Anatolian Kilims & Radiocarbon Dating
A New Approach to Dating Anatolian Kilims

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Saf kilim fragment (cf. Plate 3), Western Anatolia, Dazkırı area, ca. 265 × 128 cm, ^{14}C dated: 1487–1665 AD (95% confidence limit)
Private collection

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I am specially grateful to Robert Pinner who provided the translation from German and helped with editing the papers.

Finally I would like to thank my wife Esther. On many occasions, she neglected her own interests and advised me in my hours of uncertainty and supported me in my moments of doubt.

Jürg Rageth

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Foreword

This project for the dating of Anatolian kilims is due to the initiative of Dr. Georges Bonani of the Institute of Particle Physics at the Swiss Federal Institute of Technology Zürich. I first met Dr. Bonani in connection with the radiocarbon dating of the so-called Böhringer rug[1] of the firm Novartis in Basel. During the course of this investigation he instigated the dating of the first kilim (Plate 20) to the result of which I looked forward with eager anticipation. By coincidence this result was a good example of a useful radiocarbon dating result obtained from the period after 1650. Apparently it was also sufficiently meaningful to enthuse the first collectors friends at the ICOC Regional Conference in Morocco in May 1995. Together with Johannes Wolff I formed the idea for a second kilim symposium[2]. Herwig Bartels as well as Hans und Ingrid Siedek gave us their spontaneous agreement. Armed with this support, I approached Heinrich Kirchheim who too gave us his immediate and enthusiastic support. Before I could blink, the first fifteen kilims had been registered for dating. The next person to approach after returning home was Ignazio Vok. He too was well disposed to the project and became interested in dating some of his own kilims. From then on the bandwagon rolled almost on its own. During my frequent travels across Europe for the purpose of collecting the kilims which were to be dated I was able to encourage more collectors to contribute their pieces. By the time the symposium was held end of January 1997, a total of fifty kilims had been made available for radiocarbon dating at the ETH in Zürich. Around half of these, in particular the oldest and most beautiful examples, were exhibited on the upper floor of the Kantonsmuseum Baselland in Liestal.

The unfortunate delay of the publication of the lectures and the dated kilims has brought several benefits. Thus it proved possible to supplement the results for several pieces which had been dated, with interesting comparable examples. The Saf kilims from the Dazkiri area offer the best example for this. By the time when this volume went to press, and with the active help of Dietmar Pelz, it proved possible to discover no less than nine examples (Plates 1-8, Fig. 7.1) and with two exceptions all have now been radiocarbon dated. The last sample was taken in November 1998, very much at the last moment, when together with Diane Mott I collected a sample from the Dazkiri saf fragment in the McCoy Jones collection in the De Young Museum in San Francisco (Plate 7). Diane Mott also made it possible for the entire group of double-niche kilim fragments shown on Plates 12–15 to be radiocarbon dated. With unlimited patience, Dr. Bonani accepted and dated a veritable series of so-called "last samples". In this manner and with some delay this volume was at least completed. I am glad to be able to present this book, after four years, as a kind of "interim balance".

1 HALI 98, 1998, cover
2 The first Symposium on Anatolian Kilims was held in January 1990 and was mainly on the subject of the origin and meaning of designs (see Rageth 1990, 1991).

Introduction

The End of the Age of "Hunters and Gatherers"

Seven years ago, almost to the day, a remarkable exhibition was held in the same house, and speeches were delivered from the same podium here in Liestal. Seven years ago, the first Kilim Symposium took place at the Museum für Völkerkunde in Basel. At that time the Anatolian kilim stood at the centre of interest. Only the subject differed. It was an event, which above all dealt with kilim designs and their origins. Today, seven years later, the accent is different, the aim is to integrate technological advance, to determine the ages of the kilims by means of radiocarbon dating.

The new direction must not, of course, allow us to forget that significant gaps remain in what we know about cultural environment from which kilim patterns evolved. The subject which was topical seven years ago has lost nothing of its art historical importance. We still have no certain knowledge concerning their meaning, their symbolism and their age; in short of their cultural context. It might be important to take back the discussion to what is now incontrovertible, the Anatolian origin of the designs. Perhaps the resumption of the excavation of Çatal Hüyük may soon yield new insights.

Seven years have passed since the last symposium. They have been seven rich years, rich in exhibitions, catalogues and publications. This period has not only seen the first exhibition in Liestal but also some other milestones like the exhibition of the Caroline & H. McCoy Jones collection and soon afterwards the "100 Kilims" exhibition. In the "Yayla" exhibition at the 7th ICOC in Berlin, kilims were supplemented by brocaded textiles. Of the many further exhibitions, I would like to mention particularly that held in Schloss Lembeck in Westphalia, the catalogue of which contained an excellent review of the status of kilim research. The next exhibitions have already been announced: in April in Schloss Rheydt, also in Westphalia; at the beginning of May in Castello di Lispida, near Padua the Anatolian kilims in the Vok collection. Since Bertram Frauenknecht, the first who had the courage to offer and publish fragmentary pieces, there has been no reason to reject strongly damaged kilims. Restorers have grown ever more professional and artistic in their work so that the presentation of many fragments in the Munich exhibition gave impetus to the question whether the virtuosity of Richard Hall has not improved a little too much on the good.

In "100 Kilims", Yanni Petsopoulos ended his Introduction with the statement: "The age of the hunters and gatherers nears its end, that of the academic has only just begun." The kilims of that volume are first and foremost a monument to their collectors and with the symposium we entered the realm of science. However, it is not my task to comment on the latter. I stand here not as a representative of the new order; I stem from the period of hunting and gathering. This also is the reason why I was asked to tell a little from my personal experiences, from the time 20 to 25 years ago. My own motivation to collect kilims was elicited by my wife. From an ancestor who lived in Pomerania in the mid 19th century, she had inherited a kilim with large holes and very worn which for no good reason she loved dearly. This was a kilim with a "carnation" design like that illustrated as no. 157 in Yanni Petsopoulos's first kilim book, and even without the benefit of radiocarbon dating it could safely be dated to the late 17th or 18th century. She had already encouraged me to collect Turkish carpets in an earlier phase of my collector's life and then – we lived in Damascus at the time – she suggested that we should travel to Turkey to search for such beautiful kilims. As the purpose of our journey we combined the well-known Seljuk architecture of East Anatolia with the flatweaves still unknown to us. The latter we first discovered in Ürgüp, where thanks to the tourist shops, we were able to acquire large numbers of pieces which, it seemed to me, were splendid in composition and colours. Soon afterwards we came to know Yanni Petsopoulos in Damascus, to whom I proudly introduced my new acquisitions. My wife's kilim at this time was hidden, although it did not remain unnoticed. To make it short Yanni then gave me a lesson in the aesthetics of kilims and invited me to London where I quickly learned to distinguish the good from the less good, or even the bad. That was the particular fascination of collecting kilims in those days: there were no established aesthetic criteria, every collector was his own judge of what was good or bad, and if he did not wish to depend on accident, he had to communicate his criteria to his suppliers without driving up prices.

For the trade, and for collectors like me, these suppliers were those in Turkey. I came to know Cemal Palamutcu, who became a friend to many of us, during a journey home from Syria to Germany, when I visited what then was the leading carpet shop in Konya, where, as a student of English, he served as interpreter. He soon had his own shop which I frequented regularly and often. Konya was far away, however, normally I made use of a professional journey to the Near East to fly via Istanbul on my return. Extended weekends during the carnival period also served this purpose. In Istanbul the carpet and kilim world always met a the same hotel, and the reaction to purchases could be gained from rival collectors, in the late evenings in the bedrooms. The hotel was of great help. Not only was I a guest, but it also got me a ticket for the night train from Istanbul's Haydar Paşa railway station to Ankara. After arriving in Ankara at 7 o'clock in the morning, I set off for the bus station and from there by the Özkaymak leader service to Konya. After an intensive search through Cemal's stock and enjoyment of his proven hospitality I travelled back to Istanbul with the night bus to take the morning flight to Bonn where I reached my desk at approximately the right time.

These were the experiences of almost twenty years. I am filled with nostalgia when I see the photo which shows the gathering of the organisers and lenders of the exhibition "The undiscovered Kilim", all of them young and enthusiastic. Today, it seems to me collecting and protecting kilims has become a task for the grey haired. There are, of course, reasons for this. Twenty years ago, a kilim did not cost so much, one could get an excellent piece for a few hundred dollars. Even at the strongly depressed price levels of today, it can not be easy to enthuse the following generation to begin collecting kilims. Nevertheless, if we are to see a repeat of an exhibition such as this in another seven years, several more young and enthusiastic people will have to join the grey-haired majority.

Herwig Bartels, January 1997

Georges Bonani

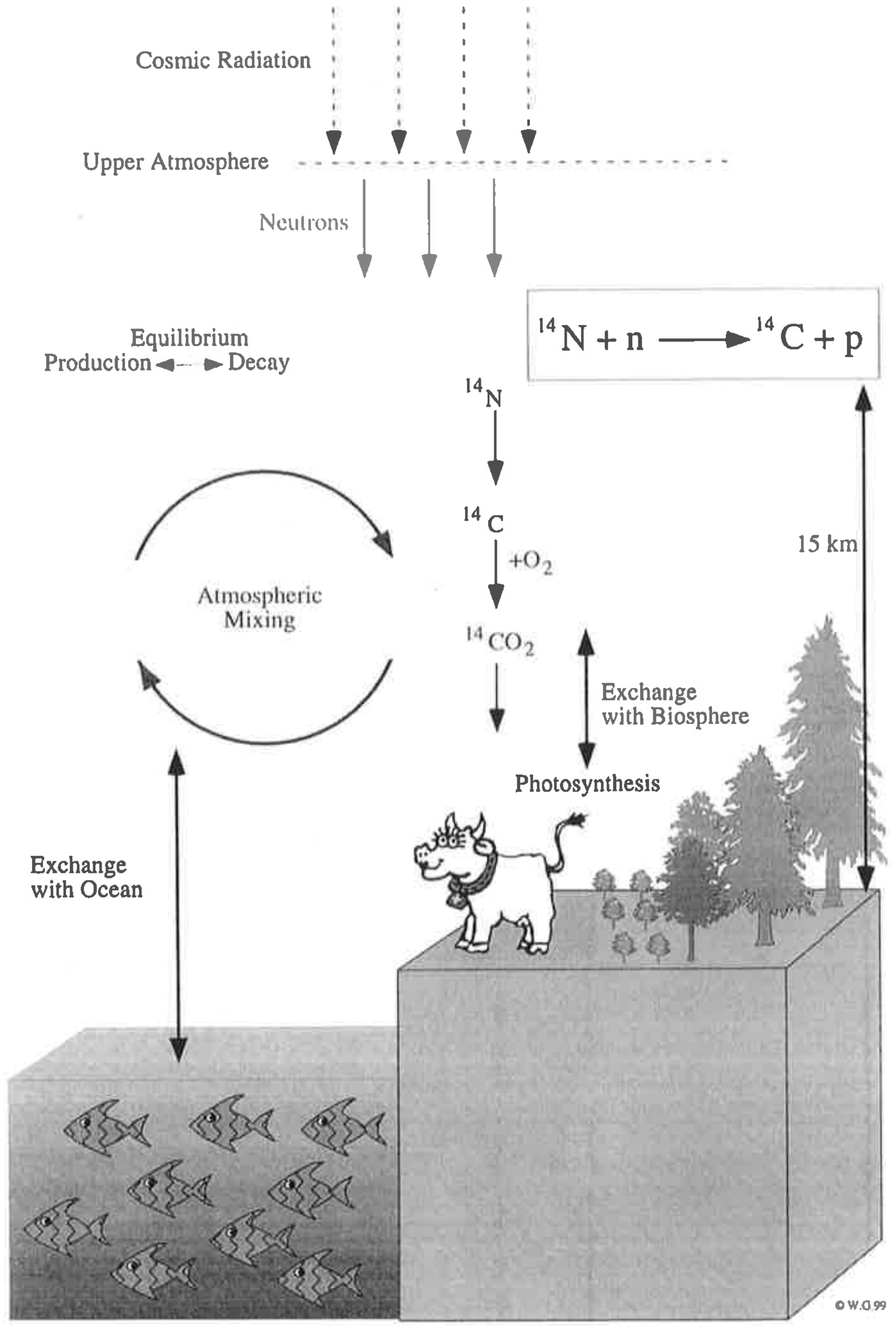
Radiocarbon Dating of Milligram Samples of Anatolian Kilims by Accelerator Mass Spectrometry

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.

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 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.

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

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 franctionation, 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.

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 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.

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 appara-

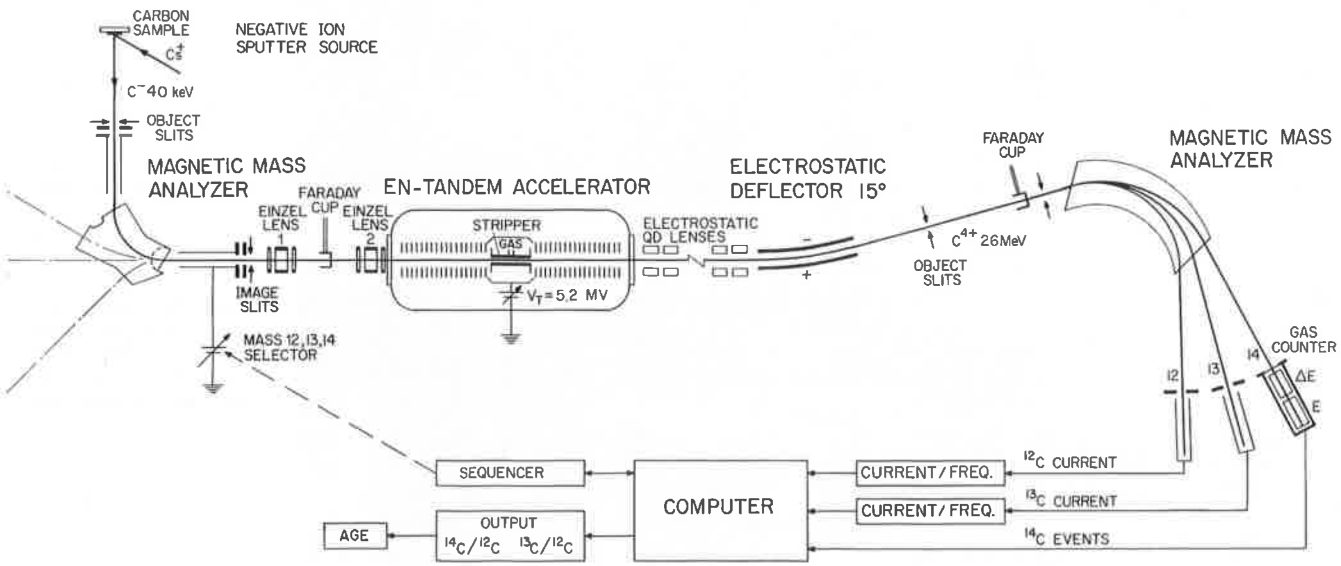


Fig. 2
Schematic diagram of the AMS principle. The prepared samples are loaded into the ion source and bombarded with a positive ceasium ion beam. The sputtered negative carbon ions are extracted from the ion source and analyzed in a first magnetic mass analyzer. They are then accelerated in the tandem accelerator to high energies. During the charge changing process in the stripper 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.

tus. 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.

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 ($t_{1/2}$ = 5 568 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 $t_{1/2} = 5\,730 \pm 30$ y has to be used. This value is about 3% higher than the half-life as measured by Libby.

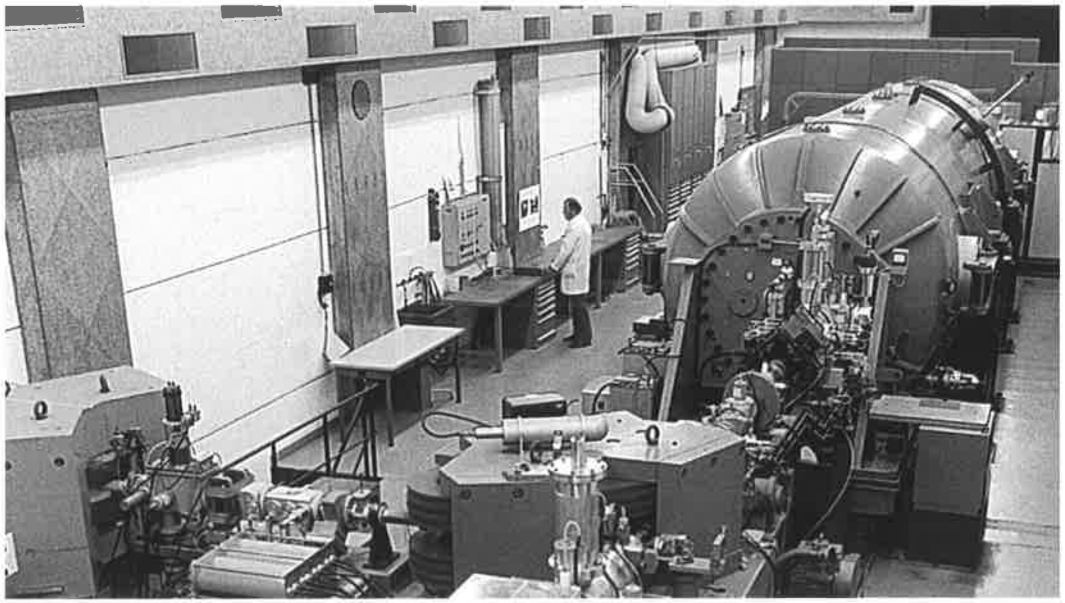


Fig. 3
View of the ETH/PSI AMS facility, ETH Hönggerberg, Zurich, Switzerland.

Fig. 4
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. 10 000 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.

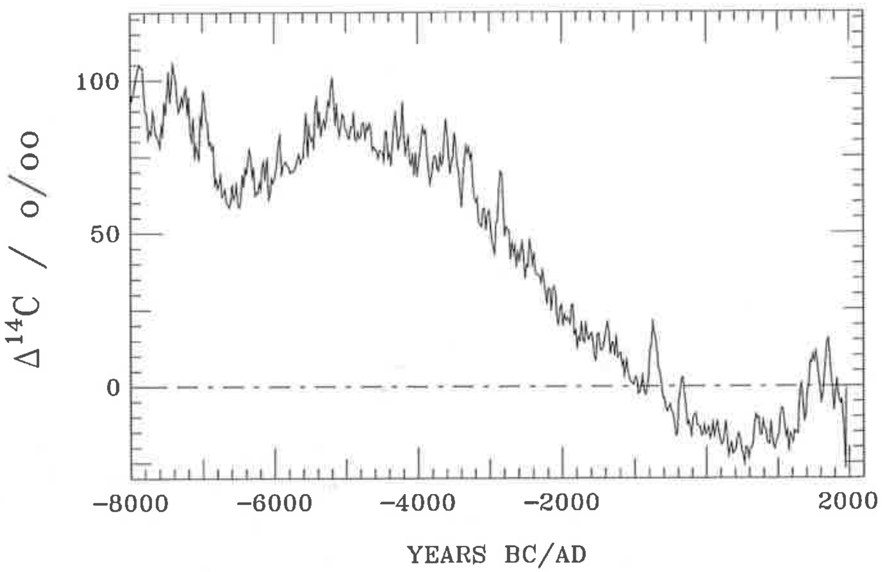
Fig. 5
Long-term observation of $\Delta^{14}C$ in atmospheric CO_2 on the northern hemisphere [8]. Shortly after the atmospheric nuclear weapons tests began in 1962, the $^{14}CO_2$ level on the northern hemisphere rose to twice the value of natural equilibrium. $\Delta^{14}C$ decreases thereafter due to exchange with the world's oceans and the terrestrial biosphere.

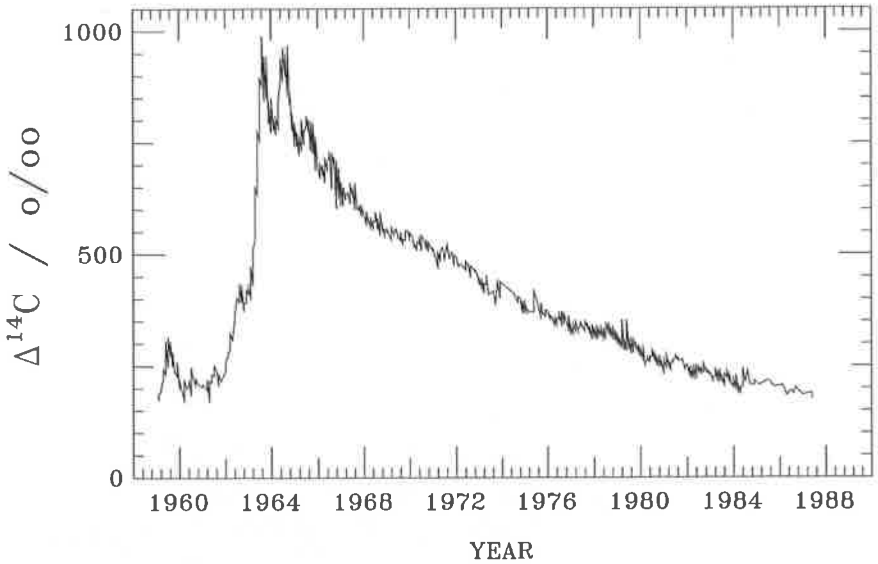
B. For samples in contact with a reservoir other than the atmosphere, an age adjustement is needed. This correction is especially important for marine samples, for which it is of the order of 5% (calculated ages are about 400 years too old).

C. The radiocarbon ages are calculated under the assumption of a 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 17^{th} 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.

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 determined 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.





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 $\pm 1\sigma$ intervall around the measured value corresponds to a probability of 68.3% (confidence limit) to find the true value within this intervall. The $\pm 2\sigma$ 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 $\pm 1\sigma$ 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.

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

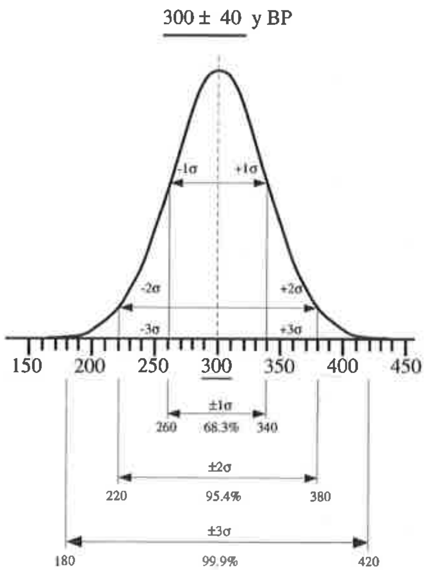
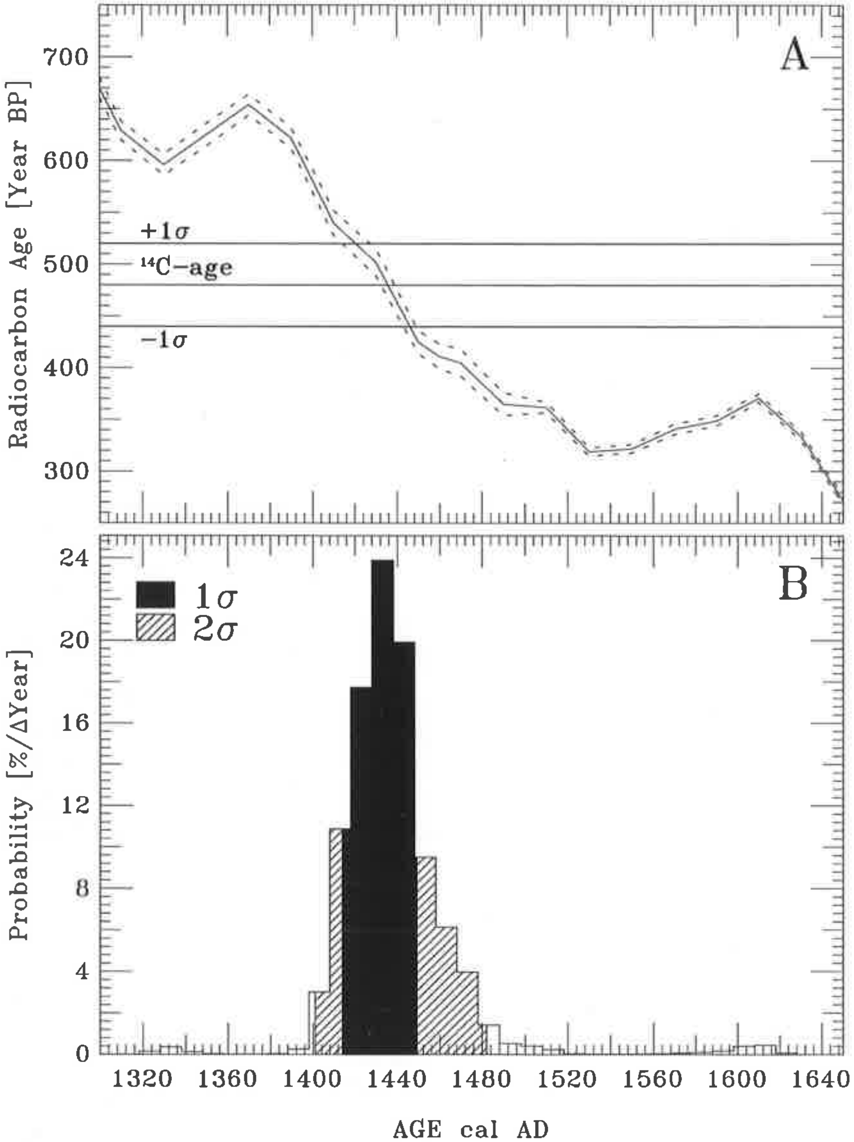


Fig. 6
The Gaussian or bell-shaped curve represents the probability distribution of measuring the true result (300 y BP) and is characterized by the standard deviation sigma (σ, ± 40 y BP).
The probability to find the true value within the 1σ interval (between 260 and 340 years) is 68.3% (confidence limit).
The probability to find it in the 2σ interval (220 to 380 y) is 95.4% (confidence limit) or in the 3σ intervall (180 to 420 y) 99.9% (confidence limit).

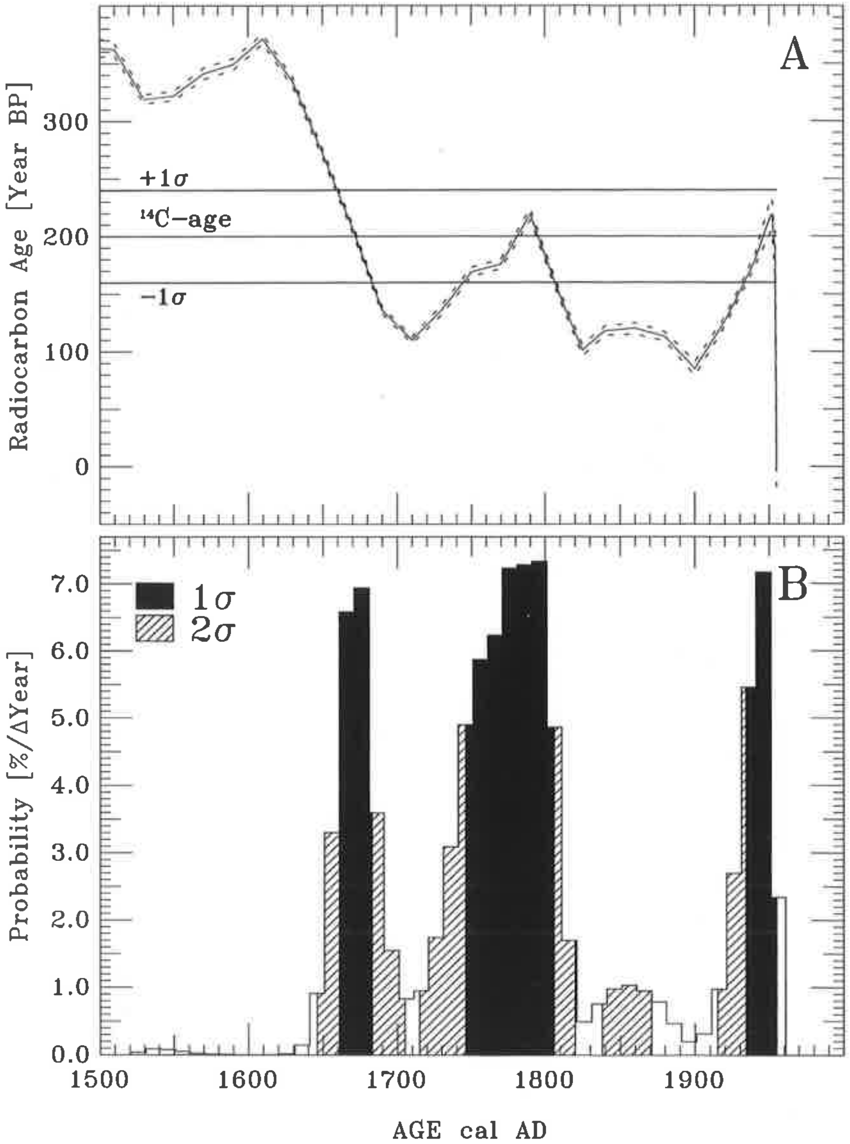
Fig. 7
(Example 1)
A: The non-linear relation between the ^{14}C age (y BP) and the calendar age (AD) for a ^{14}C age of 480 ± 40 y BP. The three horizontal lines mark the ^{14}C age with the corresponding $\pm 1\sigma$ error band.
B: The probability density distribution resulting from the calibration 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 1 sigma 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 $\pm 1\sigma$ 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.

EXAMPLE 1 480 ± 40 y BP



EXAMPLE 2 200 ± 40 y BP



^{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.

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.

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[1] Anderson et al. 1947.
[2] Vogel et al. 1984.
[3] Vogel et al. 1987.
[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.
[7] Stuiver/Reimer 1993.
[8] Levin/Kromer 1997.
[9] Bonani et al. 1987.
[10] Niklaus et al. 1992.
[11] Pearson/Stuiver 1993.
[12] Stuiver/Pearson 1993.

Jürg Rageth

A New Approach to Dating Anatolian Kilims

The remarkable increase in interest in Anatolian kilims since the early 1980's has, in the last few years, resulted in a corresponding increase of interest in their ages. Nevertheless, we are dealing with a traditional folk art, and our lack of knowledge concerning the developments and changes before 1800 has tended to confine our efforts at dating individual examples mainly to the 19th and 20th century.

Conventional dating methods

Since the end of the 19th century, paintings, notably by Italian and Dutch artists of the 15th to 17th century, have been an important aid in dating classical Oriental carpets. For Anatolian kilims this source is much less useful. As far as we are aware today, the earliest depictions of Anatolian kilims are in paintings of the second half of the 19th century and in most cases it was the "Orientalists"[1] who reproduced Anatolian kilims on their works of art. One of the few exceptions is a water-colour by Paul Cézanne[2], the great master and innovator of the late 19th century. Under the title "Les Rideaux" Cézanne painted an Anatolian kilim which he used as a door curtain in his studio in Aix en Provence. The best example with which to compare the kilim painted by Cézanne is a piece illustrated in Cootner 1990 (Plate 59). Although, in this context, the water-colour with its kilim of a rare and interesting design is particularly charming, Cézanne painted it in 1885, too late to be of significant help in dating.

