facts can be asserted: On the one hand the range between 1880 and 1900 is perfectly embedded in the range between 1813 and 1932 obtained by radiocarbon dating, and on the other hand the achieved radiocarbon age of 80 ± 35 y BP intersects the calibration curve in a last droop (downward peak) around 1900, clearly shown by the graph of the dating on Fig. 22. Here we got an almost perfect radiocarbon dating result.[98]

96 Bogolyubov 1908/09 (1973): No. 38. Thompson comments literally: „I have little doubt that it belongs to the S-Group“, meaning the Salor.

97 Tzareva 1984: 38, no. 12.

98 A comparable perfect result yielded the radiocarbon dating of a small Anatolian pile carpet with an in-woven date of 1812/13. For a picture, see Rageth 1999: 148, and p. 27 for a graphic representation of the radiocarbon dating.

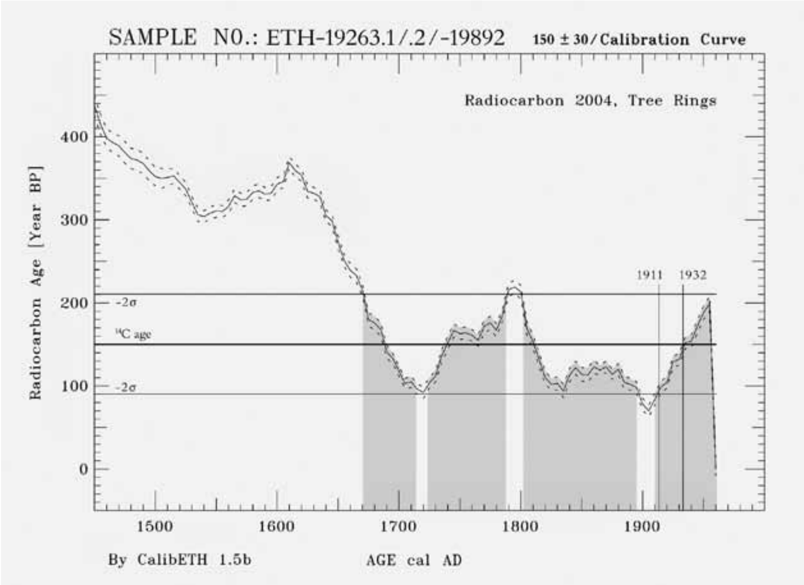
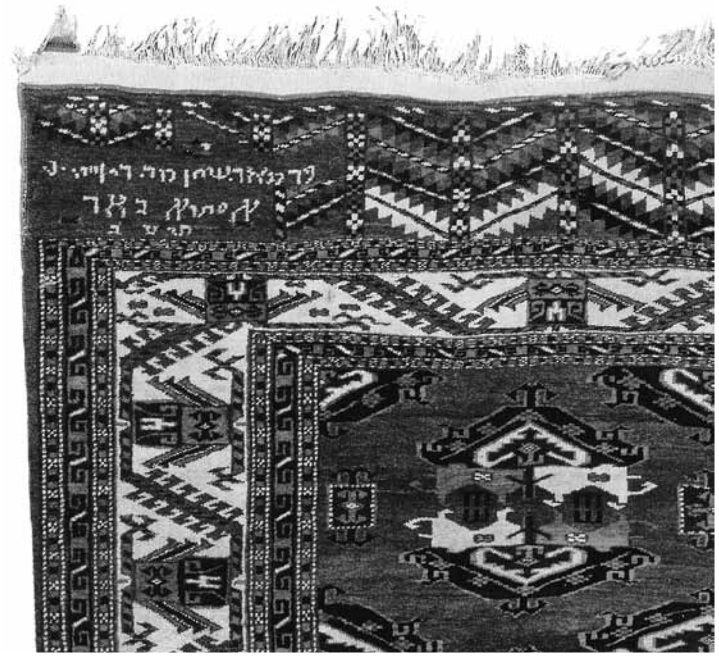


Fig. 23 (left): Graphical representation of the dating of the *khali* cat no. 157, Fig. 24, with the in-woven date of 1911 or 1931.

Fig. 24: *Khali* cat. no. 157 with in-woven Hebrew date and inscription. For the reason of an imprecise notation (caused by the knotting technique) the in-woven date can be read as both 1911 and 1931. However, both dates correspond to the latest of the calibrated age ranges of radiocarbon dating. 1931 even corresponds with an intersection of the measurement value through the calibration curve.



3.2.6 Results Obtained from 20th Century Pieces

A last, even though small, group of radiocarbon dating results concerning the period between 1650 and 1950 consists of two 20th century pieces. We will have a short look at the results from these pieces.

(1) One of the two pieces (cat. no. 159, Fig. 24) has a Hebrew date and inscription. A first effort to decipher the Hebrew date resulted in AD 1660.[99] This alleged early date led to the radiocarbon dating of the piece. Three independent tests were done, none of them reaching 1660.[100] This inconsistency led to a re-reading of both date and inscription. The independently accomplished new readings then came to the same result: 1911 or 1931.[101] 1931 resulted as an option due to the problematic legibility of one of the in-woven Hebrew letters.[102] This newly established date, namely 1911 (or 1931), now corresponds to the result of radiocarbon dating, which, with a radiocarbon age of 150±30 y BP (weighted mean of three tests) resulted in a 20th century probability range, going from 1911 to 1950. This is yet another example of a radiocarbon dating result with the range showing the lowest statistical probability being the most likely, as in the case of the forgery described earlier, reminding us once again how careful we need to be when dealing with statistical probabilities.[103]

(2) The second piece, also dating with all likelihood from the 20th century, is the relatively small *chuval gül* carpet cat. no. 86 (Fig. 5). This carpet has already been referred to in the context of visual age determination. It represents the newest example of a series of three comparison pieces with the same field design, the oldest piece being from the first half of the 17th century (Fig. 3, cat. No. 84). Regarding the small carpet cat. no. 86, a 20th century date of origin was not

99 See Hali 104, 1999: 83.
100 For the results of these three tests, see appendix I, cat. no. 159, and appendix IV, table 15.
101 I have to thank Dr. Albert Gabbai from Geneva, Switzerland, and Prof. Zvi Koren from the Shenkar College in Ramat-gan, Israel, for the second and third readings.
102 For a detailed discussion of this piece, see Vol. 2, chapter "The Eagle *gül* Groups", cat. no. 159.

103 See Figs. 8 and 9.

considered at first. We originally granted a somewhat higher age to the piece, favouring a late 19th century attribution. But with an increasing number of measurements, the result of radiocarbon dating concerned us more and more. The 19th century dating range was literally melting away, remaining with a 1.3% probability, resulting from a radiocarbon age of 175 ± 25 y BP, the weighted mean of three measurements. The probability of this range is a problem, being too small to be considered seriously, and a pre-1813 dating would completely contradict all our experience. At the end we had to accept that the piece probably was woven in the 20th century. But, as we later came to acknowledge, such a late dating of this piece is by no means impossible. This is confirmed by radiocarbon dating results obtained from other 20th century pieces. Examples for this are the above-mentioned fake (Fig. 9) with a radiocarbon age of 210 ± 30 y BP, as well as another fake of an Anatolian dragon and phoenix rug with synthetic dyes throughout, and a radiocarbon age of 90 ± 20 y BP.[104]

3.2.7 "Problematic" Radiocarbon Dating Results

This is a complicated subject, as, concerning the radiocarbon dating results discussed in this section, it is not really clear whether the problem is with the ^{14}C method, or with our own assessment of the corresponding objects and their historical environment and background. The future will possibly bring more clarity regarding such dating results.

(1) The late Qaradashlï carpet discussed above initially seemed to belong to this group, but the problems regarding the dating of this carpet have been solved, as over time we were able to accept a 20th century date for this piece.

(2) Things are a little bit less clear with the Arabachi *ensi* cat. no. 124. Here, the results of radiocarbon dating and dye analysis are somewhat contradictory. The *ensi* has been considered an 18th century piece by several authors since 1922.[105] Is this really an early piece, or did one author just follow the other's estimated dating? Excluding the 19th century to a large extent, radiocarbon dating also seems to confirm an early dating.[106] It would have been easy to go on following an 18th century dating, ignoring any conflicting results of other scientific analyses. What exactly are these possible contradictions? First, a large amount of 2Z wool dyed with Mexican cochineal has been chemically proven in this *ensi*. However, pieces pre-dating 1800 generally show only small to very small amounts of insect dyed wool, always 4Z, or 6Z.[107] Furthermore, in all the pre-1800 pieces examined for tin this mordant was chemically proven to intensify and brighten the hues dyed with either Mexican cochineal or lac dye.[108] In two pieces we found both insect dye with tin mordant and insect dye without tin. While a small amount of 4Z wool is dyed with Mexican cochineal on tin mordant, a much larger amount of only 2Z wool is dyed with the same dyestuff, but on a mordant other than tin.[109] Both pieces almost certainly date from the mid 19th century, which therefore with all likelihood can be considered the transition period from the use of tin. Things are much the same with the Arabachi *ensi* cat. no. 124. This *ensi* also contains a considerable amount of cochineal dyed 2Z wool – actually too much for an early piece – without tin mordant.[110] In our experience, these facts argue against a pre-1800 dating. Of all published Arabachi *ensi* with this design, cat. no. 124 is arguably the single most beautiful example. There is an unpublished comparison piece from the McCoy Jones Collection in the de Young Museum in San Francisco, which was shown there on the occasion of an exhibition on Turkmen carpets in 2008.[111] Interestingly, the curators of that exhibition dated their *ensi* to the 19th century, despite all the strong similarities to the piece discussed here, which was certainly known to them at least from the literature. Much speaks in favour of the two pieces being of similar age.

104 Published in Rageth 2004: 109, Fig. 5.

105 Grote-Hasenbalg 1922: No. 92; Schürmann 1969: No. 26; Andrews et al. 1993: No. 90.

106 For such radiocarbon dating results, see section "3.2.4 Radiocarbon Dating Results Excluding the 19th Century".

107 Examples for this are cat. nos. 22, 35, 37, 52, 76, 77, 108, 109, 114, 117, 119, and 127.

108 See chapter "Scarlet and Purple", section "3.6 Insect Dyes and Tin Mordant".

109 The Sarïq *aq yüp* fragment Fig. 5 in chapter "Scarlet and Purple", and the Teke *chuval* cat. no. 61.

110 For the result of the SEM element analysis, see appendix III, table 11.

111 For Tent and Trade: Masterpieces of Turkmen Weaving, December 2007 – April 2008. Report in Hali 155, 2008: 119, though without a picture of the *ensi*.

(3) A second case which caused us some concern regarding its radiocarbon dating is the Ersarï *khali* cat. no. 139. Basically this piece with its radiocarbon age of 235 ± 40 y BP belongs to the group described under section "3.2.4. Radiocarbon Dating Results Excluding the 19th century". However, current "prevailing wisdom" would not consider this piece a candidate for a pre-1800 dating. Radiocarbon dating, on the other hand, indicates a 17th/18th century dating, no later than 1800.[112] For the moment it has to be left open whether this is a less attractive but nevertheless early example from around 1800, or radiocarbon dating yielded an inaccurate result due to contamination.

Next, we will have a short glance at a few examples where an early result could not be confirmed by re-testing, probably because of sample contamination of the first test.

3.2.8 Unconfirmed Re-Testing Results

With six of the 123 examined weavings, a second test did not confirm the first measurement.[113] In these cases, the results of additional measurements did not lie within the permissible ± 2 Sigma tolerance error. In all cases a third,[114] sometimes even a fourth and a fifth measurement[115] was conducted. Though it was known, from the experience in dating Anatolian kilims,[116] that unconfirmed first measurements can occur, such corrections sometimes were a disappointment.

(1) The first such example is the outstanding Salor *chuval*, cat. no. 13. The first measurement resulted in a radiocarbon age of 325 ± 55 y BP. This was an unambiguous pre-1650 dating. The calibrated calendar age range lies between 1451 and 1664. A second measurement resulted in a radiocarbon age of 220 ± 50 y BP. This second result, although considerably lower, is still lying within the permissible ± 2 Sigma tolerance error. Calibrating the weighted mean of these two measurements still yielded a 16th/17th century dating with the highest probability (1485 – 1684 [74.6%]), though already with two additional possible post-1650 age ranges, a first in the 18th (1742 – 1808 [18%]), and a second in the 20th century.[117] For the sake of clarity, the piece was tested a third and a fourth time. But, both the third and the fourth measurement resulted in an even lower radiocarbon age than the second.[118] Nevertheless, the results of these four tests still allowed the calculation of a weighted mean, but which with 210 ± 30 y BP clearly resulted in a post-1650 calibrated calendar age. The early dating to between 1450 and 1650 could not be confirmed.

The lac dyed wool in this *chuval*, however, does not contain tin, while all other examined lac samples from Salor pieces dating from ca. 1650 – 1850 contained tin as a mordant.[119] This at least allows the possibility of a pre 1610 dating. Admittedly it must be noted that examining a higher number of lac dyed samples from Salor pieces would increase the validity of this supposition. However, the Salor *chuval* cat. no. 13 is free of tin and of such outstanding quality that considering a 17th century dating is still appropriate.

Regarding radiocarbon dating, at least the first two tests of the larger fragment (a) would not contradict such a hypothesis. The reason why the two subsequent measurements of fragment (b) resulted in a post-1650 dating can possibly be explained by section "3.2.2 Results Concerning The Problematic 17th Century", i.e. this piece could still date from the 17th century with all its corresponding radiocarbon dating challenges.[120]

(2) All was somewhat less complicated with the Teke *khali* cat. no. 71. There, a third measurement did confirm the early date. The second result, lying outside the ± 2 sigma range in relation to the first measurement, was too divergent to be included in the weighted mean.[121]

(3) As a final example we will look at the dating result of the *aq yüp* cat. no. 154. A first measurement resulted in a radiocarbon age of 410 ±

112 Due to the small size of the sample, a second test of this piece was not possible.
113 Cat. nos. 13, 71, 74, (98), 137, 151, and 154. See appendix IV, table 15, radiocarbon ages in squared brackets [].
114 For the Teke *khali* cat. no. 151 the sample size was too small for a third measurement.
115 E.g. on the *aq yüp* cat. no. 154.
116 Rageth 1999.

117 Both measurements were carried out from the larger of the two fragments (a) (sample numbers Ti 1, and Ti 1A).
118 The third and fourth tests were conducted on the smaller corner fragment (b), as the larger fragment (a) was temporarily not available for sampling.
119 C.f. appendix III, table 13.
120 Another possibility could have been a previous cleaning of the smaller corner fragment (a), causing such a contamination that could not have been completely eliminated despite the extremely strong cleaning procedure during the sample preparation for radiocarbon dating.
121 For radiocarbon dating details, see appendix IV, table 15, cat. no. 71.

50 y BP. With such a radiocarbon age, a statistical probability even for the 15th century seemed possible. Few other pieces ended up with a radiocarbon age this high.[122] It was disappointing when this first result was left unconfirmed. In all, four additional independent tests were done, but none of them confirmed the first measurement. All were clearly outside the ± 2 sigma confidence limit of the measurement error of the first dating. The reasons for this discrepancy remain unclear. The only explanation could be a contamination problem – caused by a previous cleaning procedure of the piece – only perceivable in the first tested sample.

4. Summary

With only a few exceptions, the dating of Turkmen weavings until 1997 was based on visual estimation relying on experience alone. Only some specific indications such as the proof of synthetic dyestuffs or inwoven/knotted dates facilitated the dating. However, such dating aids only pertain to the second half of the 19th century. By comparison and experience it was, at best, possible to date a piece with all probability pre-1850. How much older was unclear, entering the territory of speculation.

Since the introduction of radiocarbon dating to the field of Turkmen carpets in 1997, this situation has changed significantly. For the study presented here, 123 Turkmen weavings were examined by means of radiocarbon dating. Eighteen of these 123 pieces have been reliably dated to the 16th and 17th centuries. Therewith, not only have new standards been applied, but these new results went beyond the scope of all previous age estimations. With additional dating aids such as the special use of exotic dyestuffs like Mexican cochineal, or special dyeing methods like the use of tin mordant to obtain brighter hues, the often wide calibrated age ranges obtained by radiocarbon dating can be narrowed by up to half. Mexican cochineal most probably was not available in Central Asia before 1550, thus proof of this dyestuff in a Turkmen weaving with a calibrated age range between 1450 and 1650 obtained by radiocarbon dating allows reducing this range by about fifty percent to between 1550 and 1650.[123] A second limitation can be the proof of tin as a mordant. Tin to brighten red hues was discovered (re-discovered?) only in 1610 by the Dutchman Cornelius Drebbel. Thus, the proof of tin in piece with a pre-1650 radiocarbon dating provides a terminus post quem of ca. 1610.[124] In connection with suspected forgeries the proof of synthetic dyes can be the answer to this problem, as was the case with the example on fig. 8. Radiocarbon dating alone did not provide an unambiguous result. The additional aid of dye analysis was required.

122 E.g. cat. no. 102, there even with a somewhat smaller measurement error of ± 40.

123 See chapter "The Salor" with the Salor *khali* cat. no. 16 radiocarbon dated to between 1450 and 1650, and Mexican cochineal proven in small amounts.

124 See chapter "Scarlet and Purple" section "3.6 Insect Dyes on Tin Mordant".

Appendix IV: Tables 15 – 16
AMS Radiocarbon Dating Results

Ordered by ^{14}C age

Georges Bonani
Laboratory for Ion Beam Physics, Radiocarbon Dating, ETH Zurich

The calibrated (dendrocorrected) ages are 2σ ranges (95.4% confidence limit) and are calculated using the programs CalibETH and IntCal04 (Radiocarbon Vol. 46, No. 3, 2004: 1029 – 1058). Due to the shape of the calibration curve in the region of interest, several true age ranges are possible. [Results in brackets have not been used for weighted mean]

Table 15: Turkmen Weavings

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	δ^{13}C	Calib. age ranges 95.4%
Teke *torba* Cat. no. 56	Ra 719 ETH-17366.1/.2	Georges Bonani ETH Zurich, 28 May 1997	385 ± 50 / 370 ± 50	375 ± 35 y BP	-14.1 ± 1.0	AD 1449 – 1535 (57.9%) AD 1552 – 1640 (42.1%)
Qaradashlï *torba* Cat. no. 79	Ra 277 ETH-27368.1/.2	Jürg Rageth Hamburg, 25 May 2003	365 ± 40 / 365 ± 40	365 ± 30 y BP	-19.5 ± 1.0	AD 1453 – 1535 (53.8%) AD 1552 – 1640 (46.2%)
Yomut *khali* Cat. no. 106	Ra 242 ETH-25310.1/.2	Jürg Rageth Riehen, 18 January 2002	410 ± 40 / 320 ± 40	365 ± 45 y BP	-15.2 ± 1.0	AD 1452 – 1642 (100.0%)
"P-Chowdur" group *ak yüp* all pile Cat. no. 118	Ra 668 ETH-17361.1/.2/.3	Georges Bonani ETH Zurich, 28 May 1997	315 ± 50 / 285 ± 45 / 330 ± 45	310 ± 25 y BP	-24.0 ± 1.0	AD 1497 – 1607 (76.6%) AD 1618 – 1652 (23.4%)
Qaradashlï *khali* Cat. no. 84	Ra 721 ETH-17362.1/.2/3.	Georges Bonani ETH Zurich, 28 May 1997	350 ± 50 / 340 ± 45 / 240 ± 50	310 ± 35 y BP	-15.6 ± 1.0	AD 1482 – 1657 (100.0%)
Ersarï *khali* Cat. no. 31	Ra 253 ETH-26223.1/.2	David Reuben London, September 2002	350 ± 40 / 270 ± 40	310 ± 40 y BP	-16.2 ± 1.0	AD 1477 – 1659 (100.0%)
Sarïq *khali* Cat. no. 46	Ra 276 ETH-27367.1/.2	Collector Graz, May 2003	290 ± 40 / 295 ± 40	295 ± 30 y BP	-18.8 ± 1.0	AD 1497 – 1607 (70.2%) AD 1618 – 1663 (29.8%)
Arabachi *khali* Cat. no. 127	Ra 251B ETH-26221.1/.2	Jürg Rageth Riehen, 11 September 2003	305 ± 40 / 285 ± 45	295 ± 30 y BP	-15.4 ± 1.0	AD 1497 – 1607 (70.2%) AD 1618 – 1663 (29.8%)
Salor *khali* Cat. no. 16	Ra 214 ETH-22407.1/.2	Jürg Rageth San Francisco, 3 April 2000	305 ± 40 / 275 ± 45	290 ± 30 y BP	-15.5 ± 1.0	AD 1497 – 1607 (67.1%) AD 1618 – 1667 (32.9%)
Yomut *khali* Cat. no. 105	Ra 212 ETH-22405.1/.2	Jürg Rageth San Francisco, 3 April 2000	295 ± 40 / 290 ± 45	290 ± 30 y BP	-19.5 ± 1.0	AD 1493 – 1600 (66.6%) AD 1615 – 1660 (33.4%)
Teke *germech* Cat. no. 51	Ra 718 ETH-18900.1/.2	Peter Hoffmeister Dörfles Esbach, 2 May 1998	300 ± 55 / 280 ± 50	290 ± 35 y BP	-20.7 ± 1.0	AD 1492 – 1611 (67.1%) AD 1613 – 1670 (32.7%) AD 1792 – 1792 (0.1%)
Yomut *khali* Cat. no. 107	Ra 248 ETH-26218.1/.2	Jürg Rageth Munich, 14 September 2002	245 ± 40 / 325 ± 40	285 ± 40 y BP	-17.2 ± 1.0	AD 1487 – 1672 (97.1%) AD 1788 – 1801 (2.9%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Teke *khali* Cat. no. 73	Ra 256 ETH-26226.1/.2	David Reuben London, September 2002	295 ± 40/260 ± 40	280 ± 30 y BP	-17.6 ± 1.0	AD 1502–1509 (1.1%) AD 1517–1605 (56.3%) AD 1620–1671 (40.5%) AD 1789–1799 (2.1%)
Qaradashlï *khali* Cat. no. 89	Ra 722 ETH-19040.1/.2	Hans Christian Sienknecht Hamburg, July 1998	275 ± 50/295 ± 55	280 ± 35 y BP	-23.4 ± 1.0	AD 1495–1608 (59.2%) AD 1617–1672 (37.5%) AD 1788–1801 (3.2%)
Teke *khali* Cat. no. 71	Ra 720 ETH-25573.1/.2/3.	Collector New York, 1998	295 ± 40/[125 ± 40]/255 ± 40	275 ± 30 y BP	-17.7 ± 1.0	AD 1502–1508 (0.8%) AD 1517–1605 (50.7%) AD 1620–1673 (44.7%) AD 1787–1802 (3.9%)
"Eagle" *gül* group I or III *ak yüp* Cat. no. 110	Ra 264 ETH-27155.1/.2/-32562.1	Jürg Rageth Riehen, 28 March 2003	260 ± 40/325 ± 40/230 ± 40	270 ± 30 y BP	-11.4 ± 1.0	AD 1520–1602 (44.4%) AD 1622–1674 (49.5%) AD 1786–1803 (6.1%)
"Eagle" *gül* group I or III *ak yüp* Cat. no. 157	Ra 736 ETH-17365.1/.2	Georges Bonani ETH Zurich, 28 May 1997	280 ± 50/265 ± 45	270 ± 35 y BP	-21.4 ± 1.0	AD 1497–1607 (48.4%) AD 1618–1676 (43.4%) AD 1784–1805 (7.3%) AD 1949–1955 (0.8%)
Yomut *khali* Cat. no. 101	Ra 201A/B ETH-21736.1/.2	Jürg Rageth Milan, 26 September 1999	280 ± 40/275 ± 45/230 ± 40	260 ± 25 y BP	-19.3 ± 1.0	AD 1528–1576 (20.6%) AD 1633–1675 (68.1%) AD 1785–1804 (11.2%) AD 1952–1952 (0.1%)
Kizil Ayak *khali* Cat. no. 36	Ra 462 ETH-27707.1/.2	Jürg Rageth Hamburg, 12 August 2003	270 ± 40/250 ± 40	260 ± 30 y BP	-18.3 ± 1.0	AD 1522–1600 (29.4%) AD 1623–1677 (56.3%) AD 1782–1806 (12.7%) AD 1947–1957 (1.6%)
Sarïq *khali* Cat. no. 48	Ra 257 ETH-26227.1/.2	David Reuben London, September 2002	250 ± 40/255 ± 40	255 ± 30 y BP	-13,7 ± 1.0	AD 1525–1595 (22.1%) AD 1627–1679 (58.7%) AD 1782–1806 (16.8%) AD 1946–1957 (2.5%)
Turkmen *torba* Cat. no. 96	Ra 218 ETH-22411.1/.2	Jürg Rageth San Francisco, 3 April 2000	260 ± 45/240 ± 45	250 ± 30 y BP	-22.0 ± 1.0	AD 1527–1580 (14.9%) AD 1632–1684 (59.0%) AD 1770–1807 (22.2%) AD 1943–1959 (3.9%)
Ersarï *ensi* Cat. no. 136	Ra 730 ETH-17875. OxA-5338	Jürg Rageth ETH Zurich, 6 November 1997	235 ± 55/265 ± 50	250 ± 35 y BP	-21.3 ± 1.2	AD 1523–1598 (21.3%) AD 1625–1686 (50.6%) AD 1744–1757 (1.4%) AD 1767–1807 (21.8%) AD 1942–1959 (4.8%)
Turkmen *khali* Cat. no. 113	Ra 210 ETH-16763.1/.2/-22403.1	Jürg Rageth San Francisco, 3 April 2000	270 ± 45/260 ± 50/210 ± 40	245 ± 25 y BP	-20.8 ± 1.0	AD 1533–1557 (4.3%) AD 1638–1678 (66.9%) AD 1782–1806 (25.5%) AD 1946–1958 (3.3%)
Yomut *khali* Cat. no. 156	Ra 745A ETH-53248	Hans Christian Sienknecht Hamburg, 22 October 2013	246 ± 30	246 ± 30 y BP	-16.9 ± 1.0	AD 1520–1570 (9.6%) AD 1630–1680 (51.6%) AD 1760–1810 (23.6%) AD 1930 (10.6%)
Qaradashlï *khali* Cat. no. 85	Ra 249 ETH-26219.1/.2	Jürg Rageth Riehen, 12 September 2002	245 ± 40/240 ± 40	245 ± 30 y BP	-18.3 ± 1.0	AD 1528–1576 (10.0%) AD 1633–1686 (57.6%) AD 1745–1752 (0.6%) AD 1767–1807 (26.6%) AD 1942–1960 (5.2%)