Another dating tool, also restricted to the 19th century, is be given by the dyestuffs. Around the mid 19th century there was a significant change in the palette of traditional, i.e., peasant and nomad products. This change coincided with the introduction of the first synthetic dyes such as Mauvine and Fuchsine around 1860. Kilims with an intact colour palette[3] sometimes showed tiny amounts of one or the other of these early synthetic dyes[4]. Without these indications, the ages of such kilims would often have been thought to be earlier[5].

The slow appearance of indigosulfonic acid[6] in kilims during the second half of the 19th century resulted in a further change in palette. Indigosulfonic acid is soluble in water and is lost almost completely during the first wash. Washed green colours obtained with this dye[7] are therefore easy to recognise and allow us to date a kilim to the second half of the 19th century. An interesting example of this type is the kilim on Plate 59. The use of cochineal too, permits us to date a kilim with a high degree of probability to the second half of the 19th century, although here we must add a qualification[8]. The only kilim in this study in which we had evidence of cochineal was also dated with the highest degree of probability by the ^{14}C method to the 19th century (Plate 37). Finally we know a number of Anatolian kilims with inscribed dates. These too, however, do not reach further back than to the time around 1800. Only one Anatolian kilim has become known which with an inscribed date of 1774 can be dated to a time before 1800[9]. A few kilims are known with inscribed early 19th century dates, as, for example, an East Anatolian kilim with two adjacent "niches" which has a date of 1815[10]. However, the majority of inscribed dates in Anatolian kilims fall into the second half of the 19th century[11] or even into the early 20th century.

Radiocarbon dating: possibilities and limitations

Until recently, therefore, traditional Anatolian kilims could be reliably dated only to the 19th or early 20th century; everything else was speculative. Thanks to radiocarbon dating of milligram samples with the AMS method it is now possible to obtain relatively reliable data from the period prior to 1800[12].

It is often stated incorrectly, that radiocarbon dating is reliable only for material from the 16th century and earlier. That this is not exactly so, is illustrated by the following example: A radiocarbon age of a kilim made after 1600 is exactly as reliable as that of an object which is several thousand years old, as for example the so-called Pazyryk carpet[13] (Fig. 1). The problem lies not in the age of the object, nor in the amount of ^{14}C present; but within the calibration, i.e., with the conversion of the radiocarbon age BP into a calendar age BC or AD. Of course, the attitude and expectation of the user is also important in this. A result which yields an age interval of 100–200 years is easier to accept for a piece which is over 2000 years old, than for one which is between 250 and 300 years old.

Since we have no alternative dating method for Anatolian kilims woven before 1800, we have to live with that for the time being.

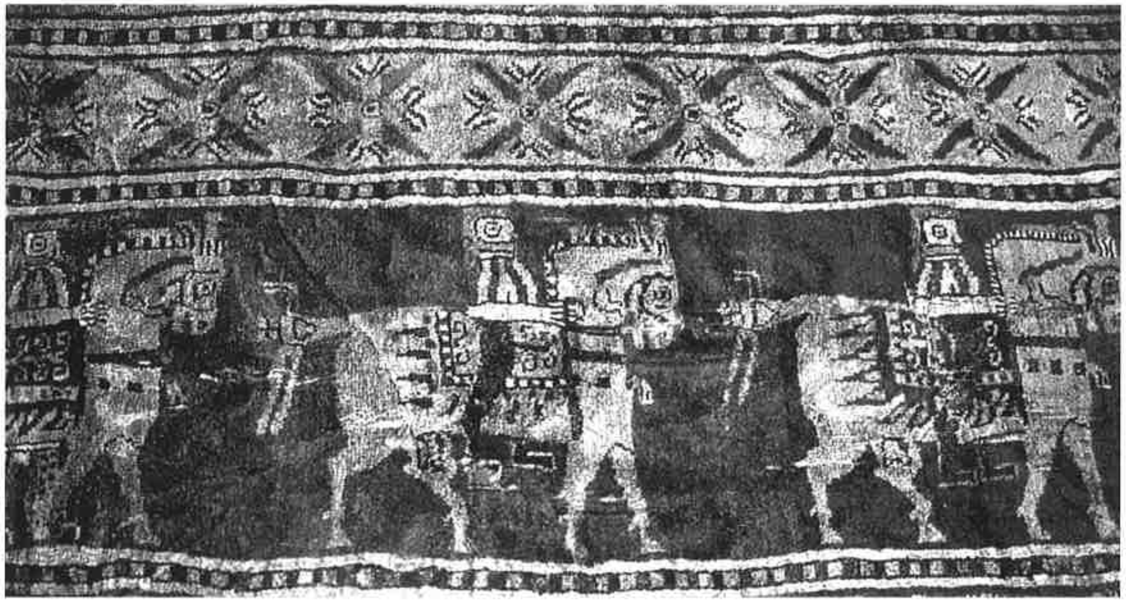


Fig. 1
Detail of the border of the so-called Pazyryk carpet, The Hermitage Museum St. Petersburg, inv. no. 1687/93.
A radiocarbon age of an object made after 1600 is exactly as reliable as that of an object which is several thousand years old. The problem lies not in the age of the object, nor in the amount of ^{14}C present; but within the calibration, i.e., with the conversion of the radiocarbon age BP into a calendar age BC or AD. A classical example of this type is the comparison of the ^{14}C-dating of the flatweave on Fig. 8 and the so-called Pazyryk carpet in the Hermitage Museum in St. Petersburg. A first radiocarbon dating of this the oldest known carpet has been executed nearly 50 years after its discovery. In spite of the low measurement error and the high radiocarbon age, the flat course of the calibration curve in the 4th and 3rd century BC result in two calibrated age ranges which together spread over 183 years.
Radiocarbon age: 2245 ± 35 y BP
Calibrated age (95% confidence limit):
BC 383–332 (25.4%)
BC 328–200 (74.6%)

The radiocarbon dating method may be somewhat imprecise for our purposes, and for the period after 1650 must be used with great care. However, this does not mean that the method is useless for pieces from this period. Several different kilims in this study have demonstrated that ^{14}C results from this critical period can yield interesting and useful data.

The range 1450 to 1650 (Figs. 2 and 3)

The kilims tested can be divided relatively clearly into three age groups: 1450–1650, 1650–1800, 1800–1950. These periods arise from the shape of the calibration curve in the last few centuries and are, therefore, related to the radiocarbon dating method itself. Only about 10% of the pieces investigated fall in the earliest range, before 1650. This percentage must not, however, be referred to the total number of all existing kilims. For this study only those kilims were selected which were thought to have been woven before 1800. Since it was especially important to obtain reliable[14] results for kilims of this earliest range, in most cases several tests were performed on the same piece (see also the section on multiple measurements).

The range 1650 to 1800 (Figs. 4 and 5)

Until recently, because of the variations in the amount of ^{14}C in the atmosphere, and the resulting irregularities in the calibration curve, an object from the time after 1650 was regarded as not suitable for ^{14}C dating.

With reference to this assumption a slight qualification is needed, in that at least in connection with traditional carpets and flatweaves we may be able to relate them to other data. In many cases, based on the results of dye analysis or the presence of inscribed dates, it is possible to assign a kilim to the 19th or early 20th century, with a degree of probability verging on certainty. A significantly small number of kilims is older and comes from the period around or before 1800. By these means the critical period for ^{14}C dating, between 1650 and 1950, can already be restricted further. Furthermore, the course of the calibration curve within this critical area helps us in that it drops steeply after 1600, reaching a minimum at ca. 1700, then rises strongly until shortly before 1800, after which is shows a drop and remaining relatively flat with only slight deviations. From 1900 it once again shows a steep rise (cf. Figs. 2–7). In the most favourable cases there are therefore possible date ranges with different probabil-

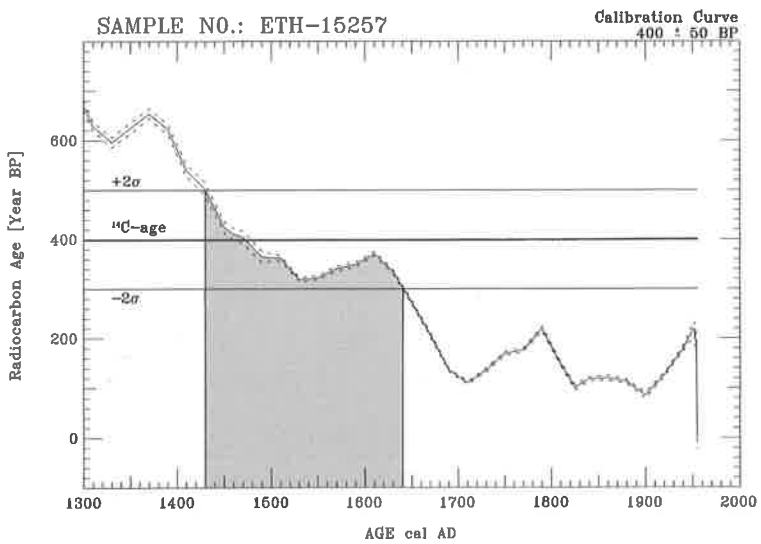


Fig. 2
Graphic representation of a dating in the range 1450–1650 with a radiocarbon age of 400 ± 50 y BP.
The graph shows the dating of the Karapınar saf kilim on Plate 9.

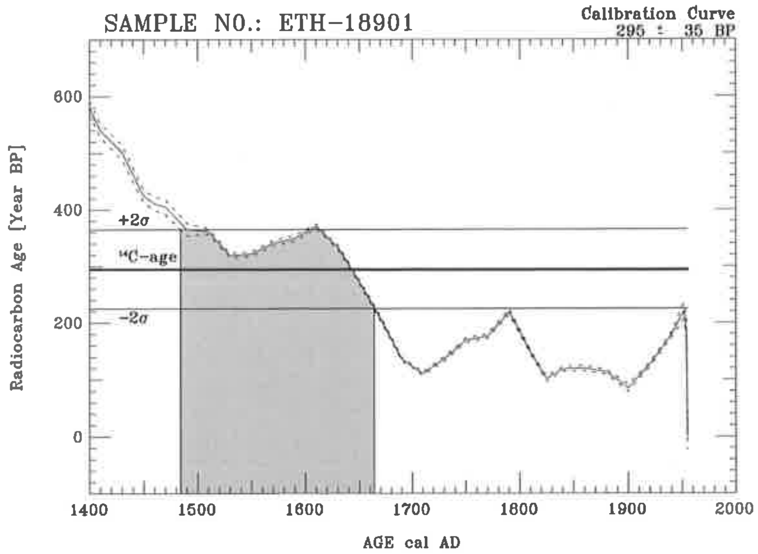


Fig. 3
Graphic representation of a dating in the range 1450–1650 with a radiocarbon age of 295 ± 35 y BP.
The graph shows the dating of the Dazkırı saf kilim on Plate 3.

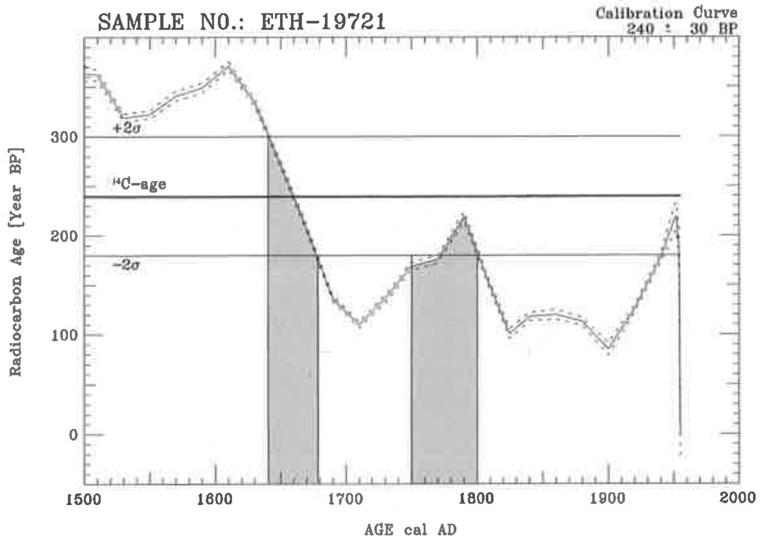
ities in the 17^{th}, 18^{th} and 20^{th} centuries (Figs. 4 and 5). Depending on the radiocarbon age and the experimental error the curve may just be touched in the 19^{th} century. In such cases this range may be given with a probability of a few per cent (cf. the results for Plates 16 and 20). For a radiocarbon age of at least 180 years BP a small measurement error can result in a tangential contact at the start of the 19^{th} century[15]. From a knowledge of features, especially of colours, it may be possible to exclude age ranges which fall entirely within the 20^{th} century with certainty.

The ^{14}C dating method, therefore, permits a satisfactory age determination between 1650 and 1800[16] and thereby reached just that range which can be excluded from a knowledge of the dyes or inscribed dates.

The range 1800 to 1950 (Figs. 6 and 7)

This range throws up the most questions and is to be treated with the greatest care. Most of those kilims which radiocarbon dating places with the highest degree of probability into this range[17], originate, on account of their colours and drawing, at least before 1850. In addition it must not be overlooked that all these results also show an origin around 1700, sometimes with a probability of up to 43%[18]. In some cases the question to which range they belong to must remain open.

The fact that radiocarbon dating results can be correct when pointing with greatest probability to a 19^{th} century origin, is shown by three examples. In all these a 19^{th} century date is also confirmed by other indicators. The first is a small carpet with the inscribed date 1228 (AD 1812/13) (Fig. 59.1; see text to Plate 59). The inscribed date tends to confirm the 19^{th} century range given with greatest probability by radiocarbon dating[19]. A second example is provided by the kilim on Plate 59. Without the radiocarbon test it might well have been doubtful that the piece belongs to the 19^{th} century. Dye analysis demonstrated the presence of indigosulfonic acid, confirming the result of the ^{14}C test[20]. The third example is the kilim fragment on Plate 37 which contains the insect dye cochineal. This again tends to confirm the ^{14}C result[21]. These three examples clearly show that radiocarbon dating results which point with highest probability to a 19^{th} century origin must by no means be rejected as useless. This applies particularly when an object has been believed to be older before applying radiocarbon dating. In such cases the attempt should



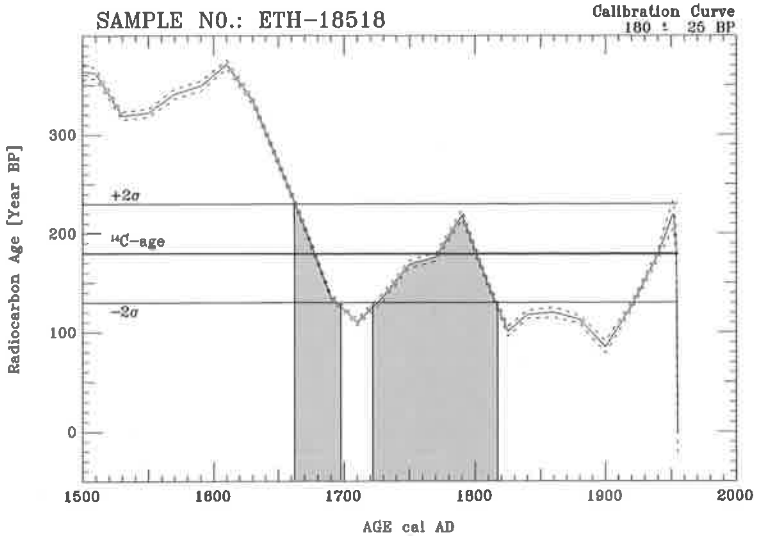


Fig. 4
Graphic representation of a dating in the range 1650–1800 with a radiocarbon age of 240 ± 30 y BP.
The graph shows the dating of the double-niche kilim fragment on Plate 15.

Fig. 5
Graphic representation of a dating in the range 1650 to 1800 with a radiocarbon age of 180 ± 25 y BP.
The graph shows the dating of the kilim on Plate 25.

be made to find a different dating aid which helps to relate the object to one of the two possible age ranges.

When and why multiple measurements

If there is no other way to confirm the first result, repetition of a ^{14}C measurement can increase its reliability. On the other hand, the reduction of the experimental error by multiple measurements, as in the kilim in Plate 39, can produce a result which even falls with the greatest probability into the 20th century. Although, in the current study this refers to a single, rather problematic case, one should not lose sight of its implications. Replicate measurements are particularly useful when a first result gives a date before 1650. But in the age range between 1650 and 1800 too, results are clearer and more reliable when they are confirmed by replicate measurements, and the reduction of the experimental error enables a result to be placed more decisively within the 1650–1800 range (cf. the examples with a radiocarbon age of 180 years BP with experimental error values of different magnitudes in note 15). An additional measurement which confirms such a result undoubtedly increases confidence in its reliability.

In this regard, multiple measurements have yet another advantage: they can show whether a first measurement may lie within a 3σ error. Although a 3σ error lies within the tolerance of the method, it will lead to unsatisfactory calibrated results, particularly after 1650[22].

On the other hand, a second measurement can also lead to new problems in case the result of one measurement is too different from the other, i.e., lies even outside the 3σ error. When this happens it is essential to perform further measurements, preferably on fresh samples. When testing samples from the kilim on Plate 44, for instance, the result of the second test deviated so far from that of the first, that a third and fourth test were undertaken, which in the end confirmed the result of the second test[23]. Such deviations are rare, and seem to occur mainly when testing textile samples. It is likely that the problem is caused by contamination with older organic material, but it has not yet proved possible to identify the causes. In the next paragraph we meet the same problem again.

Measurements at different laboratories (Fig. 8)

It is common to hear that the credibility of a radiocarbon dating is higher if "blind tests" at two or three different independent labora-

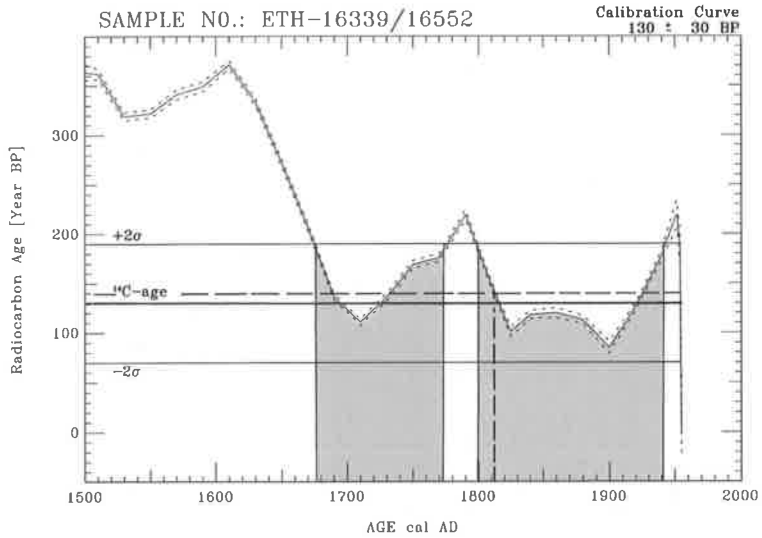


Fig. 6
Graphic representation of the dating of the carpet in Fig. 59.1 with an inscribed date of 1228 (AD 1812/13). Although the radiocarbon age of 130 y BP is very near the nominal (interrupted line) of 140 (AD 1812), i.e., the measurement turned out to be very accurate, the date 1812 lies at the very edge of the highest probability range in the 19th century.

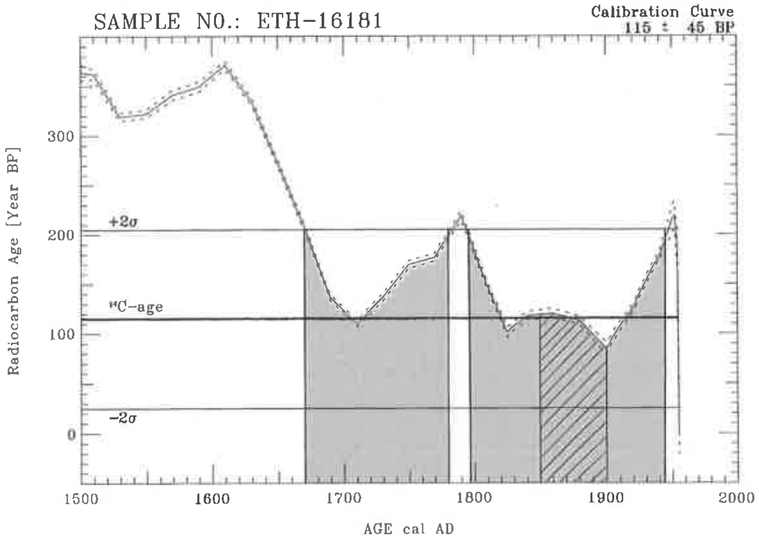


Fig. 7
(Caption see next page)

tories give the same result[24]. This is true, provided that a weighted mean[25] is obtained from all the measurements, and that, in case of disagreements, the individual laboratories are informed and asked for advice. If this is not done, such procedures have often led to an unjustified mistrust of individual laboratories, or even to total rejection of the method.

The kilim on Plate 25 exemplifies this problem. A dating performed in Arizona in 1993, placed this piece into the 14/15th century[26]. A second test undertaken at the ETH Zurich, in spite of several replicate measurements could not confirm this result but dated the kilim in the period 1650–1800[27]. A further test in Arizona on a fresh sample was thought to be indicated and was commenced.

However, as has been stated earlier, even if such replicate tests confirm each other, it should not be left at that. In such cases a weighted mean value should be calculated which not only adds to the assurance of the test result but, profits from the reduction of the experimental error. Due to the ignorance of the client or for other reasons, this is frequently left undone.

No problems were encountered in a second comparative test performed in the course of this study. This concerned a so-called double-weave of unknown origin and age from the Orient Stars collection (Fig. 8). The samples were taken by Michael Franses in the presence of the collector and were investigated at the ETH Zurich and the University of Oxford. Both laboratories reported almost identical results, i.e., radiocarbon ages of 160 ± 35 y BP from Zurich and 160 ± 50 y BP from Oxford[28].

From the view of statistics two test results which lie within a 2σ error can be combined. This means that in the case of the double-weave the test results would still have been acceptable if in the extreme case one result would differ from the other by 2σ[29]. At the same time this would have required the calculation of a weighted mean from both results.

What has this investigation shown?

Above all it has brought us the certainty that the Anatolian kilims available to us today include examples which were woven as far back as the 15th century. It has also given us certainty that post-1650 radiocarbon dating results are meaningful, assuming that the 20th century probability range can be excluded (cf. Figs. 4 and 5) and that the experimental error is less than ± 50 years. The age limit for the

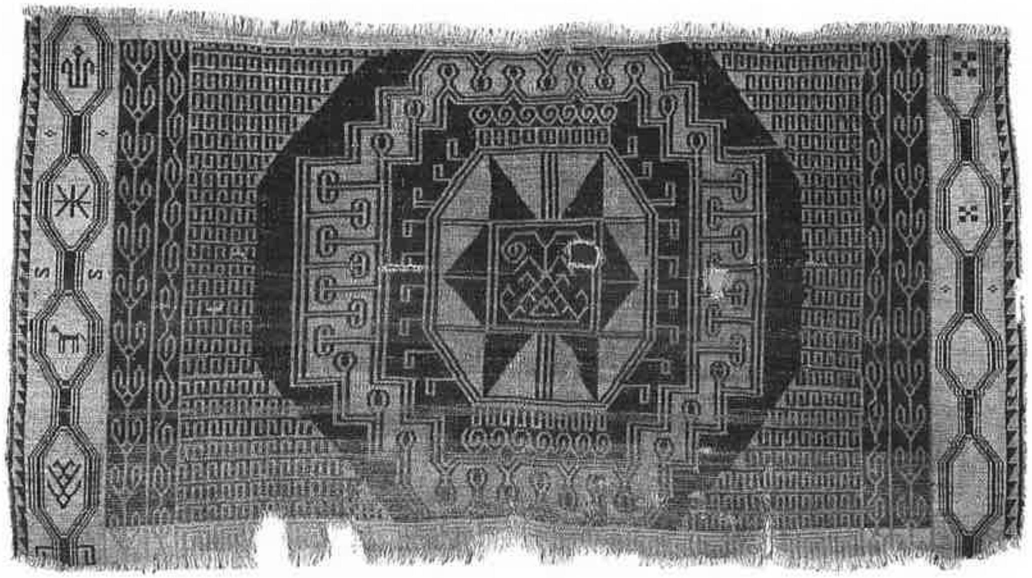


Fig. 7 (see preceding page)
Graphic representation of the dating of the kilim on Plate 59 which has its highest probability between 1800 and 1950. Since indigosulfonic acid was shown in this kilim, it is certainly from the 19th century, and with the highest probability from the period between 1850–1900.

Fig. 8
Double-weave, fragment, 140 × 270 cm, Northern Africa?, Orient Stars collection. It is common to hear that the credibility of a radiocarbon dating is higher if "blind tests" at two or three different independent laboratories give the same result. This is true, provided that a weighted mean is obtained from all the measurements, and that, in case of disagreements, the individual laboratories are informed and asked for advice. If this is not done, such procedures have often led to an unjustified mistrust of individual laboratories, or even to total rejection of the method. No problems were encountered in a comparative test performed in the course of this study. This double-weave has been radiocarbon dated at Oxford and Zurich. Both laboratories reported almost identical results, i.e., radiocarbon ages of 160 ± 35 y BP from Zurich and 160 ± 50 y BP from Oxford.
Radiocarbon age: 160 ± 30 y BP (weighted mean of both tests)
Calibrated age (95% confidence limit):
AD 1668–1787 (54.9%)
AD 1792–1823 (13.9%)
AD 1831–1884 (12.9%)

radiocarbon dating method, which had been assumed until now to be ca. 1650 can therefore be moved to ca 1800, on condition that a 20th century origin of an object can be excluded with certainty.

The study has also shown that, particularly within the range 1650 to 1800, replicate measurements are to be recommended, in order to achieve as low as possible an experimental error for the radiocarbon age. This not only increases trust in the method and yields a more accurate calendar age, but it also excludes the possibility of obtaining a single result which is 3σ away from the true age (cf. note 22).

Replicate measurements especially of textiles ensure a significantly higher guarantee for the correctness of the date whether or not this textile is from before or after 1650.

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1 The Orientalists, Orientalism = Art-historical term applied to a category of subject-matter referring to the depiction of the near East by Western artists, particularly in the 19th century. Orientalism was a facet of Romanticism (The Dictionary of Art, vol. 23, ed. Hane Turner).

2 The water-colour (49.1 × 30.5 cm) is in the Musée du Louvre, Paris (Inv. no. R. 193) and is reproduced in: Cézanne 1995, no. 102, p. 276.

3 Under "intact colour palette" we understand primarily that it is still free from synthetic, semi-synthetic or insect dyes such as indigosulfonic acid and cochineal. The colours are also dyed in differently light shades; i.e., diverse shades of red, blue and green, as well as a madder purple and yellow colour of good quality. The individual colour shades in this palette were carefully matched and the total effect was often lighter and brighter than after the introduction of the first synthetic dyestuffs.

4 Mauveine and, a little later Fuchsine, came onto the market in the Orient as the first synthetic dyes just before 1860.

5 A kilim which contained tiny amounts of fuchsine is shown in: Hull/Luzyc-Whywska 1993, Plate 272. A second kilim with the same design is illustrated by Petsopoulos 1991, Plate 54. It is not known to me whether this kilim too contains fuchsine. However, it is certain that two other dyes have been introduced into this second piece, which permits to date it to the 19th century: indigosulfonic acid in a motif on the white ground skirt on both narrow side (shown even in the illustration as an almost entirely bleached grey-blue), as well as cochineal in the field.

6 Indigosulfonic acid was invented ca. 1780 and is produced by treating indigo with concentrated sulfuric acid. In Anatolia indigosulfonic acid was used mainly in the second half of the 19th century.

7 Green colours are always a combination of a blue dye (indigo or indigosulfonic acid) with a yellow dyestuff.

8 According to Böhmer cochineal was traded in Anatolia already in the 18th century.

9 Petsopoulos 1979, Plate 261.

10 Frauenknecht 1984, Plate 55.

11 See: Wilber 1995. The list of carpets and flatweaves with inscribed dates from the 18th to 20th century shows this tendency very clearly.

12 This was already possible 20-30 years ago, although presumably no one would have been prepared to sacrifice a piece of kilim of at least 10 x 10 cm for LLC dating. (For an example see Fig. 12, p. 207 and note 35, p. 210.)

13 A classical example of this type is the so-called Pazyryk carpet in the Hermitage Museum in St. Petersburg. By request of Elena Tsareva and Robert Pinner, it was possible to obtain a sample for a first radiocarbon dating of this the oldest known carpet nearly 50 years after its discovery. In spite of the low measurement error and the high radiocarbon age (2245 ± 35 y BP), the flat course of the calibration curve in the 4th and 3rd century BC results in two calibrated age ranges which together spread over 183 years:
95% confidence limit:
BC 383–332 (25.4%)
BC 328–200 (74.6%)
(For the complete radiocarbon dating result see p. 243.)

14 This does not imply that the results of radiocarbon dating are unreliable. However, it has been shown many times that, especially with textiles, contamination of so far unknown kind, have caused errors resulting in too high a radiocarbon age. Such errors are identified by replicate tests.

15 Compare the following three results with a radiocarbon date of 180 and measurement errors increasing in the following order on Plates: 25, 60, 52, 17.

16 Cf. Plates 10, 11, 12, 14, 15, 25, 27, 42, 44, 45, 46, 47, 57, 62. For other kilims dated to this period the probability of a 19th century origin increases (up to 15.6% on Plate 18): Plates 2, 6, 13, 16, 18, 20, 21, 24, 28, 29, 30, 36, 38, 40, 48, 52, 54, 56, 58, 60, 61.

17 Cf. Plates 17, 23, 32, 37, 39, 49, 50, 51, 59.

18 Cf. Plate 17.

19 For the complete radiocarbon dating result see p. 243.

20 For the complete radiocarbon dating result see p. 241.

21 For the complete radiocarbon dating result see p. 238.

22 An example is the kilim fragment on Plate 27. A first test gave a radiocarbon age of 60 ± 50 y BP, which yields two possible true age ranges; the first with a probability of 74% between ca 1800 and 1940; and a second with a probability of 25% between ca 1680 and 1750 (95% confidence limit).

Compared with the results of the related kilims on Plates 26, 28 and 29, this result was a little unsatisfactory. A first repeat measurement then gave a radiocarbon age of 200 ± 50 years, which was significantly easier to combine with those for the comparable pieces. In order to be sure, a third test was undertaken which gave a result of 215 ± 45 years. A weighted mean of 210 ± 35 years from these two values dated the kilim to the period ca 1650–1800. The first measurement result was not incorrect; but because it lay in the 3 sigma error region it could not be included in the weighted mean.