Object **Cat. no.**	**Sample no.** **Lab. no.**	**Sample collected by**	**^{14}C age**	**Weighted mean**	**δ^{13}C**	**Calib. age ranges 95.4%**
Turkmen *ak yüp* Cat. no. 164	Ra 491 ETH-17360/-25589	Georges Bonani ETH Zurich, 28 May 1997	220 ± 50/245 ± 40	235 ± 30 y BP	-22.2 ± 1.0	AD 1534–1552 (2.6%) AD 1639–1687 (51.6%) AD 1742–1761 (2.8%) AD 1763–1809 (34.8%) AD 1940–1960 (8.2%)
"P-Chowdur" group *khali* Cat. no. 121	Ra 236 ETH-25304.1/.2	Jürg Rageth Riehen, 20 January 2002	265 ± 40/205 ± 40	235 ± 35 y BP	-17.8 ± 1.0	AD 1528–1565 (6.5%) AD 1634–1691 (46.0%) AD 1738–1812 (38.0%) AD 1934–1960 (9.5%)
Ersarï *khali* Cat. no. 139	Ra 243 (362-13) ETH-25311	Elena Tsareva St. Petersburg, 25 January 2002	235 ± 40	235 ± 40 y BP	-14.5± 1.1	AD 1525–1582 (10.5%) AD 1587–1594 (0.6%) AD 1627–1693 (41.4%) AD 1735–1815 (37.4%) AD 1930–1960 (10.1%)
Yomut *khali* Cat. no. 102	Ra 225 ETH-23311	Curator, Textile Museum Washington DC, October 2000	235 ± 45	235 ± 45 y BP	-17,2 ± 1.1	AD 1517–1605 (15.1%) AD 1620–1699 (37.9%) AD 1731–1818 (36.2%) AD 1924–1961 (10.8%)
Yomut *khali* Cat. no. 108	Ra 211 ETH-22404.1/.2	Jürg Rageth San Francisco, 3 April 2000	225 ± 40/235 ± 45	230 ± 30 y BP	-18.2 ± 1.0	AD 1642–1688 (48.1%) AD 1741–1809 (42.1%) AD 1939–1960 (9.8%)
Turkmen *torba* Cat. no. 165	Ra 208A ETH-22401.1/.2	Peter Hoffmeister Dörfles Esbach, 17 April 2000	250 ± 40/210 ± 40	230 ± 30 y BP	-22.2 ± 1.0	AD 1642–1688 (48.1%) AD 1741–1809 (42.1%) AD 1939–1960 (9.8%)
Sarïq *khali* Cat. no. 49	Ra 255 ETH-26225.1/.2	David Reuben London, September 2002	215 ± 40/235 ± 40	225 ± 30 y BP	-10.7 ± 1.0	AD 1645–1687 (43.7%) AD 1742–1809 (45.4%) AD 1940–1959 (11.0%)
'Eagle' *gül* group I *khali* Cat. no. 158	Ra 665 ETH-19254.1/.2	Jürg Rageth Dörfles Esbach, 13 August 1998	180 ± 50/260 ± 40	225 ± 40 y BP	-23.2 ± 1.0	AD 1527–1577 (5.5%) AD 1633–1699 (37.4%) AD 1732–1818 (44.0%) AD 1924–1961 (13.0%)
Yomut *ak yüp* Cat. no. 99	Ra 247 ETH-26217.1/.2/.3	Jürg Rageth Bad Leonfelden, 15 August 2002	250 ± 40/170 ± 40/245 ± 45	220 ± 25 y BP	-19.6 ± 1.0	AD 1648–1686 (42.1%) AD 1744–1757 (2.9%) AD 1767–1808 (43.6%) AD 1942–1959 (11.4%)
Yomut *khali* Cat. no. 104	Ra 250 ETH-26220.1/.2	Jürg Rageth Riehen, 12 September 2002	225 ± 40/220 ± 40	220 ± 30 y BP	-12.7 ± 1.0	AD 1647–1689 (39.3%) AD 1740–1811 (48.1%) AD 1937–1959 (12.6%)
Arabachi *ensi* Cat. no. 124	Ra 238A ETH-25306.1/.2	Jürg Rageth Riehen, 18 January 2002	235 ± 40/225 ± 40	220 ± 30 y BP	-19.4 ± 1.0	AD 1647–1689 (39.3%) AD 1740–1811 (48.1%) AD 1937–1959 (12.6%)
Yomut *khali* Ballard carpet Cat. no. 168	Ra 741 (22.100.64) ETH-39775.1/.2	Janina Poskrobko The Metropolitan Museum of Art New York, 23 February 2010	210 ± 40/215 ± 30	215 ± 25 y BP	-19.3 ± 1.0	AD 1649–1687 (37.0%) AD 1742–1761 (5.2%) AD 1763–1809 (44.8%) AD 1940–1959 (13.0%)
Salor *chuval* Cat. no. 13	Ra 733A, Ra 733B.1/.2 (b); Ra 733C (a) ETH-17871/-18967.1/.2/ ETH-27709	Jürg Rageth (A; B) ETH Zurich, 6 November 1997; Munich, 26 June 1998, (C) Riehen, 24 June 2002	325 ± 55/220 ± 50/ 180 ± 40/175 ± 40	210 ± 30 y BP	-21.1 ± 1.0	AD 1649–1691 (32.4%) AD 1738–1812 (52.3%) AD 1934–1960 (15.3%)
Qaradashlï *khali* Cat. no. 87	Ra 254 ETH-26224.1/.2	David Reuben London, September 2002	185 ± 40/240 ± 40	210 ± 30 y BP	-18.2 ± 1.0	AD 1649–1691 (32.4%) AD 1738–1812 (52.3%) AD 1934–1960 (15.3%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Salor *kapunuk* Cat. no. 3	Ra 266 ETH-27701.1/.2	Jürg Rageth Riehen, 22 August 2003	170 ± 40/250 ± 40	210 ± 40 y BP	-20.1 ± 1.0	AD 1537–1542 (0.4%) AD 1641–1701 (30.6%) AD 1729–1820 (49.8%) AD 1841–1852 (0.9%) AD 1852–1881 (2.3%) AD 1922–1961 (16.0%)
Teke *khali* Cat. no. 151	Ra 735 ETH- 18655.1/.2	Peter Hoffmeister London, 29 April 1998	[0 ± 40]/210 ± 50	210 ± 50 y BP	-20.1 ± 1.2	AD 1530–1562 (3.4%) AD 1636–1713 (28.6%) AD 1723–1892 (52.6%) AD 1916–1961 (15.4%)
Qaradashlï *chuval* Cat. no. 82	Ra 461 ETH-22706.1/.2	Jürg Rageth Hamburg, 12 August 2003	230 ± 40/175 ± 40	205 ± 30 y BP	-18.8 ± 1.0	AD 1651–1691 (29.4%) AD 1737–1813 (54.3%) AD 1933–1959 (16.3%)
Sarïq *chuval* Cat. no. 43	E.M. 19.3 (87-33) ETH-19346.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	210 ± 55/200 ± 45	205 ± 35 y BP	-20.3 ± 1.0	AD 1646–1699 (29.6%) AD 1731–1818 (53.3%) AD 1862–1862 (0.1%) AD 1924–1961 (17.1%)
Qaradashlï *asmalyk* Cat. no. 76	Ra 278 ETH-27369.1/.2	Jürg Rageth Hamburg, 24 May 2003	195 ± 40/195 ± 40	195 ± 30 y BP	-13.4 ± 1.1	AD 1652–1697 (25.2%) AD 1733–1817 (56.3%) AD 1926–1961 (18.5%)
Ersarï *ensi* Cat. no. 19	Ra 716 ETH-17872.1/.2	Jürg Rageth ETH Zurich, 6 November 1997	220 ± 45/165 ± 40	190 ± 30 y BP	-22.5 ± 1.0	AD 1653–1699 (23.7%) AD 1731–1818 (57.0%) AD 1862–1862 (0.1%) AD 1924–1961 (19.3%)
Yomut *khali* Cat. no. 109	Ra 223 ETH-22416.1/.2	Jürg Rageth New York, 13 April 2000	180 ± 40/200 ± 45	190 ± 30 y BP	-19.3 ± 1.0	AD 1653–1699 (23.7%) AD 1731–1818 (57.0%) AD 1862–1862 (0.1%) AD 1924–1961 (19.3%)
Qaradshlï *khali* Cat. no. 93	Ra 724 ETH-17868.1/.2	Jürg Rageth ETH Zurich, 6 November 1997	240 ± 55/160 ± 40	190 ± 40 y BP	-19.1 ± 1.0	AD 1649–1705 (23.6%) AD 1727–1822 (51.1%) AD 1838–1885 (7.3%) AD 1919–1960 (8.1%)
Salor *torba* Cat. no. 10	Ra 279 ETH-18968/-27710	Jürg Rageth Munich, 26 June 1998	205 ± 50/175 ± 40	185 ± 30 y BP	-18.8 ± 1.0	AD 1655–1700 (22.1%) AD 1730–1819 (56.8%) AD 1847–1847 (0.1%) AD 1859–1872 (1.5%) AD 1923–1960 (19.6%)
Arabachi hanging Cat. no. 163	R.M. 16 (KOB 224) ETH-24261.1/.2	Jürg Rageth St. Petersburg, 22 June 1998	190 ± 40/175 ± 40	185 ± 30 y BP	-18.6± 1.0	AD 1655–1700 (22.1%) AD 1730–1819 (56.8%) AD 1847–1847 (0.1%) AD 1859–1872 (1.5%) AD 1923–1960 (19.6%)
Teke *torba* Cat. no. 145	Ra 732 ETH-17873	Jürg Rageth ETH Zurich, 6 November 1997	185 ± 45	185 ± 45 y BP	-22.2 ± 1.0	AD 1651–1712 (22.6%) AD 1724–1830 (48.7%) AD 1835–1891 (11.1%) AD 1917–1960 (17.7%)
Sarïq *torba* Cat. no. 142	R.M. 9 (KOB 193) ETH-24260.1/.2	Jürg Rageth St. Petersburg, 22 June 1998	185 ± 45/175 ± 45	180 ± 30 y BP	-14.5 ± 1.0	AD 1658–1701 (20.6%) AD 1729–1820 (55.8%) AD 1842–1850 (1.0%) AD 1855–1877 (2.9%) AD 1922–1960 (19.7%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Teke *khali* Cat. no. 74	Ra 663A; Ra 663B; Ra 663C ETH-18656/-26226/-30746	(A) Peter Hoffmeister, London, 29 April 1998; (B) Longevity, London (C) Jürg Rageth, Riehen, 12 June 05	[55 ± 50]/185 ± 40/175 ± 40	180 ± 30 y BP	-21.0 ± 1.0	AD 1658–1701 (20.6%) AD 1729–1820 (55.8%) AD 1842–1850 (1.0%) AD 1855–1877 (2.9%) AD 1922–1960 (19.7%)
Qaradashlï *khali* Cat. no. 86	Ra 297 ETH-27705.1/.2/.3	Jürg Rageth Riehen, 22 August 2003	135 ± 40/215 ± 40/170 ± 40	175 ± 25 y BP	-18.8 ± 1.0	AD 1664–1700 (19.5%) AD 1730–1819 (58.6%) AD 1859–1872 (1.5%) AD 1923–1960 (20.5%)
Sarïq *ensi* Cat. no. 140	Ra 729 ETH-17367.1/.2	Jürg Rageth ETH Zurich, 28 May 1997	185 ± 45/165 ± 40	170 ± 30 y BP	-23.4 ± 1.0	AD 1663–1705 (18.6%) AD 1727–1822 (53.1%) AD 1838–1886 (8.6%) AD 1919–1960 (19.8%)
Turkmen *torba* Cat. no. 59	E.M. 32.16 (26-27) ETH-18917.1/.2	Jürg Rageth St. Peterssburg, 23 June 1998	145 ± 50/185 ± 45	170 ± 35 y BP	-21.7 ± 1.0	AD 1661–1710 (19.0%) AD 1724–1827 (50.6%) AD 1837–1889 (11.3%) AD 1917–1960 (19.1%)
Chowdur hanging Cat. no. 123	Ra 216, Ra 216A ETH-22409.1/.2/-23152.1	Jürg Rageth San Francisco, 3 April 2000	255 ± 45/150 ± 45/120 ± 40	170 ± 40 y BP	-16.8 ± 1.0	AD 1661–1712 (19.2%) AD 1724–1830 (48.6%) AD 1835–1891 (13.8%) AD 1917–1959 (18.3%)
Salor *ak yüp* Cat. no. 4	Ra 267 ETH-27702.1/.2	Jürg Rageth Riehen, 22 August 2003	175 ± 40/155 ± 40	165 ± 30 y BP	-22.0 ± 1.0	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)
Salor *chuval* Cat. no. 11	Ra 258 ETH-27699.1/.2	Jürg Rageth Riehen, 22 August 2003	165 ± 40/165 ± 40	165 ± 30 y BP	-23.0 ± 1.0	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)
Ersarï *chuval* Cat. no. 137	Ra 262 ETH-26821.1/.2/.3	David Reuben London, 21 November 2002	[40 ± 40]/135 ± 40/195 ± 40	165 ± 30 y BP	-21.3 ± 1.0	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)
Teke *khali* Cat. no. 72	Ra 691 ETH-17363.1/.2	Georges Bonani ETH Zurich, 28 May 1997	180 ± 50/155 ± 40	165 ± 30 y BP	-18.8 ± 1.0	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)
Turkmen *khali* Cat. no. 122	Ra 726 ETH-17364.1/.2	Georges Bonani ETH Zurich, 28 May 1997	185 ± 50/155 ± 40	165 ± 30 y BP	-16.4 ± 1.0	AD 1666–1707 (17.9%) AD 1725–1826 (51.7%) AD 1837–1887 (10.7%) AD 1918–1960 (19.7%)
Salor *chuval* Cat. no. 15	Ra 228/228A ETH-23838/-25574	Collector New York, 15 February 2001; 28 January 2002	125 ± 40/195 ± 40	165 ± 35 y BP	-21.2 ± 1.0	AD 1665–1712 (18.3%) AD 1724–1829 (19.2%) AD 1835–1890 (13.6%) AD 1917–1960 (18.9%)
Teke *khali* Cat. no. 148	R.M. 7 (KOB 204) ETH-19345.1/.2	Jürg Rageth St. Petersburg, 22 June 1998	240 ± 55/130 ± 40	165 ± 55 y BP	-22.9 ± 1.0	AD 1660–1897 (82.6%) AD 1912–1959 (17.4%)
Salor *torba* Cat. no. 131	Ra 728/728A ETH-17369/-17370	Georges Bonani ETH Zurich, 28 May 1997	135 ± 45/185 ± 45	160 ± 30 y BP	-20.7 ± 1.0	AD 1668–1710 (17.5%) AD 1724–1827 (49.7%) AD 1837–1889 (13.2%) AD 1917–1960 (19.5%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Teke *ak yüp* Cat. no. 53	Ra 467 ETH-27708.1/.2	Jürg Rageth Hamburg, 12 August 2003	195 ± 40/125 ± 40	160 ± 35 y BP	-19.4 ± 1.0	AD 1668–1713 (17.7%) AD 1724–1831 (47.6%) AD 1833–1892 (6.2%) AD 1917–1959 (18.5%)
Teke *asmalyk* Cat. no. 143	E.M. 27.11 (26-52/2) ETH-18914.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	105 ± 55/190 ± 40	160 ± 40 y BP	-20.6 ± 1.0	AD 1667–1715 (17.9%) AD 1722–1894 (63.9%) AD 1915–1959 (18.1%)
Salor *chuval* Cat. no. 14	E.M. 22.6 (26-79) ETH-19347.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	120 ± 55/175 ± 40	155 ± 30 y BP	-17.9 ± 1.0	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)
Qaradashlï *kahli* Cat. no. 90	Ra 671A ETH-30795.1/.2	Jürg Rageth Riehen, 26 June 2005	170 ± 40/145 ± 40	155 ± 30 y BP	-22.1 ± 1.0	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)
"Eagle" *gül* group I *ak yüp* Cat. no. 110	Ra 694 ETH-19042.1/.2	Hans Christian Sienknecht Hamburg, July 1998	155 ± 45/150 ± 40	155 ± 30 y BP	-20.9 ± 1.0	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)
"P-Chowdur" group *khali* Cat. no. 167	Ra 227 ETH-23837.1/.2	Hans Christian Sienknecht Hamburg, 19 February 2001	140 ± 40/175 ± 45	155 ± 30 y BP	-21.4 ± 1.0	AD 1670–1712 (7.3%) AD 1724–1790 (35.3%) AD 1798–1830 (11.9%) AD 1834–1891 (6.5%) AD 1917–1959 (19.0%)
Ersarï *khali* Cat. no. 30	Ra 239 ETH-25307	Jürg Rageth Riehen, 18 January 2002	155 ± 40	155 ± 40 y BP	-15.5 ± 1.1	AD 1669–1792 (49.7%) AD 1797–1896 (32.2%) AD 1913–1959 (18.1%)
Qaradashlï *khali* Cat. no. 92	Ra 725 ETH-17869.1/.2	Jürg Rageth ETH Zurich, 6 November 1997	225 ± 55/115 ± 40	155 ± 50 y BP	-22.9 ± 1.0	AD 1668–1897 (82.5%) AD 1912–1958 (17.5%)
Sarïq *mafrash* Cat. no. 40	E.M. 34.18 (26-22) ETH-18918.1/.2/.3	Jürg Rageth St. Petersburg, 23 June 1998	215 ± 50/105 ± 40/150 ± 50	150 ± 30 y BP	-20.5 ± 1.0	AD 1672–1713 (17.0%) AD 1724–1788 (32.8%) AD 1800–1831 (12.0%) AD 1833–1892 (19.8%) AD 1917–1958 (18.5%)
Yomut *khali* Cat. no. 160	Ra 739, Ra 739A ETH-19263.1/.2/-19892	Jürg Rageth Udine, 3 September 1998	160 ± 45/140 ± 50/140 ± 55	150 ± 30 y BP	-22.2 ± 1.0	AD 1672–1713 (17.0%) AD 1724–1788 (32.8%) AD 1800–1831 (12.0%) AD 1833–1892 (19.8%) AD 1917–1958 (18.5%)
Teke *chuval* Cat. no. 146	Ra 252 ETH-26222.1/.2	David Reuben London, September 2002	160 ± 40/135 ± 40	145 ± 30 y BP	-18.1 ± 1.0	AD 1673–1715 (16.9%) AD 1722–1786 (30.0%) AD 1802–1894 (34.8%) AD 1915–1958 (18.2%)
Ersarï *khali* Cat. no. 28	Ra 224 ETH-22417.1/.2	Jürg Rageth Arlington, 15 April 2000	120 ± 40/160 ± 40	140 ± 30 y BP	-19.0 ± 1.0	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Qaradashlï *chuval* Cat. no. 81	Ra 631A ETH-30794.1/.2	Jürg Rageth Riehen, 26 March 2005	145±40/140±40	140±30 y BP	-19.2±1.0	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)
"Eagle" *gül* group I *khali* Cat. no. 112	Ra 626 ETH-30254.1/.2	Hans Christian Sienknecht Copenhagen, 4 February 2005	115±40/170±40	140±30 y BP	-21.8±1.0	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)
Turkmen *torba* Cat. no. 166	Ra 209 ETH-22402.1/.2	Peter Hoffmeister London, 11 March 2000	145±40/135±45	140±30 y BP	-20.8±1.0	AD 1674–1786 (44.6%) AD 1802–1897 (37.7%) AD 1912–1951 (16.5%) AD 1953–1958 (1.2%)
Teke *torba* Cat. no. 58	Ra 222 ETH-22415.1/.2	Jürg Rageth New York, 13 April 2000	105±40/175±45	140±35 y BP	-20.1±1.0	AD 1674 –1786 (44.4%) AD 1802–1898 (37.8%) AD 1911–1958 (17.8%)
Ersarï *saf* Cat. no. 32	18308 cwt ETH-19089	Longevity London, July 1998	140±40	140±40 y BP	-17.6±1.1	AD 1673–1786 (44.3%) AD 1802–1899 (37.8%) AD 1910–1958 (17.9%)
Ersarï *chuval* Cat. no. 28	Ra 244 ETH-25575	Jürg Rageth Riehen, 19 March 2002	140±40	140±40 y BP	-21.8±1.1	AD 1673–1786 (44.3%) AD 1802–1899 (37.8%) AD 1910–1958 (17.9%)
Qaradashlï *khali* Cat. no. 94	Ra 695 ETH-17867.1/.2	Jürg Rageth ETH Zurich, 6 November 1997	95±50/160±40	135±30 y BP	-21.9±1.0	AD 1677–1784 (42.4%) AD 1804–1897 (41.2%) AD 1912–1948 (15.9%) AD 1956–1957 (0.4%)
Salor *chuval* Cat. no. 133	E.M. 39.23 (87-20) ETH-19349.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	115±55/145±40	135±35 y BP	-20.4±1.0	AD 1676–1784 (43.3%) AD 1804–1897 (40.7%) AD 1912–1948 (15.7%) AD 1957–1957 (0.2%)
Sarïq hanging Cat. no. 141	Ra 734, Ra 734A ETH-17866/-18654	Peter Hoffmeister London, September 1997 London, April 1998	120±50/150±55	135±35 y BP	-23.4±1.0	AD 1676–1784 (43.3%) AD 1804–1897 (40.7%) AD 1912–1948 (15.7%) AD 1957–1957 (0.2%)
Salor *khali* Cat. no. 18	Ra 260 ETH-27154.1/.2	Jürg Rageth Riehen, 2 February 2003	100±40/165±40	130±30 y BP	-15.6±1.0	AD 1681–1782 (39.5%) AD 1805–1899 (44.4%) AD 1910–1946 (15.8%) AD 1957–1957 (0.2%)
Salor *torba* Cat. no. 8	Ra 221, Ra 221A ETH-22414/-23438	Jürg Rageth New York, 13 April 2000	150±40/110±45	130±30 y BP	-19.9±1.0	AD 1681–1782 (39.5%) AD 1805–1899 (44.4%) AD 1910–1946 (15.8%) AD 1957–1957 (0.2%)
Sarïq *ak yüp* Cat. no. 38	Ra 294 ETH-27704.1/.2	Jürg Rageth Riehen, 25 August 2003	145±40/110±40	130±30 y BP	-19.5±1.0	AD 1681–1782 (39.5%) AD 1805–1899 (44.4%) AD 1910–1946 (15.8%) AD 1957–1957 (0.2%)
Turkmen *ensi* Cat. no. 35	Ra 237A ETH-25305	Jürg Rageth Riehen, 18 January 2002	130±40	130±40 y BP	-19.4±1.1	AD 1675–1784 (41.0%) AD 1803–1902 (41.8%) AD 1907–1949 (16.3%) AD 1955–1958 (0.9%)
"P-Chowdur" group *kapunuk* Cat. no. 119	Ra 649 ETH-17870	Jürg Rageth ETH Zurich, 6 November 1997	130±50	130±50 y BP	-21.6±1.0	AD 1674–1786 (41.1%) AD 1802–1958 (58.9%)

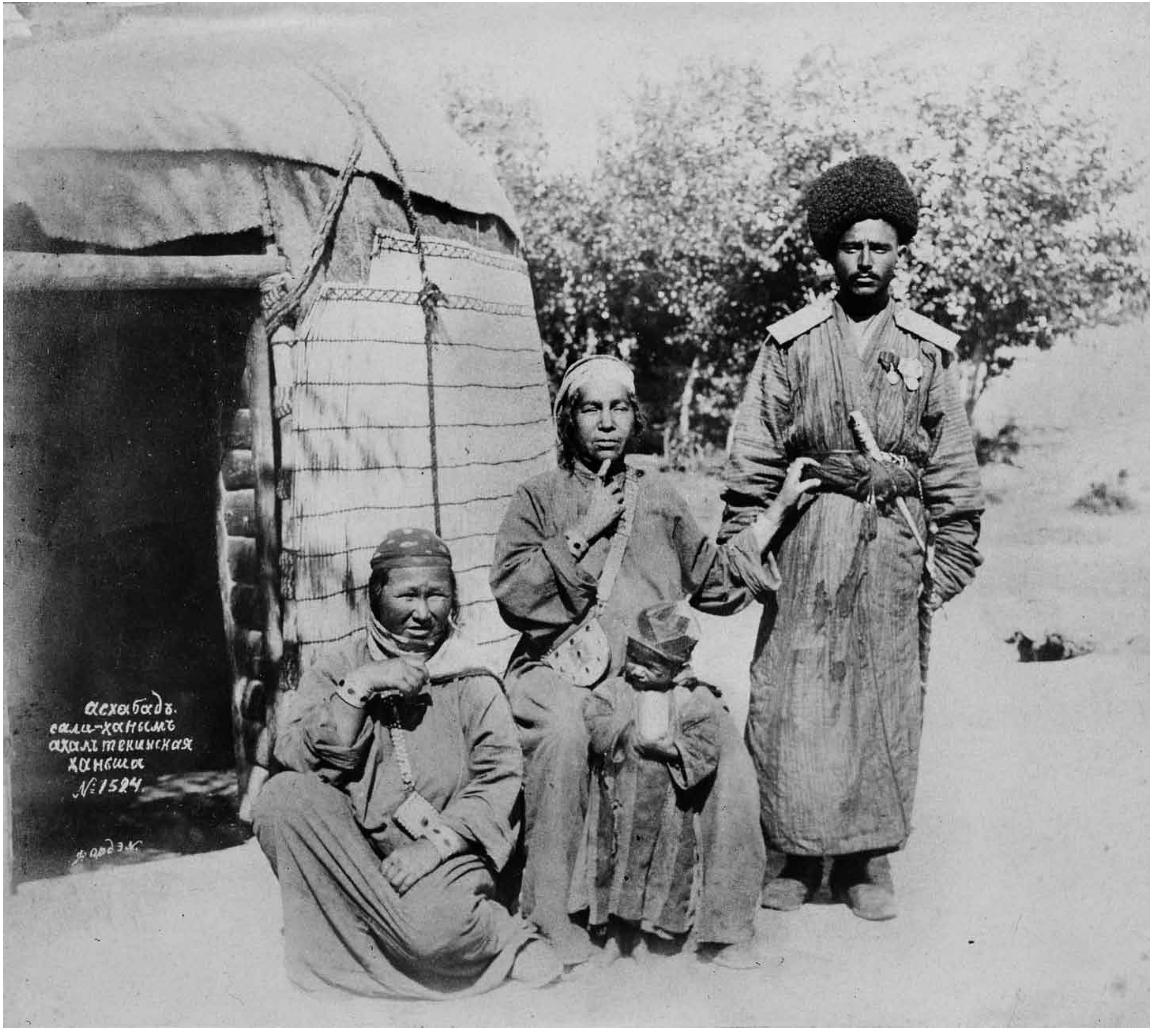
Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Yomut *ak yüp* all pile Cat. no. 98	Ra 217 (a); Ra 708 (b) ETH-22410.1/.2/-32416	Jürg Rageth (a) San Francisco, 3 April 2000 (b) San Francisco, 19 April 2006	110 ± 40/140 ± 45/[40 ± 40]	125 ± 30 y BP	-21.5 ± 1.0	AD 1681–1782 (37.0%) AD 1804–1902 (6.5%) AD 1907–1946 (15.8%) AD 1955–1958 (0.7%)
Teke *khalyk* Cat. no. 144	Ra 737 ETH-18899	Peter Hoffmeister Dörfles Esbach, 2 May 1998	120 ± 50	120 ± 50 y BP	-15.7 ± 1.1	AD 1677–1783 (39.2%) AD 1804–1947 (59.8%) AD 1955–1958 (1.0%)
Teke *khali* Cat. no. 150	Ra 738 ETH-17865	Collector Gelsenkirchen, June 1998	120 ± 55	120 ± 55 y BP	-22.2 ± 1.1	AD 1674–1786 (39.6%) AD 1802–1959 (60.4%)
Sarïq torba Cat. Nr. 96	Ra 744 ETH-50200	Jürg Rageth Riehen, 19 March 2013	114 ± 26	114 ± 26	-18.5 ± 1.1	AD 1680–1740 (27.5%) AD 1750–1770 (1.3%) AD 1800–1940 (66.6%)
Yomut *asmalyk* Cat. no. 154	R.M. 11 (KOB 191) ETH-18907.1/.2	Jürg Rageth St. Petersburg, 22 June 1998	145 ± 50/85 ± 40	110 ± 30 y BP	-19.5 ± 1.0	AD 1685–1745 (28.6%) AD 1758–1767 (1.6%) AD 1807–1943 (68.9%) AD 1955 – 1959 (0.9%)
Sarïq *chuval* Cat. no. 44	E.M. 29.13 (26-75) ETH-19348.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	115 ± 55/110 ± 45	110 ± 35 y BP	-17.6 ± 1.0	AD 1684–1769 (32.6%) AD 1806–1944 (66.4%) AD 1955–1959 (1.0%)
Sarïq *ensi* Cat. no. 37	Ra 215 ETH-22408.1/.2	Jürg Rageth San Francisco, 3 April 2000	120 ± 40/90 ± 45	105 ± 30 y BP	-18 .6 ± 1.0	AD 1685–1744 (28.4%) AD 1760–1766 (0.9%) AD 1807–1942 (69.7%) AD 1954–1959 (1.0%)
Sarïq *khali* Cat. no. 47	Ra 692 ETH-19039.1/.2	Hans Christian Sienknecht Hamburg, July 1998	90 ± 45/120 ± 60	105 ± 35 y BP	-20.3 ± 1.0	AD 1685–1745 (28.3%) AD 1757–1768 (2.1%) AD 1807–1943 (68.5%) AD 1955–1959 (1.0%)
"Eagle" *gül* group I *khali* McMullan Collection Cat. no. 159	Ra 742 (1974.149.45) ETH-39776.1/.2	Janina Poskrobko The Metropolitan Museum of Art New York, 23 February 2010	120 ± 40/80 ± 30	100 ± 25 y BP	-26.0 ± 1.0	AD 1690–1737 (27.9%) AD 1812–1933 (71.5%) AD 1956–1958 (0.6%)
Salor *khali* Cat. no. 17	Ra 473 ETH-17368.1/.2	Georges Bonani ETH Zurich, 28 May 1997	95 ± 45/100 ± 45	100 ± 30 y BP	-20.8 ± 1.0	AD 1686–1742 (28.2%) AD 1808–1940 (70.6%) AD 1954–1960 (1.2%)
Qaradashlï *chuval* Cat. no. 156	Ra 660 ETH-30793.1/.2	Jürg Rageth Riehen, 31 March 2005	75 ± 40/130 ± 40	100 ± 30 y BP	-22.1 ± 1.0	AD 1686–1742 (28.2%) AD 1808–1940 (70.6%) AD 1954–1960 (1.2%)
Yomut *ak yüp* Cat. no. 154	Ra 731, Ra 731A ETH-17874.1/.2/.3/-18898	Jürg Rageth ETH Zurich, 6 November 1997	[410 ± 50]/65 ± 40/75 ± 45/ 140 ± 50/115 ± 40	95 ± 20 y BP	-23.5 ± 1.0	AD 1696–1735 (27.8%) AD 1815–1927 (72.0%) AD 1957–1957 (0.2%)
Ersarï hanging Cat. no. 20	Ra 498 ETH-27822.1/.2	David Reuben London, 15 September 2003	125 ± 40/60 ± 40	95 ± 30 y BP	-21.3 ± 1.0	AD 1688–1741 (27.8%) AD 1809–1937 (71.0%) AD 1954–1960 (1.3%)
Ersarï *khali* Cat. no. 29	Ra 241 ETH-25309	Jürg Rageth Riehen, 18 January 2002	95 ± 40	95 ± 40 y BP	-20.7 ± 1.1	AD 1685–1746 (27.8%) AD 1752–1768 (2.7%) AD 1807–1943 (68.0%) AD 1954–1960 (1.4%)
Salor (?) *kapunuk* Cat. no. 129	E.M. 38.22 (26-94) ETH-28654.1/.2/.3	Jürg Rageth St. Petersburg, 23 June 1998	110 ± 40/65 ± 40/100 ± 40	90 ± 25 y BP	-22.1 ± 1.0	AD 1695–1735 (27.1%) AD 1815–1927 (72.6%) AD 1957–1957 (0.3%)
Salor *khali* Cat. no. 135	Ra 608A ETH-28652.1/.2/.3	Jürg Rageth Linz, 13 March 2004	125 ± 40/70 ± 45/70 ± 40	90 ± 25 y BP	-22.5 ± 1.0	AD 1695–1735 (27.1%) AD 1815–1927 (72.6%) AD 1957–1957 (0.3%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
Qaradashlï *torba* Cat. no. 80	Ra 493 ETH-27819.1/.2/.3	Jürg Rageth Riehen, 16 September 2003	130 ± 40/55 ± 40/90 ± 40	90 ± 25 y BP	-19.5 ± 1.0	AD 1695 – 1735 (27.1%) AD 1815 – 1927 (72.6%) AD 1957 – 1957 (0.3%)
Salor *chuval* Cat. no. 12	Ra 259 ETH-27700.1/.2	Jürg Rageth Riehen, 22 August 2003	90 ± 40/85 ± 40	90 ± 30 y BP	-23.9 ± 1.0	AD 1691 – 1737 (27.1%) AD 1812 – 1933 (71.8%) AD 1955 – 1959 (1.2%)
Salor *chuval* Cat. no. 134	R.M. 14 (KOB 202) ETH-18908.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	70 ± 50/100 ± 40	90 ± 30 y BP	-19.6 ± 1.0	AD 1691 – 1737 (27.1%) AD 1812 – 1933 (71.8%) AD 1955 – 1959 (1.2%)
Ersarï niche rug Cat. no. 34	E.M. 17.1 (26-61) ETH-18910.1/.2	Jürg Rageth St. Petersburg, 22 June 1998	115 ± 45/65 ± 40	90 ± 30 y BP	-21.6 ± 1.0	AD 1691 – 1737 (27.1%) AD 1812 – 1933 (71.8%) AD 1955 – 1959 (1.2%)
Teke *asmalyk* Cat. no. 54	Ra 219 ETH-22412.1/.2	Jürg Rageth San Francisco, 3 April 2003	65 ± 40/120 ± 45	90 ± 30 y BP	-19.2 ± 1.0	AD 1691 – 1737 (27.1%) AD 1812 – 1933 (71.8%) AD 1955 – 1959 (1.2%)
Teke *kizil chuval* all pile Cat. no. 65	E.M. 20.4 (2016-1) ETH-18912.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	115 ± 50/70 ± 40	90 ± 35 y BP	-21.4 ± 1.1	AD 1686 – 1743 (27.7%) AD 1762 – 1762 (0.1%) AD 1808 – 1941 (70.7%) AD 1954 – 1960 (1.5%)
Teke *khali* Cat. no. 149	R.M. 15 (KOB 176) ETH-18909	Jürg Rageth St. Petersburg, 22 June 1998	90 ± 55	90 ± 55 y BP	-22.2 ± 1.1	AD 1681 – 1782 (34.6%) AD 1805 – 1946 (63.7%) AD 1954 – 1960 (1.7%)
Arabachi *khali* Cat. no. 128	Ra 213 ETH-22406.1/.2	Jürg Rageth; San Francisco, 3 April 2000	80 ± 40/95 ± 45	85 ± 30 y BP	-18.1 ± 1.0	AD 1691 – 1737 (26.9%) AD 1813 – 1932 (71.8%) AD 1955 – 1959 (1.3%)
Salor hanging Cat. no. 7	Ra 280 ETH-27703.1/.2	Jürg Rageth; Riehen, 22 August 2003	115 ± 40/50 ± 40	80 ± 35 y BP	-23.6 ± 1.0	AD 1690 – 1738 (26.7%) AD 1812 – 1934 (71.5%) AD 1954 – 1960 (1.7%)
Ersarï *khali* Cat. no. 138	Ra 240 ETH-25308	Jürg Rageth Riehen, 18 June 2002	80 ± 40	80 ± 40 y BP	-25.5 ± 1.1	AD 1685 – 1744 (27.3%) AD 1760 – 1766 (0.8%) AD 1807 – 1942 (70.1%) AD 1953 – 1961 (1.9%)
Yomut *khali* Cat. no. 91	Ra 693 ETH-19041.1/.2	Hans Christian Sienknecht Hamburg, July 1998	135 ± 45/45 ± 40	80 ± 40 y BP	-21.9 ± 1.0	AD 1685 – 1744 (27.3%) AD 1760 – 1766 (0.8%) AD 1807 – 1942 (70.1%) AD 1953 – 1961 (1.9%)
Salor hanging Cat. no. 130	E.M. 31.15 (87-28) ETH-18916.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	80 ± 50/70 ± 40	75 ± 30 y BP	-20.8 ± 1.1	AD 1695 – 1735 (25.8%) AD 1815 – 1927 (72.6%) AD 1955 – 1959 (1.6%)
Salor *chuval* Cat. no. 132	E.M. 18.2 (87-24) ETH-18911.1/.2	Jürg Rageth St. Petersburg, 23 June 1998	60 ± 55/85 ± 40	75 ± 35 y BP	-22.2 ± 1.0	AD 1691 – 1737 (26.2%) AD 1812 – 1933 (71.8%) AD 1954 – 1960 (1.9%)
Turkmen *mafrash* Cat. no. 120	Ra 494 ETH-27820.1/.2	Jürg Rageth Riehen, 19 September 2003	120 ± 40/30 ± 40	75 ± 45 y BP	-20.6 ± 1.0	AD 1685 – 1745 (27.2%) AD 1758 – 1767 (1.3%) AD 1807 – 1943 (69.4%) AD 1953 – 1961 (2.1%)
Teke *chuval* Cat. no. 147	E.M. 28.12 (8762-22681T) ETH-18915	Jürg Rageth St. Petersburg, 23 June 1998	75 ± 50	75 ± 50 y BP	-21.5 ± 1.1	AD 1684 – 1769 (30.5%) AD 1806 – 1944 (67.4%) AD 1953 – 1961 (2.1%)
Yomut *ak yüp* Cat. no. 152	E.M. 24.8 (5153-1) ETH-18913	Jürg Rageth St. Petersburg, 23 June 1998	70 ± 50	70 ± 50 y BP	-19.0 ± 1.1	AD 1685 – 1746 (27.0%) AD 1752 – 1768 (2.5%) AD 1807 – 1943 (68.3%) AD 1953 – 1961 (2.2%)

Object Cat. no.	Sample no. Lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{13}C$	Calib. age ranges 95.4%
"P-Chowdur" group *khali* Cat. no. 161	Ra 497 ETH-27821.1/.2	David Reuben London, 15 September 2003	80±40/45±40	65±30 y BP	-25.4±1.0	AD 1698–1733 (24.2%) AD 1817–1925 (73.1%) AD 1954–1960 (2.7%)
Salor *ensi* Cat. no. 1	Ra 610A ETH-28653.1/.2/.3	Collector USA, 28 February 2004	60±40/15±40/50±40	40±25 y BP	-23.5±1.0	AD 1701–1730 (15.9%) AD 1819–1841 (10.9%) AD 1852–1852 (0.2%) AD 1882–1922 (58.8%) AD 1952–1965 (14.2%)
"P-Chowdur" group hanging Cat. no. 162	Ra 220 ETH-22413.1/.2/.3	Jürg Rageth New York, 13 April 2000	30±40/40±40/90±40	35±35 y BP	-20.6±1.0	AD 1698–1732 (20.8%) AD 1817–1925 (70.6%) AD 1953–1965 (8.5%)
Turkmen *chuval* Cat. no. 64	Ra 709 ETH-32417	Jürg Rageth Riehen, 4 June 2006	25±35	25±35 y BP	-15.2±1.1	AD 1699–1732 (18.9%) AD 1817–1861 (17.8%) AD 1870–1925 (49.5%) AD 1953–1966 (13.9%)

Table 16: Other Carpets and Textiles

Object Fig.	Sample no. lab. no.	Sample collected by	^{14}C age	Weighted mean	$\delta^{3}C$	Calib. age ranges 95.4% confid. limit
Knotted pile carpet, wool **"Pazyryk Carpet"** Vol. 1, fig. 7, chapter "From Visuel Guesstimate to Scientific Estimate"	H.M. 6 (1687/93) ETH-18906.1/.2	Ludmila Barkova The Hermitage Museum St. Petersburg, 21 June 1998	2250±55/2240±50	2245±45 y BP	20.4 ±1.0	BC 388–197 (100.0%)
Suaire dit de St. Lambert Silk samite weave Vol. 2, chapter "The Salor", Fig. 124	Ra 680 ETH-30747	Jürg Rageth Liège, 2 June 2005	1270±45	1270±45 y BP	-24.5±1.1	AD 667–835 (92.9%) AD 842–872 (7.1%)
Chasse de St. Simètre Silk samite weave Vol. 2, chapter "The Salor", Fig. 222	Ra 714 ETH-32563	Jürg Rageth Liège, 25 July 2006	1245±40	1245±40 y BP	-23.4±1.1	AD 682–883 (100.0%)
Knotted pile carpet, wool Anatolia Vol. 1, fig. 10, chapter "From Visuel Guesstimate to Scientific Estimate"	Ki 48/OS 206 ETH-23014.1/.2	Jürg Rageth Hannover, 6 March 2000	450±40/430±45	440±30 y BP	-21.1±1.0	AD 1422–1495 (99.1%) AD 1610–1614 (0.9%)
Knotted pile carpet, wool copy, Romania Vol. 1, fig. 8, chapter "From Visuel Guesstimate to Scientific Estimate"	Ki 67 ETH-23014.1/.2	Jürg Rageth Riehen, 7 September 2000	230±45/190±40	210±30 y BP	-21.5±1.0	AD 1649–1691 (32.4%) AD 1738–1812 (52.3%) AD 1934–1960 (15.3%)


асхабадъ.
сали-ханымъ
ахалъ текинская
ханша
№ 1524.
ф. ордэ Ж.

Bibliography

Left: A Teke woman with her husband and child. Her left hand holds on to her husband's belt. Her right index finger pointing at her chin is an ancient Iranian gesture of astonishment and admiration, presumably, based on her holding on to him, directed at her husband. Photograph from the 1880's.
Courtesy Ethnographic Museum, St. Petersburg.