23 For the complete radiocarbon dating result see p. 239.

24 One of the best known examples of a blind test undertaken at different laboratories is the radiocarbon dating of the Turin shroud. Not only where tests carried out in three different laboratories, but apart form the shroud whose age was related to that of the date of the crucifixion of Christ, three additional linen textiles were tested whose ages were known, but not communicated to the laboratories. These were an Egyptian linen cloth of the 1st century AD; a Nubian linen textile of the 11/12th century AD; as well as linen fibres from a choir-robe from the Dome of St. Anjou 1260–1280 AD. The tests were performed in Arizona, Oxford and Zurich. Not only did all three laboratories date the blind samples correctly, but all dated the shroud to the 13/14th century. The unweighted mean of the measurements at all the laboratories gave a radiocarbon age of 691 ± 31 y BP, i.e., calendar ages (95% confidence limit) of: 1262–1312, 1353–1384 (Nature, vol. 337, No. 6208, pp. 611–615, 16th February 1989).

25 A weighted mean usually has a lower experimental error, which can lead to a more accurate result in calibration, i.e., to a shorter period of the calibrated calendar age ranges.

26 HALI 74, p. 148 gives a date as follows: (96% confidence limit) AD 1334–1480.

27 For the complete radiocarbon dating result see p. 236.

28 For the complete radiocarbon dating result see p. 243.

29 The radiocarbon age is always given with the 1σ error; i.e., in this case 160 ± 50 corresponds to the 1σ error, 160 ± 100 to the 2σ error.

Jürg Rageth

Radiocarbon Dated Anatolian Kilims: Plates and Descriptions

In the following descriptions to the plates, only the radiocarbon age with its experimental error (1σ) and the calibrated 2σ ranges with a 95% confidence limit is given of the radiocarbon dating results. Due to the shape of the calibration curve in the region of interest, several true age ranges are possible. The figures in brackets are the probabilities for each single age range.

For radiocarbon dating only those kilims were selected which were thought to have been woven before 1800. This selection is primarily based on the knowledge of colours (dyes), in the second instance also on the comparison of designs. For all of these pieces, a 20th century origin can be excluded with certainty. This allows us to also exclude the 20th century probabilities of the radiocarbon dating results.

The complete information on the radiocarbon dating results are to be found on pages 231–245.

Plate 1

Kilim, woven in one piece
356 x 140 cm
Western Anatolia, Dazkırı area
Georgie Wolton collection

Radiocarbon age:	145±35 y BP
Calibrated age (95% confidence limit):	AD 1673–1780 (45.8%)
	AD 1796–1895 (36.9%)

Hitherto unpublished

Comparable pieces:
- Plates 2–8, Fig. 7.1

Nine saf kilims from the area of Dazkırı have become known until now (Plates 1–8, Fig. 7.1)[1]. Whether or not they are all from the same village is uncertain, although the close relationship between the kilims on Plates 1–6 suggests that they may have been. The three pieces on Plates 7, 8 and Fig. 7.1 vary from the others in two important respects and can only be included in this group with qualifications.

Only the two examples on Plates 1 and 4 are complete with ten niches[2]. Whether the other pieces originally had ten niches can be assumed but, particularly in the case of Plate 7, is doubtful[3]. By means of radiocarbon dating an origin between approximately 1450 and 1650 AD has been determined for the oldest of these saf kilims (Plates 3 and 8). The origin of this Western Anatolian saf design[4] presumably derives from the design of saf kilims of Central Anatolia (cf. Plates 9–11) wherein the stripe-character[5] of the Dazkırı pieces may be explained by the westward migration of the design from its place of origin. A similar phenomenon can also be observed in the eastward direction. East Anatolian saf and double-niche kilims with the same specific gable shape are also striped[6].

Typical for the saf kilims from the Dazkırı area are the slender niche-shapes in white cotton[7] with a red field against a green background. Every niche also has a small, white or yellow ground stripe with multicoloured motifs inside or below the gable. The palette of these saf kilims is practically reduced to the colour contrast green and red, though the high proportion of green and the absence of blue is unusual for Anatolian kilims[8]. With only one exception[9], red stripes grow from the gable of the niche toward the upper weaving edge[10]. The number of stripes varies between one and four on each side of the point of the gable. Another typical feature of the group is the multicoloured stripes at the narrow sides[11] in the sequence white-black-yellow-red, from the outside inward[12]. The complete saf kilim on Plate 1 shares a number of common designs with the fragments on Plates 2 and 3. Only in these three examples the tip of the gable is underlayed with a red stripe which reaches to the upper weaving edge. In the kilims on Plates 4–8 this applies only to the "towers" fitted on each side of the gable[13].

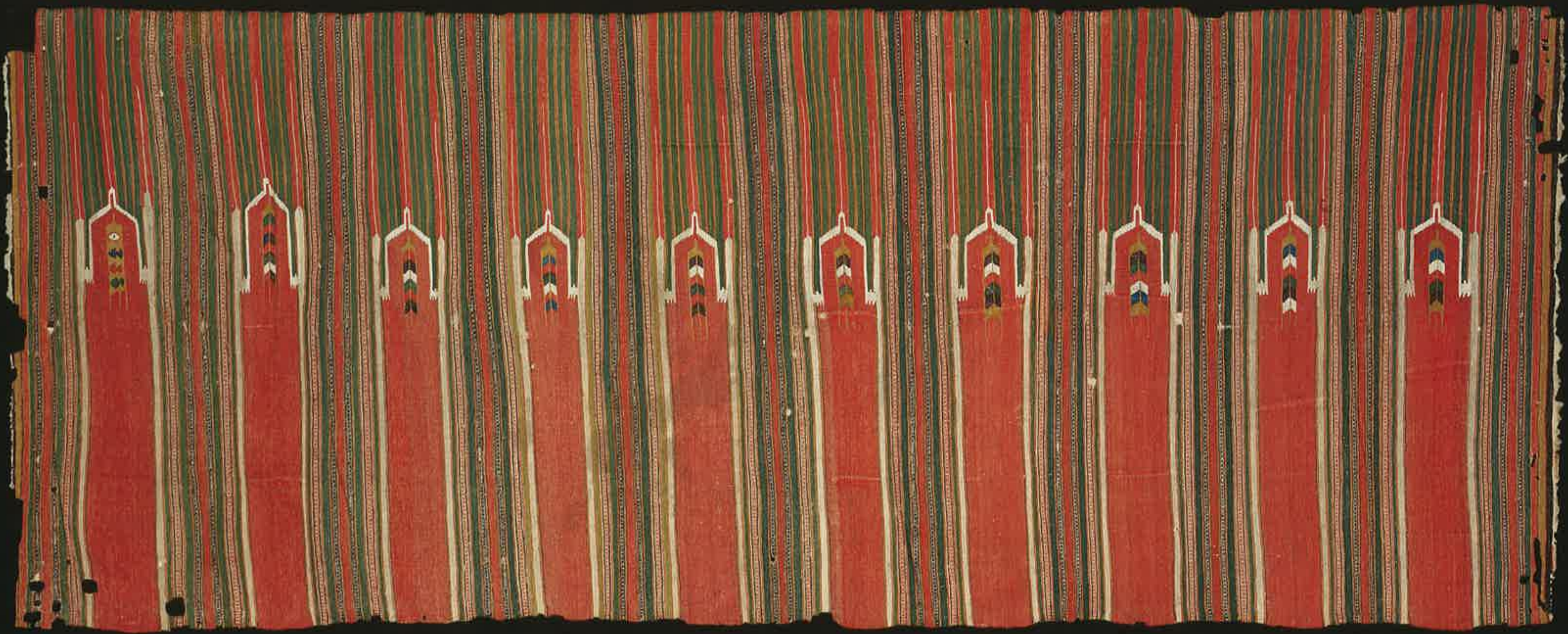


Plate 2

The fragment on Plate 2 has been assembled from six parts. The three smaller pieces sewn together, to the left on the illustration are in the Vakıflar Museum in Istanbul[14], the larger remainder, consisting of three other parts belong to a German private collection. However, all six parts with certainty belong to the same kilim which may have had an original length of approximately 470 cm.

This composite fragment has striking similarities to the complete saf kilim on Plate 1 and also to the saf fragment on Plate 3. The yellow stripes with the multicoloured triangles and "arrow-like" motifs (cf. also Fig. 2.1) are the same as those on the kilim on Plate 1, while the "tree-like" white brocading in the wide green stripes is very similar to the fragment on Plate 3. All other saf kilims tend to have smaller cruciform brocading (cf. text to Plate 1).

Kilim, woven in one piece, fragment
A: 93 x 128 cm
B: 211 x 128 cm
Western Anatolia, Dazkırı area
A: Vakıflar Museum Istanbul, inv. no. 102
B: Private collection

Radiocarbon age:	165 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1665–1823 (68.9%)
	AD 1831–1884 (12.8%)

Hitherto unpublished

Comparable pieces:
• Plates 1–8, Fig. 7.1

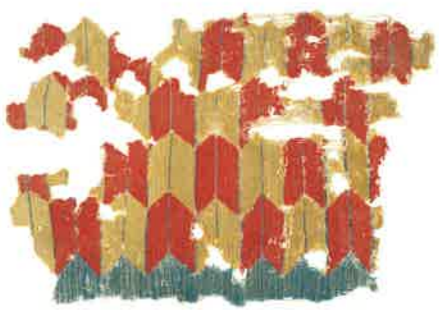


Fig. 2.1
Kilim, fragment, 82 x 55 cm, Western Anatolia, Balıkesir area, Orient Stars collection.
The small fragment with its "arrow-like" design is interesting since parallels are found only in saf kilims (cf. Plates 1 and 2) and in striped kilims[15] both from Western Anatolia.
Radiocarbon age: 225 ± 50 y BP
Calibrated age (95% confidence limit):
AD 1627–1710 (31.2%)
AD 1711–1822 (43.4%)
AD 1834–1882 (3,9%)

Plate 3

Kilim, woven in one piece, fragment
265 × 128 cm
Western Anatolia, Dazkırı area
Private collection

Radiocarbon age:	295 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1487–1607 (63.3%)
	AD 1612–1665 (36.6%)

Hitherto unpublished

Comparable pieces:
• Plates 1–8, Fig. 7.1

The fragments on Plate 3 and 8 are the oldest examples of this group of saf kilims. A comparison between the two fragments on Plates 2 and 3, which differ in age, shows that the colours of the older piece are a little more restrained and the drawing of the niche-gable is more elongated. The same can be observed on the slightly different kilim on Plate 8 which radiocarbon dating has shown to be of the same period as the piece on Plate 3. The two saf kilims from Central Anatolia on Plates 9 and 10 with their different ages as well show a difference in their colouring. There too, the older piece has less glowing colours.

Another point of similarity between the kilims on Plates 1–3 is shown by the stripes with multicoloured motives in the gable of the niche. On the one hand, they touch the point of the gable while on the other hand, the additional colour purple gives a more colourful appearance. The brocaded stripes left and right to the niches are a little wider on the kilim fragment on Plate 3, than in all other comparable pieces (see text to Plate 1).

Plate 4

Kilim, woven in one piece
392 x 108 cm
Western Anatolia, Dazkırı area
Al-Thani collection

Radiocarbon age:	170 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1663–1710 (18.2%)
	AD 1710–1822 (52.8%)
	AD 1833–1882 (10.3%)

Published:
- Skinner's 1985, lot 91
- HALI 69, 1993, advertisement pp. 58–59
- Sotheby's 1998, lot 19

Comparable pieces:
- Plates 1–8, Fig. 7.1

Apart from the piece on Plate 1, this is only the second known complete example of this group of saf kilims with ten niches[16]. It shows all the features specific to this group including the white-black-yellow-red stripes at the narrow sides.

In contrast to the three preceding examples, the pattern stripes within the niches are clearly located below the gable. They have a white ground but in some places the ground is yellow, similar to the saf kilims on Plates 1 and 2. Moreover, they end below as well as above with a sort of trident.

The stripes which point from the gables to the upper edge of the weaving, vary in number between two and four. As in the saf kilims on Plates 1–3 they are red, outlined in yellow, except for the last niche on the right, where the yellow outline is missing. This appears to be the standard for the fragments on Plates 7, 8 and Fig. 7.1 (see also text to Plate 1).

Plate 5

Kilim, woven in one piece
Measurements unknown
Western Anatolia, Dazkırı area
Vakıflar Museum Istanbul, inv. no. 320

Hitherto unpublished

Comparable pieces:
• Plates 1–8, Fig. 7.1

This saf kilim in the Vakıflar Museum in Istanbul[17] is the only piece illustrated in the Plate section of this book which has not been radiocarbon dated. Since the lack of its dimensions, it is also not possible to tell whether it is a complete saf or a fragment. The illustration shows six niches and is then cut. However, the narrow side on the left shows one of the original ends of the kilim. This becomes clear after comparing it with the corresponding narrow side on the left of the kilim on Plate 4. The damage has caused the loss of the starting stripes in white-black-yellow-red, wherein a few traces of the interior red stripe remains. The kilim is very similar in design to that illustrated on Plate 4. Only the niches are a little narrower, tending towards a red-brownish colour and at the tip of the gable they have a double "pipette-like" narrowing.

The similarities of certain details of individual saf kilims to the corresponding parts of others prompts to distinguish the eight examples described into four subgroups. Those on Plates 1–3 form a first subgroup, those on Plates 4 and 5 form a second, the fragment on Plate 6 stands alone, forming the third and the pieces on Plate 7, Fig. 7.1 and Plate 8 are so similar to each other that they seem to form a fourth subgroup. The discovery of further examples would answer the question whether the similarities are coincidents or would confirm the suggeted division into subgroups (cf. text to Plate 1).

Plate 6

The saf kilim in the Vok collection conforms to all the most important design features of the other saf kilims of the group. There are, however, differences in some details. Thus it lacks the otherwise typical red stripes from the niche gables toward the upper weaving edge. The gables are more rounded and not stepped as in other pieces. The niches are also a little less tall which creates a horizontal division of the kilim into red below and green above. This does not occur in any other saf kilim of this group which has been described. The pattern stripes in the gables are also different than in the other comparable pieces. The measurements suggest that like the safs which remained complete, this piece too originally had ten niches and a length of approximately 365 cm (cf. text to Plate 1).

Kilim, woven in one piece, fragment
302 × 141 cm
Western Anatolia, Dazkırı area
Vok collection

Radiocarbon age:	185 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1655–1706 (20.2%)
	AD 1714–1820 (55.7%)
	AD 1838–1873 (4.5%)

Published:
• Vok 1997, Plate 20

Comparable pieces:
• Plates 1–8, Fig. 7.1

Plate 7

This fragment from the McCoy Jones collection is very similar to the fragment on Fig. 7.1 and the fragment from the Galveston collection on Plate 8. In all of them the niches are of similar shape, they have very similar pattern stripes in the gables, very similar braided brocading between the niches and red stripes without outlines from the gables of the niches to the upper edge. In the fragments on Plates 7 and 8 the red in the niches has a brownish tinge. This fragment (Plate 7) with its green colour, so to speak, forms a bridge between the fragment on Plate 8 and the other pieces on Plates 1–6 (cf. also text to Plate 1).

Nevertheless, the absence of cotton and the presence of two red main stripes instead of one, between the niches, distinguishes this piece from the other saf kilims described from this group. If this kilim originally had ten niches, as is presumably the case for all the others, it would have the imposing length of 640 cm; which would be improbable[18]. It is more likely that the original kilim had six or seven niches, which would still have amounted to 400 or 460 cm respectively. A last unusual feature of this badly damaged fragment is the colour brown in the first stripe on the left side. It has not yet been investigated if there is any connection to the two shades of brown in the fragment on Fig. 7.1.

Fig. 7.1
Kilim, woven in one piece, fragment ca. 140 × 300 cm, Dazkırı area, 19th century.
This fragment shows strong similarities to Plates 7 and 8. As in Plate 7, the white areas are also ivory wool with only very little remnants of cotton in the gable of the 2nd niche from the right. The dark-brown, but specially the greenish light-brown ground colour are very unusual. Further examination will determine whether this colour was either originally green, dyed with indigosulfonic acid, or a faded dark-brown from natural undyed wool (cf. Böhmer, p. 217).

Kilim, woven in one piece, fragment
92 × 152 cm
Western Anatolia, Dazkırı area
Caroline & H. McCoy Jones collection
Fine Arts Museums of San Francisco
Inv. no. 1988.11.560

Radiocarbon age:	150 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1671–1783 (48.2%)
	AD 1794–1892 (34.5%)

Published:
- Cootner 1990, Plate 10

Comparable pieces:
- Plates 1–8, Fig. 7.1

Plate 8

Kilim, woven in one piece, fragment
260 × 79 cm
Western Anatolia, Dazkırı area
Galveston collection

Radiocarbon age:	285 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1490–1603 (53.2%)
	AD 1614–1670 (43.4%)

Published:
• Petsopoulos 1991, Plate 1

Comparable pieces:
• Plates 1–8, Fig. 7.1

The saf kilims on Plates 8 and 3 are the oldest examples of this group. Both were woven in the 16/17th century and belong to a small number of kilims which have been dated clearly to the period before 1650[19].

Despite the fact that the fragment on Plate 8 agrees in the smallest details with all the others in this group, it differs in two important points. On the one hand, it lacks the stripes in the sequence white-black-yellow-red on the narrow sides; on the other hand it lacks the characteristic green. Though it is very probable that in this fragment too green was present in the places which now appear blue. However, the attempt to demonstrate this by dye analysis failed, because although the yellow can still be seen by the naked eye where the blue has a slight green tinge, it could not be confirmed by thin layer chromatography. Curiously enough the same occurred in the attempt to analyse the brownish yellow in the pattern stripe within the first niche gable from the left. Here too it proved impossible to confirm the presence of yellow dyestuff. The question remains open why in this kilim the unusual, unidentifiable brownish shade of yellow was used in place of the more usual golden yellow.

Plate 9

Kilim, woven in two panels, fragment
363 × 147 cm
Central Anatolia, Karapınar area
Vok collection

Radiocarbon age:	400 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1435–1530 (57.4%)
	AD 1534–1635 (42.6%)

Published:
• Vok 1997, Plate 26

Comparable pieces:
• Plate 10
• Figs. 10.1, 10.2
• Vok 1997, Plate 27

The pieces shown on Plates 9–11 and Figs. 10.1 and 10.2 belong to a large group of saf kilims. This group which is devised in several subgroups, is from the region of Karapınar at the foot of the Toros range south-east of Konya in Central Anatolia[20].

Both of the radiocarbon dated fragments on Plates 9 and 10, together with two kilim fragments in the Vakıflar Museum (Figs. 10.1 and 10.2), form a small subgroup distinguished by their apricot-coloured ground, of which no further examples have become known[21]. By contrast with Figs. 10.1 and 10.2, the kilim fragments on Plates 9 and 10 show no colour changes from niche to niche; all the niches are brown (or purple-brown) and green on an apricot ground. In the fragments in Figs. 10.1 and 10.2 the colours change from niche to niche while the individual niches in Fig. 10.1 have more than two colours.

The remnants of the reciprocal end-stripes on the fragments Plates 9 and 10 also show small differences in design. Both designs are reciprocal, but that of the fragment on Plate 9 is more complicated. Due to the age difference, one might regard this as a simplification or even degeneration of the design. But this is not necessarily so; it is quite possible that the design variants on Plates 9 and 10 are of the same age.

By contrast with Plate 9, the colours of the younger fragment on Plate 10 are more intense. Presumably this is not due entirely to the ageing process. As can be seen in other kilims (cf. the text to Plate 3), the brighter colours may be characteristic for the period between 1650 and 1850 (continues with Plate 10).

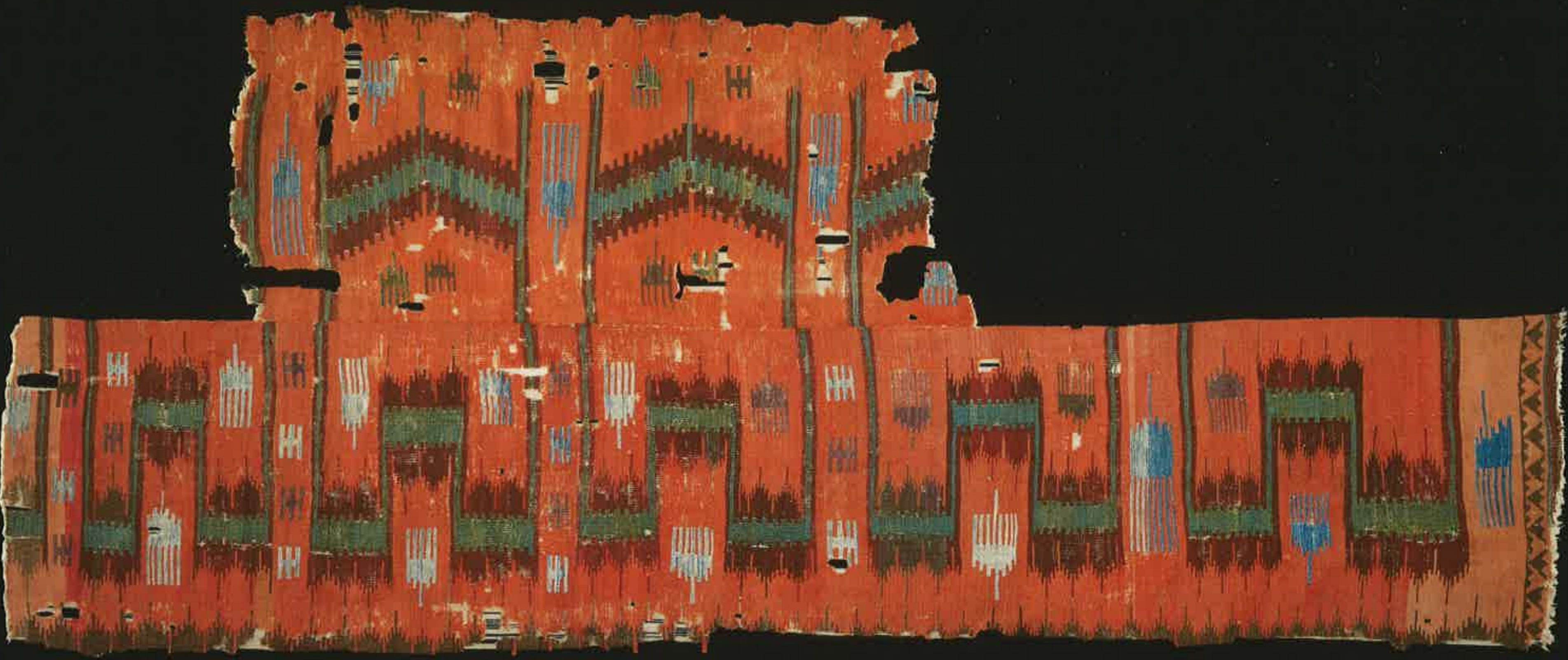


Plate 10

Kilim, one of originally two panels, fragment
350 × 75 cm
Central Anatolia, Karapınar area
Private collection

Radiocarbon age:	210 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1644–1694 (27.4%)
	AD 1726–1816 (53.0%)

Hitherto unpublished

Comparable pieces:
- Plate 9
- Figs. 10.1, 10.2
- Vok 1997, Plate 27

(Continued from Plate 9.) The closest relative to this subgroup with apricot ground is undoubtedly the saf kilim in the McCoy Jones collection[22], which is certainly the most spectacular example of all known saf kilims from Anatolia.

Comparable traditions in the production of saf kilims can be found in the area around Dazkırı in Western Anatolia (cf. Plates 1–8) as well as in the Sivas region in East Anatolia. A few individual saf kilims are also known from the regions around Erzurum and Kars in Northeastern Anatolia, but these appear to be later than those from Central and Western Anatolia. The saf kilims from the Sivas region were not radiocarbon dated, nevertheless two of them could be from the 18th century[23] and a third piece is dated 1812[24]. Apart from these three early pieces, the fact that a relatively large number of pieces are represented in the literature, also helps to confirm that these pieces represent an early tradition.

Fig. 10.1
Kilim, one of originally two panels. Vakıflar Museum Istanbul, inv. no.: Ko.Ho.122

Fig. 10.2
Kilim, one of originally two panels. Vakıflar Museum Istanbul, inv. no.: Ko.Ho.123

Plate 11

Kilim, woven in one piece
395 × 153 cm
Central Anatolia, Karapınar area
Museum für Islamische Kunst,
SMPK, Berlin, inv. no. I.3088

Radiocarbon age:	255 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1487–1610 (27.2%)
	AD 1611–1689 (37.6%)
	AD 1733–1813 (25.0%)

Published:
- Petsopoulos 1979, Fig. 86
- Enderlein 1986, Plate 2
- Brüggemann 1993, Plate 42

Comparable pieces:
- Balpınar/Hirsch 1982, Plate 17
- Frauenknecht 1984, Plate 41, 42
- HALI 26, 1985, pp. 18–19
- Rageth 1991, Plate 24
- Konzett/Ploier 1991, Plate 78
- Vok 1997, Plate 28

The saf kilim in the Museum für Islamische Kunst in Berlin differs from others of its subgroup not only by its greater age but, more so by the colours of the niche forms which are a light red and a deep blue instead of the dark brown. (For a discussion on the subject of saf kilims, see also the text to Plates 9 and 10.)

At the time when the piece came onto the market and was acquired by the Berlin Museum, its origin was still unknown; even India or North Africa were not excluded. The length of time taken to establish its true origin is the more surprising when we consider that already in 1909, Sarre had illustrated a Seljuk mihrab from the Laranda Mosque in Konya[25] in the foreground of which lay a double-niche kilim on the floor which was probably related to the examples on Plates 12–15.

While a number of very similar saf kilims have come on the market in Turkey since that time this example remains still the best of the known pieces of this subgroup. For further discussion, see the contribution of Volkmar Enderlein on pp. 171–174.

Plate 12

The fragments shown in Plates 12–15 belong to a small group of double-niche kilims which share a number of interesting common features. These include the multicoloured guard stripes at the sides of the niche fillings, the reduced palette and the resultant similarity to saf kilims (cf. Plate 11). No complete example of this group has become known to date. For a more detailed discussion see the text contributed by Dietmar Pelz on pp. 187–192.

Kilim, woven in one piece, fragment
211 × 100 cm
Central Anatolia, south of Konya
Private collection

Radiocarbon age:	240 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1514–1593 (11.1%)
	AD 1620–1696 (38.2%)
	AD 1724–1817 (36.4%)

Published:
• HALI 33, 1987, p. 36

Comparable pieces:
• Vok 1997, Plate 28
• Plates 13–15

Plate 13

The fragments shown in Plates 12–15 belong to a small group of double-niche kilims which share a number of interesting common features. These include the multicoloured guard stripes at the sides of the niche fillings, the reduced palette and the resultant similarity to saf kilims (cf. Plate 11). No complete example of this group has become known to date. For a more detailed discussion see the text contributed by Dietmar Pelz on pp. 187–192.

Kilim, woven in one piece, fragment
370 × 135 cm
Central Anatolia, south of Konya
Private collection

Radiocarbon age:	185 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1655–1706 (20.2%)
	AD 1714–1820 (55.7%)
	AD 1838–1873 (4.5%)

Hitherto unpublished

Comparable pieces:
• Plates 12, 14, 15

Plate 14

The fragments shown in Plates 12–15 belong to a small group of double-niche kilims which share a number of interesting common features. These include the multicoloured guard stripes at the sides of the niche fillings, the reduced palette and the resultant similarity to saf kilims (cf. Plate 11). No complete example of this group has become known to date. For a more detailed discussion see the text contributed by Dietmar Pelz on pp. 187–192.

Kilim, woven in one piece, fragment
310 × 160 cm
Central Anatolia, south of Konya
Private collection

Radiocarbon age:	250 ± 55 y BP
Calibrated age (95% confidence limit):	AD 1482–1702 (59.8%)
	AD 1718–1819 (29.0%)

Hitherto unpublished

Comparable pieces:
- Plates 12, 13, 15

Plate 15

The fragments shown in Plates 12–15 belong to a small group of double-niche kilims which share a number of interesting common features. These include the multicoloured guard stripes at the sides of the niche fillings, the reduced palette and the resultant similarity to saf kilims (cf. Plate 11). No complete example of this group has become known to date. For a more detailed discussion see the text contributed by Dietmar Pelz on pp. 187–192.

Kilim, woven in one piece, fragment
43 × 102 cm
Central Anatolia, south of Konya
Caroline & H. McCoy Jones collection
Fine Arts Museums of San Francisco
Inv. no. T89.51.29

Radiocarbon age:	240 ± 30 y BP
Calibrated age (95% confidence limit):	AD 1636–1682 (51.4%)
	AD 1748–1805 (33.4%)

Published:
- Cootner 1991, Plate 2

Comparable pieces:
- Plates 12–14

Plate 16

Kilim, woven in one piece, fragment
330 × 135 cm
Central Anatolia, south of Konya
Private collection

Radiocarbon age:	215 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1635–1709 (29.1%)
	AD 1711–1822 (48.9%)
	AD 1834–1881 (3.9%)

Hitherto unpublished

This kilim presumably stems from the area 40 km due south of the city of Konya[26]. Its unusual feature is the use of dovetailed tapestry weave. This rare technique is responsible for the right-angled steppes in the large diamonds, which have not so far been reported in Anatolia[27]. Only in the white stripes of the remaining skirt on the left the small stepped diamonds are woven in slit tapestry which is the usual tapestry technique in Anatolia. In this form they can be found also in other Anatolian kilims.

The dovetailed tapestry weaving may relate this kilim to two others which also show this unusual technical feature. These are the red ground saf kilim in the McCoy Jones collection[28] and the red ground kilim with three large cross-shaped 4+1 designs in the collection of the Vakıflar Museum in Istanbul[29]. The saf kilim in all probability comes from the region south of Konya. Although the kilim in the Vakıflar Museum was found in the *Ulu Cami* (Large Mosque) of Sivrihisar, the question arises whether this piece does not also stem from the same region south of Konya as the other two pieces which share this technical feature. Indeed dovetailed tapestry weaving is so unusual in Anatolia, that it could suggest a relationship between the three kilims. All three show this technique perfectly executed, entirely in contrast to the kilim on Plate 59 where the "dovetailing" was carried out so clumsily that one might assume that in this particular case the weaver "invented" the technique from new (see also text to Plate 59).

Plate 17

The beauty of this fragment rests not only on its harmonious colour composition, but also on the manner in which the different pattern elements have been drawn and integrated into a whole. The curved tooth-form in red and blue of the gable is unique in its elegance. Another remarkable feature is the play of colours in both of the outer stripes. What at first appears as a red background, under closer scrutiny is revealed as the true design. If the red motifs in the two stripes are compared with the blue motives of the black ground stripes in the skirts of the kilim on Plate 20, it is not hard to recognise that the red motifs form the true design with the coloured motifs as intermediate spaces. This is an unusual and rare style. A second fragment of the same kilim has been published by Brüggemann.