Abu'l-Ghazi Bahadur Khan 1958 Ebülgazi Bahadır Han, *Shajarah-i tarakimah Rodoslovnaja turkmen/socinenie Abu-l-Gazi Chana Chivinskogo*; mit russ. Übers. u. Anm. von Andrej Nikolaevic Kononov. Moskva - Leningrad 1958

Adaksina/Kulakova 2009 Svetlana Adaksina & Larissa Kulakova, *Textile Architecture. The Emir of Buchara's Tent in The State Hermitage*, in: Hali 161, 2009: 70–73

Agajanov 1969 (1998) S.G. Agajanov, *The States of the Oghuz, the Kimek and the Kipchak*, in: History of Civilisations of Central Asia, Vol. IV, Editors: M.S. Asimov and C.E. Bosworth, Paris 1997: 61–76. (first published in Russian in 1969)

Ahuja et al. 1999 Shyam Ahuja, with Meere Ahuja and Mirdula Maluste, *Dhurrie – Flatwoven Rugs of India*, Mumbai 1999

Al-Kashgari 1914 – 1916 Mahmud al-Kashgari, *Kitab divan lugat at-türk*, Istanbul 1914–1916

Al-Maqdissi et al. 2009 Michel Al-Maqdissi, Daniele Morandi Bonacossi und Peter Pfälzner, *Schätze des Alten Syrien – Die Entdeckung des Königreichs Qatna*, Stuttgart 2009

Almagro et al. 1975 Martin Almagro, Luis Caballero, Juan Zozaya y Antonio Almagro, *Quasyr 'Amra. Residencia y Baños Omeyas en el Desierto de Jordania*, Madrid 1975

Alvarez-Mon 2004 Javier Alvarez-Mon, *Imago Mundi: Cosmological and Ideological Aspects of the Arjan Bowl*, in: Iranica Antiqua, Vol. XXXIX, Gent, 2004

Alyilmaz 2003 Cengiz Alyilmaz, *On the Bugut Inscription and Mausoleum Complex*, in: Eran ud Aneran, Webfestschrift Marshak 2003, www.transoxiana.org/Eran

Ames 1997 Frank Ames, *The Kashmir Shawl and its Indo-French Influence*, Woodbridge 1997

Amiet 1972 Pierre Amiet, *Glyptique susienne des origines à l'époque des Perses achéménides: cachets, sceaux-cylindres et empreintes antiques découverts à Suse de 1913 à 1967*, Paris 1972

Anavian & Anavian 1975 Rahim Anavian & George Anavian, *Royal Persian & Kashmir Brocades*, edited by Tomoyuki Yamanobe, Kyoto 1975

Andrews 1973 Peter Alford Andrews, *The White House of Khurasan: The Felt Tents of the Iranian Yomut and Göklen*, in: Iran, Journal of the British Institute of Persian Studies, Vol. XI, 1973: 93–110

Andrews 1980 Peter Alford Andrews, *The Türkmen Tent*, in Mackie/Thompson 1980: 41–59

Andrews 1981 Peter A. Andrews, *The Türkmen Tent*, in: Hali vol. 4, no. 2, 1981: 108 – 117

Andrews et al. 1993 Peter Alford Andrews, Siawosch Azadi, Volker und Annette Rautenstengel, Hans Christian Sienknecht, *Wie Blumen in der Wüste. Die Kultur der turkmenischen Nomadenstämme Zentralasiens*, Hamburg 1993

Andrews 1993a Peter Alford Andrews, *Glossar turkmenischer Begriffe*, in: Andrews et al. 1993

Andrews 1993b Peter Alford Andrews, *The Türkmen Wedding Tent in Historical Context*, in: 7th ICOC 1993: 7–22

Andrews 1997a Peter Alford Andrews, *Nomad Tent Types in the Middle East*, Part 1: Framed Tents, Vol. 1: Text, Vol. 2: Illustrations, Wiesbaden 1997

Andrews 1997b Peter Alford Andrews, *Die Krönung der Braut. Zur turkmenischen Frauentracht in historischer Sicht,* in: Die Braut. Herausgegeben von G. Völker und K. Welck, Köln 1997

Andrews 1999 Peter Alford Andrews, *Felt Tents and Pavilions,* London 1999

Aruz et al. 2000 *The Golden Deer of Eurasia,* Edited by Joan Aruz, Ann Farkas, Andrei Alekseev and Elena Korolkova, The Metropolitan Museum of Art, New York 2000

Aruz et al. 2003 *Art of the first Cities, The Third Millennium B.C.,* Edited by Joan Aruz with Ronald Wallenfels, The Metropolitan Museum of Art, New York 2003

Aruz et al. 2008 *Beyond Babylon. Art, Trade, and Diplomacy in the Second Millennium B.C.,* Edited by Joan Aruz, et al., The Metropolitan Museum of Art, New York 2008

Aruz et al. 2014 *Assyria to Iberia at the Dawn of the Classical Age,* Edited by Joan Aruz, Sarah B. Graff, and Yelena Rakic, The Metropolitan Museum of Art, New York 2003

Aslanapa 1971 Oktay Aslanapa, *Turkish Art and Architecture*, London 1971

Azadi 1986 Siawosch Azadi, *Carpets in the Baluch Tradition*, München 1986

Azadi 1970 Siawosch Azadi, *Turkmenische Teppiche und die ethnographische Bedeutung ihrer Ornamente*, Hamburg 1970

Azadi 1975 Siawosch Azadi, *Turkoman Carpets and the Ethnographic Significance of their Ornaments*, London 1975

Azadi 1983 Siawosch Azadi, *Alam (Elem) – Some Aspects of Turkoman 'Additional End borders'*, in: Hali 5/3, 1983: 261–267

Azarpay 1968 Guitty Azarpay, *Urartian Art and Artifacts*, Berkeley and Los Angeles 1968

Azarpay 1981 Guitty Azarpay, *Sogdian Painting. The Pictorial Epic in Oriental Art*, Dresden, Berkeley, Los Angeles, London 1981

Azemoun 2001 Yussuf Azemoun, *Notes on Certain Turkmen Carpet Terms*, in: Oriental Carpet and Textile Studies VI, edited by Murray L. Eiland, Jr. and Robert Pinner, Danville 2001

Babayarov 2003 Gaybullah Babayarov, *Sogd under Turkish Rule during VIth – VIIIth centuries*, in: Eran ud Aneran – Webfestschrift Marshak 2003, www.transoxiana.org/Eran

Bailey 2010 Julia Bailey, *Carpets and Kufesque*, in: Thompson et al. 2010

Bailey/Hopkins 1991 Julia Bailey and Mark Hopkins, *Through the Collectors Eye. Oriental Rugs from New England Collections*, Providence 1991

Baker 1995 Patricia L. Baker, *Islamic Textiles*, London 1995

Balpinar 1990 Belkis Balpinar, *Multiple-niche Kilims within Their Historical Context*, in: Jürg Rageth (Ed.), Anatolische Kelims, Symposium Basel, die Vorträge, Basel 1990

Balpinar/Hirsch 1982 Belkis Balpinar, Udo Hirsch, *Flatweaves of the Vakiflar Museum Istanbul*, Wesel 1982

Balpinar/Hirsch 1988 Belkis Balpinar, Udo Hirsch, *Carpets of the Vakiflar Museum Istanbul*, Wesel 1988

Bancroft 1917 Edward Bancroft, *Neues Englisches Färbebuch oder gründliche Untersuchungen über die Natur beständiger Farben*, Nürnberg 1917

Barber 1991 E.W. Barber, *Prehistoric Textiles. The Development of Cloth in the Neolithic and Bronze Ages, Princeton*, New Jersey 1991

Barkova et al. 1984 *Gold der Skythen aus der Leningrader Eremitage* (exhibition catalogue), München 1984

Barkova et al. 1991 *L'or des Scythes. Trésor de l'Ermitage* (exhibition catalogue), Bruxelles 1991

Barkova 1999 Ludmilla Barkova, *The Pazyryk – Fifty Years on,* in: Hali 107, 1999: 64 – 69, London 1999

Barnett/Forman o.J. R.D. Barnett und Werner Forman*, Assyrische Palastreliefs,* Prag o.J.

Barthold 1962 V.V. Barthold, *Four Studies on the History of Central Asia*, Volume III, Mir Ali-Shir, A History of the Turkman People, Leiden 1962

Baumann 2008 Dr. Peter Baumann, *Knüpfarbeiten der Saloren aus oberösterreichischem Privatbesitz*, Linz 2008

Bausback 1969 *Alte und Antike Meisterstücke orientalischer Teppichknüpfkunst*, Mannheim 1969

Bausback 1972 *Alte und Antike Meisterstücke orientalischer Teppichknüpfkunst* (4), Mannheim 1972

Bausback 1975 *Antike Meisterstücke orientalischer Knüpfkunst*, Jubiläumsausgabe 1925 – 1975, Mannheim 1975

Bausback 1976 *Antike Orientalische Knüpfkunst*, Mannheim 1976

Bausback 1977 *Antike Orientalische Knüpfkunst*, Ausstellung 14.–24. Oktober, Mannheim 1977

Bausback 1978 *Antike Orientteppiche*, Braunschweig 1978

Bausback 1979 *Alte und Antike Orientalische Knüpfkunst*, Mannheim 1979

Bausback 1980 *Alte und antike orientalische Knüpfkunst*, Mannheim 1980

Bausback 1981a *Susani, Stickereien aus Mittelasien*, Mannheim 1981

Bausback 1981b *Alte und antike orientalische Knüpf-kunst*, Mannheim 1981

Bausback 1982 *Alte und antike orientalische Knüpfkunst*, Mannheim 1982

Bausback 1983 *Alte und antike orientalische Knüpfkunst*, Mannheim 1983

Bausback 1987/88 Peter Bausback, *Antike Teppiche Sammlung Franz Bausback 1987/88*, Mannheim 1987

Bausback 2000 Peter Bausback, *Antike Teppiche. Sammlung Franz Bausback. Erlesene Teppiche seit 1925*, Mannheim 2000

Beach et al. 2011 Milo C. Beach, Eberhard Fischer, B.N. Goswamy (Editors), Jorrit Britschgi (Project Director), *Masters of Indian Painting*, Vol. I 1100–1650, Vol. II 1650–1900, Zurich and New York 2011

Beattie 1972 May H. Beattie, *Die orientalischen Teppiche in der Sammlung Thyssen, Castagnola 1972*

Beattie 1976 May H. Beattie, *Carpets of Central Persia*, Sheffield 1976

Belenickij 1968 Aleksandr Belenickij, *Zentralasien*, Archaeologia Mundi, München 1968

Belenizki 1980 A.M. Belenizki, *Mittelasien – Kunst der Sogden*, Leipzig 1980

Benardout 1974 Raymond Benardout, *Catalogue of Turkoman Weaving including Beluch*, London 1974

Benardout 1983 *Antigue Rugs*, London 1983

Benardout 1996 *Woven Stars*, Los Angeles 1996

Benardout 2002 *A Catalogue of Turkomen and Beluch Weavings from a bygone Era*, Los Angeles 2002

Bennett 1978 Ian Bennett, *Carpets of the World*, London 1978

Bennett 1989 Ian Bennett, *All That Glisters*, in: Hali 48, 1989: 96-97.

Beresneva 1976 L. Beresneva, *The Decorative and Applied Art of Turkmenia*, Leningrad 1976

Bernheimer 1977 *Alte und antike Knüpfarbeiten der Turkmenen*, München 1977

Beselin 2011 Anna Beselin, *Geknüpfte Kunst – Teppiche des Museums für Islamische Kunst*, Berlin 2011

Besim 1, 1998 *Myth and Mystique. Old and Antique Textile Art,* Vol. 1, Vienna 1998

Besim 2, 1999 *Myth and Mystique. Old and Antique Textile Art,* Vol. 2, Vienna 1999

Besim 3, 2000 *Myth and Mystique. Old and Antique Textile Art,* Vol 3, Vienna 2000

Bier 1987 Carol Bier (Ed), *Woven from the Soul, Spun from the Heart. Textile Arts of Safavid and Qajar Iran, 16th–19th Centuries,* Washington, D.C., 1987

Bignasca et al. 1992 Andrea Bignasca (Redaktion), *Paradeisos*. Frühe Tierbilder aus Persien, Antiken-museum Basel und Sammlung Ludwig, Basel 1992

Bignasca et al. 2002 Andrea Bignasca, Peter Blome, Mirjam T. Jenny, Ella van der Meijden, Ivo Zanoni, *Orient, Zypern und frühes Griechenland*. Antiken-museum Basel und Sammlung Ludwig, Basel 2002

Bivar 2006 A.D.H. Bivar, *Sasanian Iconography on Textiles and Seals,* in Schorta 2006, 9–21.

Blair/Bloom et al. 2013
Sheila Blair and Jonathan Bloom (editors), *God is Beautiful and Loves Beauty. The Object in Islamic Art and Culture*, New Haven and London 2013

Blásquez Martínez 2003 José María Blázquez Martínez, *La herencia clásica en el Islam: Qusayr Amra y Quasrt al-Hayr al-Garbi*, Madrid 2003

Blänsdorf 2007 Catharina Blänsdorf, *Die farbige Armee, Eindruck des Lebendigen – Teil 1: Maltechnik und Farbrekonstruktion der Terrakottaarmee des Qin Shihuandi*, in: Unter der Gelben Erde (Kongressbeiträge), Mainz 2007

Blome 1993 Peter Blome, *Antikenmuseum Basel und Sammlung Ludwig*, Museen der Schweiz, Zürich 1993

Boardman 1998 John Boardman, *Early Greek Vase Painting. 11th – 6th century BC*, London 1998

Bogolyubov 1908/09 (1973) Andrei A. Bogolyubov, *Carpets of Central Asia*, Edited by JMA Thompson, Hampshire 1973(Original Publication in 1908/1909)

Boguslavskaya 2001 Irina Boguslavskaya, *Turkmen carpets from the Collection of the State Russian Museum*, St. Petersburg 2001

Böhmer 2002 (E) Harald Böhmer, Co-worker Nevin Enez, Recep Karadag, Charlotte Kwon, *Koekboya Natural Dyes and Textiles. A Colour Journey from Turkey to India and Beyond*, Ganderkesee 2002

Böhmer 2004 Harald Böhmer, *Foschi Carpets. A Design Tradition in the Yuntdag Region of West Anatolia*, in: Hali 137, 2004: 58 – 63

Born 1938 Wolfgang Born, *Scarlet*, in Ciba-Review 7, March 1938: 206–227

Borozna 1975 (1987) N. G. Borozna, *Materialien über den Amulettschmuck der Bevölkerung Mittelasiens*, in: Turkmenenforschung Band 10, Berlin 1987

Botta/Flandin 1850 Paul Emile Botta, *Monument de Ninive*, découvert et décrit par P. E. Botta et Flandin, Paris 1849–1850

Bowman 1990 Sheridan Bowman, *Interpreting the Past - Radiocarbon Dating*, London 1990 (1995)

Brandenburg/Brüsehoff 1980 Dietrich Brandenburg/ Kurt Brüsehoff, *Die Seldschuken – Baukunst des Islam in Persien und Turkmenien*, Graz 1980

Bregel 1981 Yuri Bregel, *Nomadic and sedentary elements among the Turkmens*, in: Central Asiatic Journal, Vol. XXV, Wiesbaden 1981

Bregel 2003 Yuri Bregel, *An Historical Atlas of Central Asia*, Leiden 2003

Brend 1991 Barbara Brend, *Islamic Art*, London 1991

Brentjes 1979 Burchard Brentjes, *Mittelasien – Kunst des Islam*, Leipzig 1979

Briggs 1940 Amy Briggs, *Timurid Carpets, I. Geometric Carpets*, in: Ars Islamica, Vol. VII, 1940

Briggs 1946 Amy Briggs, *Timurid Carpets, II. Arabesque and Flower Carpets*, in: Ars Islamica, Vol. XI–XII, 1946

Brisch et al. 1986 Klaus Brisch, Almut von Gladiss, Jens Kröger, Elke Niewöhner, *Islamische Kunst – Verborgene Schätze*, (exhibition catalogue), Berlin 1986

Brosseau et al. 2009 C.L. Brosseau, A. Gambardella, F. Casadio, C.M. Grzywacz, J.Wouters, and R.P. Van Duyne, *Ad-hoc surface-enhanced Raman spectroscopy for the detection of artist dyestuffs: thin layer chromatography-surface enhanced Raman spectroscopy and in situ on the fiber analysis*, in: Analytical Chemistry 81, 2009: 3056-3062

Brüggemann 1993 Werner Brüggemann, *Yayla – Form und Farbe in türkischer Textilkunst,* Berlin 1993

Brunello 1973 Franco Brunello, *The Art of Dyeing in the History of Mankind*. Vicenza 1973: 80

Brunner-Traut 1990 Emma Brunner-Traut, *Frühformen des Erkennens am Beispiel Ägyptens*, Darmastadt 1990

Bühler 1972 Alfred Bühler, *Ikat Batik Plangi – Reservemusterungen auf Garn und Stoff aus Vorderasien, Zentralasien, Südosteuropa und Nordafrika*, Basel 1972

Bugday 1996 *Evliya Celebis Anatolienreise*. Aus dem dritten Band des Seyahatnameh. Edition, Korkut M. Bugday, Leiden 1996

Bunker 2002 Emma C. Bunker, *Nomadic Art of the Eastern Eurasian Steppes*, New York 2002

Burns 2002 James D. Burns, *Antique Rugs of Kurdistan. A Historical Legacy of Woven Art*, UK 2002

Cahn 1974 Walter Cahn, *The Romanesque Wooden Doors of Auvergne*, New York 1974

Calmeyer 1973 Peter Calmeyer, *Zur Genese altiranischer Motive*, in: Archaeologische Mitteilungen aus Iran, Neue Folge Band 6, 1973

Campana 1966 Michele Campana, *Tappeti d'Oriente*, Milano 1966

Cardon 2007 Dominique Cardon, *Natural Dyes. Sources, Tradition, Technology and Science*, London 2007

Carpet Collector The magazine exclusively for carpets and textile art, Hamburg, since 2012

Carter/Newberry 1904 Howard Carter and Percy F. Newberry, *The tomb of Thutmosis IV, Catalogue générales Antiquités égyptiennes du musé de Caire*, Westminster 1904

Cassel-Pihl et al. 2003 Eva Helena Cassel-Pihl, Ingallil Jansson, Jennifer Wearden, Anette Granlund, *The Hallwyl Collection of Oriental Carpets and Textiles*, Stockholm 2003

Cassin/Hoffmeister 1988 Jack Cassin, Peter Hoffmeister, *Tent Band – Tent Bag, Classical Turkmen Weaving*, Coburg/Esbach 1988

Caubet/Bernus-Taylor 1991 Annie Caubert et Mathe Bernus-Taylor, *Le Louvre, Les antiquités orientales et islamiques*, Paris 1991

Chaldecott 2003 Nada Chaldecott, *Dhurries. History · Pattern · Technique · Identification,* London 2003

Champdor 1977 Albert Champdor, *Das ägyptische Totenbuch in Bild und Deutung*. Bearbeitet und Herausgegeben von Manfred Lurker, Bern-München-Wien 1977

Ciarla 2006 Roberto Ciarla (Hg.), *Krieger für die Ewigkeit – Die Terrakotta-Armee des ersten Kaisers von China*, Wiesbaden 2006

Clark 1922 Hartley Clark, *Bokhara, Turkmen and Afghan Rugs*, London 1922

Claro et al. 2008 A. Claro, M.J. Melo, S. Schäfer, u.a., *The use of microspectrofluorimetry for the characterization of lake pigments*, in: Talanta 74, 2008: 922-929.

Clauson 1972 Sir Gerard Clauson, *An Etymological Dictionary of Pre-Thirteenth-Century Turkish*, Oxford 1972

Cleveland Beach/Koch 1997 Milo Cleveland Beach & Ebba Koch, *King of the World, The Padshanama, An Imperial Mughal Manuscript from the Royal Library, Windsor Castle*, Smithsonian Institution 1997

Cohen 2004 Steven Cohen, *Indian or Persian?*, in: Hali 134, 2004: 91.

Collins 2008 Paul Collins, *Assyrian Palace Sculptures*, London 2008

Collon 1987 Dominique Collon, *First Impressions – Cylinder Seals in the Ancient Near East*, London 1987

Concaro/Levi 1999 Edoardo Concaro, Alberto Levi (Ed), *Sovrani Tappeti, Il tappeto orientale dal XV al XIX secolo, Duecento capolvari di arte tessile*, Milano 1999

Cooper 1978 Cooper, J.C., *An Illustrated Encyclopeadia of Traditional Symbols*, London 1978

Cootner/Muse 1990 Cathryn M. Cootner, and Gary Muse, *Anatolian Kilims. The Caroline and H. McCoy Jones Collection*, London 1990

Curatola/Scarcia 2004 Giovanni Curatola et Gianroberto Scarcia, *Iran – 2500 ans d'Art Perse*, Milan 2004

Curtis 1933 (2005) Vesta Sarkhosh Curtis, *Persian Myths – The Legendary Past*, Bath 2005

Dalley 1991 Stephanie Dalley, *Ancient Assyrian Textiles and the Origins of Carpet Design*, in: Iran, Vol. 29, 1991: 117–135

Damon et al. 1989 P.E. Damon et al, *Radiocarbon Dating of the Shroud of Turin*, in: Nature, Vol. 337, 16 February 1989: 611-615.

Damon/Peristykh 2000 Paul E. Damon & Alexei N. Peristykh, *Radiocarbon Calibration and Application to Geophysics, Solar Physics, and Astrophysics*, in: Radiocarbon, Vol. 42, Nr. 1, 2000: 137–150.

Davis 2000 *Fathers and Sons – Stories of the Shahnameh of Ferdowsi*, Volume II, translated from Persian by Dick Davis, Washington, DC, 2000

Davis 2004 *Sunset of Empire – Stories of the Shahnameh of Ferdowsi*, Volume III, translated from the Persian by Dick Davis, Washington, DC, 2004

Davis 2005 *The Lion and the Throne – Stories of the Shahnameh of Ferdowsi*, Volume I, translated from Persian by Dick Davis, Washington, DC, 2005

Day et al. 1996 Susan Day (Ed), *Great Carpets of the World*, London 1996

Dede Korkut 1958 *Das Buch des Dede Korkut. Ein Nomadenepos aus türkischer Frühzeit*, Zürich 1958

de Couliboeuf 1980 M. Henri de Couliboeuf de Blocqueville, *Gefangener bei den Turkomanen 1860 – 1861 im Grenzgebiet von Turkestan und Persien*. Nomad Press 1980

de Guardiola Callanan 2005 Jeanne de Guardiola Callanan, Carlton C. Rochell Jr., *Silken Splendor – Ancient Textiles from China and Central Asia*, New York 2005

de la Vaissière 2005 Étienne de la Vaissière, *Sogdian Traders – A History*, Translated by James Ward, Brill, Leiden, Boston 2005

De Lotto 1974 G. De Lotto, *On the Status and Identity of the Cochineal Insects (Homoptera: Coccoidea: Dactylopiidae)*, The Journal of the Entomological Society of South Africa 37, 1974

De Moor et al. 1993 Antoine De Moor, *Coptic Textiles from Flemish Private Collections.* Zottegem 1993

De Moor et al. 2008 Antoine De Moor, Chris Verhecken-Lammens and André Verhecken, *3500 Years of Textile Art*, Tielt 2008

De Moor/Fluck 2007 Antoine De Moor and Cäcilia Fluck (Ed), *Methods of dating ancient Textiles of the 1st millennium AD from Egypt and neighbouring countries.* Proceedings of the 4th meeting of the study group "Textiles from the Nile Valley", Antwerp 2007

De Moor/Fluck 2009
Antoine De Moor and Cäcilia Fluck (ed), *Clothing the house. Furnishing textiles of the 1st millennium AD.* Proceedings of the 5th meeting of the research group "Textiles from the Nile Valley", Antwerp 2009

Denny 1979 Walter B. Denny, *Oriental Rugs*, Cooper-Hewitt Museum, 1979

Denny 2002 Walter B. Denny, *The Classical Tradition in Anatolian Carpets,* Washington D.C. 2002

Diba/Ekhtiar 1998 Layla S. Diba, with Maryam Ekhtiar (Ed.), *Royal Persian Paintings – The Qajar Epoch, 1785 – 1925*, Brooklyn 1998

Dienes/Reinisch 2001 Gerhard M. Dienes, Helmut Reinisch (Ed), *Teppiche und Textilien aus Privatsammlungen*, Graz 2001

Dilley 1959 Arthur U. Dilley, *Oriental Rugs and Carpets.* A comprehensive Study by U. A. Dilley, Philadelphia – New York 1959

Dimand/Mailey 1973 M.S. Dimand, Jean Mailey, *Oriental Rugs in the Metropolitan Museum of Art*, New York 1973

Dodds 1992 Jerrilynn D. Dodds (Ed), *Al-Andaluz. The Art of Islamic Spain*, New York 1996

Dodds/Eiland 1996 Dennis Dodds, Murray L Eiland Jr. (Ed), *Oriental Rugs from Atlantic Collections*, 8th ICOC, Philadelphia 1996

Donkin 1977a R. A. Donkin, *Spanish Red: An Ethnogeographical Study of Cochineal and the Opuntia Cactus*, in: Transactions of The American Philosophical Society 67/5, 1977: 1–84

Donkin 1977b R. A. Donkin, *The Insect Dyes of Western and West-Central Asia*, in: Antrophos 72: 847 – 80

Dovodov/Chodzamuchammedov 1983 (1987)
N. Dovodov und N. Chodzamuchammedov, *Teppiche und Teppichprodukte Turkmenistans*, in: Turkmenenforschung Band 12, Hamburg 1987

Dshikijew 1991 (1994)
Ata Dshikijew, *Das turkmenische Volk im Mittelalter*, in: Turkmenenforschung Band 18, Berlin 1994

Du Bourguet 1964 Pierre Du Bourguet, *Catalogue des Étoffes Coptes*, *Musée du Louvre,* Paris 1964

Dudin 1928 (1998) S.M. Dudin, *Teppiche Mittelasiens*, in: Materialien Band 1 zu V.G. Moschkowa Teppiche der Völker Mittelasiens, herausgegeben von Reinhold Schletzer: Berlin 1998

Dunn 1910 Eliza Dunn, *Rugs in their Native Land*, New York 1910

Dutra Moresi/Wouters 1997 Claudia Maria Dutra Moresi and Jan Wouters, *HPLC Analysis of Extracts, Dyeings and Lakes, prepared with 21 species of the genus Relbunium*, in: Dyes in History and Archeology 15, York 1997: 85-97.

Eder 1979 Doris Eder, *Orientteppiche, Band 1: Kaukasische Teppiche*, Battenberg Antiquitäten-Katloge, München 1979

Ehlers 2002 Abu'l Qasem Ferdausi, *Rostam – Die Legenden aus dem Šahname*, Stuttgart 2002.

Eiland 1973 Murray L. Eiland Jr., *Oriental Rugs. A Comprehensive Guide*, New York 1973

Eiland 1973 b Murray L. Eiland Jr., *Oriental Rugs from Western Collections*, Berkeley 1973

Eiland 1976 Murray L. Eiland Jr., *Oriental Rugs. A Comprehensive Guide*, Revised and expanded edition, New York 1976

Eiland 1990 Murray L. Eiland Jr., *Oriental Rugs from Pacific Collections*. Catalogue of an Exhibition for the 6th ICOC, San Francisco 1990

Eiland 1999 Murray L. Eiland Jr., *Fieldwork in Turkmenistan*, in: OCTS, Vol. V, Part 1, M. L. Eiland, Jr. and R. Pinner (Ed), Danville 1999

Eiland 2001 Murray L. Eiland Jr., *Rugs From Shah Abbas's Provincial Workshops*, in: OCTS Vol. VI, M. L. Eiland, Jr. and R. Pinner (Ed), Danville 2001

Eiland 2003 Murray L. Eiland, Jr. (Ed) a.o., *A World of Carpets & Textiles*, Exhibitions at the 10th ICOC, Washington D.C. 2003

Eiland III 1993 Murray Eiland, III, *Evidence for Pile Carpets in Cuneiform Sources and A Note on the Pazyryk Carpet*, in: OCTS Vol. IV, M. L. Eiland, Jr., R. Pinner and W. Denny, Berkeley 1993

Eiland III 2011 Murray Eiland, III, *Textile Cultures of Syria. Palmyra, Mamluks and Beduins*, in: OCTS Vol. VII, 2011

Eiland/Shockley 1976 Emmette Eiland & Maureen Shockley, *Tent Bands of The Steppes*, Berkeley 1976

Ekhtiar et al. 2011 *Masterpieces from the Department of Islamic Art in the Metropolitan Museum of Art*. Edited by Maryam D. Ekhtiar, Priscilla P. Soucek, Sheila R. Canby, and Navia Najat Haidar, New York 2011

Ellerbrock/Winkelmann 2012 Uwe Ellerbrock, Sylvia Winkelmann, *Die Parther. Die vergessene Grossmacht*, Darmstadt/Mainz 2012

Ellis 1975 Charles Grant Ellis, *Early Caucasian Rugs*, Washington DC, 1975

Elmby I, 1990 *Antique Turkmen Carpets*, Exhibition catalogue, Copenhagen 1990

Elmby II, 1994 *Antique Turkmen Carpets II*, Exhibition catalogue, Copenhagen 1994

Elmby III, 1996 *Antique Turkmen Carpets III*, Exhibition catalogue, Copenhagen 1996

Elmby IV, 1998 *Antique Turkmen Carpets IV*, Exhibition catalogue, Copenhagen 1990

Elmby V, 2003 *Antique Turkmen Carpets V*, Exhibition catalogue, Copenhagen 2003

Enderlein/Meinecke1992 Volkmar Enderlein und Michael Meinecke, *Graben – Forschen – Präsentieren. Probleme der Darstellung vergangener Kulturen am Beispiel der Mschatta-Fassade*, Sonderdruck aus dem Jahrbuch der Berliner Museen, Vierunddreissigster Band, 1992

Engelhardt I, 1977 *Teppiche, die Bilder des Orients*, Heidelberg 1977

Engelhardt II, 1978 *Teppiche, die Bilder des Orients/ Carpets, the Pictures of the Orient*, Heidelberg 1978

EOTHEN IV Jahrbuch der Gesellschaft der Freunde islamischer Kunst und Kultur, München 2007

Ercoli 1942 Edoardo Ercoli, *Il tappeto orientale – Nella storia nell'arte nel commercio con un breve studio sui tappeti rustici italiani*, Roma 1942

Erdmann Hanna 1978 Hanna Erdmann, *Die Beziehungen der vorosmanischen Teppichmuster zu den gleichzeitigen Ornamenten*, in: Hali Vol. I, Nr. 3, 1978: 228 – 233

Erdmann 1941 (1969) Kurt Erdmann, *Das Iranische Feuerheiligtum*, Osnabrück 1969

Erdmann 1942 Kurt Erdmann, *Eberdarstellung und Ebersymbolik in Iran*, in: Bonner Jahrbücher des Rheinischen Landesmuseums in Bonn, Heft 147, Darmstadt 1942

Erdmann 1943 (1969) Kurt Erdmann, *Die Kunst Irans zur Zeit der Sasaniden*, Darmstadt 1943

Erdmann 1953 Kurt Erdmann, *Arabische Schriftzeichen als Ornamente in der abendländischen Kunst des Mittelalters*, in: Akademie der Wissenschaften und der Literatur. Jahrgang 1953, Nr. 9: 467–513

Erdmann 1955 Kurt Erdmann, *Der orientalische Knüpfteppich. Versuch einer Darstellung seiner Geschichte*, Tübingen 1955

Erdmann 1957 (1977) Kurt Erdmann, *Die Geschichte des frühen türkischen Teppichs (Der türkische Teppich des 15. Jahrhunderts)*, 1957 (Neuausgabe London 1977)

Erdmann 1966 Kurt Erdmann, *Siebenhundert Jahre Orientteppich – Zu seiner Geschichte und Erforschung*, Herausgegeben von Hanna Erdmann, Herford 1966

Errera 1927 Isabelle Errera, *Catalogue d'Étoffes Anciennes et Modernes*, Bruxelles 1927

Eskenazi 1983 John J. Eskenazi, *Il tappeto Orientale*, Milano 1983

Ettinghausen 1959 Richard Ettinghausen, *New Light on Early Animal Carpets*, in: Festschrift für Ernst Kühnel zum 75. Geburtstag, Heraugegeben von Richard Ettinghausen, Berlin 1959

Evans/Ratliff 2012 Helen C. Evans with Brandie Ratliff (Editors), *Byzantium and Islam – Age of Transition 7th–9th Century*, The Metropolitan Museum of Art, New York 2012

Felkersam 1914/15 (1979) A. Felkersam, *Alte Teppiche Mittelasiens*, Berlin-Hamburg 1979

Fihl 2002 Esther Fihl, *Exploring Central Asia, Collecting Objects and Writing Cultures from the Steppes to the High Pamirs 1896–1899,* Copenhagen 2002

Ferdowsi 2000–2005 *Stories from the Shahnameh of Ferdowsi*, Volume I – III, by Abolqasem Ferdowsi, translated from the original Persian by Dick Davis, Vol. I 2005, Vol. II 2000, Vol. III 2004

Fitz Gibbon/Hale 1997 Kate Fitz Gibbon & Andrew Hale, *Ikat Silks of Central Asia*, The Guido Goldman Collection, London 1997

Flandin/Coste 1841 Eugène Flandin et Pascal Coste, *Voyage en Perse*, 6 Folio volumes, Paris 1841

Fogg Art Museum 1966 *Turkoman Rugs*, Foreword by Joseph V. McMullan, Massachusetts 1966

Ford 1982 P.R.J. Ford, *Der Orientteppich und seine Muster.* Die Bestimmung orientalischer Knüpfteppiche anhand ihrer Muster, Symbole und Qualitätsmerkmale, Herford 1982

Franses 1999 Michael Franses, *Some Wool Pile Persian-Design Niche Rugs*, in: OCTS Vol. V, Part 2, Danville 1999

Franses 2004 Michael Franses, *Tying the Knot – Some Jufti-Knotted Lattice Carpets from Northeast Persia*, in: Hali 25 Years, Special Anniversary Edition, integral Part of Hali 135, 2004

Franses 2013 Michael Franses, *An Early Anatolian Animal Carpet and Related Examples*, in Blair/Bloom et al. 2013: 242 – 271

Franz 1984a Heinrich Gerhard Franz, *Palast, Moschee und Wüstenschloss. Das Werden der islamischen Kunst 7.–9. Jahrhundert,* Graz 1984

Franz 1984b Heinrich Gerhard Franz, *Von Baghdad bis Cordoba. Ausbreitung und Entfaltung der islamischen Kunst 850 – 1050,* Graz 1984

Frye 1954 Richard N. Frye, *The History of Bukhara*, Translated from a Persian Abridgment of the Arabic Original by Narshakhï, Massachusetts 1954

Frye 1965 Richard N. Frye, *Bukhara – The Medieval Achievement*, Oklahoma 1965

Galea-Blanc 1996 Clothilde Galea-Blanc, *The Origins of the Knotted Carpet,* in Day et al. 1996: 18–29

Gall/Heydenreich 1958 Ernst Gall und L.H. Heydenreich, *Reallexikon zur Deutschen Kunstgeschichte*, Stuttgart 1958

Galloway 2000 Francesca Galloway, *Asian Textiles, Indian Miniatures & Works of Art*, London 2000

Galloway 2004 Francesca Galloway, *Asian Textiles, Persian & Indian Miniatures*, London 2004

Gangler/Gaube/Petrucioli 2004 Anette Gangler, Heinz Gaube, Attilio Petrucioli, *Bukhara – The Eastern Dome of Islam. Urban Development, Urban Space, Architecture and Population*, Stuttgart/London 2004

Gans-Ruedin 1978 E. Gans-Ruedin, *Der persische Teppich*, Fribourg 1978

Gantzhorn 1990 Volkmar Gantzhorn, *Der christlich orientalische Teppich – Eine Darstellung der ikonographischen und ikonologischen Entwicklung von den Anfängen bis zum 18. Jahrhundert*, Köln 1990

Gaube 1995 Heinz Gaube, *Usbekistan und seine Nachbargebiete in vorislamischer Zeit*, in: Kalter/Pavaloi 1995

Gaube/Ilyasov 2003 Heinz Gaube und Jangar Ilyasov, *Die Türken Mittelasins in vorislamischer Zeit*, in: Kalter/Schönberger 2003

Geijer 1963 Agnes Geijer, *Some Thoughts on the Problem of Early Oriental Carpets*, in: Ars Orientalis V, 1963: 79 ff. Second publication in: Schletzer 2000: 55

Gewerbemuseum Basel 1974 *Textilkunst der Steppen und Bergvölker Zentralasiens*, Ausstellung im Gewerbemuseum Basel 1974

Ghereh International Carpet and Textile Review; Turin, since 1993

Ghirshman 1962 Roman Ghirshman, *Iran – Parther und Sasaniden*, München 1964

Ghirshman 1964 Roman Ghirshman, *Iran – Protoiraner, Meder, Achämeniden*, München 1964

Gilles et al. 2004 Roland Gilles, Joelle Lemaistre, Maria Fernanda Pasos Leite, Friedrich Spuhler, Richard de Unger, Daniel Walker, *Heaven in a Carpet*, Paris 2004

Gimbutas 1989 Marija Gimbutas, *The Language of the Goddess*, London 1989

Gobineau 1971 J. A. de Gobineau, *Die Welt der Perser*, München – Berlin 1971

Goguel 1927 T.N. Goguel, *Some Turcoman Carpets and Their Ornamentation*, in: The Burlington Magazine for Connoisseuirs, Vol. 50, no. 290: 251-254, London 1927

Golikov 1990 V.P. Golikov, *Technology of dyeing silk by cochineal. Part I. Theoretical analysis of the problem and development of investigation method*, proceedings of the 9th triannual Meeting of ICOM-CC, Vol. 1, 289-293.

Golikov 1998a V.P. Golikov, *The Technology of Silk Dyeing by Cochineal. II. The experimental Investigation of the Influences of Types and Concentrations of Cations,* in: Dyes in History and Archaeology 17, 1998: 10–20.

Golikov 1998b V.P. Golikov, *The Technology of Silk Dyeing by Cochineal. III. The experimental Investigation of the Influences of pH, Water Quality, Cream of Tartar and Oak Galls,* in: Dyes in History and Archaeology 17, 1998: 21-33.

Gombos 1975 Karoly Gombos, *Old Turkmenian Rugs*, Museum of Applied Arts Budapest, Budapest 1975

Goswamy/Fischer 1987 B.N. Goswamy und Eberhard Fischer, *Wunder einer goldenen Zeit – Malerei am Hof der Moghul-Kaiser, Indische Kunst des 16. und 17. Jahrhunderts aus Schweizer Sammlungen*, Zürich 1987

Grabar 2000 Oleg Grabar, *Mostly Miniatures – An Introduction to Persian Painting*, Princeton University Press 2000

Granger-Taylor 1989 Hero Granger-Taylor, *The Weft-patterned Silks and their Braid: The Remains of an Anglo-Saxon Dalmatic of c. 800?*, in: Gerald Bonner, David Rollason, Clair Stancliff (Hrsg.), *St. Cuthbert, his Cult and his Community to AD 1200*, Woodbridge 1989, 303–327.

Gray 1961 Basil Gray, *Persische Malerei*, Genève 1961

Greenfield 2004 Amy Butler Greenfield, *A Perfect Red – Empire, Espionage, and the Quest for the Color of Desire*, New York 2004

Gröpper/Yaldiz 2003 Doris Gröpper und Marianne Yladiz (Hg.), *Kunst der Seidenstrasse – Faszination Buddha*, Berlin 2003

Grote-Hasenbalg 1922 Werner Grote-Hasenbalg, *Der Orientteppich – Seine Geschichte und seine Kultur*, Band 1 –3, Berlin 1922

Grube 2003 Ernst J. Grube, *Keshte – Central Asian Embroideries*, The Marshall and Marilyn R. Wolf Collection, New York 2003

Gunter 2009 Ann C. Gunter, *Greek Art and The Orient*, Cambridge University Press 2009

Guy et al. 1990 Rosemary Crill, John Guy, Veronica Murphy, Susan Stronge and Deborah Swallow, *Arts of India: 1550–1900*, Edited by John Guy and Deborah Swallow, London 1990

Haack 1956 Herrmann Haack, *Echte Teppiche – Einführung in die Orientteppichkunde*, München 1950

Hajdas et al. 2004 I. Hajdas, G. Bonani, I.Y. Slusarenko and M. Seifert, *Chronology of Pazyryk 2 and Ulandryk 4 Kurgans based on High Resolution Radiocarbon Dating and Dendrochronology – A Step Towards More Precise Dating of Scythian Burials,* in: Impact of the Environment on Human Migration in Eurasia, edited by E. Scott, A. Alekseev and G. Zaitseva. NATO Science Series 4, Earth and Environmental Sciences 42, Dordrecht: Kluwer Academic, 2004

Hallett/Pereira et al. n.y. Jessica Hallett & Teresa Pacheco Pereira, *Carpets and Paintings, 15th– 18th Centuries – The Oriental Carpet in Portugal,* Museu Nacional de Arte Antigua, Lisbon

Hali The International Magazine of Antique Carpet and Textile Art, London, since 1978

Hamilton 1959 R. W. Hamilton, F.S.A., with a contribution by Dr. Oleg Grabar, *Khirbat Al Mafjar – An Arabian Mansion in The Jordan Valley*, Oxford 1959

Hampe/Simon 1980 Roland Hampe, Erika Simon, *Tausend Jahre Frühgriechische Kunst*, München 1980

Hanyu 1987 Gao Hanyu, *Soieries de Chine*, Avant-propos de Krishna Riboud, chargée de mission au musée Guimet, Paris 1987 (English edition Hong Kong 1986)

Harper et al. 1978 Prudence Oliver Harper, *The Royal Hunter – Art of The Sasanian Empire*, with contributions by Jens Kröger, Carol Manson Bier, and Martha L. Carter, New York 1979

Harper et al. 1992 Prudence O. Harper, Joan Aruz, and Françoise Tallon (Ed), *The Royal City of Susa, Ancient Near Eastern Treasures in The Louvre*, New York 1992

Harvey 1996 Janet Harvey, *Traditional Textiles of Central Asia*, London 1996

Hauser-Schäublin et al. 1991 Brigitta Hauser-Schäblin, Marie Louise Nabholz-Kartaschoff und Urs Ramseier, *Textilien in Bali*, Basel 1991

Haussig 1983 Hans Wilhelm Haussig, *Die Geschichte Zentralasiens und der Seidenstrasse in Vorislamischer Zeit*, Darmstadt 1983

Haussig 1992 Hans Wilhelm Haussig, *Archäologie und Kunst der Seidenstrasse*, Darmstadt 1992

Hawley 1913 Walter A. Hawley, *Oriental Rugs – Antique and Modern*, London 1913

Herodot *Historien*. Deutsche Gesamtausgabe. Übersetzt von A. Horneffer, Stuttgart 1971

Herrero 1988 Concha Herrero Carretero, *Museo de Telas Medievales. Monasterio de Santa Maria la Real de Huelgas*, Madrid 1988

Herrmann I, (o.J. 1978) Eberhart Herrmann, *Von Lotto bis Tekke – Seltene Orientteppiche aus vier Jahrhunderten*, München

Herrmann II, (o.J. 1979) Eberhart Herrmann, *Von Uschak bis Yarkand – Seltene Orientteppiche aus vier Jahrhunderten*, München

Herrmann III, (o.J. 1981) Eberhart Herrmann, *Von Konya bis Kokand – Seltene Orientteppiche*, München

Herrmann IV, (o.J. 1982) Eberhart Herrmann, *Seltene Orientteppiche IV*, München

Herrmann V, 1983 Eberhart Herrmann, *Seltene Orientteppiche V*, München 1983

Herrmann VI, 1984 Eberhart Herrmann, *Seltene Orientteppiche VI*, München 1984

Herrmann VII, 1985 Eberhart Herrmann, *Seltene Orientteppiche VII*, München 1986

Herrmann VIII, 1986 Eberhart Herrmann, *Seltene Orientteppiche VIII*, München 1986

Herrmann IX, 1987 Eberhart Herrmann, *Seltene Orientteppiche IX*, München 1987

Herrmann X, 1988 Eberhart Herrmann, *Seltene Orientteppiche X*, München 1988

Herrmann 1, 1989 Eberhart Herrmann, *Asiatische Teppiche und Textilkunst,* Band 1, München 1989

Herrmann 2, 1990 Eberhart Herrmann, *Asiatische Teppiche und Textilkunst,* Band 2, München 1990

Herrmann 3, 1991 Eberhart Herrmann, *Asiatische Teppiche und Textilkunst,* Band 3, München 1991

Herrmann 4, 1992 Eberhart Herrmann, *Asiatische Teppiche und Textilkunst,* Band 4, München 1992

Herzfeld 1920 Ernst Herzfeld, *Am Tor von Asien. Felsdenkmale aus Irans Heldenzeit,* Berlin 1920

Herzfeld 1923 Ernst Herzfeld, *Der Wandschmuck der Bauten von Samarra und seine Ornamentik*, Berlin 1923

Herzfeld 1941 (1988) Ernst E. Herzfeld, *Iran in The Ancient East*, Archaeological Studies Presented in The Lowell Lectures at Boston, New York 1988

Hirsch 1991 Udo Hirsch, *The Fabric of Deities & Kings*, in: Hali 58, 1991: 104 – 111

Hodenhagen 1997 *Grosse Taschen – Kleine Taschen. Miniaturkunst der Turkmenen aus der Sammlung HCS,* Ausstellung des Freundeskreises orientalischer Teppiche und Textilien in Norddeutschland (Photo-Album, 100 Exemplare), Hodenhagen 1997

Hofenk de Graaff 2004 Judith H. Hofenk de Graaff, with contributions from Wilma G. Th. Roelofs and Maarten van Bommel, *The Colourful Past – Origins, Chemistry and Identification of Natural Dyes*, Riggisberg/ London 2004

Hofenk de Graaff/Roelofs 2006 Judith Hofenk de Graaff and Wilma G. Th. Roelofs, Dyestuffs Along the Silk Road: Identification and Interpretation of Dyestuffs from Early Medieval Textiles, in: Schorta 2006: 35 – 48

Hoffmeister 1980 Peter Hoffmeister, *Turkoman Carpets in Franconia*, Edinburgh 1980

Hornung 1989 Erik Hornung, *Geist der Pharaonenzeit*, Zürich und München 1989

Housego 1978 Jenny Housego, *Tribal Rugs. An Introduction to the Weaving of the Tribes of Iran*, London 1978

Hrouda 1965 Barthel Hrouda, *Die Kulturgeschichte des assyrischen Flachbildes*, Bonn 1965

Hrouda 1991 Barthel Hrouda, *Der Alte Orient. Geschichte und Kultur des alten Vorderasien*, München 1991

Hubel 1972 Reinhard G. Hubel, *Ullstein Teppichbuch. Eine Teppichkunde für Käufer und Sammler*, Frankfurt/ Berlin/Wien 1972

Ibn Battuta *The Adventures of Ibn Battuta*, A Muslim Traveler of the 14th Century. Ross E. Dunn, Berkeley, Los Angeles, London 2005

7th ICOC 1993 7th International Conference on Oriental Carpets, Papers - Presentations, Hamburg 17.-20.6.1993, Berlin 20.-22.6.1993

Ierusalimskaja 1972 (2000) A.A. Ierusalimskaja, *Die Schule der künstlerischen Seidenweberei in Sogdiana,* in: Mittelasiatische Studien, Band 2, Herausgegeben von Reinhold Schletzer; Textilien Mittelasiens, Band 1, Beiträge zur sasanidischen und frühislamischen Kunst. Entwicklung – Ornamente – Symbolik, Berlin 2000

Ierusalimskaja 1996 Anna A. Ierusalimskaja, *Die Gräber der Moscevaja Balka*, Frühmittelalterliche Funde an der nordkaukasischen Seidenstrasse, München 1996

Ierusalimskaja/Borkopp 1996 Anna A. Ierusalimskaja und Brigitt Borkopp, *Von China nach Byzanz*, *Frühmittelalterliche Seiden aus der Staatlichen Ermitage St. Petersburg*, München 1996

Irons 1975 William Irons, *The Yomut Turkmen: A Study of Social Organization among a Central Asian Turkic-speaking Population*, Ann Arbor 1975

Irons 1980 William Irons, *The Place of Carpet Weaving in Turkmen Society*, in: Mackie/Thompson 1980: 25 – 39

Irons 1990 William Irons, *Production and use of Textiles by the Turkmen*, in: O'Bannon 1990: 45 – 58

Irwin 1997 Robert Irwin, *Islamic Art*, London 1997

Isaacson 2007 Richard Isaacson, *Architectural Textiles: Tent Bands of Central Asia*, Washington DC, 2007

Isaacson 2009 Richard Isaacson, *Almost Forgotten Images. Old Photographs of Nomadic Life and Textiles in Central Asia*, in: Hali 159, 2009: 30 – 33.