Kilim, fragment, woven in two panels
80 × 170 cm
Central Anatolia
Private collection

Radiocarbon age:	140 ± 40 y BP
Calibrated age (95% confidence limit):	AD 1673–1779 (43.0%)
	AD 1797–1945 (56.5%)

Published:
- Bernheimer 1988, no. 11
- HALI 75, 1994, p. 143

Comparable examples:
- Rageth 1991, Plate 10
- Brüggemann 1993, Plate 42

Plate 18

Kilim, originally woven in two panels, fragment
195 × 76 cm
Central or Eastern Anatolia
Private Collection

Radiocarbon age:	160 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1667–1788 (52.6%)
	AD 1791–1824 (13.7%)
	AD 1828–1886 (15.6%)

Hitherto unpublished

Comparable pieces:
- Erbek 1988, Plate 90
- Brüggemann 1993, Plate 47
- HALI 78, 1995, advertisement p. 29

This fragment includes a little more than one half of a single panel of an original two-panel kilim with rows of double-niches. The two purple-green-red niches on a red ground point to a colour symmetry about the vertical central axis of the kilim and allows us to estimate the original location of the centre of the design.

The design of the halved double-niches as of the intermediate patterned stripes are woven with great care. When drafting the design of the stripes, the weaver also took into account the background. Not only the coloured motifs are perfect in drawing but the white intermediate spaces are executed in careful oval forms, which correspond, for example, in form to the motifs within the stripes of the kilim on Plate 20. Further the colours of the entire fragment are of the highest quality, presumable the results of good wool as well as perfect dyeing. It is rare to see a purple (madder-violet) of this quality. In order to highlight the white areas slightly in the weaving process, half the undyed wool was mixed with white cotton (always one strand wool and one strand cotton). A slightly younger, complete kilim of the same design type shows the original appearance of the fragment in Plate 18[30]. Kilims of this double-niche variant have no skirt (under skirt we understand an additional border at the narrow ends).

Plate 19

Kilim, two fragments of one piece
198 × 158 cm / 203 × 150 cm
Western Anatolia, Isparta Area (?)
David Lantz collection

Radiocarbon age:	300 ± 60 y BP[31]
Calibrated age (95% confidence limit):	AD 1450–1679 (92.6%)
	AD 1769–1802 (5.0%)

One of the two fragments has been published in:
• Mellaart/Hirsch/Balpınar 1989, Vol. I, p. 88, no. 8

Comparable pieces:
• HALI 26, 1985, p. 23
• Museum Schloss Rheydt, 1997, no. 29

From this kilim, samples of the wool as well as of the cotton, have been radiocarbon dated[32]. The result given on the left shows the weighted mean of the two determinations.

Of particular charm are the powerfully drawn double-niches with their lateral design stripes on which small stepped diamonds are formed in rows, like coloured pearls. A comparison piece which was identical in all details, but was in perfect condition and had somewhat warmer colours, came onto the market in Konya in the 1980's. Another identical kilim fragment from the Georgie Wolton collection and has been published in HALI.

Plate 20

Kilim, woven in two panels
425 × 170 cm
Central Anatolia
Private collection

Radiocarbon age:	205 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1642–1708 (25.6%)
	AD 1712–1821 (50.6%)
	AD 1835–1880 (5.3%)

Hitherto unpublished

Comparable pieces:
- Black/Loveless 1977, Plate 14
- HALI 26, 1985, p. 22
- Cootner 1990, Plate 6
- HALI 54, 1990, Sailer advertisement p. 3
- Kirchheim 1993, Plate 93
- Türck 1995, Plate 23

Although at first sight, this kilim seems a little overcrowded, a closer look reveals it to be strongly symmetrical and ordered. Its complicated-seaming design is constructed of surprisingly few elements. The total composition consists of the field with three double-niches, intermediate stripes and a skirt on each of the narrow ends. Within the skirt are motifs which appear nowhere else; S-forms locked into one another in different colours on white ground, as well as so-called "birth-motifs" in blue on a black (dark brown) ground connected by a bar.

The field is dominated by three bold white double-niche forms. The two outer ones with blue fillings flank the double-niche in the centre which has a green filling. The colour symmetry towards the centre is underlined by an additional perfect symmetry of the design. A surprising feature is the four longitudinal zip-fastener-like designs which form a 4+1 configuration together with the central double-niche. Even the colour sequence of this "zip-fasteners" toward the centre was presumably maintained in accordance with the symmetry about the central axis[33]. Practically the whole of the small decorations consists of a motif framed by a hexagon which is also known as the "Hacilar-cross", and which is shown within the stripes either joined by a bar or halved. The field pattern is formed by only three motifs: the double-niche, the "Hacilar-cross" and confronted triangles separated by a bar.

Plate 21

On the basis of what remains of this kilim, a colour change between the cartouches is subject to a rhythm in which every second is in red. This does not apply to the two comparable pieces with Cootner. Also worth mentioning is the design concept without borders either on the long or the short sides (skirts).

Kilim, two fragments of one piece
216 + 81 × 145 cm
Central Anatolia
Vok collection

Radiocarbon age:	205 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1639–1824 (74.0%)
	AD 1828–1886 (7.9%)

Published:
- Vok 1997, Plate 22

Comparable pieces:
- Cootner 1990, Plates 17, 100

Plate 22

The colour palette is almost reduced to red, black and brown which imparts an archaic impression to this kilim with its six cartouches. The presence of so little blue is unusual. In the traditional palette of Anatolian carpets and kilims, red and blue have a predominant role.

Kilim, fragment, woven in two panels
295 × 152 cm
Central Anatolia, Cappadocia (?)
Marshall and Marilyn R. Wolf collection

Radiocarbon age:	365 ± 66 y BP[34]
Calibrated age (95% confidence limit):	AD 1438–1654 (100.0%)

Published:
• Hajji Baba 1996, no. 5, p. 10

Comparable pieces:
• Cootner 1990, Plate 32

Plate 23

Kilim, fragment, woven in two panels
336 × 141 cm
Central Anatolia
Private collection

Radiocarbon age:	105 ± 40 y BP
Calibrated age (95% confidence limit):	AD 1680–1761 (31.5%)
	AD 1803–1938 (68.5%)

Published:
- Sailer 1991
- HALI 61, 1992, pp. 176–177

Comparable pieces:
- Cootner 1990, Plate 11
- Vok 1997, Plate 60
- HALI 92, 1997, advertisement p. 19

The design composition used in this kilim is shared by only very few pieces illustrated in the literature. If the fragment illustrated here were in better condition, it would be surely rank as unsurpassed and aesthetically the most satisfying of this group.

The purple-green-orange colour sequence in the field has a particular charm. In addition to this the effectively structured skirts with their inner white stripes which form a prominent field boundary and the outer blue stripes, which, thanks to their compatibility with the orange at the long sides, serve to contain the design within a uniform frame. Exciting is also the strong contrast between the large scale field pattern and the small-scale design, worked in the finest detail, within the skirts. Of special charm are the small stripes with multi-coloured weavy lines in the skirts. A less successfully designed example of the same type is shown in: Petsopoulos 1991, Plate 86.

Plate 24

Kilim, woven in one piece, fragment
322 × 182 cm
Anatolia
Private collection

Radiocarbon age:	175 ± 40 y BP
Calibrated age (95% confidence limit):	AD 1659–1823 (70.7%)
	AD 1832–1883 (10.9%)

Published:
- Petsopoulos 1979, Plate 24
- HALI 61, 1992, cover

No other piece has yet been found which resembles this kilim. While the design is close to that of double-niche kilims the palette is unique. Highly unusual too is the pale, almost skin-coloured "pink" which imparts a particular charm to the colour combination. The original length of the kilim is unclear. The width of 182 cm suggests that three double-niches are missing. Indeed the kilim would gain in beauty if it had ten double-niches.

On one of the short sides (left in the illustration) four pairs of warp yarns form small loops which indicate that this is where weaving began. The composition starts directly with the field pattern, has neither skirts nor narrow coloured stripes as is otherwise usual. At the beginning of the weaving only one narrow stripe of ivory coloured wool served to fasten the warp yarn on the loom.

Plate 25

Kilim, woven in one piece, fragment
318 × 160 cm
Anatolia
Caroline McCoy-Jones collection

Radiocarbon age:	180 ± 25 y BP
Calibrated age (95% confidence limit):	AD 1660–1702 (18.5%)
	AD 1718–1819 (60.5%)

Published:
- HALI 74, 1994, p. 148
- Sotheby's 1998 bis, lot 57

Comparable pieces:
- Brüggemann 1993, Plate 55 (HALI 76, 1994, p. 41)
- Sotheby's 1998 bis, lot 51

It is the combination and interdependence of motifs and background which attracts the eye in this kilim. Multicoloured, stepped motifs are each placed on a uniform background forming two similarly adjacent stepped diamonds. This play with pattern is not observed at first sight and demonstrates a high degree of skill with shapes and colours.

By contrast with the kilim on Plate 16 which also has large stepped diamonds, the weaver has employed the slit tapestry technique which is traditional in Anatolia. By these means large slits are formed in the warp direction alongside the diamonds. Along the central axis (warp direction), the weaver has solved the problem of long slits formed by the classical Anatolian method. Where two different coloured areas meet, she included a "zip-fastener-like" design with an elongated tooth-shape.

Apart from the comparison piece in the literature, another kilim of the same design, presumably from the 19th century, appeared on the market in the early 1990's. More distantly related is a kilim from the Sailer collection (Sotheby's 1998 bis, lot 57).

Plate 26

The special feature of this kilim is the design of two large medallions and a third much smaller medallion with another drawing between them (compare also Plates 27 and 28). This design is a variant of the type which has three medallions of the same size and design (cf. Plate 29). The latter type of kilim is relatively common and was still woven in Anatolia in the 20^{th} century. The variant on a white ground belongs to the common type while the orange of the kilim on Plate 28 is much rarer.

Kilim, woven in two panels, fragment
368 × 173 cm
Central or Eastern Anatolia
Vok collection

Radiocarbon age:	300 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1469–1673 (96.1%)
	AD 1779–1796 (2.5%)

Published:
- Mellaart/Hirsch/Balpınar 1989, Vol. I, Plate XII, no. 11
- Rageth 1991, Plate 6
- Vok 1997, Plate 70

Comparable pieces:
- Plates 27, 28, 29

Plate 27

Kilim, one of originally two panels, fragment
300 × 64 cm
Central Anatolia
Private collection

Radiocarbon age:	210 ± 35 y BP
Calibrated age (95% confidence limit):	1644–1694 (27.4%)
	1726–1816 (53.0%)

Published:
• Sailer 1991

Comparable pieces:
• Plates 26, 28, 29

This kilim fragment is very similar to that on Plate 26. Of special quality is the drawing of the two, in this instance halved main motifs on a white ground. As on Plate 26 the two motifs are very similar in colour, while in contrast to Plate 26 the main motifs on Plate 27 are smaller.

The vulture or *gülbudak* (rose branch) motif in the central stripe of the surviving skirt is unique in its two-coloured version (red/blue). The four-part bird design (?) on the two red subsidiary stripes is also very rare.

Plate 28

The interesting feature of this kilim in contrast with the kilims on Plates 26 and 27 is the orange ground colour and the light-blue and brown borders in the long sides (cf. Plate 23).

Kilim, woven in two panels
392 × 156 cm
Central or Eastern Anatolia
Vok collection

Radiocarbon age:	205 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1642–1708 (25.6%)
	AD 1712–1821 (50.6%)
	AD 1835–1880 (5.2%)

Published:
- Vok 1997, Plate 71

Comparable pieces:
- Plates 26, 27, 29

Plate 29

Kilim, woven in one piece, fragment
355 × 145 cm
Central Anatolia
Private collection

Radiocarbon age:	180 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1658–1707 (19.3%)
	AD 1713–1821 (55.0%)
	AD 1836–1878 (6.4%)

Hitherto unpublished

Comparable pieces:
• Plates 26, 27, 28
• Balpınar/Hirsch 1982, Plate 37
• Eskenazi 1984, Plate 7
• Valcarenghi 1994, no. 36
• Vok 1997, Plate 73
• Cootner 1990, Plate 47

This kilim with its three symmetrical hooked hexagonal medallions[35] on a white ground, belongs to a small subgroup of a very widespread design type in which the hooks of the medallions have many additional small hooks[36]. Characteristic for the subgroup which includes this example, as well as the fragments on Plates 26, 27 and 28, are the four (2+2) anthropomorphic (?) forms, which grow from the "shoulders" of the hexagonal medallions in the weft direction[37]. Plate 47 in Cootner 1990, illustrates a variant with a single medallion.

Plate 30

There is an obvious design relationship between this kilim and those on Plates 26–29, but it exemplifies a variant with three connected hexagons of different sizes with asymmetrically arranged large hooks and double-hooks.

All known examples of this group have three or four interconnected hexagonal medallions[38]. In the illustrated fragment, a skirt and possibly a fourth hexagon are missing.

Kilim, woven in two panels, fragment
345 × 172 cm
Central Anatolia
Private collection

Radiocarbon age:	190 ± 40 y BP
Calibrated age (95% confidence limit):	AD 1652–1707 (21.5%)
	AD 1713–1821 (53.4%)
	AD 1836–1878 (6.0%)

Published:
- Frauenknecht n. d., Plate 14
- HALI Vol. 5, no. 4, 1983, p. 479
- Brüggemann 1993, Plate 62

Comparable pieces:
- Frauenknecht n. d., Plate 13
- Rageth 1986, Plate 16
- HALI 33, 1987, p. 81
- Hull/Barnard 1988, p. 168
- Mellaart/H./B. 1989, Vol. I, p. 41
- Valcarenghi 1994, no. 38
- Kreissl 1995 (cover), Plate 50
- Türck 1995, Plate 6

Plate 31

This kilim is another design variant to Plate 30 with a row of contiguous hexagons. Here the double-hooks have become almost independent anthropomorphic (?) shapes only loosely connected to the hexagons.

The kilim shows a finely executed reciprocity in the skirts as well as in the long border which was woven in one piece together with the central field (the second border was woven separately). The coloured motifs are often of equal weight with the reciprocal black or white motifs in the ground colour or outlines the latter (see the long border)[39].

Kilim, woven in two panels
435 × 152 cm
Central Anatolia
Private collection

Radiocarbon age:	290 ± 25 y BP
Calibrated age (95% confidence limit):	AD 1516–1591 (50.4%)
	AD 1622–1663 (49.6%)

Hitherto unpublished

Comparable pieces:
• Brüggemann 1993, Plate 58

Fig. 31.1
Kilim, one of originally three panels (the borders are missing), fragment, 490 × 125 cm, Central Anatolia, Private collection.

Radiocarbon age:	140 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1674–1777 (43.5%)
	AD 1798–1898 (39.4%)

This kilim only differs very little in design from the example on Plate 31. Beside the latter and the kilim illustrated in Brüggemann 1993, this is only the third piece known in the literature with this specific design. Concerning radiocarbon dating, it is younger than the kilim illustrated on Plate 31.

Plate 32

Kilim, one of originally two panels, fragment
165 × 65 cm
Central Anatolia
Private collection

Radiocarbon age:	75 ± 30 y BP
Calibrated age (95% confidence limit):	AD 1691–1729 (17.8%)
	AD 1814–1923 (82.2%)

Hitherto unpublished

Comparable pieces:
• Frauenknecht n. d., Plate 7
• Kreissl 1995, Plate 36

This small fragment is from an originally double-panel kilim with presumably ten (twice five) hexagons in the field. Unusual in this piece are the differently coloured outlines of the hexagons with small spiral-shaped hooks. In this pattern too reciprocity is to be found in its accomplished form (cf. Plate 31). Within the spaces between the adjacent hexagons, the spiral-shaped hooks form a negative design, also seen on the kilims on Plates 33 and 34.

Also interesting is the comparison between the white (anthropomorphic?) forms in mirror-image in the centre of each hexagon, with the forms in Plate 31. This has very similar, but much larger design motifs of the same type. They are coloured and outlined in dark brown and not placed within the hexagons but between them.

According to radiocarbon dating and our knowledge on colours, this fragment was woven either in the early 18th or in the first half of the 19th century. A date of manufacture before 1850 can be assumed in all probability.

Plate 33

Kilim, woven in one piece
370 × 150 cm
Anatolia
David Lantz collection

Radiocarbon age:	320 ± 88 y BP[40]
Calibrated age (95% confidence limit):	1427–1692 AD (86.4%)
	1728–1815 AD (9.8%)

Hitherto unpublished

Comparable pieces:
• Fig. 33.1
• Plate 34
• OCTS 3, p. 57, Fig. 20

Comparison of the three white ground examples (cf. also Plate 34) of this design type which are known[41] shows a sequence in clarity of the design. This may correlate with the age differences of the three kilims. Clearly the oldest example of this small group is the piece illustrated on Plate 33. Comparing this kilim with its two relatives, the feature which appears at first sight is the significantly larger c-shaped pendants at the hexagons. Furthermore, the secondary motifs (small hooked hexagons) always form a 4+1 composition together with the primary motif (large hexagons with hooks and c-shaped pendants) while the five large hexagons also form a centre on the vertical axis (warp direction) by their arrangement of colour. This is not the case with the other two pieces. Additional uniformity and calming of the whole design is achieved by the fact that the border design corresponds to that of the secondary field design. This example, clearly the earliest of the group, differs from the two latter pieces (Fig. 33.1 and Plate 34) by its markedly calmer and more harmonious conception (continues on Plate 34).

Fig. 33.1
Kilim, Anatolia, Private collection. This is the youngest piece of this design group. It presumably dates from the 2nd half of the 19th century. The secondary motifs are replaced here by adjacent small chain-like ornaments instead of the small hooked hexagons. Concerning the design, this youngest kilim bears a closer relationship to his oldest relative on Plate 33 than it does to the piece on Plate 34.

Plate 34

Kilim, woven in two panels, fragment
335 × 137 cm
Anatolia
Private collection

Radiocarbon age:	80 ± 30 y BP
Calibrated age (95% confidence limit):	AD 1690–1730 (19.2%)
	AD 1814–1924 (80.8%)

Published:
- Türck 1995, Plate 4

Comparable pieces:
- Plate 33
- Fig. 33.1
- OCTS 3, p. 57, Fig. 20

(Continued from Plate 33.) The third piece belonging to the same design group as Plate 33 and Fig. 33.1 is the one illustrated here. It is particularly the colours which suggest that this kilim is earlier than the one on Fig. 33.1. It also differs in having only four hexagons, and while here too, the secondary motifs show no organisation, they are somewhat more closely related to the oldest piece on Plate 33.

Plate 35

Kilim, woven in one piece
330 × 80 cm
Central Anatolia, Cappadocia
Private collection

Radiocarbon age:	150 ± 30 y BP
Calibrated age (95% confidence limit):	1672–1781 (49.7%)
	1795–1889 (33.0%)

Hitherto unpublished

Comparable pieces:
- Plates 36, (37)
- Petsopoulos 1991, Plate 93
- Brüggemann 1993, Plates 14, (15)
- HALI 82, 1995, advertisement p. 61
- HALI 104, 1999, p. 89

In all six known examples of this group[42] the individual saw-toothed medallions almost contact each other and are separated only by narrow coloured stripes. This is unusual in Anatolian kilims[43] and seems to come from an earlier design concept which has remained for these kilims until late into the 19th century[44].

Compared with other Anatolian kilims all these pieces have an unusual amount of yellow and little or no white in their colours, as is also the case in this piece. It differs only from Plate 36 in the additional outermost stripe of the skirts with the reciprocal design which is incorrectly called "running dog".

Plate 36

By contrast to the example on Plate 35 this kilim has been woven in two panels and is more than twice as wide. The warps are monochrome and not brown and ivory coloured as in the piece on Plate 35 (cf. the text to Plate 35).

Kilim, woven in two panels
367 × 171 cm
Central Anatolia, Cappadocia
Private collection

Radiocarbon age:	195 ± 40 y BP
Calibrated age (95% confidence limit):	AD 1649–1706 (22.7%)
	AD 1714–1821 (53.4%)
	AD 1837–1875 (4.7%)

Published:
- Petsopoulos 1991, Plate 92
- Rageth 1991, Plate 2

Comparable pieces:
- Plates 35, 37
- Petsopoulos 1991, Plate 93
- Brüggemann 1993, Plates 14, (15)
- HALI 82, 1995, advertisement p. 61
- HALI 104, 1999, p. 89

Plate 37

Kilim, woven in one piece, fragment
195 × 125 cm
Central Anatolia, Cappadocia (?)
Private collection

Radiocarbon age:	85 ± 50 y BP
Calibrated age (95% confidence limit):	1679–1764 (30.4%)
	1803–1938 (69.3%)

Hitherto unpublished

Comparable pieces:
- Plates 32, 33
- Kirchheim 1993, Plate 97 (HALI 80, 1995, p. 61)
- HALI 91, 1995, p. 24
- HALI 104, 1999, p. 89

This striped kilim is quite closely related to the two kilims on Plates 35 and 36. Here the medallions have turned into cartouches overlying the coloured stripes. There is also a relationship to one of the kilims in the Orient Stars collection (see comparable pieces).

As the kilim on Plate 59, also this piece confirms the accuracy of the radiocarbon dating method. Harald Böhmer detected cochineal by thin layer chromatography[45], which dates this kilim clearly to the 19th century. This is in agreement with the later probability range of the radiocarbon dating result.

Plate 38

In contrast to the kilims on Plates 35 and 36, this example has two adjacent rows of diamond shaped saw-toothed medallions. They are arranged in pairs separated from one another by decorated stripes, as is standard for a high proportion of Anatolian kilim designs.

Compared with the only known comparison piece illustrated by Türck, both the design and the colours produce a clearer image on the piece illustrated here. This may indicate that the comparison piece is later and originates from the 19th century.

Kilim, woven in two panels
400 × 150 cm
Central Anatolia, Nevşehir/Karapınar area
Private collection

Radiocarbon age:	205 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1639–1824 (74.0%)
	AD 1828–1886 (7.9%)

Published:
- Mellaart/Hirsch/Balpınar 1989, Vol. I, Plate VI, no. 2
- Rageth 1991, Plate 9

Comparable pieces:
- Türck 1995, Plate 24

Plate 39

The dating result for this kilim has led to some confusion, because the radiocarbon age is much less than had generally been expected. The same result was given by three independent measurements, which brought an increasing degree of probability for an origin in the 20th century. The question of the contradictory nature of this result, and whether it is nevertheless permissible to date this piece in a range with a probability of only 2.7%, must remain open at that time.

A forgery can be excluded with some certainty and all we know about kilims from the 1950's, makes it more probable that this piece was woven at the end of the 19th century.

Kilim, woven in one piece
315 × 150 cm
Central Anatolia, Afyon/Kütahya area
Vok collection

Radiocarbon age:	5 ± 25 y BP
Calibrated age (95% confidence limit):	AD 1899–1901 (2.7%)
	AD 1954–1956 (97.3%)

Published:
- Mellaart/Hirsch/Balpınar 1989, Vol. I, Plate VII, no. 6
- Rageth 1991, Plate 21

Comparable pieces:
- Balpınar/Hirsch 1982, Plate 78
- Cootner 1990, Plate 55

Plate 40

Kilim, woven in one piece
500 × 170 cm
Central Anatolia
Marshall and Marilyn R. Wolf collection

Radiocarbon age:	235 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1514–1594 (10.7%)
	AD 1620–1705 (34.0%)
	AD 1715–1820 (38.6%)

Hitherto unpublished

Comparable pieces:
- Herrmann 1988, Plate 25
- Petsopoulos 1991, Plates 37, 64
- Kultkelim 1999, Plate 21

What is remarkable about this kilim is the unusually large dimensions not only of the piece as a whole but also of the four paired primary ornaments. These reach a length up to 80 cm which make them around 1/3 larger than comparable ornaments on other Anatolian kilims.

The use of only four different motifs for the entire design is highly effective. The field design consists of the four paired primary ornaments with a so-called "Hacilar-cross" at the centre, and eight more such crosses on the horizontal axis (in the warp direction). Each of the paired primary ornaments is separated by two stripes with two different ornaments, one of which is half of an ornament seen on the skirt. The use of only a few different large-scale ornaments imparts a serene image to the kilim.

Plate 41

The white field of this kilim decorated with paired hooked hexagons ("birth-motifs") is framed by actual borders only in the skirts. This structural principle, of a central field with skirts fitted at the sides, contained by a zigzag or wavy-line, is particularly attractive and typical for kilims (cf. the kilims on Plates 53–58).

Kilim, woven in two panels
460 × 165 cm
Central Anatolia
Private collection

Radiocarbon age:	155 ± 55 y BP
Calibrated age (95% confidence limit):	AD 1667–1790 (46.5%)
	AD 1790–1895 (35.4%)

Hitherto unpublished

Comparable pieces:
- Herrmann 1988, Plate 23
- HALI 59, 1991, p. 144
- Brüggemann 1993, Plate 12
- Cassin 1989, Vol. 2, Plate 5

Plate 42

Kilim, woven in one piece
344 × 196 cm
Central Anatolia
Private collection

Radiocarbon age:	220 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1641–1689 (32.4%)
	AD 1732–1813 (48.9%)

Hitherto unpublished

Comparable pieces:
• Herrmann 1987, Plate 20
• Cootner 1990, Plate 35

The principle of three rows of hooked hexagons ("birth-motifs") as a field design is rare. The colour distribution is symmetrical about both the horizontal and the vertical axes. Herrmann's related piece lacks the colour symmetry along the two axes; the example published by Cootner comes closer in the arrangement of colours to the piece illustrated here.

Plate 43

This kilim, together with three related pieces (Fig. 43.1; Cootner 1990, Plate 62; Brüggemann 1993, Plate 73) shows a figure composed of geometric shapes, with a bird each under the spread arms. This anthropomorphic motif known in mythology as "animal mistress" was described by Hirsch[46]. The kilim on Plate 43 is certainly the most impressive, and also presumably the oldest of the known examples of this small design group. The figures measuring up to 55 cm are not only unique in drawing and dimensions, they are also unsurpassed in their colours. The borders on the long sides are missing. Perhaps there may have been a second half, but most probably the lower of the lost borders may have been woven separately, as occasionally happens with other Anatolian kilims (cf. the kilims on Fig. 43.1 and Plate 31).

The design of the kilims on Plate 44 and in Balpınar/Hirsch 1982, Plate 26, both derive from this small group. They show the lower half of the figure doubled in mirror image about the horizontal axis of the figure.

Kilim, woven in two panels, fragment
407 × 109 cm
Central Anatolia
Private collection

Radiocarbon age:	270 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1511–1599 (33.3%)
	AD 1617–1677 (53.2%)
	AD 1773–1801 (8.6%)

Hitherto unpublished

Comparable pieces:
- Fig. 43.1
- Plate 44
- Balpınar/Hirsch 1982, Plate 26
- Frauenknecht 1984, Plate 6
- Cootner 1990, Plate 62
- Petsopoulos 1991, Plate 77
- Brüggemann 1993, Plate 73

Fig. 43.1
Kilim, originally woven in three panels (the borders are missing), fragment, Central Anatolia, private collection. (A detail of this kilim has been published in: Mellaart/Hirsch/Balpınar 1989, Plate XIII, 12.)

Plate 44

Kilim, woven in two panels
361 × 178 cm
Central Anatolia,
Private collection

Radiocarbon age:	220 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1641–1689 (32.4%)
	AD 1732–1813 (48.9%)

Published:
- Volkmann 1985, Plate 42
- Petsopoulos 1991, Plate 77

Comparable pieces:
- Plate 43
- Fig. 43.1
- Balpınar/Hirsch 1982, Plate 26
- Frauenknecht 1984, Plate 6
- Cootner 1990, Plate 62
- Brüggemann 1993, Plate 73

The design of this kilim is related to the rare and small design-group discussed in the description of the piece on Plate 43. It shows the lower half of the figure with birds (cf. Plate 43) doubled in mirror image about the horizontal axis. In its unusual large size, this figure in the field design is as impressive as the one of the kilim on Plate 43. Compared with the two related pieces published by Balpınar/Hirsch 1982, Plate 26; and Frauenknecht 1984, Plate 6, the drawing of the design of this kilim is somewhat more "rounded".

Plate 45

The design of this kilim is unique. Particularly impressive are the large figures (40 cm) in the skirts. Such motifs are called *eli belinde* by the Anatolian weavers; in English "hands-on-hips". A tapestry fragment from Upper Egypt (Fig. 45.1) which is approximately 1000 years older and is surprisingly similar to the figures in the skirts of this kilim, indicates a tradition of this motif back to the 9th century[47]. The figure on the Egyptian tapestry-woven fragment is less abstract and shows quite clearly the face, hands and feet, as well as the costume. Of special interest is the representation of the face which is very similar to that of the Anatolian kilim variant. Both the Egyptian and the Anatolian variants are formed by two triangles joined through a central bar.

Kilim, woven in one piece
370 × 159 cm
Central Anatolia, Mut/Ermenek area
Vok collection

Radiocarbon age:	230 ± 30 y BP
Calibrated age (95% confidence limit):	AD 1642–1682 (41.3%)
	AD 1747–1806 (41.1%)

Published:
- Mellaart/Hirsch/Balpınar 1989, Vol. I, Plate VIII, no. 4
- Rageth 1991, Plate 4
- Vok 1997, Plate 37

Fig. 45.1
Tapestry-woven fragment,
wall hanging, 27 × 18 cm,
wool and linen,
Upper Egypt, 9th century,
Collection Jean-François Bouvier,
JFB M 34.

Plate 46

Kilim, woven in one piece
400 × 170 cm
Central Anatolia
Museum Schloss Rheydt

Radiocarbon age:	250 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1488–1607 (22.7%)
	AD 1612–1692 (37.2%)
	AD 1728–1815 (28.8%)

Published:
- Kirchheim 1993, Plate 100

Comparable pieces:
- Plate 45
- Konzett/Ploier 1991, Plate 27

This kilim presumably originates from the same village as the example on Plate 47. The primary ornament in the field shows the most frequent form of the Anatolian *eli belinde* design, a geometric abstract figure, flanked by two birds shown in mirror image (cf. the kilims on Plates 47 and 48).

The colouring of the mirrored *eli belinde* motifs in the kilim illustrated here differs in being executed in only one colour instead of being two-coloured as in the piece on Plate 47, as well as the arrangement of the colouring in the field is vertical in this piece and not diagonal.

Plate 47

Kilim, woven in one piece, fragment
195 × 175 cm
Central Anatolia
Private collection

Radiocarbon age:	200 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1647–1702 (24.1%)
	AD 1718–1819 (55.6%)

Published:
• HALI 52, 1990, p. 194, Fig. 4

Comparable pieces:
• Plate 46
• Konzett/Ploier 1991, Plate 27

The colours glow so vividly in this fragment that laymen often believe that they were formed by synthetic dyes. The primary ornament arranged diagonally through the field shows the most frequent form of the Anatolian *eli belinde* design, a geometric abstract figure, flanked by two birds shown in mirror image (cf. the text to the kilims on Plate 46 and 48).

Noteworthy in the design of this fragment is the impression that all the motifs, those in the side borders, part of the skirt as well as those in the field, are floating on a dark-brown ground. This is not the case in the kilim on Plate 46 and in that of the comparable piece in Konzett/Ploier.

Plate 48

This fragment shows a colour variant in the field in comparison to the *eli belinde* kilims on Plates 46 and 47.

Kilim, woven in one piece, fragment
425 × 150 cm
Central Anatolia
Private collection

Radiocarbon age:	215 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1643–1690 (29.6%)
	AD 1730–1814 (51.2%)

Hitherto unpublished

Comparable pieces:
• HALI 27, 1985, p. 92

Plate 49

Kilim, one of originally two panels
360 × 80 cm
Anatolia
Galveston collection

Radiocarbon age:	195 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1650–1703 (22.5%)
	AD 1717–1819 (56.0%)

Hitherto unpublished

The type of complex design[48], executed twice in blue and red to the left and right in the white field is found on Anatolian kilims in different variations from a single, primary field motif to a hardly recognisable repeated field design[49]. The kilim on Plate 50 shows a similar design from the same type as a medallion in the centre.

The skirts of this kilim show two beautiful variants of the *eli belinde* motif: an easily recognisable figure[50] in the central stripe and an abstract variant of the figure with two birds[51].

Plate 50

The field design on a blue ground consists of two large medallions[52] and a smaller third medallion, slightly different in shape, in the centre[53]. The last is related to the motifs on a white ground in the kilim on Plate 49.

The very small scale design in the skirt as well as the swastika-like motifs[54] in both larger medallions witness the Western Anatolian influence.

Also remarkable is the design of the long borders. The brown-red ground bears a white zigzag line with closely adjacent spirals on both sides. Such a border pattern is found in a red ground kilim with an undecorated field in the Vok collection (Fig. 50.1), but with spirals only on one side of a dark-brown zigzag line on an ivory ground[55].

Kilim, woven in three panels (separate borders)
399 × 158 cm
Western Anatolia, Eğridir area
Private collection

Radiocarbon age:	135 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1673–1779 (41.5%)
	AD 1797–1945 (58.1%)

Published:
- Petsopoulos 1991, Plate 56
- Museum Schloss Rheydt 1997, no. 10

Comparable pieces:
- Vok 1997, Plate 65
- Erbek 1988, Plate 63
- Balpınar/Hirsch 1982, Plate 17

Fig. 50.1
Kilim, woven in two panels, 335 ×145 cm, Central Anatolia, Vok collection.

Plate 51

Kilim, woven in one piece
344 × 196 cm
Western Anatolia
Private collection

Radiocarbon age:	35 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1688–1733 (18.8%)
	AD 1812–1926 (79.2%)

Published:
• Türck 1995, Plate 16

Comparable pieces:
• Cootner 1990, Plate 34

Apart from this kilim and the one in the McCoy Jones collection, no other example of this type has yet become known. If this piece really stems from the period indicated by the 79.2% probability given by the radiocarbon dating result, it would once more confirm that pieces with attractive colours were produced at least until the first half of the 19th century.

Plate 52

This kilim too has a unique design. In other kilims with similar designs, the medallions lie on a monochrome ground or are otherwise combined with comb-designs (cf. Plate 53).

Kilim, woven in one piece
430 × 160 cm
Anatolia
Marshall and Marilyn R. Wolf collection

Radiocarbon age:	135 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1672–1781 (41.6%)
	AD 1795–1946 (58.0%)

Hitherto unpublished

Plate 53

The kilim illustrated here belongs to the design group called *parmaklı* which means finger-like. This piece differs from all comparable examples cited in that the fingers are not rounded at one side, that is why they should rather be referred to as combs. The design structure is similar in all these pieces.

Kilim, woven in one piece, fragment
376 × 155 cm
Western Anatolia
Private collection

Radiocarbon age:	180 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1655–1824 (68.1%)
	AD 1827–1887 (13.8%)

Published:
- Bausback 1983, Plate 30
- Petsopoulos 1991, Plate 44

Comparable pieces:
- Petsopoulos 1991, Plate 43
- Balpınar/Hirsch 1982, Plate 176
- Vok 1997, Plate 46
- Valcarenghi 1994, Plate 118

Plate 54

Kilim, woven in one piece, fragment
213 × 137 cm
Western Anatolia, Balıkesir/Akhisar area
Vok collection

Radiocarbon age:	145 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1671–1783 (44.3%)
	AD 1794–1899 (38.1%)

Published:
- Vok 1997, Plate 55

Comparable pieces:
- Petsopoulos 1991, Plate 12
- Kirchheim 1993, Plate 85

This kilim is a *sofra,* an eating cloth. The food was presented in a large dish on a tray *(tepsje)* in the centre of the *sofra,* which was spread on the floor. People would set themselves around it, place a napkin on their crossed legs and eat together from the central dish. *Sofra* are known throughout the entire orient and usually share the same design concept: a red field, framed in most cases by a blue zigzag line with a green cruciform medallion in the centre.

The weavers, some of them still weave for their own use, are convinced that food eaten from such a *sofra* kilim is far more nutritious, protects against illness and also never runs out. In the eyes of the weavers, the *sofra* design represents a land of milk and honey.

I believe this design concept to be a representation of the cosmos, an *imago mundi,* known from artefacts all over the world. It symbolises the world as inhabited by human beings: the red earth rising from the blue primordial swamp or world ocean, the centre marked by a 4+1 motif (cruciform medallion), which represents the "navel of the earth". This point is also where many different mythologies place the world-tree or tree-of-life and the accompanying spring of all waters. This centre represents always the highest place on earth, which, for example, would not be affected by the great deluge. It is identified with paradise which is also frequently linked to the seat of a deity. Such designs perhaps express the wish of the weavers to participate in the great cycle of universe, the great cycle of life. They may even signify a desire to be part in the continuous regeneration of the cosmos and the ceaseless recreation of all things[56].

However, the example illustrated here belongs to a group of *sofra* kilims which have only one blue and green stripe at each end instead of the surrounding blue zigzag line (cf. also the Antalya kilims on Plates 55 and 56).

Plate 55

Kilim, woven in one piece
368 × 155 cm
Southern Anatolia, Antalya area
Orient Stars collection

Radiocarbon age:	175 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1661–1708 (18.6%) AD 1712–1821 (54.1%) AD 1835–1880 (8.2%)

Published:
• Kirchheim 1993, no. 84
• Schloss Rheydt 1997, no. 8

Comparable pieces:
• Plate 56
• Cootner 1990, Plates 83, 101
• Petsopoulos 1991, Plate 28
• Valcarenghi 1994, Plate 1

This kilim belongs to a group from the area around Antalya in Southern Anatolia. The group was first mentioned by Belkıs Balpınar in 1984 although at that time she gave its origin as Western Anatolian[57]. This kilim and the example on Plate 56 differ from all other Antalya kilims in their sparse field decoration and the lack of many small white diamonds which are otherwise characteristic of Antalya kilims.

The design of the two pieces (Plates 55 and 56) closely follows that of the *sofra* kilims from Western Anatolia (cf. text to Plate 54). A blue zigzag line frames a red field which has a green cruciform motif at the centre. By contrast with the *sofra* kilims from Western Anatolia, additional anthropomorphic forms reach from the short sides into the field and the dimensions are significantly larger.

Plate 56

Kilim, woven in one piece, fragment
185 × 145 cm
Southern Anatolia, Antalya area
Private collection

Radiocarbon age:	140 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1674–1777 (43.5%)
	AD 1798–1898 (39.4%)

Published:
- Petsopoulos 1991, Plate 30

Comparable pieces:
- Plate 55
- Cootner 1990, Plates 83, 101
- Petsopoulos 1991, Plate 28
- Valcarenghi 1994, Plate 1

This fragment belongs to the same group as the kilim on Plate 55. Its design differs from the latter in that the cruciform figure in the centre is larger and that the remaining short side contains only one, rather differently drawn anthropomorphic (?) figure. A later, although similar example from the Fethye area, slightly to the west, has been published in: Valcarenghi 1994, Plate 1.

Plate 57

Kilims with an undecorated white field are very rare, not only in Anatolia.

Kilim, woven in one piece, fragment
165 × 147 cm
Western Anatolia, Afyon area
Private collection

Radiocarbon age:	240 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1633–1685 (46.1%)
	AD 1742–1808 (35.5%)

Published:
- Sailer 1988, p. 46

Plate 58

No similar kilim is so far represented in the literature. Remarkable is the drawing of the red reciprocal side borders and the small motifs, which form an x-shape by their colour arrangement in the white field. Despite the relatively small size and fine design and because of its colour arrangement which is basically reduced to red and blue, this kilim has a very archaic appeal.

Kilim, woven in one piece, fragment
192 × 125 cm
Central Anatolia
Private collection

Radiocarbon age:	185 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1652–1824 (69.5%)
	AD 1828–1886 (12.3%)

Published:
- HALI 50, 1990, p. 174
- Kirchheim 1993, no. 92

Plate 59

Apart from showing the technique of "dovetailed" tapestry weave, which is very rare in Anatolia (cf. text to Plate 16), and its unique design[58], this kilim became a key example in the context of our radiocarbon dating project.

Originally an origin within the 16th to 18th centuries has been assumed. The radiocarbon dating result, which placed this kilim with the highest probability into the 19th century was somewhat disillusioning. In the attempt to confirm or contradict the result, attention was drawn to the unusual olive-green in the centre of the eight-pointed star. A dye analysis of this colour gave the solution to the problem[59]. This dye turned out to contain indigosulfonic acid for the blue component. Indigosulfonic acid is a semisynthetic dyestuff which was used in Anatolia mainly in the second half of the 19th century. This may be a good example to show how two different methods of dating complement each other.

Kilim, woven in one piece
310 × 177 cm
Southwestern Anatolia, Fethye area (?)
Galveston collection

Radiocarbon age:	115 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1677–1773 (36.1%)
	AD 1800–1941 (63.9%)

Published:
- Petsopoulos 1979, Fig. 86
- Museum Schloss Rheydt, 1997, no. 2

Fig. 59.1
Carpet, Central Anatolia, 115 × 70 cm, goat hair (tiftik), dated 1812/13 AD, private collection.
Another type of "testing" radiocarbon dating and simultaneously a useful comparison to the dating of the kilim on Plate 59 resulted from the investigation of a small and unusual pile-carpet, the age of which had been inscribed as 1228 (1812/13 AD).
Here too, the radiocarbon dating result pointed correctly with the highest probability to the 19th century:
Radiocarbon age: 130 ± 30 y BP
Calibrated age (95% confidence)
AD 1679–1767 (38.6%)
AD 1802–1939 (61.4%)
(For a graph of this dating see p. 27, Fig. 6)
Thus, in the case of both the carpet and the kilim it was possible to confirm the accuracy of radiocarbon dating.

Plate 60

Kilim, woven in three panels
340 × 140 cm
Central (?) Anatolia
Private collection

Radiocarbon age:	180 ± 35 y BP
Calibrated age (95% confidence limit):	AD 1658–1707 (19.3%)
	AD 1713–1821 (55.0%)
	AD 1836–1878 (6.4%)

Hitherto unpublished

Comparable pieces:
• Petsopoulos 1979, Plate 133
• Cootner 1990, Plate 66
• Kirchheim 1993, Plate 104
• Vok 1997, Plate 40

This example belongs to kilims in which both the borders on the long sides were always woven separately. Besides the piece illustrated by Cootner 1990, Plate 66, all comparable pieces have an ivory coloured central field with multicoloured cicim motifs which are reminiscent of small florets. The kilim illustrated here together with the fragment on Fig. 60.1 are exceptions as the field is not ivory in colour but green or red respectively. It is also very unusual, that the warp yarn too is dyed to the corresponding field colour in both pieces. This is a peculiarity which has not been otherwise observed in Anatolian kilims. Also remarkable is the vertical band which divides the central field of both pieces in a similar way into two parts of unequal size.

Fig. 60.1
Kilim, one of originally three panels (the borders are missing), fragment, 380 × 80 cm, Central (?) Anatolia, private collection.

Plate 61

In spite of its missing long borders, the "prayer-kilim" illustrated here is an excellent example of its type. By contrast to many other "prayer-kilims", particularly from Northeast Anatolia[61], this example follows the classical arrangement of colour palette with a red niche field on a green ground (for "prayer-kilims" see also texts to Plates 62 and 63)[62].

Kilim, woven in one piece, fragment
196 × 83 cm
Eastern Anatolia
Private collection

Radiocarbon age:	190 ± 50 y BP
Calibrated age (95% confidence limit):	AD 1649–1824 (70.8%)
	AD 1828–1886 (11.1%)

Published:
- Frauenknecht n. d., Plate 23
- HALI, Vol. V, no. 4, 1982, p. 479
- Brüggemann 1993, Plate 38

Plate 62

Apart form the many so-called "prayer-kilims" from Obruk with a single niche[63], this example has until now remained unique. All the white is woven in cotton. In a mythological context, the design of this kilim is to be understood as an *imago mundi,* a representation of the cosmos. This consists of the primordial waters (blue-green background and wavy line), the earth (red-brown field) and the two mountains which represent a gate at the end of the world. In Eastern Mediterranean mythology, since the 3rd millennium BC, written sources have referred to such double mountains as the gate to another cosmic level which can be passed by a human being only by the loss of its life[64].

Kilim, woven in one piece, fragment
160 × 90 cm
Central Anatolia, Obruk
Private collection

Radiocarbon age:	210 ± 25 y BP
Calibrated age (95% confidence limit):	AD 1654–1683 (27.1%)
	AD 1745–1806 (52.8%)

Published:
- artis, no. 1, 1987, p. 44, Fig. 1
- OCTS, Vol. IV, 1993, p. 129, Fig. 7

Plate 63

This kilim too is considered to be a "prayer-kilim" because of its one sided orientation. However, the design is presumably based on the precursor of an old Anatolian form[65]. The idea of a prayer niche would then be a later reinterpretation.

Kilim, woven in one piece
173 × 96 cm
Central Anatolia
Galveston collection

Radiocarbon age:	115 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1677–1773 (36.1%)
	AD 1800–1941 (63.9%)

Published:
- Petsopoulos 1991, Plate 45
- HALI 67, 1993, p. 84

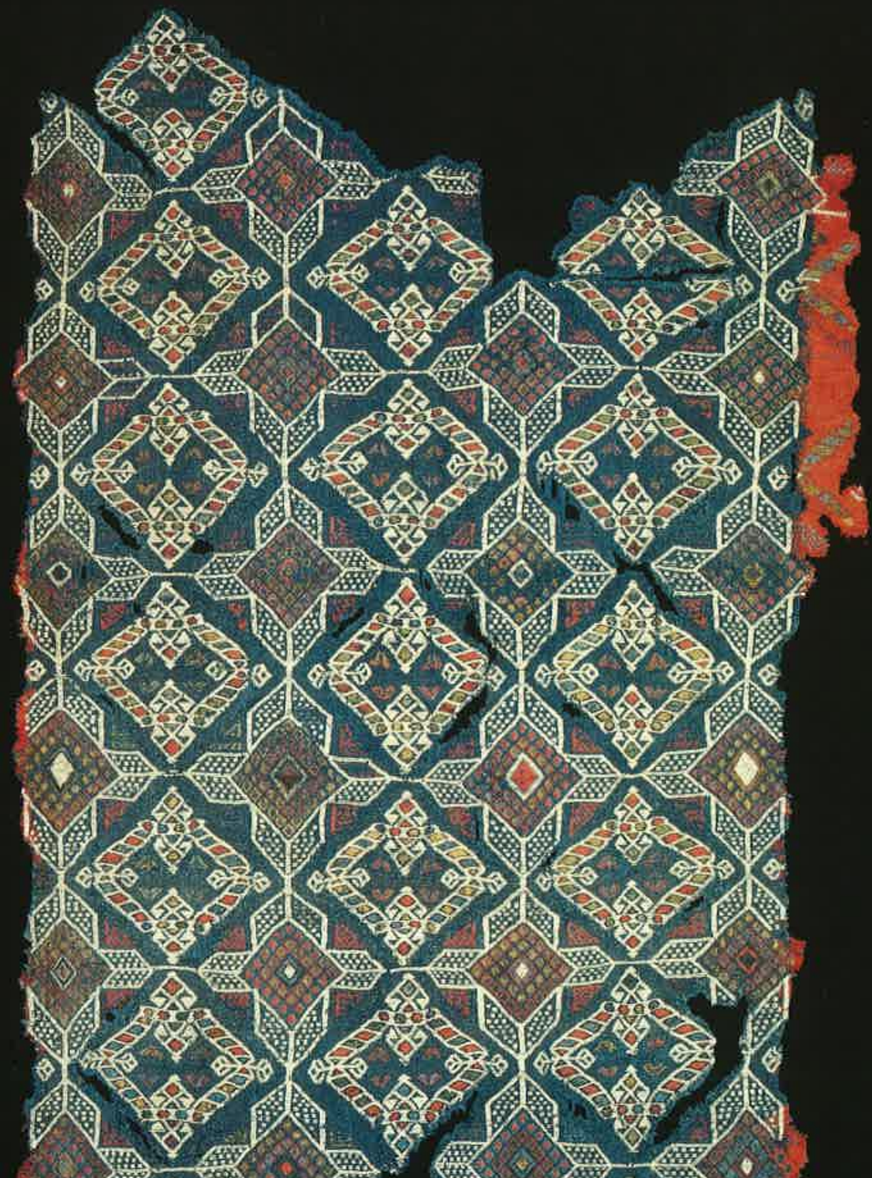
Plate 64

Among the colour plates, this is the only flatweave not beeing a tapestry-woven rug, but a so-called *zili*. By virtue of its high age and its beauty it has been added to the kilims in this volume, and also marks the end of the colour plates.

Zili/Cicim, woven in one piece, fragment
193 × 120 cm
Anatolia
Private collection

Radiocarbon age:	370 ± 45 y BP
Calibrated age (95% confidence limit):	AD 1450–1636 (100.0%)

Published:
- Brüggemann 1993, Plate 94
- HALI 67, 1993, p. 84



1 Thanks to the kind support and exchang of ideas with Dietmar Pelz who has also concerned himself with this group of saf kilims, it was possible to bring these nine examples together by the time this volume went to press. In particular he was responsible for the first publication of the two fragments in the Vakıflar Museum (Plates 2 and 5) and the fragment on Fig. 7.1 which were the last to come in.

2 It is not known of the saf kilim in Plate 5 whether it is complete or a fragment. The photograph shows only six niches.

3 With ten niches, the original length of the fragmented pieces would be:
Plate 2: ca 470 cm
Plate 3: ca 470 cm
Plate 6: ca 385 cm
Plate 7: ca 640 cm (?)
Fig. 7.1: ca 600 cm (?)
Plate 8: ca 470 cm
Before going to press, no measurements were available for the saf kilim (Plate 5) in the Vakıflar Museum, Istanbul (inv. no. 320).

4 By the term "saf design" is meant the multiple row of specific niche shapes which consist of a gable with "towers" attached on both sides. Apart from saf kilims (cf. Plates 1–11) this traditional niche shape is also often seen in so-called "double-niche" kilims, where they are repeated downward in mirror image (cf. Plates 13–15, 17–20). The earliest example of such an Anatolian niche form is shown in a neolithic wall painting from Çatal Hüyük (ca. 5900 BC, illustrated in Mellaart 1967, p. 53, Plate 8).

5 The niches of the saf kilims from the Dazkırı area end in a stripe at the lower edge and are more narrow than their assumed precursors in Central Anatolia. The Central Anatolian niche is closed at the base and has a kind of bulge into the niche from the bottom (cf. Plate 11).

6 Cf. Black/Loveless 1977, Plate 9; HALI Vol. 4, no. 1, p. 321, Figs. 6 and 7; Petsopoulos 1991, Plate 50; Herrmann 1990, Plate 16; HALI 71, p. 103, illustration top right.

7 An exception are the fragments on Plate 7 and Fig. 7.1.

8 The dominance of the colour contrast red/green with an unusually high proportion of green can also be seen in other kilims from the Dazkırı area (cf. Note 12). There is, as well, a small group of double-niche kilims which also has a high proportion of green in the colour palette (cf. Notes 23 and 24 in the essay by Dietmar Pelz, p. 192).

9 The saf kilim in the Vok collection, Plate 6.

10 This can be found in a single double-niche kilim, which also has a high proportion of green (cf. Sotheby's 1998, lot 4; Ampe 1994, Plate 19).

11 Here too, there is one exception: these multicolour stripes at the narrow sides are absent in the saf fragment on Plate 8. Instead there is only a single, slightly wider red stripe.

12 These multicoloured stripes on the narrow sides are also seen on kilims with different designs from the Dazkırı area (cf. Frauenknecht 1984, Plate 16; Kirchheim 1993, Plate 88; Balpınar/Hirsch 1982, Plate 80; Hull/Luzyc-Wyhowska 1993, Plate 285, p. 146; Ölçer 1989, Plate 13; HALI 26, 1986, cover). These kilims too have a pronounced red/green contrast with an unusually high proportion of green.

13 This characteristic is also seen in many double-niche kilims with this specific niche-form (cf. Plates 12–15, 17–20).

14 Danny Shaffer, editor of HALI discovered and photographed these three parts, already separated, in Istanbul at an exhibition in November 1995. The illustration (Plate 2) shows the condition as it was found in the *Hünkâr Kâsrı Yeni Valide Cami* in Istanbul in 1981 and brought to the Vakıflar Museum.

15 For example on three striped kilims with "hand" (?) motifs which have become known: (1) Cassin 1989, Plate 3; (2) Petsopoulos 1991, Plate 15; (3) Vok 1997, Plate 29.

16 Thanks are due to Michael Franses that this kilim was radiocarbon dated and published in this volume.

17 The kilim was found in the Balıklı Cami in Kütahya and transferred to the Vakıflar Museum in Istanbul.

18 See note 3 for a comparison of the measurement of all the saf kilims belonging to this group.

19 1650 is an important year in connection to radiocarbon dating (cf. Bonani pp. 15–22 and Rageth pp. 23–30).

20 For more information about saf kilims, see also Balpınar 1990.

21 Another interesting piece is published on plate 27 of the catalogue of the Vok collection Anatolia, 1997. This kilim shows the lower part of three niches halved along the horizontal axis and is strongly reminiscent of the lower half of the saf kilims of the type discussed here.

22 Cootner 1990, Plate 1.

23 Illustrated in: (1) Balpınar/Hirsch 1982, Plate 88; (2) Konzett/Ploier 1991, Plate 79.

24 Illustrated in: Frauenknecht 1984, Plate 55.

25 Sarre 1909. Sarre's photograph is also reproduced in: Brüggemann/Böhmer 1980, p. 77, Fig. 61.

26 The region is approximately of the same longitude as Cumra, on the western side of the road from Konya to Karaman. Cemal Palamutcu, the dealer from Konya through whose hands the kilim passed, is of the opinion that the kilim on Plate 16 with large right-angled stepped diamonds might have come from the same village as the kilim with double niches on Plate 14. Anyway, both kilims are believed to have come onto the Konya market from the same village.

27 Stepped diamonds are most often formed by the so-called *baklava* design, which does not actually include right angles but is stepped with sharp peaks. *Baklava* is the name given to a sweet, diamond shaped Turkish puff-pastry. Probably the best known representatives of kilims with the so-called stepped *baklava* diamonds come from the Karapınar area southeast of Konya.
The example most closely related to the kilim on Plate 16 is illustrated in: Brüggemann 1993, Plate 16, a kilim which also has three large stepped diamonds with sharp peaks. The classical type of Karapınar diamond kilim

generally has four large stepped diamonds. For examples see: Petsopoulos 1991, Plate 41; Frauenknecht 1984, Plates 45 and 46; Balpınar/Hirsch 1982, Plates 5 and 6; Vok collection 1997, Plate 35.

28 Illustrated in: Cootner 1990, Plate 1.

29 Illustrated in: Mellaart/Hirsch/Balpınar 1989, Vol. 1, p. 19, no. 10.

30 The kilim has eight double-niches, the same niche drawing, similar colours (although without white cotton), colour symmetry about the vertical central axis, and the same motives in the outermost stripes at both ends of the weaving as the kilim on Plate 18 in the stripes between the niches. At the time of printing, this comparison piece was in the collection of Udo Hirsch.

31 Radiocarbon dating of this kilim has been carried out at the Rafter Radiocarbon Laboratory of the Institute of Geological and Nuclear Sciences Ltd., New Zealand.

32 For the complete radiocarbon dating results see p. 235.

33 The fact that this seems to be a tradition is confirmed by the existence of such designs also in Western Anatolian double-niche kilims of the same design type. For a complete piece, but without this special feature of design, see Petsopoulos 1991, Plate 11.

34 See note 31.

35 Such medallions were called "tortoise" motifs, by Belkıs Balpınar and Udo Hirsch in Balpınar/Hirsch 1982 (Plates 37 and 38).

36 Cf. Eskenazi 1980, Plate 3; Frauenknecht n. d., Plate 17; Frauenknecht 1984, Plates 27 and 38; Balpınar/Hirsch 1982, Plate 38; Dublin 1979, Plate 4, with blue ground; Valcarenghi 1994, Plate 37 and 39.

37 Described by Udo Hirsch as felines in Mellaart/Hirsch/Balpınar 1989, Vol. 1, 52–57.

38 An unpublished half of such a kilim with four hexagonal medallions, asymmetrically organised hooks and double-hooks is in a private collection in Switzerland. An exception among the examples listed as comparison pieces is a complete kilim included by Frauenknecht n. d. as Plate 13. This kilim has five hexagons of equal size with large, almost symmetrically organised double-hooks. There are no individual large hooks. If one compares a further piece published by Türck 1995, with four interconnected hexagons and symmetrically arranged double-hooks one might consider this a degenerative variant of the design of the kilim on Plate 30. Yet another example of this type which may be a little older than that illustrated by Türck 1995 was published by Mellaart/Hirsch/Balpınar 1989, Vol. 1, p. 41, Fig. 4.

39 Compare with the black ground borders with blue motifs in the skirts of the double-niche kilim on Plate 20, as well as both outer red ground design stripes of the double-niche fragment on Plate 17.

40 Radiocarbon dating of this kilim has been carried out at the Rafter Radiocarbon Laboratory of the Institute of Geological and Nuclear Sciences Ltd., New Zealand. The result of this dating is only comparable to the results from the ETH Zurich with some reservations. The New Zealand results show a much larger experimental error of the radiocarbon age than the results from Zurich. An experimental error of ± 50 (1 sigma) should normally be achieved and is considered as standard. See also: Bowman 1990, p. 40.

41 The piece illustrated by Powell in OCTS 3/2 has a coloured ground.

42 (1, 2) Plates 35 and 36; (3) Petsopoulos 1991, Plate 93; (4) Brüggemann 1993, Plate 14; (5) HALI 82, 1995, p. 61; (6) HALI 104, 1999, p. 89.

43 Normally medallion designs such as this or similar are separated from one another by decorated stripes, such as e.g., on Plates 38–40.

44 See also the comparable piece in HALI 82, p. 61. This may be the youngest example of this group from the late 19th century. However, it still shows the group-specific features of design and colour.

45 Analysis No. Ra/2, 11 November 1994.

46 Udo Hirsch, *Zum Wiedergeburtsmotiv im anatolischen Kelim,* in: Rageth 1990, 105–119, Fig. 29.

47 The fragment is in the Bouvier collection in Switzerland and is illustrated in: Martiniani-Reber 1993, Plate 29.

48 Udo Hirsch interprets this design which forms a mirror image about the horizontal axis, as a standing figure flanked by two animals (see: Mellaart/Hirsch/Balpınar 1989, Vol. 1, Plate XII, Figs. 9, 10, 15); Josephine Powell interpreted the same design at the First Symposium on Anatolian Kilims 1990, and also at the 6th ICOC, San Francisco, as a derivate of the Chinese Tao Tie mask (unpublished).

49 The design appears constructed in different variants, on kilims throughout Anatolia. E.g. in: Brüggemann 1993, Plates 18–20; Petsopoulos 1991, Plates 57 and 58; Konzett/Ploier 1991, Plates 58–60; Vok 1997, Plate 68; Cootner 1981, cover. This last East Anatolian example illustrated by Cootner is not completely identical to the West and Central Anatolian variants, but is still clearly recognisable as derived from them.

50 Cf. also Plate 45 and Fig. 45.1.

51 Cf. also Plates 46–48.

52 This design variant appears also on various other Anatolian kilims. See Dublin 1979, no. 8, Balpınar/Hirsch 1982, Plate 36; Enderlein 1986, p. 68; Erbek 1988, p. 83; Vok 1997, Plate 65.

53 For other examples of this design see note 48.

54 In her description of this kilim, Belkıs Balpınar refers to the fact that theses swastika motifs occur in a very similar form particularly on kilims of the Karakeçeli nomads in Western Anatolia. Cf. the piece in: Valcarenghi 1994, Plate 134; a second, slightly older example is published in: Sotheby's 1998, lot 32

55 For another interesting design comparison see also Plate 32 in: Spuhler/König/Volkmann 1978.

56 For a detailed discussion of Western Anatolian *sofra* kilims see: Rageth, 1996.

57 Cf. Eskenazi 1984, Plate 15.

58 The design composition with an eight-pointed star in the centre is not found elsewhere on Anatolian kilims. However, zili's from the region of Fethye in South-western Anatolia shows several similarities in the design structure as in the colours. Cf. Acar 1975, Fig. 45, p. 38; Atlıhan 1993, Fig. 9, p. 30.

59 By the use of thin layer chromatography in the Laboratory for Natural Dyes at Marmara University Istanbul, Harald Böhmer has been able to confirm that olive-green colour is obtained by use of a mixture of Rahmannetin (yellow) and indigosulfonic acid (Analysis no. Ra/B.1, 17.3.1997).

60 Published in: HALI 61, 1992, p. 96.

61 Many so-called "prayer-kilims" from Northeast Anatolia have a green niche field on a red ground, which is not in accordance with the traditional colour combination of so-called "prayer kilims" or prayer-carpets. More than 80% of all published prayer-rugs (kilims and carpets) have a red niche field. For examples of "prayer-kilims" with a green niche field from Northeast Anatolia see: Vok 1997, Plates 5–8; Frauenknecht/Frantz 1978, Plates 31 and 32; Brüggemann 1993, Plate 37.

62 For further discussion on the design of so-called "prayer-kilims" see: Rageth 1990.

63 E.g. Petsopoulos 1979, Plates 162–166.

64 For further discussion on this Obruk kilim see: Rageth 1993.

65 See the description of Belkıs Balpınar for this kilim in: Petsopoulos 1991, description of Plate 145.

Norman Indictor

AMS Radiocarbon Dating of Textiles; Some Important Successes

The number of laboratories performing this analysis for textiles as a commercial service routinely in response to external research is small. Four places have had considerable experience: Arizona[1], Oxford[2], New Zealand[3] and Zurich[4]. At least two other places have reported significant data[5]. Unfortunately the cost per assay is still relatively high (CHF 900.–/sample at ETH Zurich). These laboratories make a sincere attempt to service scholarly research rather than casual or curious inquiry. The obvious power of the tool in providing objective dating and the market appearance of costly early textiles, sometimes in excess of US$ 100 000 – the twin aphrodisiacs - greed and curiosity – has encouraged the use of this technique for establishing a textile's age.

The question that might immediately arise to textile lovers is: why has not more data from these analytical laboratories been available in textile publication? Apart from a few countable instances[6] few analyses have been reported and quite frequently studies and exhibitions are mounted which do not take into account this scientific possibility of dating.