Jahn 1969 Karl Jahn, *Die Geschichte der Oguzen des Rašid ad-Din*, in: Forschungen zur islamischen Philologie, Herausgegeben von Adolf Grohmann, Band IV, Wien 1969

Jahn 1980 Karl Jahn, *On Rašid al-Din's "History of the Oghuz and Turks",* in: Pinner/Franses 1980

Jarrige 1987 Jean-Francois Jarrige, *Die frühesten Kulturen in Pakistan und ihre Entwicklung* in: Kat. Aachen 1987

Jarrige et al. 1993 J-F. Jarrige, Kenneth White, Jerome Ghesquière, *Frontières d'Asie. Photographies Et Notes De Voyage Du Fonds Louis Marin*, Museé Guimet Paris 1993.

Jenkins 1983 Marilyn Jenkins, *Islamic Art in the Kuwait National Museum. The al-Sabah Collection*, London 1983

Jettmar 1964 Karl Jettmar, *Die frühen Steppenvölker – Der eurasische Tierstil – Entstehung und sozialer Hintergrund*, Zürich 1964

Jourdan 1989 Uwe Jourdan, *Orientteppiche Band 4: Turkmenische Teppiche*, München 1989

Jourdan 2004 Uwe Jourdan, *Pinning Down The Asmalyk*, in: *Hali 25 Years Anniversary Edition*, Hali 135, London 2004

Jull/Douglas 1990 A.J. Timothy Jull and J. Donahue Douglas, *Radiocarbon Dating with Accelerator Methods and Application to Textiles*, in: Orientations, June 1990

Junker/Alavi 1965 Heinrich Junker und Bozorg Alavi, *Persisch-deutsches Wörterbuch*, Leipzig 1965

Kaelin 2007 Oskar Kaelin, *Ägypten als Modell für mesopotamisches «hoch bauen» – akkadisch zaqaru(m) und ägyptisch sq'j als sprachliches Indiz*, in: HSB 20, 2007: 59 – 63

Kaffel 2007 Ralph Kaffel, *Beshir prayer rugs*, in: Hali 151, 2007: 75 – 83.

Kalter/Pavaloi 1995 Ed. J. Kalter, M. Pavaloi, *Usbekistan, Erben der Seidenstrasse*, Stuttgart 1995

Kalter/Schönberger 2003 Ed. J. Kalter, I. Schönberger, *Der lange Weg der Türken – 1500 Jahre türkische Kultur*, Stuttgart 2003

Karpov 1929 (1979) G.I. Karpov, *Tamga (Besitzbezeichnungen der Turkmenen),* Turkmnovedenie Nr. 6 – 7, 1930, in: Turkmenenforschung Band 1, Berlin - Hamburg 1979

Karpov/Arbekov 1930 (1979) G.I. Karpov und P.B. Arbekov, *Die Salor,* Turkmnovedenie Nr. 6 – 7, 1930, in Turkmenenforschung Band 2, Berlin - Hamburg 1979

Cat. Aachen 1987 *Vergessene Städte am Indus. Frühe Kulturen in Pakistan vom 8. – 2. Jahrtausend v. Chr,* Aachen 1987.

Cat. Antwerpen 1997 *Music for the eyes - Textiles from the People of Central Asia*, Antwerp 1997

Cat. Basel 1980 *Sammler zeigen: Alte Teppiche aus dem Orient*, Freunde des Orientteppichs Basel 1980

Cat. Basel 2012 *Petra* – Wunder in der Wüste. Auf den Spuren von J.L. Burckhardt *alias* "Scheich Ibrahim". Antikenmuseum Basel und Slg. Ludwig, Basel 2012

Cat. Berlin 1995 *Schätze der Alhambra. Islamische Kunst aus Andalusien*, Berlin 1995

Cat. Bonn 2004 *Die Thraker. Das goldend Reich des Orpheus,* Bonn 2004

Cat. München 1984 *Gold der Skythen aus der Leningrader Eremitage*, München 1984

Cat. München 2012 *Die unsterblichen Götter Griechenlands*, München 2012

Cat. München/Hamburg 2007 *Im Zeichen des Goldenen Greifen – Königsgräber der Skythen*, München/Hamburg 2007

Cat. New York 1996 *Ancient Art from the Shumei Family Collection*, The Metropolitan Museum of Art, New York 1996

Cat. New York 1999 *Egyptian Art in the Age of the Pyramids*, The Metropolitan Museum of Art, New York 1999

Cat. Paris 2000 *l'Asie des steppes d'Alexandre le Grand à Gengis Khan*, Musée Guimet, Paris 2006

Cat. Paris 2006 *Les Perses Sassanides, Fastes d'un empire oublié (224–642)*, Musée Cernuschi, Paris 2006

Cat. Speyer 2006 *Das Persische Weltreich – Pracht und Prunk der Grosskönige*. Historisches Museum der Pfalz Speyer 2006

Kat. Speyer 2010 *Amazonen – Geheimnisvolle Kriegerinnen*, Historisches Museum der Pfalz Speyer 2010

Cat. Washington/San Francisco/Houston/New York 2008/2009 *Afghanistan. Hidden Treasures from the National Museum, Kabul*, San Francisco/Houston/New York 2009

Keel 1972 Othmar Keel, *Die Welt der altorientalischen Bildsymbolik und das Alte Testament am Beispiel der Psalmen*, Zürich/Einsiedeln/Köln 1972

Keller et al. 2001 Dominik Keller, Du Gencheng and Zhang Yuzhong, *Sampula in Xinjiang of China – Revelation and study of Ancient Khotan Civilization*, Xinjiang Uygur Autonomous Region Museum/Xinjiang Institute of Archaeology, Urumqi 2001

Keller/Schorta 2001 Dominik Keller and Regula Schorta (Ed), *Fabulous Creatures from the Desert Sands. Central Asian Woolen Textiles from the Second Century BC to the Second Century AD*, Riggisberger Berichte 10, Riggisberg 2001

Kellner 1991 Hans-Jörg Kellner, *Gürtelbleche aus Urartu*, Stuttgart 1991

Khlopin 1982 Igor N. Khlopin, *Die Herstellung von Florteppichen in Zentralasien in der Bronzezeit*, in: Hali Vol. 5, Nr. 2, 1982

Kirchheim et al. 1993 E. Heinrich Kirchheim, Michael Franses, Friedrich Spuhler, Garry Muse, Jürg Rageth, Eberhart Herrmann, *Orient Stars – Eine Teppichsammlung*, London 1993

Kljaštornyj/Sultanov 2004 (2006) S.G. Kljaštornyj, T.I. Sultanov, *Staaten und Völker in den Steppen Eurasiens. Altertum und Mittelalter*, Berlin 2006

Knauer 1978 Elfriede R. Knauer, *Toward a History of the sleeved Coat. A Study of the Impact of an Ancient Eastern Garment in the West*, in: Expedition, The University Museum Magazine of Archaeology/Anthropology, University of Pennsylvania 21.1, 1978: 18–36.

Koch 2006 Heidemarie Koch, *Königreiche im alten Vorderen Orient*, Mainz 2006

Komaroff/Carboni 2002 Linda Komaroff and Stefano Carboni (Ed), *The Legacy of Genghis Khan – Courtly Art and Culture in Western Asia, 1256 – 1353*, The Metropolitan Museum of Art, New York, New Haven and London 2002

Kononov 1958 Abu al-Gazi Bahadur Han, Rodoslovnja turkmen (Shajarah-i tarakimah), socinenie Abu-l-Gazi Chana Chivinskogo, Russische Übersetzung und Anmerkungen von Andrej Nikolaevic Kononov, Leningrad 1958

König 1983 Hans König, *A Typical Ensi?*, in: Hali 5/3, London 1983: 257–260.

König 1962 Wolfgang König, *Die Achal-Teke, Zur Wirtschaft und Gesellschaft einer Turkmenen-Gruppe im XIX. Jahrhundert*, Berlin 1962

Kosztarab/Kozar 1988 M. Kosztarab and F. Kozar, *Scale insects of Central Europe*, published by Akadémiai Kiado and J. Junk Publishers, Budapest 1988

Krahl 1998 Regina Krahl, *Designs on Early Chineses Textiles*, in: Chinese and Central Asian Textiles; Selected Articles from Orientations 1983 – 1997; Hong Kong 1998

Kröger 1982 Jens Kröger, *Sasanidischer Stuckdecor*, Baghdader Forschungen, Band 5, Mainz 1982

Kröger 1982.1 Jens Kröger, *Werkstattfragen iranisch-mesopotamischen Baudekors in sasanidisch-frühislamischer Zeit*, in: Künstler und Werkstatt in den orientalischen Gesellschaften. Herausgegeben von Adalbert J. Gail, Graz 1982

Kröger 1995 Jens Kröger, *Nishapur: Glass of The Early Islamic Period*, The Metropolitan Museum of Art, New York 1995

Kurt 1975 Dieter Kurt, *Den Himmel Stützen. Die «Tw3 pt»-Szenen in den ägyptischen Tempeln der griechisch - römischen Epoche. Rites Égyptiens II*, Bruxelles 1975

Lamm 1985 Carl Johan Lamm, *Carpet fragments – The Marby rug and some fragments of carpets found in Egypt*, Uddevalla 1985

Landreau 1978 Anthony N. Landreau, *Yörük – The Nomadic Weaving Tradition of the Middle East*, Pittsburgh, Pennsylvania, 1978

Langauer 2011 Udo Langauer, *Turkmen Collection 2011*, Perchtoldsdorf 2011

Layard 1853 Austin Henry Layard, *The Monuments of Nineveh from Drawings made on the Spot*, London 1853

Lentz/Lowry 1989 Thomas W. Lentz and Glenn D. Lowry, *Timur and the Princely Vision. Persian Art and Culture in the Fifteenth Century*, Los Angeles 1989

Lederman 1996 A.J. Lederman, Editor: *A Skein Through Time – Carpets from the Collections of Members of the Hajji Baba Club*, New York 1996

Ledderose 1985 Lothar Ledderose (Hsg.), *Palast-museum Peking – Schätze aus der Verbotenen Stadt*, Museum für Völkerkunde Wien, Frankfurt am Main 1985

Lessing 1913 Julius Lessing, *Die Gewebesammlung des Königlichen Kunstgewerbemuseums*, Berlin 1913

Lettenmair 1962 Josef G. Lettenmair, *Das grosse Orient-Teppich-Buch*, Wesermühl 1962

Loges 1978 Werner Loges, *Turkmenische Teppiche*, München 1978

Loges 1985 Werner Loges, *Doors of the Chodor*, in: Hali 26, 1985: 30–33

López Redondo/Marinetto Sánchez 2012 Amparo López Redondo, Purification Marinetto Sánchez, *A la Luz de la Seda*, Catálogo de la Colección de Tejidos Nazaríes del Museo Lázaro Galdiano y el Museo de la Alhambra. Orígenes y Pervivencias. Granada 2012.

Loukonine/Ivanov 2003 Vladimir Loukonine & Anatoli Ivanov, *Persian Art – Lost Treasures*, London 2003

Mackie 2015 Louise W. Mackie, *Symbols of Power – Luxury Textiles from Islamic Lands, 7th – 21st Century*, London 2015

Mackie/Pollard Rowe 1976 Louise W. Mackie and Ann Pollard Rowe, *Masterpieces in the Textile Museum*, The Textile Museum, Washington, D.C. 1976

Mackie/Tompson 1980 Louise W. Mackie and Jon Thompson (Ed), *Turkmen – Tribal Carpets and Tradition*, The Textile Museum, Washington, D.C. 1980

Mahdihassan 1954 S. Mahdihassan, *The Natural History of Lac as known to the Chinese: Li Shih-Chen's Contribution to our Knowledge of Lac*, in: Indian Journal of Entomology 16, 322-323.

Mallett 1998 Marla Mallett, *Woven Structure. A Guide to Oriental Rug and Textile Analysis*, Atlanta 1998

Mallory 1989 J. P. Mallory, *In Search of the Indo-Europeans – Language, Archaeology and Myth*, London 1989

Mallory/Mair 2000 J. P. Mallory, Victor H. Mair, *The Tarim Mummies – Ancient China and the Mystery of the Earliest People from the West*, London 2000

Mankowski 1938 Tadeusz Mankowski, *Some Documents from Polish Sources Relating to Carpet Making in the Time of Shah Abbas I*, in: Pope/Ackerman 1938

Mark 1997 Samuel Mark, *From Egypt to Mesopotamia. A Study of Predynastic Trade Routes*, Texas A&M University Press 1997

Marschak 1986 Boris Marschak, *Silberschätze des Orients. Metallkunst des 3.–13. Jahrhunderts*, Leipzig 1986

Marshak 1992 Boris Marschak, *The Historico-Cultural Significance of the Sogdian Calendar*, in: Iran, Journal of the British Institue of Persian Studies, Vol. XXX, 1992: 145 – 154. London 1992

Marshak 1995/96 Boris I. Marshak, *On the Iconography of Ossuaries from Biya-Naiman*, in: Silk Road Art and Archaeology 4, 1995/96: 299 – 321, Journal of the Institute of Silk Road Studies, Kamakura

Martiniani-Reber 1986 Marielle Martiniani-Reber, *Lyon, musée historique des tissus – Soieries sassanides, coptes et byzantines* V[e]-*XI*[e] *siècles*, Inventaire des collections publiques françaises, 30; Paris 1986

Martiniani-Reber 1993 Marielle Martiniani-Reber, *Tissus d'Egypt, temoins du monde Arabe*, VIII[e] – XV[e] siècles. Collection Bouvier. Musée d'art et d'historie, Genève, Institute du monde arabe, Paris, 1993

Martiniani-Reber et al. 1991 Marielle Martiniani-Reber, *Tissus Coptes*, vol. I, textes et catalogue, vol. II planches, Musée d'art et d'histoire Genève 1991

Masschelein-Kleiner 1967 Liliane Masschelein-Kleiner, *Microanalysis of anthraquinones in red lakes*, in: Microchimica acta 6, 1080-1085, Vienna 1967

Masson/Sarianidi 1972 V. M. Masson and V. I. Sarianidi, *Central Asia – Turkmenia before the Achaemenids*, New York/Washington 1972

Matsumoto 1984 Kaneo Matsumoto, *Jodai-Gire, 7th and 8th century Textiles from the Shosho-in and Horyu-ji*, Kyoto 1984

Maxwell-Hyslop 1989 Rachel Maxwell-Hyslop, *An Early Group of Quadruple Spirals*, in: Anatolia and the Ancient Near East. Studies in Honour of Tahsin Özgüç. Edited by Kutlu Emre et al., Ankara 1989: 215–223.

May 1957 Florence Lewis May, *Silk Textiles of Spain – Eighth to Fifteenth Century*, New York 1957

Mazaheri 1970 A. Mazaheri, *Der Iran und seine Kunstschätze. Meder und Perser – die Schätze der Magier – Die Iranische Renaissance*, Genève 1970

McCoy Jones/Boucher 1972 H. McCoy Jones and Jeff W. Boucher, *Weavings of the Tribes in Afghanistan*, The Washington Hajji Baba Society Inc., Washington, D.C. 1972

McCoy Jones/Boucher 1973 H. McCoy Jones and Jeff W. Boucher, *Tribal Rugs from Turkmenistan*, The International Hajji Baba Society Inc. Washington, D.C. 1973

McCoy Jones/Boucher 1975 H. McCoy Jones and Jeff W. Boucher, *The Ersari and their Weavings*, The International Hajji Baba Society, Inc., Washington, D.C. 1976

McCoy Jones/Boucher 1976 H. McCoy Jones and Jeff W. Boucher, *Rugs of the Yomut Tribes*, The International Hajji Baba Society, Inc., Washington, D.C. 1975

McMullan 1965 Joseph V. McMullan, *Islamic Carpets*, New York 1965

McMullan/Reichert (o.J.) Joseph V. McMullan in collaboration with Donald O. Reichert, *The George Walter Vincent and Belle Townsley Smith Collection of Islamic Rugs*, George Walter Vincent Smith Art Museum, Springfield, Masachusetts o.J. (1970)

Mellaart 1967 James Mellaart, *Çatal Hüyük – Stadt der Steinzeit*, Bergisch Gladbach 1967

Menander R.C. Blockley (ed. and trans.), *The History of Menander the Guardsman*, Introductory Essay, Text, Translation, and Historiographical Notes, (ARCA 17), Liverpool 1985

Meyer 1914 Eduard Meyer, *Reich und Kultur der Chetiter*, Berlin 1914

Mirtov 1974 B. A. Mirtov, *Quellen des turkmenischen Teppichornaments*, in: Turkmenenforschung, Band 8. Die Teppichkultur der Turkmenen und ihre Glaubenswelt, Hamburg o.J.

Moortgat 1982 Anton Moortgat, *Die Kunst des Alten Mesopotamien. Die Klassische Kunst Vorderasiens. I Sumer und Akkad*, Köln 1982

Moortgat 1984 Anton Moortgat, *Die Kunst des Alten Mesopotamien. Die Klassische Kunst Vorderasiens. II Babylon und Assur*, Köln 1984

Milhofer 1966 Stefan A. Milhofer, *Taschenführer Orient-Teppiche*, Hannover 1966

Milhofer 1968 Stefan A. Milhofer, *Die Teppiche Zentralasiens*, Hannover 1968

Mills 1978 John Mills, *"Small Pattern Holbein" Carpets in Western Paintings*, Part 1, in: Hali 1/4, 1978

Mode 1993 Markus Mode, *Sogdien und die Herrscher der Welt. Türken, Sasaniden und Chinesen in Historiengemälden des 7. Jh. n. Chr. aus Alt-Samarqand*, Frankfurt am Main 1993

Moorey et al. 1981 P.R.S. Moorey, Emma C. Bunker, Edith Porada, Glenn Markoe, *Ancient Bronzes, Ceramics and Seals. The Nasli M. Heeramaneck Collection of Ancient Near Eastern, Central Asiatic and European Art.* Los Angeles County Museum of Art 1981

Moran 2005 Neil K. Moran, *Kipling and Afghanistan. A Study of the Young Author as Journalist Writing on the Afghan Border Crisis of 1884 – 1885*, Jefferson, North Carolina, and London 2005

Moscati et al. 1988 Sabatino Moscati (direzione scientifica), *i Fenici*, Palazzo Grassi, Milano 1988

Moshkova 1946 (1980) V.G. Moshkova, *Tribal Göl in Turkoman Carpets*, in: Pinner/Franses 1980: 16–26.

Moschkowa 1951 (1998) V.G. Moschkowa, *Dschulchirs* (zwei usbekische Teppichunikate aus dem 19. Jh. aus der Sammlung des Geschichtsmuseums der Akademie der Wissenschaften Usbekistans), in: Materialien Band II zu V.G. Moschkowa Teppiche der Völker Mittelasiens, S. 101 – 111, Mittelasiatische Studien, Band 5, herausgegeben von Reinhold Schletzer: Berlin 1998

Moshkova 1970 (1996) V.G. Moshkova, *Carpets of the People of Central Asia of the Late XIX and XX Centuries*, Edited and translated by George W. O'Bannon and Ovadan K. Amanova-Olsen, Tucson 1996

Moschkowa 1970 (1998) V.G. Moschkowa, *Teppiche der Völker Mittelasiens im späten 19. und frühen 20. Jahrhundert*, Mittelasiatische Studien, Band 3, herausgegeben von Reinhold Schletzer, Berlin 1998

Mulder-Erkelens 1977 A.M.L.E. Mulder-Erkelens, *Osterse tapijten uit de schenking Van Aardenne*, Amstardam 1977

Mumford 1915 John K. Mumford, *Oriental Rugs*, fourth edition, New York 1915

Munis & Agahi Shir Muhammad Mirab Munis and Muhammad Riza Mirab Agahi, *Firdaws Al-Iqbal: History of Khorezm*, Leiden 1999

Munkacsi 1994 Kurt Munkacsi, *Dividing the Chodor*, in: Hali 77, 1994: 96 – 107

Munkacsi/d'Heurle/Saunders 2003 Kurt Munkacsi, David d'Heurle, Peter Saunders, *Bigger is Better, Main Carpets of the Turkmen* (publication on CD), New York 2003

Muradova 1975 (1985) A. Muradova, *Zur Terminologie der turkmenischen Teppichknüpferei*, in: Turkmenenforschung Band 6, Hamburg 1985

Muthesius 1997 Anna Muthesius, *Byzantine Silk Weaving AD 400 to AD 1200*, Vienna 1997

Muthmann 1982 Friedrich Muthmann, *Der Granatapfel. Symbol des Lebens in der Alten Welt*, Bern 1982

Myers 2004 Harold R. Myers, *Pacific Northwest Collections*, ACOR 7, exhibition catalogue, Seattle 2004

Natali et al. 1996 A. Natali, J.-F. Manen, M. Kiehn and F. Ehrendorfer, *Tribal, generic and specific relationships in the Rubioideae-Rubieae (Rubiaceae) based on sequence data of a cpDNA intergene region*, in: Opera Botanica Belgica 7, 1996: 193-203

Naumann 1983 Friederike Naumann, *Die Ikonographie der Kybele in der phrygischen und der griechischen Kunst*, Istanbuler Mitteilungen, Beiheft 28, Tübingen 1983

Naumkin 1993a Vitaly V. Naumkin (Series Editor), *Bukhara. Caught in Time: Great Photographic Archives*, Reading 1993

Naumkin 1993b Vitaly V. Naumkin (Series Editor), *Khiva. Caught in Time: Great Photographic Archives*, Reading 1993

Neff/Maggs 1977 Ivan C. Neff, and Carol V. Maggs, *Dictionary of Oriental Rugs, with a monograph on identification by weave*, Johannesburg 1977

Neugebauer/Orendi 1909 Rudolf Neugebauer, und Julius Orendi, *Handbuch der orientalischen Teppichkunde*, Leipzig 1909

Noever 2005 Peter Noever (Ed), *Verletzliche Beute, Spätantike und frühislamische Textilien aus Ägypten*, Wien 2005

Nunn 2006 Astrid Nunn, *Alltag im alten Orient*, Mainz 2006

O'Bannon et al. 1990 George W. O'Bannon, William A. Wood, William Irons and Paul Mushak, *Vanishing Jewels: Central Asian Tribal Weavings*, Rochester 1990

O'Bannon 1998 George W. O'Bannon, *Tribal and Village Rugs from Arizona Collections*, Tucson 1998

OCTS *Oriental Carpets and Textile Studies*, Edited by Robert Pinner, Walter B. Denny and Murray L. Eiland, Jr., seit 1985

Oepen et al. 2011 Joachim Oepen, Bernd Pfäffgen, Sabine Schrenk, Ursula Tegtmeier, *Der hl. Severin von Köln. Verehrung und Legende. Befunde und Forschungen zur Schreinsöffnung von 1999*, Siegburg 2011

Opie 1992 James Opie, *Tribal Rugs, Nomadic and Village Weavings from the Near East and Central Asia*, London 1992

Oppenheim 1977 A. Leo Oppenheim, *Ancient Mesopotamia: Portrait of a Dead Civilisation*, Chicago, London 1977

Orendi 1930 Julius Orendi, *Das Gesamtwissen über antike und neue Teppiche des Orients*, Band I & II, Wien 1930

Orientations 1983 – 1997 *Chinese and Central Asian Textiles*. Selected articles from Orientations 1983 – 1997

ORR Oriental Rug Review, A bi-Monthly Journal of Oriental Rugs and other Textiles, 1981-1996

Orcel/Orcel/Hurni 1992 Alain Orcel, Christian Orcel und Jean Pierre Hurni, *Dendrochronologie in der Praxis*, in Mitteilungen des Historischen Vereins des Kantons Schwyz, Heft 84, 1992

Otavsky/Muhammad Salim 1995 Karel Otavsky, Muhammad 'Abbas Muhammad Salim, *Mittelalterliche Textilien I, Ägypten, Persien und Mesopotamien, Spanien und Nordafrika*, Riggisberg 1995

Otavsky 1998 *Entlang der Seidenstrasse: Frühmittelalterliche Kunst zwischen Persien und China in der Abegg-Stiftung*, Herausgegeben von Karel Otavsky, Riggisberger Berichte 6, Riggisberg 1998

Otavsky 1998a Karel Otavsky, *Zur kunsthistorischen Einordnung der Stoffe*, in Otavsky 1998: 119 – 224

Otavsky/Wardwell 2011 Karel Otavsky, Anne E. Wardwell, *Mittelalterliche Textilien II. Zwischen Europa und China*, Abegg-Stiftung, Riggisberg 2011

Overlaet 1998 Bruno Overlaet, *Sasanian Bronze Sculptures in the Werner Abegg Collection*, in Otavsky 1998: 247 – 265

Pancaroglu 2007 Oya Pancaroglu, *Perpetual Glory. Medieval Islamic Ceramics from the Harvey B. Plotnick Collection*, The Art Institute of Chicago, 2007

Parrot 1960 André Parrot, *Sumer. Die mesopotamische Kunst von den Anfängen bis zum XII. vorchristlichen Jahrhundert*, München 1960

Parrot 1961 André Parrot, *Assur. Die mesopotamische Kunst vom XIII. vorchristlichen Jahrhundert bis zum Tode Alexanders des Grossen*, München 1961

Parzinger 2006 Hermann Parzinger, *Die frühen Völker Eurasiens. Vom Neolithikum bis zum Mittelalter*, München 2006.