Some Successful Results (Figs. 1–6)

A few examples of using this dating method by the David Collection illustrate some important successes of the young technology (Figs. 1–4): Fig. 1 shows a recently acquired silk from Tibet sometimes attributed to Sogdiana in Central Asia whose calibrated radiocarbon result places it into the 7/9th century, a time span appropriate to the collection's special emphasis on early Islam. The next two pieces (Figs. 2 and 3), also from Tibet, are examples of silk weaving whose geographic origin may have been in question but owing to features of the metallic threads is now generally attributed to China, woven for the Islamic market. They date from the 11/13th century according to the calibrated radiocarbon dating results obtained. The roundel (Fig. 4), showing a courtly scene reminiscent of Minai pottery, tapestry-woven with metallic threads suggests also a Chinese origin. The textile had been offered to numerous museums and rejected as fake; the David Collection acquired the textile after replicate radiocarbon analyses[7] indicated a 14th century date.

Another set of successful calibrated radiocarbon dating results[8] comes from a recent Ashmolean Museum study of printed (resist dyed) cotton textiles found in Fustat and said to originate from India (Figs. 5 and 6). So far fifteen of these textiles have been ^{14}C dated. Apparently some of them have a very early date and the wide range of ages indicates a long and continuous tradition. It is hoped that the study will examine about fifty examples in all. Other examples (not illustrated) of successful analyses are for a small group of Coptic textiles[9]; and some miscellaneous Asian textiles[10].

Groups of Textiles Not Yet Radiocarbon Dated

1. Ottoman and Aegean embroideries, Ottoman velvets and other woven fabrics
2. Classical carpets from all regions
3. Pre-Columbian textiles
4. Fatimid, Thulunid, and Mamluk textiles

The Ashmolean Museum eventually hopes to analyse by radiocarbon dating about 50 embroideries from their collection believed to date from the Fatimid to the Mamluk period[11]. The age of some Fatimid textiles is considered so secure with respect to their dates of manufacture that the act of radiocarbon dating them would represent more a confirmation for doubters than a test of the age of the textiles. One dated *tiraz* textile from the Ashmolean Museum is currently being analysed by the Oxford Laboratory.

Carpets (Figs. 7–12)

Since Lessing in 1877[12], a number of publications cataloguing the occurrence of classical carpets mainly in Italian, but also in Dutch[13] paintings illustrate the use of "mainstream" art historical practice in fixing the dating and type of a carpet according to its appearance in the graphic illustrative medium provided by the highly skilled painters of the 15/17th century in Italy and the Netherlands. Although there are some dating problems indicated concerning the production of the carpets pictured (there are fewer problems in dating the paintings), even in the last few years no mention of the possibility of radiocarbon dating of the carpets is suggested. This is not

to minimize archival or comparative studies. A work is best criticized according to what it does rather than according to what it does not do, and this study provides a valuable resource to scholars. But the fact remains that some of the problems raised by this work could be solved by radiocarbon dating when such procedures and materials are available. Radiocarbon dating has been performed on five animal rugs (Figs. 7–11) discovered in Tibet over the last few years[14]. These rugs have not yet been firmly attributed to a specific region of origin. Generally the art historical dating of these animal rugs has been based on the date of an early 15th century Italian panel painting which depicts a representation of such a rug with considerable accuracy[15]. The date of the painting is well established and the representation of the carpet is extremely close in pictorial detail to three of the carpets (Figs. 7–9) under discussion.

It may be seen that all these rugs give calibrated radiocarbon dating results very close to each other suggesting a very high confidence for the general correctness of the analyses, in fact there is overlapping of the uncertainties for all the results of the animal carpets. It is possible to arrange a chronology, a listed order, based on these data, but the confidence level for this chronology would approach zero since any of the results would be an acceptable replicate result for any other. A reasonable conclusion, based on the data is that all of these carpets were produced within the same 2–3 centuries. Other carpets or fragments possibly related are known, such as the famous phoenix and dragon rug of Berlin and the Marby rug in Stockholm. The undated examples should certainly be examined by radiocarbon dating; and replication of the examples already cited might produce a greater sense of well-being for the possessors of these examples.

Agitation caused by ^{14}C results occurred at the 1996 ICOC conference in Philadelphia. A whole session was given to discuss the so called Salting carpets (Fig. 12), its history and evidence for its Persian 16th vs Turkish early 19th century origin[16]. There seems to be ever increasing evidence for a Persian 16th century origin, not only concerning the radiocarbon dating results[17].

When to use Radiocarbon Dating in a Scholarly Study

A student has recently begun a project at the Cooper-Hewitt Museum on a group of printed textiles similar to a group at the Victoria & Albert Museum in London. The group at the V&A was

Fig. 1
Silk samite (detail), post Sasanian, Sogdian, or Iranian.The David Collection, Copenhagen, 9/1996. Radiocarbon dated in Copenhagen, Radiocarbon age: 1300 ± 75 y BP, calibrated age (95% confidence limit): AD 617–893 (99.6%)

Fig. 2
Lampas-woven silk (detail) with metal thread on proteinaceous substrate, Central Asian or Chinese for the Islamic market. The David Collection, Copenhagen, 14/1992. Radiocarbon dated in Copenhagen, Radiocarbon age: 885 ± 60 y BP, calibrated age (95% confidence limit): AD 1029–1262 (100.0%)

Fig. 3
Lampas-woven silk (detail) with metal thread on proteinaceous substrate, Central Asian or Chinese for the Islamic market. The David Collection, Copenhagen, 32/1989. Radiocarbon dated in Copenhagen, Radiocarbon age: 735 ± 80 y BP, calibrated age (95% confidence limit): AD 1159–1408 (98.5%)

Fig. 4
Tapestry-woven silk roundel with metal thread on proteinaceous substrate, Central Asian or Chinese for the Islamic market. The David Collection, Copenhagen, 13/1995. Radiocarbon dated in Copenhagen, Radiocarbon age: 620 ± 40 y BP, calibrated age (95% confidence limit): AD 1298–1405 (100.0%)

Fig. 5
Resist dyed cotton (detail), India.
The Ashmolean Museum,
inv. no. 1990.247.
Radiocarbon dated in Oxford,
Radiocarbon age: 940 ± 50 y BP,
calibrated age (95% confidence limit):
AD 1000–1220 (100.0%)

Fig. 6
Resist dyed cotton (detail), India.
The Ashmolean Museum,
inv. no. 1990.1123.
Radiocarbon dated in Oxford,
Radiocarbon age: 500 ± 50 y BP,
calibrated age (95% confidence limit):
AD 1300–1480 (100.0%)

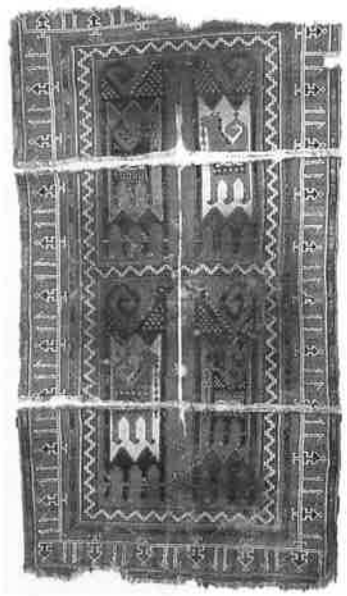
studied some time ago by Donald King[18] who suggested that they were 19th century imitations of medieval textiles possibly printed on medieval cotton. The goal of the student's research is to produce a technical description of the printing processes used on these textiles. This is an excellent and interesting problem, probably soluble with microscopic and microchemical examination. The art historical problem – whether these textiles are 19th century fakes – may or may not be solved by describing the printing technique(s), especially if the forger consciously and carefully used medieval recipes, available to be sure. Radiocarbon dating them could produce ambiguous results only if the cotton used is medieval. If the forger used 19th century cotton, perhaps treated to look old, the result of radiocarbon dating would expose it. Therefore it was suggested that radiocarbon dating ought to precede any other study, since the art historical question was probably the significant issue. In doing so a protocol would be introduced for the scholarly investigation: radiocarbon dating preceding other technical investigation would provide a basis for examining the materials at issue. The student protested that the problem could then become trivial and less interesting if the result of radiocarbon dating proved to be late, and that the cost of the analysis was high. To the best of my knowledge no radiocarbon dating of this material has been done. At issue in this case is the relationship between the technical investigation of the art object as compared to its decisive placement in its art historical context.

Prior to its radiocarbon dating a lot of technical work was performed on the Shroud of Turin[19] that left many technical problems unresolved, but since the radiocarbon dating results were obtained no further significant work has been done[20]. This radical abandonment of technical studies after the radiocarbon dating results were obtained raised questions concerning the hierarchical status of disciplines in cross disciplinary studies.

The "Buyid" Textiles (Figs. 13–15)

A group of textiles commonly known as "Buyid" collected principally at the Cleveland Museum of Art, the Victoria & Albert Museum in London, the Textile Museum in Washington, and Abegg Stiftung in Riggisberg constitute the largest coherent group of textiles so far submitted for radiocarbon dating[21].

Upon the occasion of a planned exhibition and cataloguing of



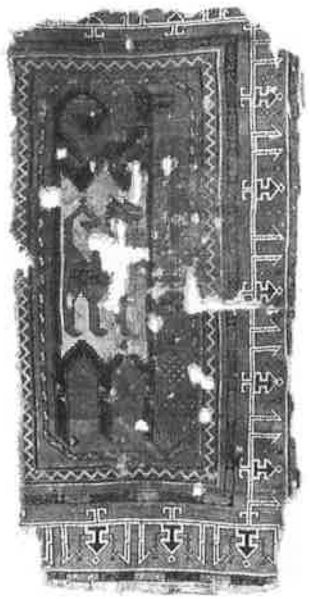


Fig. 7
Animal rug, 126 × 153 cm, wool.
The Metropolitan Museum of Art; Harris Brisbane Dick Fund, Joseph Pulitzer Bequest, Louis V. Bell Fund and Fletcher, Pfeiffer and Rogers Funds, 1990 (1990.61). Radiocarbon dated in Oxford, calibrated age (95% confidence limit): AD 1040–1290

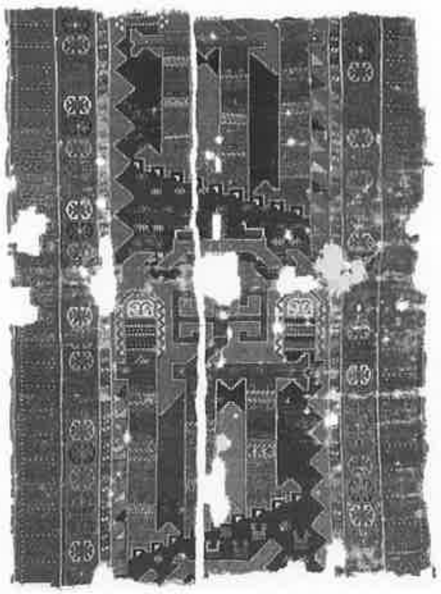
Fig. 8
Animal rug, 173 × 310 cm, wool. Al-Thani collection. Radiocarbon dated in New Zealand, calibrated age (95% confidence limit): AD 1190–1300

Fig. 9
Animal rug fragment, 98 × 198 cm, wool. Private collection. Radiocarbon dated in New Zealand, calibrated age (95% confidence limit): AD 1205–1375

the Cleveland Museum's holdings of these textiles the textile curator, Anne Wardwell, decided to have a group of them analyzed by radiocarbon dating. She examined their weave structures and arranged to have reread their epigraphic ornamentation. Most of the inscriptions had been read earlier by a now deceased epigrapher (H. C. Glidden) as requested by a now deceased curator (Dorothy Shepherd). Sixteen examples were radiocarbon dated, a few of them at two laboratories. As Shepherd was not dead, but retired, at the inception of this study, the radiocarbon dating results were not only an embarrassment to the museum but most especially to Shepherd who had spent a large part of her scholarly life acquiring and defending these textiles as authentically Buyid. The results have been reported in Ars Orientalis[22]. A much larger sample set was envisioned and much more extensive replication than was actually performed. The results obtained were so disappointing to the Cleveland Museum that no exhibition was mounted and for several years permission to publish the radiocarbon dating results was withheld.

Part of the withholding of permission was related to the obvious embarrassment to the museum whose holdings in Buyid textiles is diminished considerably, but also because of the epigraphers involved. They required that their work anticipate the examination of radiocarbon dating, so that it would appear that radiocarbon dating was used to substantiate their work. Unfortunately the decipherment of epigraphic material can be used to prove any thesis designed by the historian including the primacy of that discipline. That is not to say that the readings of epigraphic embellishments are unimportant, especially when they are consistent with other evidence.

Although four of the textiles in the study had calibrated radiocarbon results consistent with the Buyid dynasty (e.g. Fig. 13), most of the textiles that were radiocarbon dated suggested that they were of a later production (Figs. 14–15). One of two textiles with identical weave patterns that differed only in colours gave a calibrated radiocarbon result corresponding to the late Timurid/early Safavid period. Neither the patterns nor the epigraphy of the examples Figs. 14 and 15 had sensible correlation to the results of radiocarbon dating. The physical differences, weaves, epigraphy, and ornament seem to provide no reliable distinction between those textiles with radiocarbon dating results corresponding to the Buyid dynasty and those which do not. It appears that the vast majority of "Buyid" textiles were produced much later than the Buyid Dynasty.



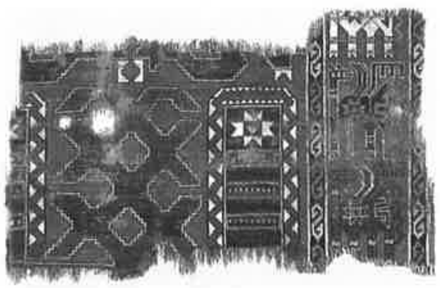


Fig. 10
Animal rug fragment, 170 × 235 cm, wool. Orient Stars collection. Radiocarbon dated in New Zealand, calibrated age (95% confidence limit): AD 1270–1420

Fig. 11
Animal rug fragment, 122 × 73 cm, wool. George and Marie Hecksher collection. Radiocarbon dated, ETH Zürich, Radiocarbon age: 715 ± 30 y BP, calibrated age (95% confidence limit):
AD 1249–1309 (89.6%)
AD 1356–1382 (10.4%)[24]

Fig. 12
The Karlsruhe Imperial Niche Rug. Central Persia, circa 1575, 112 × 180 cm, wool pile on a silk foundation, with metal thread. Private collection, Switzerland. Radiocarbon age: 300 ± 35 y BP, calibrated age (95% confidence limit):
AD 1488–1607 (66.6%)
AD 1612–1662 (33.4%)

The Problem of Belief; Sultanate Textiles (Figs. 16–18)

A final example of the difficulty facing radiocarbon dating is shown by the following: A textile scholar has recently undertaken a study of a group of woven silks referred to as Sultanate (Figs. 16–18). The group had been known mainly as a number of tent panels in the Calico Museum of uncertain age and origin with sparse published acknowledgement. A few years ago similar textiles with a much larger array of motifs appeared from Tibetan sources and their presence prompted a number of publications[23], offerings in sales catalogues, and wonderment concerning this newly expanded group. This may be the earliest group of woven textiles so far attributable to the Indian subcontinent. Some of the printed textiles, mentioned earlier, have been dated to the 11th century. The examples shown on Figs. 16–18 had all calibrated radiocarbon results that agreed with each other. They were closely replicated in two different labs, and are almost certainly of 15th century production. Not all of the textiles in this group gave such clear-cut results as the ones illustrated: some dated earlier, some later. The textile scholar undertook the study of this group without requesting that the textiles be radiocarbon dated and became aware during his study that not all the radiocarbon dating results conformed to his stylistic analysis. For this and other scholarly reasons the initial project was discontinued. It is unclear whether or not this problem will come to full fruition but it is clear that scholarly protocol ought to demand that matters of radiocarbon dating be in place before the wheels of stylistic exegesis commence. The strategy may save embarrassment.

Acknowledgements

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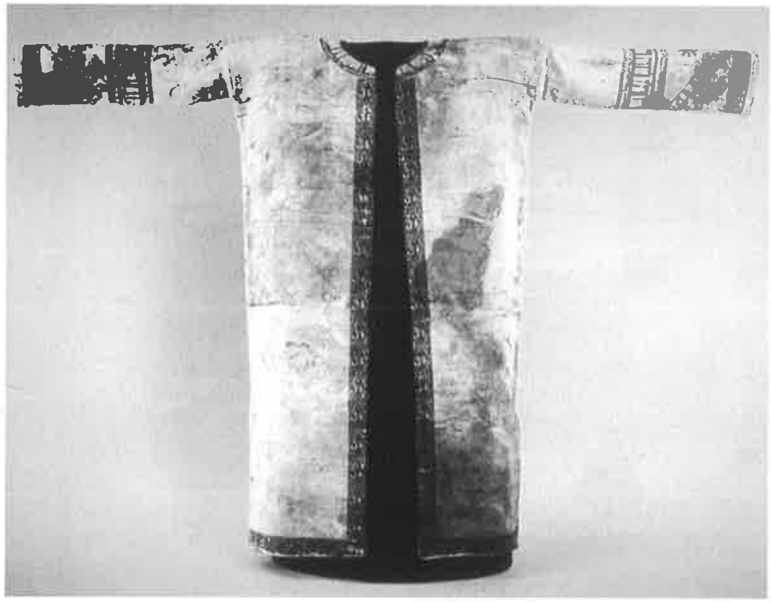


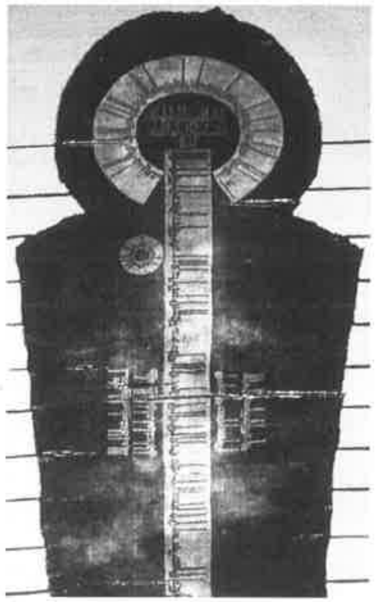


Fig. 13
"Buyid Silk" (detail), The Cleveland Museum of Art, CMA 39.506
Radiocarbon dated in Arizona,
Radiocarbon age: 906 ± 41 y BP,
calibrated age
(95% confidence limit):
AD 1027–1210

Fig. 14
"Buyid Silk", The Cleveland Museum of Art, CMA 85.59
Radiocarbon dated in Oxford,
modern, after 1950 (?)

Fig. 15
"Buyid Silk" (detail), The Cleveland Museum of Art, CMA 54.780
Radiocarbon dated in Arizona,
Radiocarbon age: 185 ± 55 y BP,
calibrated age
(95% confidence limit):
AD 1650–1890 (82.1%)
AD 1907–1955 (17.9%)

1 NSF-Arizona AMS Facility, Physics Building #81, The University of Arizona, Tucson, Arizona 85721, USA; Anthony J.T. Jull.
2 Research Laboratory for Archaeology and the History of Art, University of Oxford, 6 Keble Road, Oxford OX1 3QJ; Robert E. M. Hedges.
3 Institute of Geological and Nuclear Sciences Ltd., The Rafter Radiocarbon Laboratory, PO Box 31312, New Zealand; Rodger Sparks.
4 Institute of Particle Physics, Swiss Federal Institute of Technology, ETH Hönggerberg, CH-8093 Zurich; Georges Bonani.
5 Folsach/Bernsted 1993; de Jonghe/Verhecken-Lammens 1993.
6 Crill 1989; Barnes 1990, 1993, 1996, 1997a, 1997b; Blair/Bloom/Wardwell 1993; Folsach/Bernsted 1993; de Jonghe/Verhecken-Lammens 1993; Simcox/Galloway 1989.
7 Four separate samples have been tested.
8 Barnes op.cit.; Hedges 1996.
9 de Jonghe/Verhecken-Lammens 1993.
10 Crill 1989; Simcox/Galloway, 1989.
11 For some of these analyses: Hedges 1996.
12 Lessing 1877.
13 Mills 1978a, 1978b, 1981, 1983a, 1983b, 1986, 1996; Ydema 1991.
14 Franses 1993.
15 Mills 1994.
16 The whole session is published in: Eiland/Pinner 1999.
17 Of the two examples presented by Michael Franses (Fig. 12) one gave clear indication of a 15/16th century date of manufacture; the other gave dates that were unacceptably old (12/13th century) as well as 15/16th century on replication. It may have been impossible to remove carbon-containing occlusions in the pre-treatment from some of the samples before the analyses. Further analyses are being attempted on this example. Daniel Walker presented the Baker rug from the collection of the MMA, which belongs to the group of Salting carpets, which also have been ^{14}C dated. Walker only mentioned, that the result of radiocarbon dating does not correspond with his early 19th century art historical dating of the rug, i.e., the ^{14}C result is earlier. Since the Philadelphia conference in 1996, another 5 carpets belonging to the Salting group have been radiocarbon dated to the 16th century. These new results will be published in: Eiland/Pinner 1999 (Personal information from Michael Franses, London).
18 King 1962.
19 Microscopy, surface dust analysis, pigment and paint analysis, fabric examination, etc.
20 For an account of the radiocarbon dating of the Shroud of Turin: Damon 1989; Harbottle/Heino 1989; Hedges 1989. For more recent discussion see: Orna 1996.
21 Blair/Bloom/Wardwell 1992; Lemberg 1973, 1973 bis; Picard-Schmitter 1973; Shepherd 1967, 1973, 1974, 1975; Thompson 1985; Vial 1973, 1973 bis, 1973 ter.
22 Blair/Bloom/Wardwell 1993.
23 Cohen 1995.
24 For the complete radiocarbon dating result see p. 243.
25 No replicate measurement for Fig. 14.

Fig. 16
Sultanate silk with eight-petalled flowers (detail), India.
Radiocarbon dated in New Zealand and Arizona*,
Radiocarbon age: 415 ± 59 y BP (480 ± 50 y BP*),
calibrated age (95% confidence limit):
AD 1425–1635 (AD 1328–1480*)

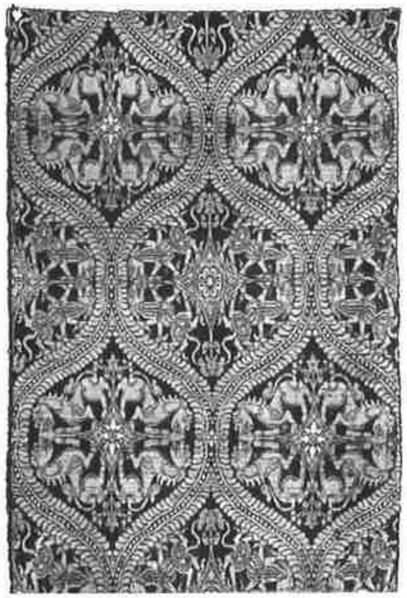


Fig. 17
Sultanate silk with confronted animals (detail), India.
Radiocarbon dated in New Zealand and Arizona*,
Radiocarbon age: 375 ± 60 y B (375 ± 50 y BP*),
calibrated age (95% confidence limit):
AD 1440–1646 (AD 1430–1650*)

Fig. 18
Sultanate silk with elephants (detail), India.
Radiocarbon dated in New Zealand and Arizona*,
Radiocarbon age: 401 ± 65 y BP (401 ± 65 y BP*),
calibrated age (95% confidence limit):
AD 1428–1642 (AD 1415–1635*)

Volkmar Enderlein

Radiocarbon Reference Dating of Classical Carpets and Textiles from the 15th to 19th Centuries

As is usual in the natural sciences, the radiocarbon dating method should also be tested in a controlled series. Carpets with inscribed dates and textiles which are accurately datable by art historical methods are suitable for this purpose.

For understandable reasons, the best known among dated carpets[1], the Ardebil carpet in the Victoria and Albert Museum in London, and the Hunting Carpet in the Museo Poldi Pezzoli in Milan were not available. There is a whole series of kilims with inscribed dates from the 19th century. These too were not available in the collection of the Berlin Museum. The pieces which were selected were the white-ground Persian animal carpet from the 16th century (Fig. 1), a tapestry woven fragment from al-Fustat (Fig. 2) and the well-known multiple-niche kilim of the Berlin Museum (Fig. 3, Plate 11), all of which had been the subject of art historical study and corresponding attempts to date them.

The investigation at the Institute of Particle Physics at the ETH Zurich was carried out under the direction of Dr. Georges Bonani. The pieces form which the samples were taken were not known to the investigators, i.e., they took part in a blind experiment. If the results of the radiocarbon investigation coincided with those of the art historical datings, this could be judged as a further indication of the reliability of the radiocarbon dating method. The results obtained are reported in the following.

For dating Oriental carpets, Wilhelm von Bode at the end of the 19th century used the method developed by Julius Lessing by which Oriental carpets are dated from European paintings which depicted carpets.[2] With the aid of the many examples available to Bode it was possible to him to give the period of time during which the carpet must have been produced. He did this for different carpet types, e.g., for the Holbein carpets and Ushak carpets. A hundred years later many of his datings have not been revised. Datings obtained by this method depend upon the development of trade, the preference of the customer for specific carpet groups, i.e., on the market. However, such datings can be tested against comparative observations, e.g., dated works in the art of the book or architectural decoration.

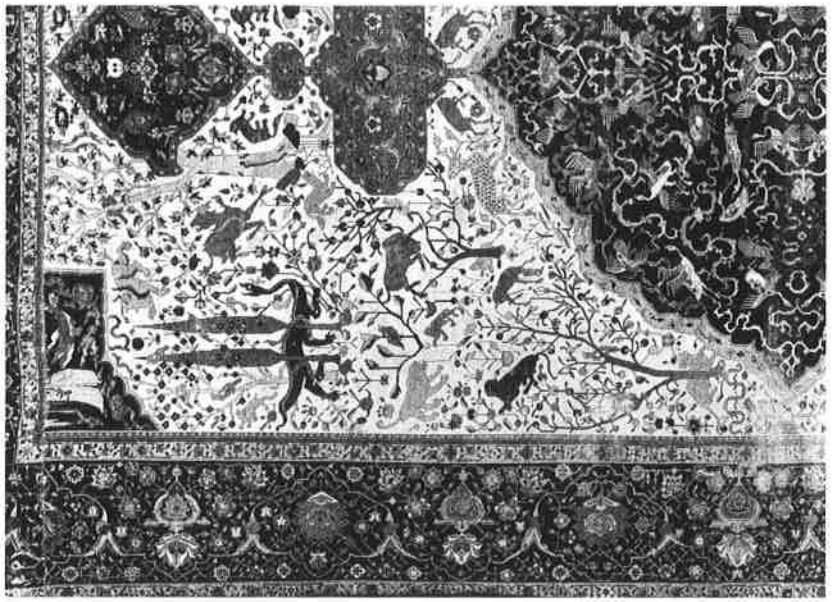
The white-ground animal carpet (Fig. 1)

The first sample investigated was from the white-ground animal carpet of the Museum für Islamische Kunst, Berlin (Fig. 1)[3]. Wilhelm von Bode had acquired this carpet, which had originally been in the Synagogue of Genoa, in Venice in 1891 and had placed it in the centre of a discussion on Oriental carpets a year later[4]. Since then the carpet has been dated to the first half of the 16th century, i.e., the reign of Shah Tahmasp which represents a high point in the development of the Safavid carpet. Kurt Erdmann followed this dating in his review of Oriental carpets in 1955[5]. Nevertheless, the dating has not been uncontroversial. On stylistic grounds, F. R. Martin dated the carpet exactly one century earlier, i.e., to the period around 1450[6]. Arthur Upham Pope too referred to the fact that iconographic details such as the representation of the genies in the corner spandrels have their closest parallel in a miniature dated 1437[7]. In combination these datings reach from the Timurid to the Safavid period. The results of the scientific investigation carried out at the ETH Zurich cover a period from AD 1448–1635 (95% confidence limit), a period long enough to include the widely spaced art historical datings[8].

The tapestry fragment from al-Fustat (Fig. 2)

Among the carpet fragments of the *Museum für Islamische Kunst* which stem from the waste tips of al-Fustat, there is the fragment of a textile in slit tapestry technique (Fig. 2)[9]. In 1986, the piece was published as an early example of this technique[10]. The illustration shows a section from a line of Arabic letters in a curved calligraphy. Both of the hexagonal ornaments at the beginning of the letters are reminiscent of the shapes of Mamluk heraldry, in particular, a three-part coat of arms[11], although the interior drawing can not be identified with a correct heraldic symbol. The circumstances of the excavation and the formal form indicate an origin in the 15th century within the Mamluk period.

The calibrated ^{14}C result from the ETH Zurich confirms this dating. According to this the fragment was produced with highest probability between AD 1412 and 1527 (95% confidence limit)[12].



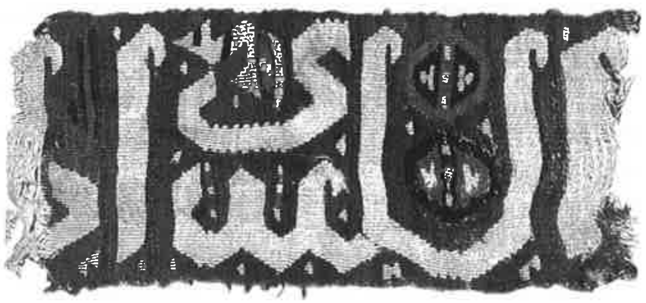


Fig. 1
White-ground animal carpet, Northwest Iran, 1st half 16th century.
Museum für Islamische Kunst, SMPK, inv. no. I, 1.
Radiocarbon age: 375 ± 45 y BP, calibrated age (95% confidence limit):
AD 1448–1635 (100.0%)

Fig. 2
Fragment of a tapestry-woven band from al-Fustat, Egypt, 15th century.
Museum für Islamische Kunst, SMPK, inv. no. I, 6360.
Radiocarbon age: 430 ± 50 y BP, calibrated age (95% confidence limit):
AD 1412–1527 (74.4%)
AD 1554–1633 (25.6%)

This corresponds to the late phase of the Mamluk reign in Egypt, that is the period in which the so-called Mamluk carpets were produced.

The Karapınar saf kilim (Fig. 3, Plate 11)

In 1919 a saf kilim (Fig. 3, Plate 11) with seven niche fields was acquired in the art market for the Berlin collection. Since no similar piece was known, the origin of this piece was controversial for several decades.

In the meantime several similar pieces have come to light. Three years ago an identical kilim was shown to me in the Istanbul carpet market. It is now possible to assume that multiple niche prayer rugs with this drawing originated in the Konya region. The time it was produced remains controversial however. Its monumental impact, the geometrical stylisation of the drawing and its archaic colouring one is reminded of the early Turkish multiple-niche prayer rugs[13].

According to the investigation in Zurich the calibrated radiocarbon result for the saf is distributed over three periods ranging from the end of the 15^{th} to the early 19^{th} centuries.

A range which fell into the 20^{th} century was ignored. Only the 17^{th} century date range is awarded a slightly higher degree of probability[14].

If one considers the results of the investigations of these three pieces, we see that each of the datings span a period of two to three centuries. Only when the section which represents the greatest degree of probability is used, we find a date range of approximately one century. With that the radiocarbon dating method reforms the art historical dating suggestions. The need for a closely accurate dating method is not yet been satisfied, although modern forgeries of Oriental textiles can be detected by this technique.