Parzinger et al. 2007 Hermann Parzinger (Hg.), *Im Zeichen des goldenen Greifen. Königsgräber der Skythen*. München, Berlin, London, New York, 2007

Pazyryk Gesellschaft 1988 Das Jahrbuch der Pazyryk Gesellschaft, Band 1 – 1988

Peggie et al. 2007 D.A. Peggie, A. N. Hulme, H. McNab, and A Quye, *Towards the identification of characteristic minor components from textiles dyed with weld (Reseda luteola L.) and those dyed with Mexican cochineal (Dactylopius coccus Costa)*. Microchemica Acta, 371-380, 2007

Peter 1976 Irmgard Peter, *Textilien aus Ägypten im Museum Rietberg Zürich*, Zürich 1976

Pfister 1935 René Pfister, *Teinture et alchimie dans l'Orient hellénistique*. Seminarium Kondakovianum 7, Prague 1935, 1-59

Piccirillo 1993 Michele Piccirillo, *The Mosaics of Jordan*, Amman 1993

Pinner 1980 Robert Pinner, *The Animal Tree and the Great Bird in Myth and Folklore*, in: Pinner/Franses 1980: 204 – 219.

Pinner 1980 a Robert Pinner, *Some Aspects of the Tekke Chuval*, in: Mackie/Thompson 1980: 202–215.

Pinner 1991 Robert Pinner, *Salor Ensis*, in: Hali 60, London 1991: 86–95.

Pinner 1993 Robert Pinner, *The Rickmers Collection - Turkoman Rugs in the Ethnographic Museum Berlin*, London 1993

Pinner 1999 Robert Pinner, *Rugs of the Turkmen and other People of Central Asia*, in: Concaro/Levi 1999

Pinner 2004 Robert Pinner, *The Turkmen Ensi in Literature and Life*, in: Hali 132, 2004: 97–107

Pinner/Eiland 1999 Robert Pinner and Murray L. Eiland Jr. (Ed), *Between the Black Desert and the Red*, Turkmen Carpets from the Wiedersperg Collection, Fine Arts Museum of San Francisco, San Francisco 1999

Pinner/Franses 1980 Robert Pinner and Michael Franses (Ed), *Turkoman Studies I, Aspects of the weaving and decorative arts of Central Asia*, London 1980

Pinsent 1969 John Pinsent, *Griechische Mythologie*, Wiesbaden 1969

Pirkulijewa 1966 (1998) A. N. Pirkulijewa, *Das Teppichhandwerk der Turkmenen am Mittellauf des Amu-Darja*, Materialien, Band I, zu V. G. Moschkowa, Teppiche der Völker Mittelasiens, Mittelasienstudien Band 4, Reinhold Schletzer (Hg.), Berlin 1998

Ponomaryov 1931 (1980) O. Ponomaryov, *The Motifs of Turkmen Carpets –Salor, Tekke and Saryk,* in: Pinner/Franses 1980: 27–35

Pope/Ackerman 1938 Arthur U. Pope/ Phyllis Ackerman (Hrsg.), *A Survey of Persian Art from Prehistoric Times to the Present*, London/New York 1938

Porada 1950 Edith Porada, *A Leonine Figure of the Protoliterate Period of Mesopotamia*, in: Journal of the American Oriental Society, Vol. 70, no. 4, October –December 1950

Poullada 2006 Peter Poullada, *Kizil Ayak & Ali Eli Chuvals*, in: Hali 148, 2006: 66–71

Poullada 2008 Peter Poullada, *Qizilbash From Khorasan? A mystery carpet from the Heckhser Collection*, in: Hali 156, 2008: 54–59

Pugliese Carratelli 1996 Giovanni Pugliese Carratelli, *The Western Greeks*, Venezia 1996

Purdon 1996 Nicholas Purdon, *Carpet and Textile Patterns*, London 1999

Quye/Wouters 1992 Anita Quye and Jan Wouters, *An application of HPLC to the identification of natural dyes*, in: Dyes in History and Archaeology 10, 1992: 48-54

Rageth 1990 Jürg Rageth (Hg.), *Anatolische Kelims. Symposium Basel – Die Vorträge.* Basel 1990

Rageth 1990a Jürg Rageth (Hg.), *Anatolische «Gebets-Kelims» – frühe Sinnbilder des Kosmos, in:* Rageth 1990: 135 – 151.

Rageth 1991 Jürg Rageth (Hg.), *Frühe Formen und Farben, Gewebe aus Anatolien. Symposium Basel – Die Ausstellung* (Ausstellung zu Rageth 1990), Basel 1991

Rageth 1991a Jürg Rageth, *When form is more than just decoration*, in: Rageth 1991: (19–23) 35 – 37.

Rageth 1993 Jürg Rageth, *The Iconography of the Patterns of Two So-Called "Prayer Kilims" From Obruk*, in: OCTS, Vol. IV, Berkeley 1993: 125–134.

Rageth 1999 Jürg Rageth (Hg.), *Anatolian Kilims and Radiocarbon Dating*, Basel 1999

Rageth 1999a Jürg Rageth, *A New Approach to Dating Anatolian Kilims,* in: Rageth 1999: 23-30

Raspopova 2006 Valentina I. Raspopova, *Textiles Represented in Sogdian Murals*, in: Schorta 2006

Rautenstengel/Azadi 1990 Annette & Volker Rautenstengel und Siawosch Azadi, *Studien zur Teppichkultur der Turkmenen*, Hilden 1990

Rautenstengel 1992 Annette & Volker Rautenstengel, *Die Bogça,* in: Weltkunst 15, 1992: 1999 ff.

Reed 1966 Christopher Dunham Reed, *Turkman Rugs*, Fogg Art Museum, Massachusetts 1966

Reeder et al. 1999 Ellen D. Reeder (Ed), *Scythian Gold – Treasures from Ancient Ukraine*, With essays by: Esther Jakobson, Lada Onyshkevych, Ellen Reeder, (and others), New York 1999

Rehm 1997 Ellen Rehm, *Kykladen und Alter Orient*, Bestandeskatalog des Badischen Landesmuseums Karlsruhe, Karlsruhe 1997

Reuben I, 1998 David M. Reuben, *Gols and Guls, Turkmen Carpets From the* 18th and 19th *Centuries*, London 1998

Reuben II, 2001 David M. Reuben, *Gols and Guls II, Turkmen and Related Carpets From the* 17th to 19th *Centuries*, London 2001

Reuben 2007 David M. Reuben, *Yomut or not? Asymmetrically-knotted "Yomut" ensi*, in: Hali 153, 2007: 61–63

Riboud 1983 Krishna Riboud, *Brief Comments on the Depiction of the Simurgh*, in: National Museum Bulletin (New Delhi) 4, 5 and 6, 1983: 107–113.

Riboud et al. 1995 Krishna Riboud, Amina Okada, Marie-Hélène Guelton, *Le motif floral dans les tissus Moghols*, A.E.D.T.A., Paris 1995

Riboud et al. 1998 Krishna Riboud, Amina Okada, Rahul Jain, Marie-Hélène Guelton (and others), *Samit & Lampas, Motifs indiens – Indian motifs*, A.E.D.T.A./Calico Museum, Paris 1998

Richardson 2012 David and Sue Richardson, *Qaraqalpaqs of the Aral Delta*, London/New York, 2012

Riegl 1923 Alois Riegl, *Stilfragen. Grundlagen zu einer Geschichte der Ornamentik.* 2. Auflage, Berlin 1923

Robinson 1982 Francis Robinson, *Weltatlas der alten Kulturen. Der Islam*, München 1982

Robinson et al. 1988 B.W. Robinson (Ed.), R.W. Skelton, Friedrich Spuhler, Géza Fehérvári, Oliver Watson, R.H. Pinder-Wilson, *Islamic Art in the Keir Collection*, London 1988

Rorex/Fong 1974 *Eighteen Songs of a Nomad Flute. The Story of Lady Wen-Chi.* A Fourteenth-Century Handscroll in the Metropolitan Museum of Art, New York 1974

Rossetti 1992 Brigitte Rossetti, *Die Turkmenen und ihre Teppiche – Eine ethnologische Studie*, Berlin 1992

Rossi-Osmida et al., n.y. *Turkmenistan* (in Italian), Centro Studi Ricerche Ligabue, Veneizia o.J.

Rossi-Osmida et al. 1996 Gabriele Rossi-Osmida (ed.), *Turkmenistan – Environment, History, Monuments Ethnography*, Venezia 1996

Rostovtzeff 1922 M. Rostovtzeff, *Iranians & Greeks in South Russia*, Oxfrord 1922

Rothberg 1998 Michael Rothberg, *Arabachi*, in: Hali 96, 1998: 92–99

Roxburgh et al. 2005 David J. Roxburgh, *Turks – A Journey of a Thousand Years, 600 – 1600*, Royal Academy of Arts, London 2005

Rudenko 1969 S. I. Rudenko, *Die Kultur der Hsiung-Nu und die Hügelgräber von Noin Ula*, Bonn 1969

Rudenko 1970 Sergei I. Rudenko, *Frozen Tombs of Siberia, The Pazyryk Burials of Iron Age Horseman*, Berkeley and Los Angeles 1970

Rudolph 1984 Hermann Rudolph, *Der Turkmenen-schmuck – Die Sammlung Kurt Gull*, Stuttgart/London 1984

Rudolph 2007 Hermann Rudolph, *Schutz und Segen. Abwehr- und Fruchtbarkeitsmagie in der turkmenischen Frauentracht*, in: Eothen IV, München 2007

Russell 1998 John Malcolm Russell, *The Program of the Palace of Assurnasirpal II at Nimrud: Issues in the Research and Presentation of Assyrian Art*, in: American Journal of Archaeology, Vol. 102, no. 4, Oct. 1998

Sandberg 1997 Gösta Sandberg, *The red dyes: Cochineal, Madder and Murex purple. A World Tour of Textile Techniques.* Asheville 1997

Sarre 1967 Friedrich Sarre, *Konya Köskü*, Ankara 1967

Sarianidi 1985 Viktor Sarianidi, *Bactrian Gold. From the Excavations of the Tillya-Tepe Necropolis in Northern Afghanistan*, Leningrad 1985

Sarianidi 1986 Viktor Sarianidi, *Die Kunst des alten Afghanistan*, Leipzig 1986

Sarre 1909 Friedrich Sarre, *Erzeugnisse islamischer Kunst,* Leipzig 1909

Sarre/Trenkwald 1926/1928 Friedrich Sarre & Hermann Trenkwald, *Altorientalische Teppiche*, 2 Bände, Wien/Leipzig 1926 und 1928

Sassezkaja 2009 Sassezkaja 2009 L. P. Sassezkaja, *Die Sarmaten im nördlichen Schwarzmeergebiet*, in: Seipel et al. 2009: 30–41.

Schäfer/Andrae 1925 Heinrich Schäfer und Walter Andrae, *Die Kunst des Alten Orients,* Propyläen-Kunstgeschichte II, Berlin 1925

Scharlipp 1992 Wolfgang-Ekkehard Scharlipp, *Die frühen Türken in Zentralasien – Einführung in ihre Geschichte und Kultur*, Darmstadt 1992

Schefold 1978 Karl Schefold, *Götter- und Heldensagen der Griechen in der spätarchaischen Kunst*, München 1993

Schefold 1993 Karl Schefold, *Götter- und Heldensagen der Griechen in der Früh- und Hocharchaischen Kunst*, München 1993

Schiltz 1994 Véronique Schiltz, *Die Skythen und andere Steppenvölker – 8. Jh. v.Chr. bis 1 Jh. n.Chr.*, München 1994

Schlesier/Schwarzmaier 2008 Renate Schlesier und Agnes Schwarzmaier (Hg.), *Dionysos – Verwandlung und Ekstase*, Berlin 2008

Schletzer 1983 Dieter und Reinhold Schletzer, *Alter Silberschmuck der Turkmenen – Ein Beitrag zur Erforschung der Symbole in der Kultur der Nomaden Zentralasiens*, Berlin 1983

Schletzer 2000 Mittelasiatische Studien, Band 2. Herausgegeben von Reinhold Schletzer: *Textilien Mittelasiens, Band 1, Beiträge zur sasanidischen und frühislamischen Kunst. Entwicklung- Ornamente- Symbolik*. Berlin 2000

Schmidt 2006 Klaus Schmidt, *Sie bauten die ersten Tempel. Das rätselhafte Heiligtum der Steinzeitjäger. Die archäologische Entdeckung von Göbekli Tepe*, München 2006

Schmidt-Colinet 1977 Andreas Schmidt-Colinet, *Antike Stützfiguren – Untersuchungen zu Typus und Bedeutung der menschengestaltigen Architekturstütze in der griechischen und römischen Kunst*, Frankfurt/Main 1977

Schmidt-Colinet 1991 Andreas Schmidt-Colinet, *Zwei verschränkte Quadrate im Kreis*, in: Stauffer 1991

Schmidt-Colinet/Stauffer/Al-Ascad 2000 Andreas Schmidt-Colinet, Annemarie Stauffer, Khaled Al-Ascad, *Die Textilien aus Palmyra - Neue und alte Funde*, Mainz 2000

Scholz 1929 Rudolf Scholz, *Aus der Geschichte des Farbstoffhandels im Mittelalter.* Dissertation. Universität München, 1929

Schorta 1995–1996 Regula Schorta, *Les Rideaux du Lectionaire G. 44 de la Pierpont Morgan Library, New York*. In: Bulletin du CIETA, 73, 1995–1996, 54–62

Schorta 1998 Regula Schorta, *Beobachtungen zu früh-mittelalterlichen Webtechniken anhand von zehn Seiden-stoffen der Abegg-Stiftung*, in: Otavsky 1998: 43–94

Schorta 2001 Regula Schorta, *Monochrome Seiden-gewebe des hohen Mittelalters*, Untersuchung zu Webtechnik und Musterung, Berlin 2001

Schorta 2006 *Central Asian Textiles and Their Contexts in the Early Middle Ages*, Regula Schorta (Ed.), Riggisberger Berichte 9, Riggisberg 2006

Schrenk 2004 Sabine Schrenk, *Textilien des Mittelmeerraumes aus spätantiker bis frühislamischer Zeit*, Abegg-Stiftung, Riggisberg 2004

Schrenk 2007 Sabine Schrenk, *Newly discovered textiles from the early Middle Ages in Cologne*, in: NESAT IX, Archäologische Textilfunde, Braunwald, 18 – 21 Mai 2005: 102 – 107, Ennenda 2007

Schürmann 1960 Ulrich Schürmann, *Bilderbuch für Teppichsammler*, Berlin 1960

Schürmann 1969 Ulrich Schürmann, *Central Asian Rugs*, Frankfurt a. M. 1969

Schürmann 1974 Ulrich Schürmann, *Caucasian Rugs*, Hampshire 1974

Schürmann 1979 Ulrich Schürmann, *Teppiche aus dem Orient*, 4. erw. Auflage, Frankfurt a. M. 1979

Schuster 1965 Carl Schuster, *Remarks on the Design of an Early Ikat Textile in Japan*, in: Festschrift Alfred Bühler, herausgegeben von Carl A. Schmitz und Robert Wildhaber, Basler Beiträge zur Geographie und Ethnologie, Ethnologische Reihe, Band 2, 339–368, Basel 1965

Schuster/Carpenter 1996 Carl Schuster & Edmund Carpenter, *Patterns that Connect – Social Symbolism in Ancient & Tribal Art*, New York 1996

Schwab 1975 (1932) Gustav Schwab, *Sagen des klassischen Altertums*, in drei Bänden, Leipzig 1975

Schweppe 1992 Helmut Schweppe, *Handbuch der Naturfarbstoffe – Vorkommen · Verwendung · Nachweis*, Landsberg/Lech 1992

Seidl 2004 Ursula Seidl, *Bronzekunst Urartus*, Mainz 2004

Seifert 2010 Mathias Seifert, *Zur absoluten Datierung der Hügelgräber der Pazyryk-Kultur*, in: Kat. Speyer 2010: 138–139

Seiler-Baldinger 1991 Annemarie Seiler-Baldinger, *Systematik der Textilen Techniken*, Basler Beiträge zur Ethnologie, Band 32, Basel 1991

Seipel 1996 *Weihrauch und Seide – Alte Kulturen an der Seidenstrasse*, Herausgegeben von Wilfried Seipel, Kunsthistorisches Museum Wien 1996

Seipel 2003 *7000 Jahre Persische Kunst – Meisterwerke aus dem Iranischen Nationalmuseum Teheran*, Wilfried Seipel (Hg.), Milano 2003

Seipel et al. 2009 *Gold der Steppe*, Wilfried Seipel (Hg.), Mannheim 2009

Selz 2005 Gebhard J. Selz, *Sumerer und Akkader. Geschichte – Gesellschaft – Kultur*, München 2005

Senn et al. 1995 *Schätze der Alhambra, Islamische Kunst aus Andalusien*, Rolf Th. Senn et al., Milano 1995

Serjeant 1943 – 1951 Robert Betram Serjeant, *Islamic Textiles: Material for a History up to the Mongol conquest*, in: Ars Islamica, IX, 1942 – XV/XVI, 1951

Semjonov 1911 (1979) A.A. Semjonov, *Teppiche des Russischen Turkestan*, in: *Turkmenenforschung Band 3*, Reinhold Schletzer Verlag, Hamburg 1979

Seyller 2003 John Seyller, *Die Abenteuer des Hamza*, Museum Rietberg Zürich 2003

Saffer 1992 J.G. Shaffer, *Pre-Indus and Early Indus Cultures of Pakistan and India*, in: History of civilisations of Central Asia, Vol. I. The dawn of civilisation: earliest times to 700 B.C. Editors: A.H. Dani, V.M. Masson, UNESCO, Paris 1992

Shimoyama/Noda 1994 S. Shimoyama and Y. Noda, *Non-destructive Determination of Natural Dyestuffs used for Ancient Coloured Cloths using a Three-Dimensional Fluorescence Spectrum Technique*, in: Dyes in History and Archaeology 12, York 1994: 45-56.

Sienknecht 1989 Hans Sienknecht, *A Turkic Heritage – The Development of Ornament on Yomut C-Gül Carpets*, in: Hali 47, 1989: 30–39

Sims 2002 Eleanor Sims, *Peerless Images, Persian Painting and its Sources*, New Haven and London 2002

Skelton 1972 R. Skelton, *A decorative Motif in Mughal Art*, in: Aspects of Indian Art, Papers presented in a Symposium at the Los Angeles County Museum of Art, October 1970, ed. Pratapaditya Pal, pp. 147–52. Leiden 1972

Smith/Weng 1979 Bradley Smith and Wan-go Weng, *China: A History in Art*, Gemini Smith Inc. Book, 1979

Sourdel-Thomine/Spuler 1973 Janine Sourdel-Thomine und Bertold Spuler (Hg.), *Die Kunst des Islam*, Propyläen Kunstgeschichte in achtzehn Bänden, Band 4, Berlin 1973

Sourdel/Sourdel-Thomine 1969 Dominique Sourdel, Janine Sourdel-Thomine, *A propos des monuments de Sangbast*, Iran 7: 109 – 144

Soustiel/Porter 2003 Jean Soustiel et Yves Porter, *Tombeaux de Paradis – Le Shâh-e Zende de Samarcande et la céramique architecturale d'Asie Central*, Saint-Rémy-en-l'Eau 2003

Spring/Hudson 1995 Christopher Spring & Julie Hudson, *North African Textiles*, London 1995

Spuhler 1978 Friedrich Spuhler, *Islamic Carpets and Textiles in the Keir Collection*, London 1978

Spuhler 1987 Friedrich Spuhler, *Die Orientteppiche im Museum für Islamische Kunst Berlin*, München 1987

Spuhler 1998 Friedrich Spuhler, *Carpets and Textiles,* The Thyssen-Bornemisza Collection, London 1998

Spuhler 2014 Friedrich Spuhler, *Pre-Islamic Carpets and Textiles from Eastern Lands. The al-Sabah Collection, Kuwait*. London 2014

Spuhler et al. 1978 Friedrich Spuhler, Hans König, Martin Volkmann, *Alte Orientteppiche, Meisterstücke aus deutschen Privatsammlungen*, München 1978

Spuler 1965 Bertold Spuler, *Die Goldene Horde. Die Mongolen in Russland, 1223–1502*, 2, Wiesbaden 1965

Spuler 1968 Bertold Spuler, *Geschichte der Mongolen. Nach östlichen und europäischen Zeugnissen des 13. und 14. Jahrhunderts*, Zürich und Stuttgart 1968

Stanzer 1988 Wilfried Stanzer, *Kordi – Leben, Knüpfen, Weben der Kurden Khorasans*, Wien 1988

Stark 2008 Sören Stark, *Die Alttürkenzeit in Mittel- und Zentralasien*, Wiesbaden 2008

Stark 2012 Sören Stark, *Nomads and Networks: Elites and Their Connections to the Outside World*, in: Stark et al. 2012: 106–138.

Stark et al. 2012 Sören Stark and Karen S. Rubinson, with Zainolla S. Samashev and Jennifer Y. Chi (Ed.), *Nomads and Networks – The Ancient Art and Culture of Kazakhstan*, New York 2012

Stauffer 1991 Annemarie Stauffer, *Textilien aus Ägypten aus der Sammlung Bouvier – Spätantike, koptische und frühislamische Gewebe*, Fribourg 1991

Stauffer 1991b Annemarie Stauffer, *Die mittelalterlichen Textilien von St. Servatius in Maastricht*, Riggisberg 1991

Stausberg 2002 Michael Stausberg, *Die Religion Zarathustras. Geschichte – Gegenwart – Rituale.* Band 1, Stuttgart 2002

Stausberg 2005 Michael Stausberg, *Zarathustra und seine Religion*, München 2005

Stein 1996 L. Stein, *Kleider der Pferde, Asiatische Sattel-decken aus der Sammlung des Salgo Trust for Education, New York*, Leipzig 1996

Sterner/Kinch 1929 Maj Sterner & Jacob Kinch, *Orientaliska Mattor med ett Kapitel om Svenska Mattor*, Stockholm 1929, second edition 1938

Sternlicht 1980 M. Sternlicht, *The dye of the Coccid*, in: Israel Land and Nature 6, 1980: 17-21

Straka/Mackie 1978 Jerome Straka and Louise Mackie, *The Oriental Rug Collection of Marie and Jerome Straka*, New York 1978

Stronach 1993 David Stronach, *Patterns of Prestige in the Pazyryk Carpet: Notes on the Representational Role of Textiles in the First Millennium BC*, in: OCTS, Volume IV, Berkeley 1993

Stronach 2002 David Stronach, *Icons of Dominion: Review Scenes at Til Barsip and Persepolis*, in: Iranica Antiqua, Volume XXXVII, Gent 2002

Stronach 2004 David Stronach, *On the Antiquity of the Yurt: Evidence from Archan and Elsewhere*, in: www.silkroadfoundation.org/newsletter/2004vol2num1/yurt.htm

Studniczka 1914 Franz Studniczka, *Das Symposion Ptolemaios II. Nach der Beschreibung des Kallixeinos*, Leipzig 1914

Sumner/Feltham 1999 Christina Sumner, with Heleanor Feltham, *Beyond the Silk Road – arts of Central Asia* – From the Power House Museum Collection, Sydney 1999

Suriano/Carboni 1999 Carlo Maria Suriano and Stefano Carboni, *Islamic Silk – Design and Context*, 9th ICOC, Museo Nationale del Bargello, Florence 1999

Synal et al 2007 H.-A. Synal, M. Stocker and M. Suter, *MICADAS: A new compact radiocarbon AMS system,* in Nuclear Instruments and Methods in Physics Research B 259, 2007: 7-13

Synal et al 2010 H.-A. Synal and L. Wacker, *AMS measurement technique after 30 years: Possibilities and limitations of low energy systems,* in Nuclear Instruments and Methods in Physics Research B 268, 2010: 701–707

Talbot Rice 1969 Tamara Talbot Rice, *Some Reflections on The Subject of Arm Bands*, in: Forschungen zur Kunst Asiens. In Memoriam Kurt Erdmann, Herausgegeben von Oktay Aslanapa und Rudolf Naumann, Istanbul 1969

Tanavoli 1985 Parviz Tanavoli, *Lion Rugs. The Lion in the Art and Culture of Iran*, Basel 1985

Terrasse 1932 Henri Terrasse, *L'art hispano-mauresque des orgines au XIIIe siècle*, Publications de l'Institut des hautes-études marocaines, Paris 1932

Thacher 1940 (1978) Amos Bateman Thacher, *Turkoman Rugs,* An Illustrative Monograph on the Rugs Woven by the Turkomen Tribes of Central Asia, New York 1940 (Reprint London 1978)

Thompson 1971 Deborah Thompson, *Coptic Textiles in The Brooklyn Museum*, New York 1971

Thompson 1981 Jon Thompson, *Centralised designs*, in: Herrmann III (o.J., [1981])

Thompson 1983 Jon Thompson, *Carpet Magic - The Art of carpets from the tents, cottages and workshops of Asia*, London 1983

Thompson 1988 Jon Thompson, *Silk, Carpets and the Silk Road*, Osaka 1988

Thompson 2004 Jon Thompson, *Silk – 13th to 18th centuries - Treasures from the Museum of Islamic Art, Qatar*, Doha 2004

Thompson/Tabibnia 2006 Jon Thompson, Moshe Tabibnia, *Milestones in the History of Carpets*, Milan 2006

Thompson 2008 Jon Thompson, *Timbuktu to Tibet - Exotic Rugs and Textiles from New York Collections*, The Hajji Baba Club, New York 2008

Thompson 2010 Jon Thompson, *Carpets in the Fifteenth Century*. in: Thompson et al. 2010

Thompson et al. 2010 Jon Thompson, Daniel Shaffer and Pirjettya Mildh (Ed.), *Carpets and Textiles in the Iranian World, 1400 – 1700*, Proceedings of the Conference held at the Ashmolean Museum on 30-31 August 2003. Oxford 2010

Tilia 1972 Ann Britt Tilia, *Studies and Restauration at Persepolis and other Sites of Fars.* IsMEO, Reports and Memoirs Vol. 16, Rome 1972

Tilia 1978 Ann Britt Tilia, *Studies and restauration at Persepolis and other Sites of Fars.* IsMEO, Reports and Memoirs Vol. 18, Rome 1978

TKF Wien 1986 *Antique Oriental Carpets from Austrian Collections – Society for Textile Art Research Vienna (TKF)*, Vienna 1986

TKF Wien 1986 Beiheft mit Strukturanalysen Strukturanalysen zu «Orientalische Teppiche aus Österreichischem Privatbesitz», Wien 1986.

TKF Graz 1999 *Textil Kunst Feuer, Teppiche und Textilien aus österreichischen Privatsammlungen*, Herausgegeben von der Gesellschaft zur Förderung der Textil-Kunst-Forschung (TKF), Graz 1999

Tolstov et al. 1963 S.P. Tolstov, T.A. Gdanko, S.M. Abramson, N.A. Kislaykov, *Die Völker Mittelasiens und Kasachstans II*, Moskau 1963 (in Russian)

Tosi et al. 1992 M. Tosi, S. Malek Shahmirzadi and M. A. Joyenda, *The Bronze Age in Iran and Afghanistan*, in: History of civilisations of Central Asia, Vol. I. The dawn of civilisation: earliest times to 700 B.C., Ed. A.H. Dani, V.M. Masson, UNESCO, Paris 1992

Trever 1964 C. Trever, *Tete de senmurv en argent des collections de l'Ermitage*, in: Iranica Antiqua, Vol. IV, Leiden 1964

Tsareva 1990 Elena Tsareva, *Thirty Rug Masterpieces from the Collection of S.M. Dudin*, in ORR 1990, Vol. 11, no. 1: 64 – 96

Tsareva 1993 Elena Tsareva, *Carpets of Central Asian Nomads from the collection of the Russian Museum of Ethnography St. Petersburg*, exhibition catalogue, Palazzo Ducale, Genova 1993

Tsareva 2011a Elena Tsareva, *The Compartment Group of Middle Amu Darya Pile Rugs and the Bactrian Carpet Making Tradition*, in: OCTS VII, Published by ICOC 2011

Tsareva 2011b Elena Tsareva, *Masterpieces of Steppe Art, from 16th to 19th Centuries. The Hoffmeister Collection*, Stuttgart 2011

Tschepeleweskaya 1961 G.L. Tschepeleweskaya und O.A. Sucharewa, *Susani Usbekistans – Ein Beitrag zur Technik, Ornamentik und Symbolik der usbekischen Seidenstickerei*, Schletzer Verlag, Hamburg 1991

Türck 2000/2001 Ulrich Türck, *Mauerkronenkelim von der Antike bis zur Gegenwart. Zum historischen Ursprung eines anatolischen Kelimmusters*, in: Boreas. Münsterische Beiträge zur Archäologie, Band 23/24, Münster 2000/2001

Türck 2001 Ulrich Türck, *Mural Crown' Kilims. The Historic Origin of an Anatolian Kilim Design*, in: Hali 115, 2001: 89–92.

Türck 2004 Ulrich Türck, *Antike Stadttore und ihre textilen Abbilder. Anatolische Kelim als überlebende Zeugnisse antiker Torarchitektur*, in: Bildergschichten – Festschrift Klaus Stähler, herausgegeben von Jörg Gebauer et al.: 469–505, und Tafel 4–7, Bibliopolis, 2004

Türck 2009 Ulrich Türck, *Strait is the Gate. Ancient City Gateways & Their Textile Reproductions*, in: Hali 159, 2009: 60–69.

Tzareva 1984.1 Elena Tzareva, *Salor Carpets*, in: Hali 6/2, 1984: 126–135

Tzareva 1984.2 Elena Tzareva, *Rugs & Carpets from Central Asia*, The Russian Collections, Leningrad 1984

Tzareva 1985 Elena Tzareva, *The Dudin Collection*, in: Hali 27, 1985: 14 – 23

Uldry 1994 *Chinesisches Gold und Silber*, Die Sammlung Pierre Uldry, Museum Rietberg, Zürich 1994

Vainker 2004 Shelag Vainker, *Chinese Silk: A Cultural History*, London 2004

Vámbéry 1885 (1970) Hermann Vámbéry, *Das Türkenvolk in seinen ethnologischen und ethnographischen Beziehungen*, Leipzig 1885 (Neudruck Osnabrück 1970)

Vanden Berghe et al. 2004 Ina Vanden Berghe, Marie-Chistine Maquoi and Jan Wouters, *Dye analysis of Ottoman Silks*, in: The Ottoman Silk Textiles of the Royal Museums of Art and History in Brussels, Turnhout 2004: 49-60

Verhecken-Lammens et al. 2006 Chris Verhecken-Lammens, Antoine de Moor & Bruno Overlaet, *Radiocarbon Dated Silk Road Samites in The Collection of Katoen Natie, Antwerp*, in: Iranica Antiqua, Vol. XLI: 233–301 (2006)

Verhecken/Wouters 1988/89 André Verhecken and Jan Wouters, *The Coccid Insect Dyes, Historical, Geographical and Technical Data*, in: Institut Royal du Patrimoine Artistique, Koninklijk Instituut Voor Het Kunstpatrimonium, Bul. XXII - 1988/89: 207–239.

Vibert-Guigue/Bisheh 2007 Claude Vibert-Guigue et Ghazi Bisheh, *Les Peintures de Qusayr Amra. Un bain omeyyade dans la badiya jordanienne*, Beyrouth 2007

Vok 1994 Ignazio Vok, *Vok Collection Suzani – Eine Textile Kunst aus Zentralasien*, München 1994

Vok 2006 Ignazio Vok, *Vok Collection Suzani 2 – Eine Textile Kunst aus Zentralasien*, München 2006

Völker 2001 Angela Völker, *Die orientalischen Knüpfteppiche im MAK Österreichisches Museum für angewandte Kunst*, Wien 2001

Volkmann 1985 Martin Volkmann, *Alte Orientteppiche, Ausgewählte Stücke deutscher Privatsammlungen*, München 1985

von Folsach 2001 Kjeld von Folsach, *Art from the World of Islam in the David Collection*, Copenhagen 2001

von Gall 1971 Hubertus von Gall, *Entwicklung und Gestaltung des Throns im vorislamischen Iran*, in: Archaeologische Mitteilungen aus Iran. Herausgegeben vom Deutschen Archäologischen Institut, Abteilung Teheran. Neue Folge Band 4, 1971

von Nagel 1970 Alfred von Nagel, *Fuchsin, Alizarin, Indigo – Der Beginn eines Weltunternehmens*, BASF, Schriftenreihe des Firmenarchivs der Badischen Anilin- & Soda-Fabrik AG, Ludwisghaven 1970

von Ranke-Graves 1955 (1990) Robert von Ranke-Graves, *Griechische Mythologie – Quellen und Deutung*, Reinbek, 1990

von Soden 1965 Wolfram von Soden, *Akkadisches Handwörterbuch*, Band 1, Wiesbaden 1965

von Wickede 1990 Alwo von Wickede – *Prähistorische Stempelglyptik in Vorderasien*, München 1990

von Wilckens 1991 Leonie von Wilckens, *Die textilen Künste – Von der Spätantike bis um 1500*, München 1991

von Wilckens 1992 Leonie von Wilckens, *Mittelalterliche Seidenstoffe, Staatliche Museen zu Berlin, Kunstgewerbemuseum*, Berlin 1992

Walker 1982 Daniel S. Walker, *Oriental Rugs of the Hajji Babas*, Published in assotiation with The Asia Society, New York and Sotheby's, New York 1982

Walker 1997 Daniel Walker, *Flowers Underfoot – Indian Carpets of the Mughal Era*, The Metropolitan Museum of Art, New York 1997

Wamser et al. 2004 Ludwig Wamser (Ed.), *Die Welt von Byzanz – Europas östliches Erbe. Glanz, Krisen und Fortleben einer tausendjährigen Kultur*, München 2004

Watt/Wardwell 1997 James C. Watt, Anne E. Wardwell, *When Silk was Gold – Central Asian and Chinese Textiles*, The Metropolitan Museum of Art, New York 1997

Wearden 2003 Jennifer Wearden, *Oriental Carpets and Their Structure, Highlights from the V&A Collection*, London 2003

Wehr 1985 Hans Wehr, *Arabisches Wörterbuch für die Schriftsprache der Gegenwart, Arabisch – Deutsch*, 5. Auflage, Wiesbaden 1985

Welch 1985 Stuart Cary Welch, *India. Art and Culture 1300–1900*, New York 1985

Welch 1987 Stuart Cary Welch, *The Metropolitan Museum of Art – The Islamic World*, New York 1987

Welch et al. 1987 Stuart Cary Welch, Annemarie Schimmel, Marie L. Swietochowski, Wheeler M. Thackston, *The Emperors' Album – Images of Mughal India*, New York 1987

Whitehouse 2005 David Whitehouse, *Sasanian and Post-Sasanian Glass in the Corning Museum of Glass*, New York 2005

Whiting 1978a Mark Whiting, *Dye Analysis in Carpet Studies*, in: Hali 1/1, 1978, pp. 39–43

Whiting 1978b Mark Whiting, *The Dyes of Turkoman Rugs*, in: Hali 1/3, 1978: 281–283

Whiting 1979 Mark Whiting, *Progress in the Analysis of Dyes of Oriental Carpets*, in: Hali 2/1, 1979: 28–29

Whiting 1980 Mark Whiting, *The Dyes in Turkmen Carpets*, in: Mackie/Thompson 1980: 217 – 224

Whiting 1985 Mark C. Whiting, *A Report on the Dyes of the Pazyryk Carpet*, in: OCTS, London 1985

Wilkinson 1986 Charles K. Wilkinson, *Nishapur – Some Early Islamic Buildings and Their Decoration*, The Metropolitan Museum of Art, New York, 1986

Wilson 1986 Eva Wilson, *Ancient Egyptian Designs*, British Museum Publication, London 1986

Wölfli 1991 Willy Wölfli, *Möglichkeiten und Grenzen der Beschleunigermassenspektrometrie in der Archäologie*, in: 10 Jahre Beschleunigermassenspektrometrie in der Schweiz, Symposium, Institut für Mittelenergiephysik der ETH Zürich, Schweiz, 27. September 1991

Wood 1990 William A. Wood, *Turkmen Ethnohistory*, in: O'Bannon 1990: 27–44

Wood 1999 William A. Wood, *Turkmen Saryk*, in: Ghereh 21, Autumn 1999: 7–19

Woolley 1934 Leonard Woolley, *Ur Excavations, Vol. II, The Royal Cemetery*, New York 1934

Wouters 1985 Jan Wouters, *HPLC of anthraquinones: analysis of extracts from plants and insects and dyed textiles*, in Studies in Conservation 30, 1985: 119-128

Wouters 1993a Jan Wouters, *Dye analysis of Coptic textiles*, in: Coptic Textiles from Flemish private collections, Publicaties van het Provinciaal Archeologisch museum van Zuid-Oost-Vlaanderen, A. De Moor, ed., Zottegem 1993: 53-64.

Wouters 1993b Jan Wouters, *L'analyse des colorants naturels par chromatographie liquide haute performance: méthodologie et application à une série de textiles médiévaux conservés en Languedoc-Roussillon ou exposés dans le cadre de l›exposition «Fils Renoués - Trésors textiles du Moyen Age en Languedoc-Roussillon»*, in: Fils Renoués - Trésors textiles du Moyen Age en Languedoc-Roussillon, Musée des Beaux-Arts de Carcassonne 1993: 158-165.

Wouters 1998 Jan Wouters, *The dyes of early woven Indian silks*, in: Riboud et al. 1998: 145-152.

Wouters 2000 Jan Wouters, *La position et l'application de la CLHP dans l'analyse des colorants et des pigments organiques dans les oeuvres d'art*, in: Art et Chimie, La Couleur, CNRS Editions, Paris 2000: 180-186

Wouters 2001 Jan Wouters, *The dye of Rubia peregrina. I. Preliminary Investigations*, in: Dyes in History and Archaeology 16/17, London 2001: 145-157

Wouters 2010a Jan Wouters, *Natural organic dyes and pigments in art,* in: Scientific Methods and Cultural Heritage. An Introduction to the Application of Material Science to Archaeometry and Conservation Science. Gilberto Artioli Ed., London 2010: 399-407

Wouters 2010b Jan Wouters, *HPLC High Performance Liquid Chromatography*, in: Scientific Methods and Cultural Heritage. An Introduction to the Application of Materials Science to Archaeometry and Conservation Science. Gilberto Artioli Ed., Oxford University Press, 2010: 410-413

Wouters/Rosario-Chirinos 1992 Jan Wouters, and N. Rosario-Chirinos, *Dyestuff analysis of Precolumbian Peruvian Textiles by High Performance Liquid Chromatography and Diode-array Detection*, in: Journal of the American Institute for Conservation 31, 1992: 237-255.

Wouters/Verhecken 1989a Jan Wouters & André Verhecken, *The Coccid Insect Dyes: HPLC and Computerized Diode-Array Analysis of Dyed Yarns,* in: Studies of Conservation, 34, 1989: 189 – 200

Wouters/Verhecken 1989b Jan Wouters & André Verhecken, *The Scale Insect Dyes (Homoptera : Coccoidea). Species Recognition by HPLC and Diode-Array Analysis of the Dyestuffs,* in: Annales de la Société entomologique de France, Nouvelle série, 25(4): 393–410 (1989)

Wouters/Verhecken 1991 Jan Wouters & André Verhecken, *Potential taxonomic applications of HPLC analysis of Coccoidea pigments (Homoptera: Sternorhyncha)*, in: Belgian Journal of Zoology 121: 211-225 (1991)

Wouters et al. 2010 Jan Wouters, Cecily Grzywacz and Ana Claro, *Markers for Identification of Faded Safflower (Carthamus tinctorius L.) Colorants by HPLC-PDA-MS; Ancient Fibres, Pigments, Paints and Cosmetics, Derived from Antique Recipes*, in: Studies in Conservation 55: 186-203 (2010)

Wouters et al. 2011
Jan Wouters, Cecily Grzywacz and Ana Claro, *A comparative investigation of hydrolysis methods to analyze natural organic dyes by HPLC-PDA - Nine methods, twelve biological sources, ten dye classes, dyed yarns, pigments and paints*, in: Studies in Conservation 56: 231-249 (2011)

Wright 2004 Richard E. Wright, *Reflections on the Engsi*, www.richardwright.com, May 2004

Yang 1999 Xiaoneng Yang (Ed.), *The Golden Age of Chinese Archaeology.* Celebrated discoveries from the People's Republic of China, Washington 1999

Yetkin 1981 Serare Yetkin, *Historical Turkish Carpets*, Istanbul 1981

Zebrowski 1997 Mark Zebrowski, *Gold, Silver & Bronze from Mughal India*, London 1997

Zerling/Bauer 2003 Clemens Zerling, *Lexikon der Tiersymbolik*, Herausgegeben von Wolfgang Bauer, München 2003

Zhao 1999 Feng Zhao, *Treasures in Silk*, *An Illustrated History of Chinese Textiles*, Hong Kong 1999

Zhao 2002 Zhao Feng (Ed.), *Recent Excavations of Textiles in China*, Hangzhou 2002

Zhao/Yu 2000 Feng Zhao and Zhiyong Yu, *Legacy of the Desert King – Textiles and Treasures Excavated at Niya on the Silk Road*, Hangzhou/Urumqi 2000

Zurkinden-Kohlberg 2015 Zurkinden-Kohlberg, *IDD Iconography of Deities and Demons in the Ancient Near East*, Zurich 2015

This study and publication have been made possible by

Lotteriefonds Basel-Landschaft
Lotteriefonds Basel-Stadt
Freunde des Orientteppichs, Basel

Additional support provided by

Silvia and Jörg Affentranger, Muttenz
Dr. Albert Gabbaï, Geneva
Elly and Jean-Pierre Gersbach, Basel
Marie and George Hecksher, San Francisco
Marion and Hans König, Minusio
Antje and Prof. Dr. Dieter Ladewig, Bettingen
Fritz Langauer, Vienna
Caroline McCoy Jones, Reno
Nancy Jeffries and Kurt Munkacsi, New York
Kristal Hale-Murray and Thomas Murray, Mill Valley
Amie and Michael Rothberg, Mill Valley
Ingrid und Hans Siedek, Düsseldorf
Hans Christian Sienknecht, Hamburg
Dr. Arch. Ignazio Vok, Padua
Marshall and Marilyn R. Wolf

Jacket illustration:
Qaradashlï *khali* cat. no. 84, first half 17th century

Frontispiece:
Khalil Shirin, a young Teke woman in full regalia with silver jewellery and a *chirpy* over her head. See also frontispiece in vol. 2.
Photo: Pavel Lassar, beginning of the 1880's.
Courtesy Museum of Ethnography, St. Petersburg.

Published by Jürg Rageth and "Freunde des Orientteppichs, Basel".
German edition 200 copies
English edition 300 copies

Design, typesetting, and lithographs: Jürg Rageth

Colour photography:
Otello Damonte, ©David Reuben, London: cat. nos 20, 27, 31, 48, 49, 73, 87
Alexander Laurenzo, ©Museum Five Continents, Munich: cat. no. 107
Jürg Rageth, Basel: cat. nos. 3, 4, 5, 6, 7, 10, 11, 12, 13, 18, 19, 21, 22, 23, 24, 25, 26, 29, 30, 35, 36, 38 39, 41, 42, 47, 50, 51, 52, 53, 55, 56, 57, 60, 61, 62, 63, 64, 66, 67, 68, 69, 70, 72, 74 75, 76, 77, 78, 88, 89, 90, 91, 92, 93, 94, 97, 99, 100, 101, 104, 106, 110, 111, 112, 114, 115, 117, 118, 119, 120, 121, 123, 124, 125, 126, 127;
Don Tuttle, Emeryville: cat. nos. 1, 2, 8, 9, 15, 16, 17, 33, 37, 45, 54, 58, 71, 95, 96, 98, 105, 118, 109, 116, 122, 128
©Moshe Tabinia Gallery, Milan: cat. no. 103
©textile-art, London: cat. no. 32
©The Russian Museum of Ethnography, St. Petersburg: cat. nos. 14, 40, 43, 44, 59, 65
©The Textile Museum, Washington D.C.: cat. nos. 28, 102

Cartography: Klaus Kühner, huettenwerke.de

Printers: Abächerli Media AG, Sarnen
Printed on Magno Satin, matte coated, white, 150 gm^2
Binding: Buchbinderei Burkhardt AG, Mönchaltdorf
Printed in Switzerland