The radiocarbon dating method has been considerably improved in recent decades and now requires quite small amounts of material for investigation. I can not judge what future perspectives will open in this field. As a scientific method it has already justified its place, side by side with the techniques of technological investigation and dye analysis.

I would like to thank the sponsors who facilitated the investigations at the ETH Zurich by their donations.

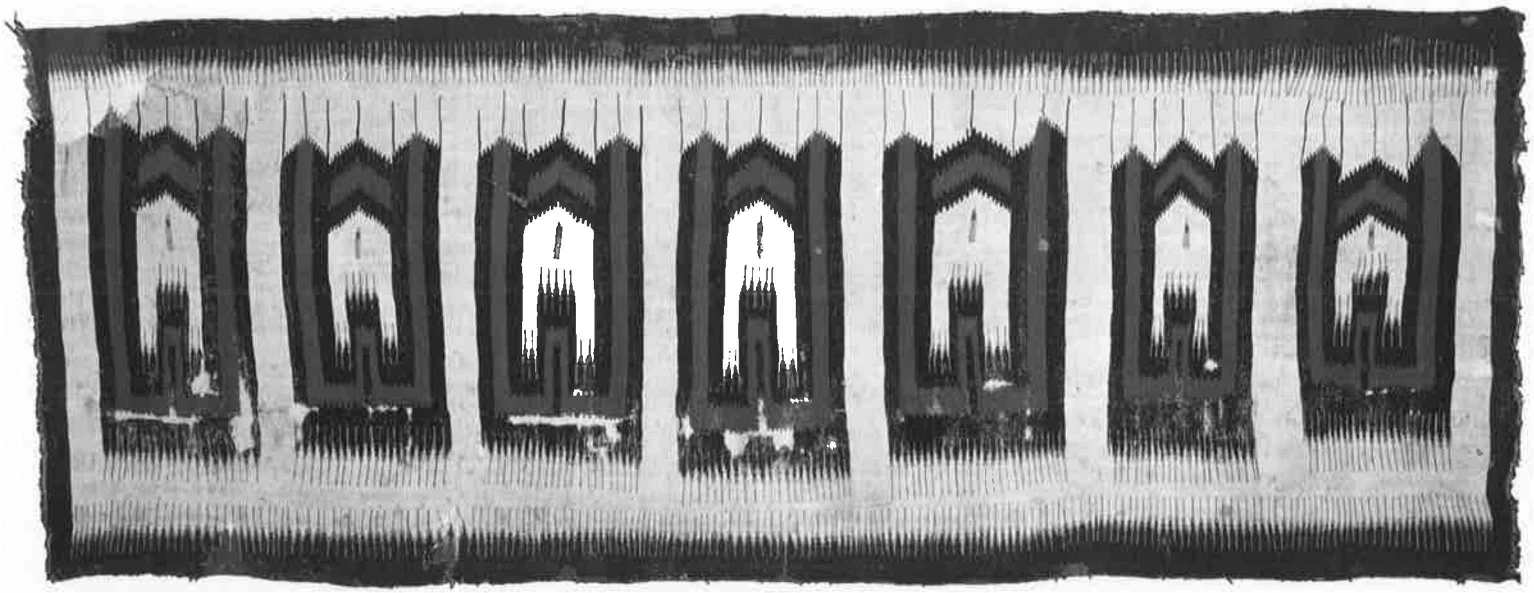


Fig. 3
Saf kilim, Anatolia (Karapınar), 17^{th}–18^{th} century.
Museum für Islamische Kunst, SMPK, inv. no. I. 3088.
(Illustrated in colour on Plate 11)
Radiocarbon age:
255 ± 50 y BP,
calibrated age
(95% confidence limit):
AD 1487–1610 (27.2%)
AD 1611–1689 (57.0%)
AD 1733–1813 (25.0%)

1 Erdmann 1970, *Dated Carpets of the 16th and 17th century.*
2 Bode 1901, p. 3.
3 Inv. no. I. 1. Destroyed by fire to a quarter of its size March 10, 1945.
4 Bode 1892, p. 26, et seq.
5 Erdmann 1955, p. 29, Abb. 50.
6 Martin 1908, p. 35.
7 Pope 1939, vol. 3, p. 2313.
8 For the complete radiocarbon dating result see p. 243.
9 Inv. no. I. 6360. Another fragment probably from the same piece is illustrated in: HALI 93, 1997, p. 135.
10 Enderlein 1986, p. 11, Fig. 5.
11 Meinecke 1972, p. 236 et seq.
12 For the complete radiocarbon dating result see p. 243.
13 Ölcer 1996, Pl. 116 & 118.
14 For the complete radiocarbon dating result see p. 233.

Daniel Walker

Early Tapestry-Woven Fragments from the Eastern Mediterranean Region

In 1927, The Metropolitan Museum of Art acquired, on the recommendation of Herbert Winlock, then Director of the Museum's Egyptian Expedition and later Director of the Museum itself, a large group of textiles of various types, which included 40 *tiraz,* linen textiles with tapestry-woven decorations, sometimes in silk; 2 knitted woolen socks; 10 fragments of tapestry-woven rugs; and 4 fragments of pile carpets. The pieces were purchased from an established dealer named Joseph Abemayor, and the material was said by him, plausibly but unproveably, to have come from the rubbish mounds of Fustat.

Fustat, sometimes referred to as Old Cairo, was founded by the Arabs when they conquered Egypt in 641 AD. Even after the founding of Cairo nearby by the Fatimids in 969 AD, Fustat continued to prosper. As a center of commerce and industry, attested by contemporaneous textual references and also by high-quality glassware and ceramics excavated there, Fustat was one of the wealthiest urban centers of the Muslim world. Gradually, however, its prosperity waned and it became a refuse area. By the time of the Mamluks it was the souks of Cairo, not Fustat (or Misr, as it was called by then), that drew comment from impressed European visitors.

Egypt, with its dry climate and sandy soil, has yielded significant quantities of textiles, mostly in fragmentary form, both imported and of local manufacture. Many pieces have been linked to Fustat, though this connection must be viewed with caution since it derives largely from hearsay. But in 1980 Fustat did yield the first sizeable corpus of medieval Islamic textiles to be found in a proper excavation[1]. Few of the approximately 3000 fragments were found in stratigraphic or dateable contexts, but the 1980 site has been dated between 750 and 1100 AD based on comparative finds, and many of the textiles have been dated to the latter part of that range. Most fragments are linen and of local manufacture, but the approximately 150 others are of wool, silk, and cotton, some used in combination.

Some of these, to go by material or structural features, are probably imports.

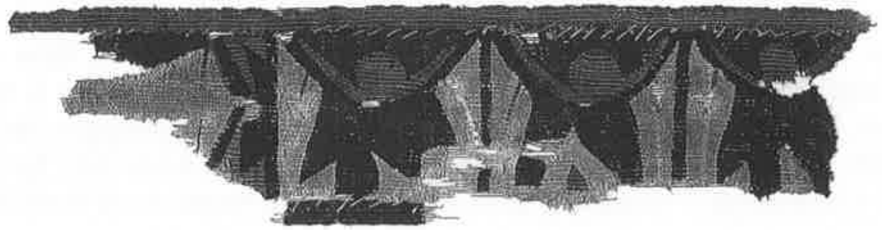
The most artistically compelling material linked to Fustat (correctly or not) is to be found in various museum collections. Of particular note is the collection of pile carpet fragments formed by the Swedish scholar C. J. Lamm in Cairo in the 1930's and subsequently donated by him to, in large part, the National Museum in Stockholm[2]; Metropolitan Museum acquisitions of 1927 and other years, consisting of tapestry-weave and pile examples; and the highly diverse Bouvier Collection[3], formed in Egypt between 1930 and 1960.

Egypt, probably Fustat itself, has yielded a vast variety of textile types. Following the pattern established by the 1980 excavated finds, local material predominates, particularly linen goods with tapestry-woven decoration in wool, silk, cotton, and linen. Local sources can also be assigned examples of knitting, embroidery, and pieces with painted decoration. But there are, in addition, imported goods from many sources – embroidered *tiraz* from Iran or Iraq, ikat *tiraz* from Yemen, woven reed floor coverings from Palestine, resist-dyed cottons from India, and pile carpet fragments from Spain and Anatolia.

The Museum's 1927 purchase of textiles allegedly from Fustat consists largely of tapestry-woven fragments. Local types include (Fig. 1) a typical Tulunid linen-ground piece with limited palette and figural elements evoking, especially in the fluttering scarves, the widely disseminated style formulated in Sasanian Iran, and (Fig. 2) another 9^{th} century piece with part of a band of kufic script.

Of special interest, however, is a small group of tapestry-woven fragments, pieces made entirely of wool or wool and cotton, whose materials and patterns link them in some way to Anatolian kilims or pile carpets[4]. Four of these pieces have been subjected to radiocarbon dating, with results ranging overall from the end of the 10^{th} to the second half of the 13^{th} century[5], in some cases 2 or even 3 centuries later than the dates previously assigned largely on the basis of style, material, and structure.

One fragment (Fig. 3) is worth mentioning because it is a rare example of dovetailed twill tapestry. Made entirely of wool, with Z2S warps and single Z wefts in thin strands, this piece is probably not of Egyptian manufacture but was imported, perhaps from Syria or Iraq. It has an undecorated zone (field?) and also a broad band of kufic whose letters (and their mirror images) repeat and terminate in



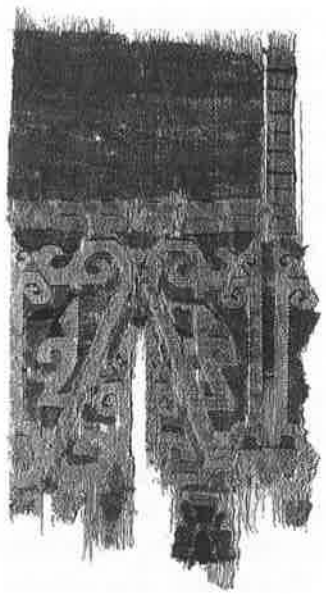


Fig. 1: Tapestry-woven fragment, wool and linen, 54.6 × 15.2 cm. Egypt, 9^{th}–10^{th} century AD. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.73)

Fig. 2: Tapestry-woven fragment, wool and linen, 45.7 × 12.7 cm. Egypt, 9^{th} century AD. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.79)

Fig. 3: Tapestry-woven fragment, wool, 50.8 × 26.0 cm. Possibly Syria or Iraq, 11^{th} century AD. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.86)

Fig. 4: Tapestry-woven fragment, wool and cotton, 45.7 × 26.6 cm. Possibly Anatolia. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.82).
Radiocarbon age: 935 ± 60 y BP, calibrated age (95% confidence limit): AD 1005–1229 (100%)

full or split palmettes. This type of inscription-based decoration is rare in tapestry-woven pieces, but versions also exist in pile carpet fragments made in Anatolia[6].

Two fragments in the 1927 group are reminiscent, in a generic way, of Anatolian kilims dating from the 16th to the 19th century. Such kilims are notoriously difficult to date: some specialists prefer to divide the material into two groups, 19th century and pre-1800, but radiocarbon dating may help clarify dating issues. One fragment (Fig. 4) features strictly geometricized hooks of a type seen in many later kilims, but radiocarbon dating indicates a date of manufacture between 1005 and 1229 AD (95% confidence limit)[7]. Warps are Z2S "hairy" wool, like later Anatolian pieces, and wefts are Z-spun wool and, in small areas, cotton. This fragment may be from Anatolia, although the extremely thin wefts indicate another origin (but not Egypt).

The second fragment (Fig. 5) bears a somewhat softer pattern consisting of stylized blossoms placed within the compartments of a hexagonal lattice. Its recognizably floral elements are precursors of 16th century Ottoman kilims, but radiocarbon dating shows a date of manufacture between 1023 and 1261 AD (95% confidence limit)[8]. The "hairy" wool warps and wefts, all Z-spun (as are the cotton wefts employed in small areas), indicate an Anatolian origin.

Another fragment (Fig. 7) serves as a kind of link or bridge between earlier and later material. Radiocarbon dating indicates a date of manufacture between 1043 and 1279 AD (95% confidence limit)[9]. The pattern is divided into two zones. The "border" area features what remains of a crested bird within a hexagonal compartment. An animal or bird contained in a circular or other compartment is a common artistic theme in pre-Islamic Middle Eastern cultures. A pearl border, popular in the art of Sasanian Iran, separates "border" from "field". The latter area has a bold, highly geometricized pattern reminiscent of later kilims. Hexagonal units contain pairs of stylized human figures of the "hands-on-hips" variety so familiar to Anatolian kilim specialists[10]. Similar figures are also found in mirrored pairs in the spaces between these large hexagons, which were probably stacked in columns extending the length of the field.

Scholars have attempted to connect this so-called goddess figure and other symbols found in later kilims to neolithic prototypes without intermediate stages of development[11], but there is a far more immediate model to consider (Fig. 6), also made in the tapestry-weave

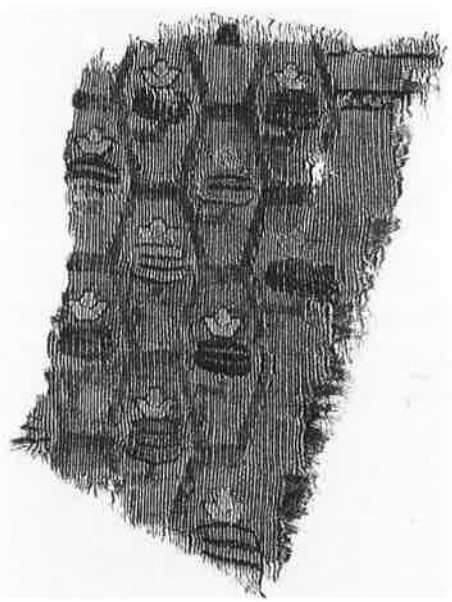


Fig. 5: Tapestry-woven fragment, wool and cotton, 25.4 × 16.5 cm, Anatolia.
The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.81).
Radiocarbon age: 895 ± 65 y BP, calibrated age (95% confidence limit): AD 1023–1261 (100.0%)

Fig. 6: Tapestry-woven fragment, wool and linen, 27.0 × 18.0 cm. Upper Egypt, 9th century AD.
Collection J.-F. Bouvier; JFB M 34

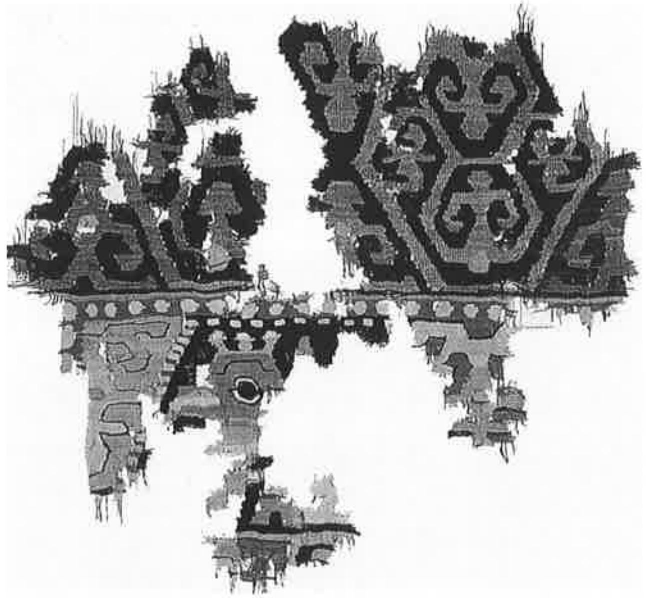


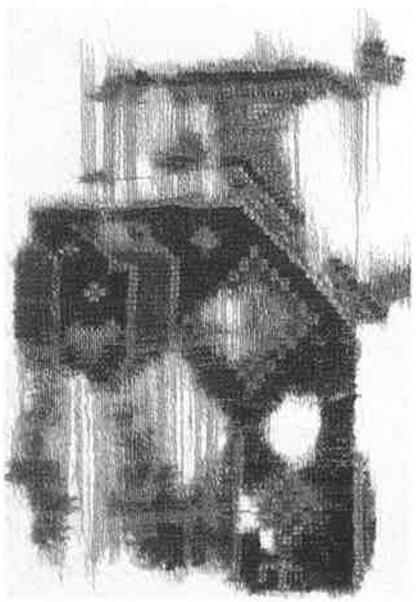
Fig. 7: Tapestry-woven fragments, wool and cotton, 46 × 49.5 cm. Possibly Egypt.
The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.74 & 75).
Radiocarbon age: 855 ± 55 y BP, calibrated age (95% confidence limit):
AD 1043–1106 (18.8%)
AD 1111–1148 (11.1%)
AD 1151–1279 (70.1%)

technique, and it may not reflect an Anatolian heritage. In fact, despite pattern affinities with later Anatolian kilims, the Museum's fragment itself does not seem Anatolian, so soft and pliable are the warps and wefts (it was woven under low tension); perhaps the fragment was woven in Egypt.

Mention should also be made of the evident relationship between tapestry-woven rugs and pile carpets. Several relatively early pile carpets or fragments bear motifs whose stepped diagonals betray the influence of slit tapestries. A pile carpet fragment (Fig. 8) acquired as part of the Museum's 1927 purchase has a stepped diamond occupying the space between the upright neck of the bird and right upper diagonal of the frame of the octagonal compartment. The Museum's approximately contemporaneous animal rug (Fig. 9) features fanciful quadrupeds with raised forelegs, antenna-like tails and smaller animals within, and much of the animal outline is depicted with stepped diagonal lines.

In both instances, the weaver was perfectly capable of executing smooth diagonals, so the inclusion of stepped lines must be viewed as a conscious aesthetic choice, perhaps to lend tension and vitality to the pattern. There is no technical need or explanation for the stepped line in pile carpets as there is in slit tapestry. Both the stepped diagonal and the slit tapestry technique to which it probably owes its original appearance and continuing popularity reflect Turkic traditions of Central Asia, the Caucasus and Anatolia. A tapestry-woven textile fragment (Fig. 10), believed to have been produced in late Sasanian or early Islamic Iran or Iraq[12], is of interest in this regard. Its pattern combines the relatively naturalistic and curvilinear style preferred at this time in the Iranian world with geometric stylization of the stepped pattern of the shoulder and back more typical of Central Asian taste. The stepped pattern here also reflects an aesthetic preference since it was executed in the dovetailed tapestry technique favored in the Iranian world rather than the slit-tapestry technique of the Turkic world that would have necessarily resulted in such a pattern.

The connection between tapestry-woven textiles and pile carpets can be demonstrated not only through design characteristics like the stepped diagonal but through the use of similar overall patterns. Several of the supposedly Seljuq carpets found in Konya have tapestry-like field patterns, including one (Fig. 13) whose small-scale repeating geometric pattern recalls, in its simplicity of form, high



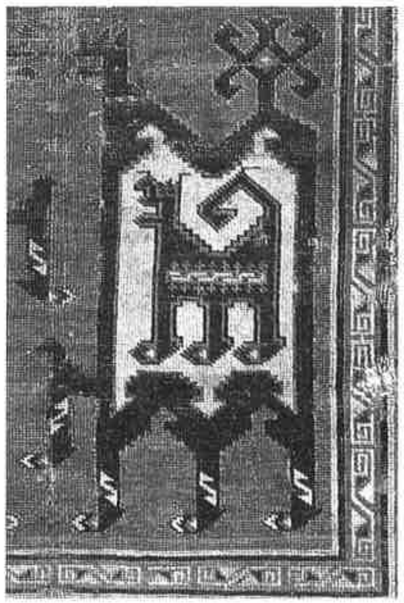


Fig. 8
Carpet fragment, wool, 25.4 × 17.8 cm, Anatolia, 14th century AD. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.89)

Fig. 9
Animal carpet (detail), wool, 126 × 153 cm, Anatolia, 14th century. The Metropolitan Museum of Art; Harris Brisbane Dick Fund, Joseph Pulitzer Bequest, Louis V. Bell Fund and Fletcher, Pfeiffer and Rogers Funds, 1990 (1990.61)

Fig. 10
Tapestry-woven fragment, wool, 37.5 × 27.0 cm, Iran or Iraq, 6th–8th century AD.
Yale University Art Gallery; Hobart Moore Memorial Collection, gift of Mrs. William H. Moore (1937.4604)

contrast, and emphasis on diagonals, that of one of the Museum's tapestry-woven fragments (Fig. 7).

Another of the Museum's tapestry-woven fragments (Fig. 12) has a pattern of stylized floral forms densely arranged in staggered rows. This pattern, and even the coloring of light blue motifs containing red centers displayed against dark blue ground, is echoed in another of the Seljuq carpets from Konya (Fig. 11). The Museum's fragment has been radiocarbon dated to between 997 and 1222 AD (95% confidence limit)[13], so it could be contemporary with the carpet, but the kilim's S-spun wool indicates an Egyptian origin.

In the end, based on just these few examples, it would seem best to view Anatolian kilims as less the product of exclusively local and linear developments than the result of broader exchanges and influences throughout the eastern Mediterranean region.

1 Mackie 1985, pp. 23–35.
2 Lamm 1985.
3 Martiniani-Reber 1993.
4 I wish to thank Nobuko Kajitani, Head of Textile Conservation at The Metropolitan Museum of Art, for her assistance, particularly in technical matters, in the preparation of this paper.
5 Tests were conducted in late 1996 by Dr. Georges Bonani at the Institute of Particle Physics, Swiss Federal Institute of Technology, Zurich; the report is dated December 19, 1996.
6 Another tapestry-woven piece belongs to the al-Sabah collection, Kuwait; see Petsopoulos 1979, p. 273. Pile carpet examples may be found in Lamm 1985, especially plate 14.
7 For the complete radiocarbon dating result see p. 244. All four radiocarbon dated pieces were washed in the Metropolitan Museum Textile Conservation lab during the 1970's.
8 For the complete radiocarbon dating result see p. 244.
9 For the complete radiocarbon dating result see p. 244.
10 Mellaart/Hirsch/Balpınar 1989, Vol. IV, p. 43, 7. Elibelinde "Deity" Motiv (hands-on-hips). See also Plates 43–48 herein.
11 Mellaart/Hirsch/Balpınar 1989.
12 Harper 1978, no. 55.
13 For the complete radiocarbon dating result see p. 244.

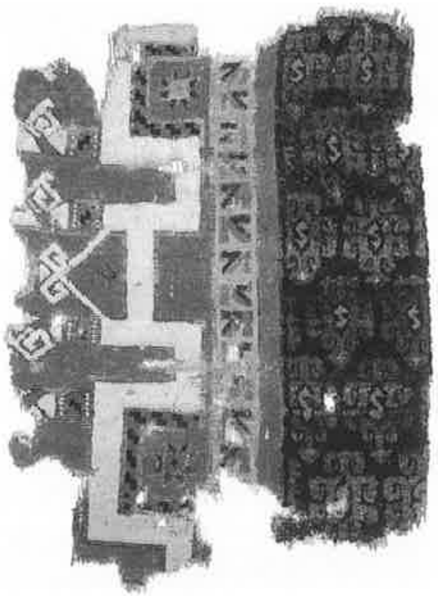
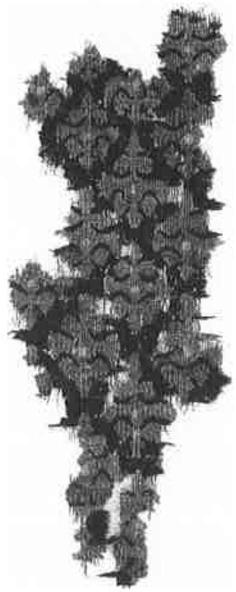
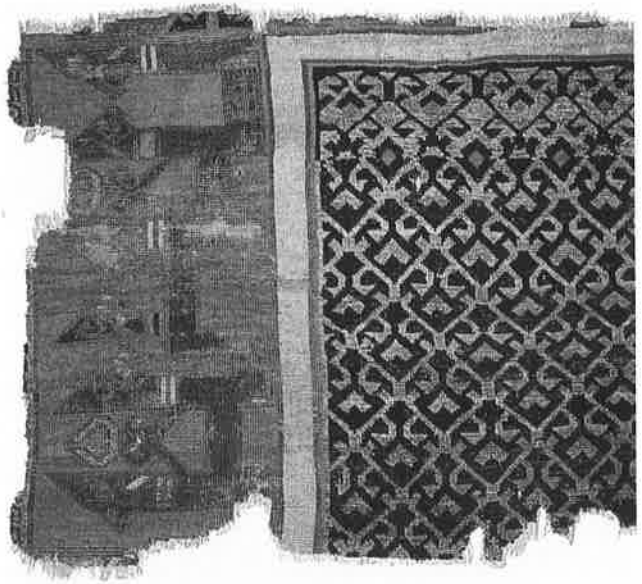




Fig. 11
Carpet fragment, wool, 90 × 74 cm, Anatolia, 13th century AD. Istanbul, Museum of Turkish and Islamic Art; inv. no. 684

Fig. 12
Tapestry-woven fragment, wool, 29.2 × 12.7 cm, Egypt. The Metropolitan Museum of Art; Rogers Fund, 1927 (27.170.76).
Radiocarbon age: 950 ± 60 y BP, calibrated age (95% confidence limit): AD 997–1222 (100.0%)

Fig. 13
Carpet fragment (detail), wool, 226 × 123 cm, Anatolia, 13th century AD. Istanbul, Museum of Turkish and Islamic Art; inv. no. 693

David Lantz

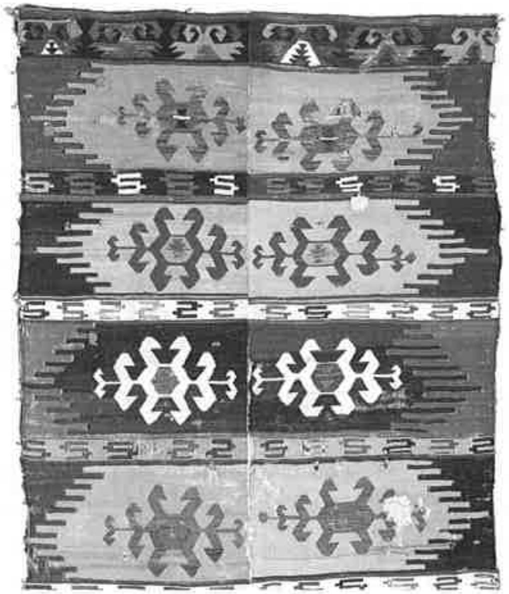
Using Radiocarbon Dating in Developing Chronologies for Anatolian Kilims

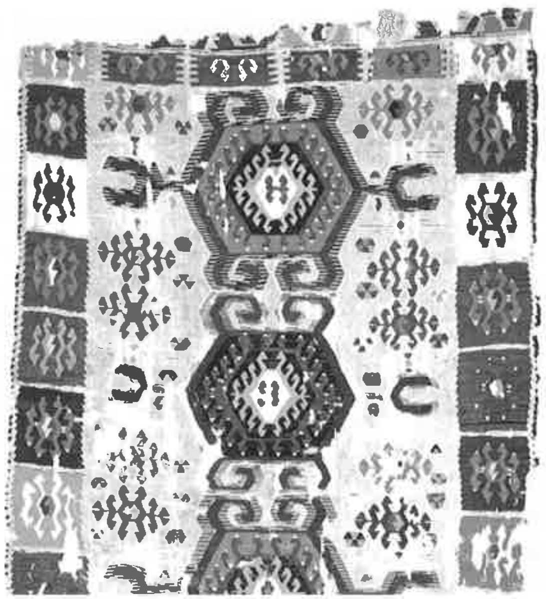
The last 20 years have seen growing recognition that some Anatolian kilims are great works of art. Many exceptional kilims have entered the art market during this period and are now in European and American collections. However, much about the geographic and ethnic origins, possible significance, and dates of extant kilims remains unclear. Attempts to address these issues have been problematic and controversial. The dating of individual extant kilims may seem to be the least problematic of these issues, however there has been almost no good art historical evidence to provide a reliable basis for attributing dates to kilims woven before the 1850's. This is the case for several reasons: (1) Records and inventories (if any) in Turkish mosques and pious foundations provide neither identifications of specific kilims nor dates of their donation; (2) No kilims appear in European paintings predating the 19th century; (3) Inventories and records of noble families and the church do not contain any evidence for dating attributions prior to 1800; (4) The number of kilims with woven-in dates is very small, and most of those kilims have 19th or 20th century dates. This lack of evidence notwithstanding, dealers, collectors, and scholars have all been willing to venture pre-1850 dates to certain kilims.

My own views on dating were first made explicit in an exhibition review I wrote for "Oriental Rug Review" in 1984. This exhibition, entitled "In Search of Early Kilims", contained many of the kilims illustrated in Bertram Frauenknecht's book, Early Turkish Tapestries. This publication was one of the first to show highly damaged and fragmented kilims and to propose dates for some of these kilims that were earlier than any that had ever before appeared in print.

At that time my approach to dating rested on three hypothesises that I found plausible and helpful. First, I believed the body of the extant kilims formed a non-linear decreasing distribution back in time. Taking a generation (20–25 years) as the basic unit of time, this sort of distribution seams reliable for kilims up to the fifth or sixth generation from the present. Kilims from the first half of the 19th century are much rarer than those from the second half of the 19th century, kilims from the second half of the 18th century are much rarer than those from the first half of the 19th century. Second, I believe that the vast majority of existing kilims can be attributed to the period from 1850 to the present on the basis of actual testimony from their makers, descendants of their makers and members of the communities in which they were made. Tens of thousands of kilims exist to provide stylistic and structural information for this period. Kilims which did not fall into this group, whose motifs, composition, drawing, and colouring were rare or unique, became candidates for early kilim status. Third, I believed that the motifs on many kilims were originally iconographic; they were intended to communicate cultural values and cultural identity, rather than being purely decorative surface patterning, possibly abstracted from plant or animal forms but without any further signification. I held this hypothesis for several reasons. Patterns are used to convey cultural information throughout the world. Historically it is the exception rather than the rule that textile patterns are merely decorative and devoid of cultural signification. This viewpoint was also supported by ethnographic fieldwork in Anatolia. In certain communities weavers continued to make one or two types of kilims with particular motifs and composition completely unlike those of their nearest neighbours; moreover, these kilims were not made for everyday uses on the floor, but for special uses and occasions such as dowries, funerals, an important guest, etc. I felt such kilims must have (or once had) iconographic content whether or not such content was fully or consciously understood today.

This hypothesis suggested a closely related hypothesis. If certain kilims were once clearly and consciously conceived to convey iconographic content, then in communities with very long term cultural stability, over time, such content would be distilled to visual forms that conveyed that content with the greatest expressive clarity, economy and force. In such kilims, conceptual clarity and meaning have visual correlates and visual consequences. With kilims, the elements and means for such successful communication involve: (1) the number and types of motifs employed; (2) the drawing, scale, balance and disposition of the motifs in the overall design composition; and (3) the colour choice and colour juxtapositions of the





motifs and their background. These hypotheses together with the experience of seeing a large number of kilims allowed me to identify certain kilims as possible pre-1850 kilims. The most obvious candidates contained unique or unusual motifs, combinations of motifs, overall composition, and colour combinations. Other candidates bore closer correspondence in motifs and composition with later kilims; they have some descendants that persist to the present day. However, a number of features differentiated the earlier kilims from their later descendants. In the earlier kilims the scale of major and minor motifs is often larger, there are fewer motifs, and different types of motifs are less crowded together; thus the motifs stand out more clearly against the field. Minor motifs are not randomly scattered over the field, but are placed in such a way as to produce design reciprocities between motifs and ground – so that the ground itself can be seen as motifs. This reciprocity is sometimes so extreme that it is difficult to say what is ground and what is primary motif (though both are graphically clear and distinct). Furthermore, early kilims often project a strong overall visual unity by completely lacking side borders or by employing various sorts of minimal, reciprocally patterned borders that do not disrupt or dominate the principal field motifs.

Dating based on the preceding hypothesis and observations is of course fraught with problems. At its best it only provides a relative stylistic chronology for placing one kilim or a group of kilims earlier than another, not an absolute chronology that assigns actual date ranges to individual kilims. Moreover, applying such criteria would result in placing "earlier" in the sequence kilims made by a culturally conservative community, and placing "later" kilims made by weavers subjected to cultural disruptions and disintegration – though the actual dates of weaving would be reversed. And such criteria provide no answer to the question: "How early are the earliest surviving kilims?"

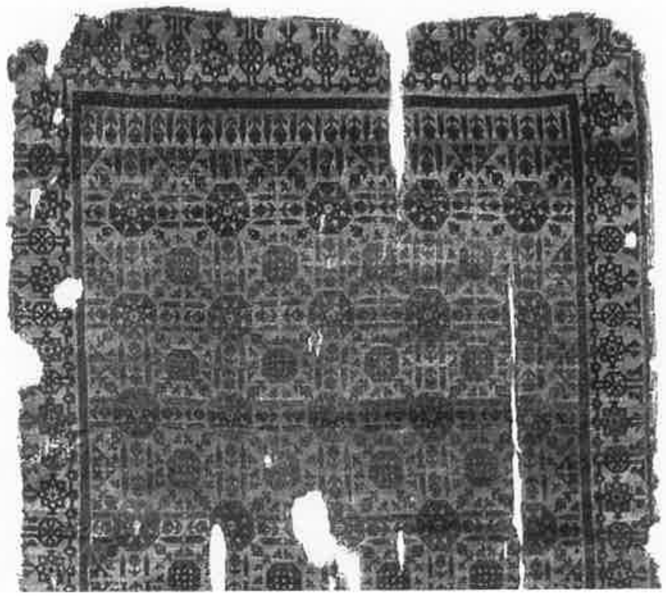
We have good art historical grounds for saying that some Anatolian carpets survive from as early as the 13th century. If a few carpets can survive from such early times, why not kilims as well? In 1992, while writing a catalogue for a group of hopefully "early" kilims that I was offering for sale, I decided to test my intuitions by selecting a number of those kilims for radiocarbon dating. I selected those which I thought might have the best chance of being woven before 1600 since radiocarbon dating usually provides fewer possible time ranges, and thus less ambiguous results in the pre-1600 time period

Fig. 1
(Detail) Kilim with four double-niches, two fragments of one piece, 198 × 158 cm / 203 × 150 cm, Western Anatolia. David Lantz collection. (Illustrated in colour on Plate 19)
Radiocarbon age: 300 ± 60 y BP, calibrated age (95% confidence limit):
AD 1450–1679 (92.6%)
AD 1769–1802 (5.0%)

Fig. 2
(Detail) Kilim with six cartouches, fragment, woven in two panels, 295 × 152 cm, Central Anatolia. Marshall and Marilyn R. Wolf collection. (Illustrated in colour on Plate 22). Radiocarbon age: 365 ± 66 y BP, calibrated age (95% confidence limit): AD 1438–1654 (100.0%)

Fig. 3
(Detail) Kilim with five hexagons in a row on white ground, woven in one piece, 370 × 150 cm, Anatolia. David Lantz collection. (Illustrated in colour on Plate 33)
Radiocarbon age: 320 ± 88 y BP, calibrated age (95% confidence limit):
AD 1427–1692 (86.4%)
AD 1728–1815 (9.8%)

Fig. 4
(Detail) Carpet, 380 × 230 cm, Eastern Anatolia, found in the Ulu Mosque in Divriği, Sivas. Vakıflar Museum Istanbul, inv. no. A-344 (Illustrated in colour in: Balpınar/Hirsch 1988, Plate 1)
Radiocarbon age: 747 ± 94 y BP
Calibrated age (95% confidence limit):
AD 1047–1095 (5.4%)
AD 1116–1144 (3.2%)
AD 1153–1406 (91.5%)



than in the post-1600 time period. In 1994 I tested another group of kilims that I had subsequently acquired. I was very pleased to find that for some of the kilims tested my intuition was confirmed. (Fig. 1, Plate 19, kilim with four double niches; Fig. 2, Plate 22, kilim with six cartouches; Fig. 3, Plate 31, kilim with five hexagons in a row on white ground.)

I have spoken to several people who claim not to "believe" in radiocarbon dating. I find this claim puzzling and am not quite sure what such people really mean. There is no doubt that accelerator mass spectrometry (AMS) radiocarbon dating is a complicated multi-step process using complicated equipment, and that the results of such testing, the uncalibrated radiocarbon age, must be corrected and recalibrated in various ways. Nevertheless, the physical explanation underlying radiocarbon dating, for which Willard Libby received the Nobel Prize in 1960, is indisputable.

My samples were tested by the Rafter Radiocarbon Laboratory of the Institute of Geological and Nuclear Sciences, Ltd., owned and operated by the government of New Zealand. This laboratory has many years of experience in radiocarbon dating on many types of organic material. They also have considerable experience in testing textiles and have done a substantial number of tests whose results were supported by independent art historical evidence. Along with my first group of kilim samples, I also submitted a carpet sample whose date had good independent art historical support as my own sort of control sample. This wool came from the well known carpet with Kufic border in the Vakıflar Museum, Istanbul (Fig. 4). In her commentary on this carpet Belkıs Balpınar links elements of its design to some highly distinctive design elements on the mosque in which it was found and to several other mosques built at approximately the same time. She makes a persuasive case for claiming that this carpet was woven as part of the original furnishings of the mosque, which was completed in 1228/1229 AD, and thus the carpet should date to that period. The calibrated radiocarbon dating result 1153–1406 AD (95% confidence limit) is in agreement with Belkıs Balpınar's art historical dating.

Of course I do not wish to claim that every radiocarbon dating result is correct and must be accepted. As in any testing procedure, errors can occur. If the result of a test seems wildly at variance with one's intuition or art historical information, then the sample should be retested.

In concluding the subject of radiocarbon dating reliability, I also wish to note that most AMS laboratories participated in the Third International Radiocarbon Inter comparison (1992); these laboratories, including Oxford, Arizona, Lawrence Livermore, Zurich, and New Zealand analyzed similar blind samples. The uniformity of outcome among these institutions gives considerable grounds for confidence in the current state of AMS radiocarbon dating.

I would also like to point out that radiocarbon dating results with post 1600 dates can still be useful, since our independent knowledge of post 1800 kilims can allow us to rule out such later age intervals when appropriate[1].

AMS radiocarbon dating results now exist for over 60 Anatolian kilims. What initial conclusions can be drawn from this data? First, we now have a much better sense of the distribution of extant kilims through time. Radiocarbon dating, together with independent art historical knowledge of 19th and 20th century kilims, permit dividing extant kilims into 3 major time-interval groups - groups with imprecise and somewhat overlapping edges. These groups are: (1) pre-1600 kilims, (2) 1600–1825 kilims, and (3) 1825-present kilims. Pre-1600 kilims are very rare; the number of 17th and 18th century kilims is much larger; the number of 19th and 20th century kilims vastly larger still.

How can these results help us place other kilims in their proper chronological position? The few pre-1600 kilims are stylistically quite distinct from one another and from other known kilims, so it is unlikely that we will be able to ascribe many other kilims to the pre-1600 period on the basis of comparison to tested pre-1600 kilims. Although the kilim illustrated on Plate 33 may seem quite similar to the kilim on Plate 34, there are enough subtle differences in drawing, scale, placement, and colouring of motifs that I would not feel confident in saying that they are the same age[2]. The only way we are likely to discover whether or not a kilim can be placed in the pre-1600 group is to have it radiocarbon dated.

However, as testing proceeds, and more data is generated, I think it likely that the dated 17/18th century group will be useful in correlating its examples with untested examples so that every kilim will not have to be tested in order to convincingly ascribe it to the 17/18th century period.

Finally, I believe the results of radiocarbon dating support my earlier hypothesis of a link between the extent of our aesthetic response to a work of art and the communicative content expressed by that work of art. I believe that most of the earliest surviving kilims, including Figs. 1–3, have greater aesthetic merit and evoke a greater aesthetic response because they more clearly communicate, in visual terms, deep and fundamental beliefs of the weavers and cultures that produced them.

In conclusion, I believe that all human patterning activities whether in speech, visual media, or sound, initially arise from a desire to communicate. I feel that certain works of art termed "primitive" or "tribal", whether from the Pre-Columbian Americas, Africa, Asia or Europe, are particularly expressive and moving because they embody a distillation of the most fundamental human concerns. They possess a spiritual dimension and content that often seem lacking in high-style or court art of Europe and Asia (particularly in the case of so called decorative or minor arts). If we are responsive, the results of radiocarbon dating can guide us to a deeper appreciation of Anatolian kilim art.

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1 Cf. plate 21.

2 The kilim on Plate 34 had also been radiocarbon dated shortly after the symposium. Concerning radiocarbon dating it is with a carbon age of 80 ± 30 y BP (weighted mean of 2 different tested samples) clearly younger than Plate 33 with a carbon age of 320 ± 88 y BP. Unfortunately the comparison of the two radiocarbon dating results is not very satisfying because of the much higher experimental error (± 88) of the earlier result.

Dietmar Pelz

A Small Group of Four Kilim Fragments with Rows of Double-niches

The small group of kilims with rows of double-niches which is discussed possesses a number of interesting and unusual specific features. Only four such fragments are recently known. I do not know of a complete example of the group[1]. It may be that this publication may lead to further examples coming to light. Fragment 1 (Fig. 1/Plate 12) was first published in 1987, in HALI[2]. Closer examination reveals two double-niches. Fragment 2 (Fig. 2/Plate 13), with four double-niches and fragment 3 (Fig. 3/Plate 14) with two and a half double-niches are published here for the first time. Fragment 4 (Fig. 4/Plate 15) was first published in 1990, in the catalogue of the McCoy Jones collection[3]. Since only one double-niche has survived of this fragment and it differs significantly in structure from the other three, it can only be included provisionally in this group.

The Common Features

The most specific feature of this small group are the multicoloured guard stripes (red and yellow alone, or with either purple or brown) at the sides of the niche-fields[4]. In fragments 1 and 2 which are dominated by the contrasting red and purple, the guard-stripes are narrower than in fragments 3 and 4 where the dominant contrast is between red and blue-green. These multicoloured guard-stripes on the edge of the niche-fillings are known to me in this form only in this group. In a somewhat different form they appear in three other double-niche kilims[5], and also in the saf-kilims of the Dazkırı type[6]. Guard-stripes appear in a number of other double-niche kilims, but these are monochrome[7]. The most obvious feature common to these kilims is the uniform use of colours for the double-niches; the form of the niche, as well as the filling and interior drawing of all the niches in the same piece. This is plain in fragments 1, 2 and 3, in the case of fragment 4, we can assume this, based on the other common features. In double-niche kilims this is very unusual[8]. Indeed, it was the uniformity of the colours that prompted me to look for other correspondences. At the same time the assumption that the group is uniform in colour is provisional since as yet no such complete kilim has yet become known. Indeed, there is an indication in fragment 3 that at least one of the double-niches varied in colours. At the bottom of the niche field at the left edge of the fragment it is possible to see residues of dark brown fabric.

The restricted number of colours in the four pieces – four in fragment 1 and five in the three others – is also very characteristic. The effect of the colours is determined by the contrast between two colours. In fragments 1 and 2 it is the contrast between the red and the purple, which is highly unusual; in fragments 3 and 4 the contrast is between the red and the blue-green.

The drawing of the double-niche is basically similar in all four pieces. The outlines are mutually interlocked, particularly subtly in fragment 4 and show a similarly interlocked gable form. This combination of interlocking and gable shape is specific to the group. In the gable forms of other double-niche kilims the outlines show sharply pointed "teeth"[9], a narrow, extended interlock[10], or a combination of both[11].

With one exception[12], I have seen this type of interior drawing of the niche-fillings only in the four fragments in our group. Although the form varies slightly in fragment 3, nevertheless it clearly belongs to the group.

The structure of fragments 1, 2 and 3 is rather loose and coarse[13]. Fragment 4 is distinctly finer, and the detail photograph in the exhibition catalogue shows a different weave[14]. All the fragments were woven in one piece with an original width of between 1.50 and 1.70 m[15].

Similarities to other Double-niche Kilims

A double-niche kilim published by Herrmann (1984) and Vok (1997)[16] is the example closest to the four fragments of the group. A visit to the exhibition of Anatolian kilims in the Vok collection[17] brought back this piece which I had seen in 1984. Although, by contrast with fragments 1–4 (Plates 12–15) the colour changes from one niche-field to the next, at this time it is the only kilim for which membership of this group could be considered. Why?

Firstly, here too, the niche-fillings show several multicoloured guard-stripes. The drawing of the double-niches too is very similar. The only slight difference lies in the shape of the gable which is

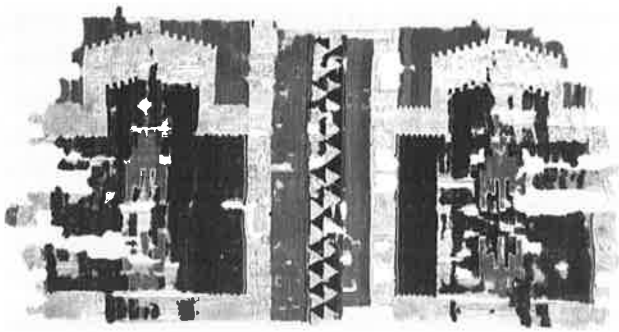

Fig. 1
Kilim (Detail), woven in one piece, fragment, 211 × 100 cm,
Central Anatolia, south of Konya, private collection.
(Illustrated in colour on Plate 12)
Radiocarbon age: 240 ± 45 y BP
Calibrated age
(95% confidence limit):
AD 1514–1593 (11.1%)
AD 1620–1696 (38.2%)
AD 1724–1817 (36.4%)

Fig. 2
Kilim (Detail), woven in one piece, fragment, 370 × 135 cm,
Central Anatolia, south of Konya, private collection.
(Illustrated in colour on Plate 13)
Radiocarbon age: 185 ± 35 y BP
Calibrated age
(95% confidence limit):
AD 1655–1706 (20.2%)
AD 1714–1820 (55.7%)
AD 1838–1873 (4.5%)

stepped rather than interlocked. On the other hand, the interior drawing of the niche-filling is identical. Except for the colours, the design of the stripe adjacent the outer left double-niche is identical to that of fragment 1 (Plate 12). Like all the fragments, the kilim was also woven in one piece. Probably the original width was a little greater than the present 1.45 m since the selvages are not original. In these respects the kilim corresponds to the fragments 1–4 (Plates 12–15). With the length being 4.75 m the kilim must have been complete except for a few cm. The kilim is richly coloured[18], which distinguishes it clearly from the restricted palette of fragments 1–4. The age of this kilim was given as "19th century" by Eberhart Herrmann[19] and as "ca. 1900" by Udo Hirsch[20]. No radiocarbon dating results are available. Might this be a later version of our group?

A second multi-niche kilim with several multicoloured guard-stripes is in the McCoy Jones collection in San Francisco[21]. The sequence of the multicoloured guard-stripes in the central double-niche is identical to that in fragment 3, Plate 14 (red, yellow, brown). In this kilim too there is no uniformity of colours of the double-niches. However, the outlines of the niche-shapes are similar and the interlocked form also appears similar despite the fact that the drawing is right-angled, i.e., flat, rather than gabled. Gary Muse refers specifically to the contrast between the red and purple of the double-niche with yellow ground. This is found as the dominant contrast in fragments 1 and 2 (Plates 12 and 13) and is really unusual.

Another double-niche kilim in the McCoy Jones collection[22] shows the following parallel features: In the two outer fields the position of the colours is the same although it differs in the central field. The drawing of the double-niches is interlocked at the edges. There is one guard stripe in the niche fields. The interior drawing of the niche-fields resembles that in fragment 3 (Plate 14).

Three pieces have been published of another type of kilim with uniformly coloured double-niches[23]. In one piece the outer niches (four out of five) are of the same design and have the same colours, while the centre niche differs in both respects. In the second example, a fragment with three double-niches, and in the third, the double-niches are uniform in colour. All three kilims have a distinctive red-green contrast.

Two further double-niche kilims with uniform colours in the one case with two double-niches[24], in the other case with three[25], have been published in HALI. Apart from the shared uniformity in

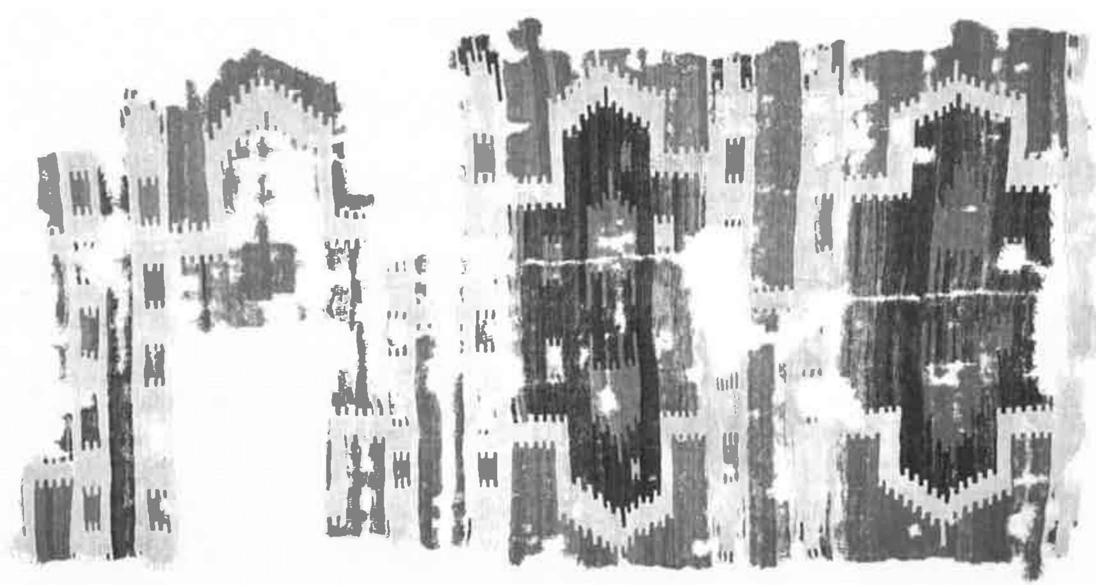

Fig. 3
Kilim, woven in one piece, fragment,
310 × 160 cm, Central Anatolia, south of Konya,
privat collection. (Illustrated in colour on Plate 14)
Radiocarbon age: 250 ± 55 y BP
Calibrated age (95% confidence limit):
AD 1482–1702 (59.8%)
AD 1718–1819 (29.0%)

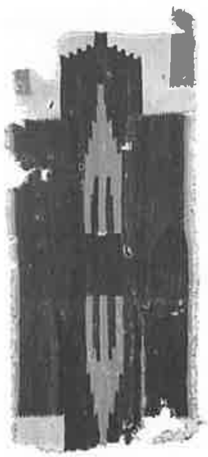

Fig. 4
Kilim, woven in one piece, fragment 43 × 102 cm,
Central Anatolia, south of Konya
The Caroline and H. McCoy Jones collection
The Fine Arts Museums of San Francisco,
Inv. No. T89.51.29
(Illustrated in colour on Plate 15)
Radiocarbon age: 240 ± 30 y BP
Calibrated age (95% confidence limit):
AD 1636–1682 (51.4%)
AD 1748–1805 (33.4%)

colours, accompanied by single guard-stripes and by the single-band feature, no others are similar to the four fragments of our group.

Two groups of double-niche kilims, one from Western Anatolia[26] and one from the East[27], have uniform niche colours but share no other features with the group of four.

Similarities to Saf-Kilims

A comparative search of the literature for saf- and double-niche kilims shows that some saf-kilims are less rich in colours throughout than the majority of double-niche pieces[28]. This is also true in the absence of a white ground[29]. This impression is comparable with that left by the four fragments (Plates 12–15). Searching for an explanation for this similarity, a possible cause is that in some saf-kilims the colours of the niches is also uniform[30] and where nevertheless there is a change in colour, there is no impression of richness of colours because the change is regular and the palette is limited[31]. This restriction in the number of colours itself is a feature shared with fragments 1–4 (Plates 12–15). In some saf-kilims the niches are on a monochrome ground. Does that also apply to fragments 1 to 4? The fragmentary condition makes it difficult to decide, especially for fragment 4 (Plate 15).

Nevertheless the question can be answered with "yes". All the double-niches stand on a uniform red ground. The stepped multicoloured diamonds between the white double-niches of fragment 2 (Plate 13) would then correspond to the designs between the niches of several saf-kilims[32]. Another pointer to such a view is a feature in fragment 3 (Plate 14) which until now I had seen in no other kilim: three white double-niches are connected through a white bar. In other words, the red area between the niches does not form a continuous bar which separates the double-niches.

The Probable Dating

For all of the fragments (Plates 12–15), radiocarbon dating tests have been undertaken by the Institute of Particle Physics at the ETH Zurich. The calibrated radiocarbon results show several probabilities for all of the fragments[33]. They show that with measurements of 240 ± 45, 185 ± 35, 250 ± 55, and 240 ± 30 y BP respectively so-called carbon years, they most probably all belong to the period of the 17/18th centuries. A low degree of probability remains for the 19th century which can be largely ruled out. These results give us an idea, but equally interesting is the comparison with other double-niche and saf-kilims obtained by this radiocarbon dating study. Given the small number of the comparison pieces the validity of the results must remain in question; nevertheless, they may be mentioned. The four double-niche fragments (Plates 12–15) are of considerable age. From the double-niche pieces tested, only the example on Plate 19 seems to be older. The saf-kilims in the Vok collection (Plate 9), in the Galveston collection (Plate 8) and in a private German collection (Plate 3) were dated to the 15/16th centuries[34] and 16/17th centuries[35] respectively and are therefore older than the fragments 1–4 (Plates 12–15). The dating of the Berlin saf-kilim[36] (Plate 11) with a carbon age of 255 ± 50 y BP places it in a period approximately equivalent to that of fragments 1–4.

Possible Origin

An accurate geographical attribution for the group cannot be demonstrated. Kilim specialists have stated that the four fragments may have been woven ca. 40 km south of Konya (as the crow flies).

Summary and Conclusions

The fragments 1–4 form a self-contained and homogenous group among types of double-niche kilims. Specific features include the multicoloured guard stripes within the double-niches; the very limited palette; the absence of colour changes between double-niches; and red as a monochrome ground colour resulting in a distinct resemblance in appearance to the saf-kilims. Looking at the radiocarbon dating results, the fragments 1–4 are most probably older than the other double-niche kilims tested at the ETH Zurich. However, three saf-kilims examined were older than the fragments 1–4.

The radiocarbon dating results obtained and the proximity of the four fragments to the saf-kilims, yield additional material for the discussion whether single or double niches are related in their development and could have influenced one another[37]. Reference to a later development might be provided by the double-niche kilim in the

Vok collection[38]. If we assume that the age-estimates by Herrmann and Hirsch are correct and there is indeed a relationship to the group under discussion, this leads to interesting questions about the development of the basic design on the one hand and the colours on the other. The design would then have remained almost unchanged over several generations, while the colour range is almost unrecognizable. Where it concerns our group of double-niche kilims it is tempting to speculate thus: uniform colours of the double-niches in combination with a limited number of colours = early. Change of colour from one double-niche to another combined with a wide palette = late. Due to few data on which these speculations are based, their validity must not be regarded as assured. Nor would it be safe to transfer them to other groups of kilims. Their value is to point the way to new insights.

Acknowledgements

This contribution is based not only on my own reflections but also on discussions with my friends: Michael Bischof, Dietlinde and Christian Erber, Jürg Rageth, Ulrich Türck and, not least, my wife Gerti. Diane Mott, Associate Curator at the Fine Arts Museums San Francisco, has approved to radiocarbon date and publish fragment 4 and has provided a structure analysis. The illustration of Plate 15 (fragment 4) is thanks to HALI. Bertram Frauenknecht kindly provided the photograph and a material specimen for analysis for fragment 1 (Plate 12).

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1 The double-niche kilim in Vok 1997, Plate 25, could be regarded as an exception with a later date of origin.

2 ...and in Bertram's chamber, Report on the 6th ICOC, Vienna/Budapest 1986, HALI 33, 1987, p. 36, top.

3 Cootner 1990, Plate 2.

4 The colours of the guard stripes in the four fragments as seen from the interior outward:
fragment 1: red, yellow, purple
fragment 2: red, yellow
fragment 3: red, yellow, brown
fragment 4: red, yellow, (?)

5 (1) The kilim from the Vok collection. The piece is illustrated in: Vok 1997, Plate 25; the same piece is also illustrated in: Herrmann 1984, Plate 1; (2) The double-niche kilim in Cootner 1990, Plate 3; (3) A double-niche kilim from the Lake Van region in East Anatolia, HALI 71, 1993, p. 103 top right. According to personal information from Jürg Rageth, this kilim has three double-niches of the same colour with three very narrow guard stripes, in the sequence: blue, red, white (from the interior outward) on both sides. A fragment of the same design type appeared on the market in Istanbul.

6 E.g., Plates 1–6, Petsopoulos 1991, Plates 1 and 6; Vok 1997, Plate 20.

7 E.g., Cootner 1990, Plate 6; Petsopoulos 1991, Plate 11; Türck 1995, Plate 23; etc.

8 For a number of other double-niche kilims also with no colour change between one double-niche and the next, see the list under "Similarities to other double-niche kilims".

9 E.g. Plate 11; see also Brüggemann 1993, p. 141 et seq.

10 E.g., Cootner 1990, Plate 8.

11 E.g., ibid, Plate 14.

12 Vok 1997, Plate 25.

13

	warp/dm	weft/dm
fragment 1	40	150
fragment 2	35	140
fragment 3	35	140
fragment 4	50	244

14 Cootner 1990, p. 2 (frontispiece).

15

	length (cm)	width (cm)
fragment 1	211	100
fragment 2	370	135
fragment 3	310	160
fragment 4	45	100

16 See note 5 (1.).

17 Exhibition at Castello di Lispida, NR. Monselice, ca. 20 km south of Padua, 9–11 May 1997.

18 Herrmann 1984, structure analysis by Ulricke Herrmann, text to Plate 1, gives 14 colours.

19 Herrmann 1984, text to Plate 1.

20 Vok 1997, text to Plate 25.
21 Cootner 1990, Plate 3.
22 Cootner 1990, Plate 6. A related piece is shown in Kirchheim 1993, Plate 93. Also of interest in this connection is a third piece (HALI 54, 1990, p. 3, adv. Galerie Sailer) which has parallel features to both these kilims, with the addition of a colour palette reduced to red-white, and is thus slightly reminiscent of the relationship between our group to the saf-kilims. See also Plate 14, a double-niche kilim related to the pieces mentioned above.
23 Presumably, these three kilims are not from the same place. For illustrations see: (1) Sailer 1988, p. 42; (2) Sailer 1991; (3) HALI 67, 1993, p. 38, adv. by Battilossi, third row, right.
24 HALI 71, 1993, p. 193, top right. The left of the illustrations shows a little more than half of a central Anatolian kilim with two double-niches in the same colour.
25 HALI 90, 1997, p. 32, adv. Johannik.
26 Herrmann 1988, Plate 22; Cootner 1990, Plate 14, Petsopoulos 1991, Plate 3.
27 HALI 71, 1993, p. 103, top right. The photograph on the right shows a Kurdish double-niche kilim from the lake Van region. This kilim also has a very finely drawn multicoloured guard stripe in the double-niche (blue, red, white, from interior outward); see also note 5 (3).
28 E.g., the saf-kilim in the Museum für Islamische Kunst, Berlin, see Plate 11.
29 E.g., Cootner 1990, Plate 1, or the Karapınar saf-kilim in the Vok collection, see Plate 9.
30 Cf. note 28.
31 Rageth 1991, Plate 24; Vok 1997, Plate 28.
32 Cf. the apricot ground Karapınar saf in the Vok collection, Plate 9.
33 For the complete radiocarbon dating results of the fragments 1–4, see p. 233–234.
34 For the complete radiocarbon dating result of the Karapınar saf-kilim in the Vok collection, see p. 233.
35 For the complete radiocarbon dating results of the Dazkırı saf-kilim in the Galveston collection (Plate 8) and in a German private collection (Plate 3), see p. 233.
36 For the complete radiocarbon dating result of the Karapınar saf-kilim in the Museum für Islamische Kunst, Berlin, see p. 233.
37 Cf. Brüggemann 1993, 168 et seq., also Cootner 990, p. 49 et seq.
38 See note 1.

Belkıs Balpınar

Ottoman Tapestry-Kilims

There is a small number of kilims, which I would like to describe as Ottoman tapestry-kilims (Figs. 1–4). Some of these were discovered in the *Ulu* mosque in Divriği (Sivas province), and others in a mosque in Gümüş (Amasya province) about 200 km to the North-west. They were brought to the Vakıflar Kilim Museum in Istanbul where they were displayed in a special room. Unfortunately, this Museum is closed at this time.

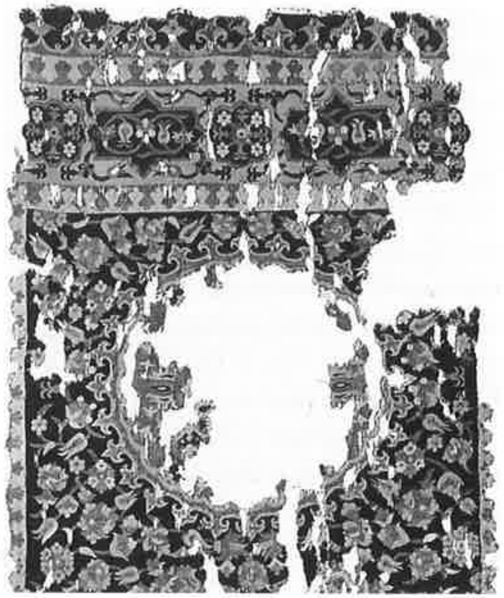
Experience has shown that traditional kilims can not be dated accurately because their designs do not necessarily reflect trends current in the art forms of their time or even of earlier times. Instead, the designs are transmitted down the generations from mother to daughter by the weavers themselves. Because of this traditional transmission process, even where it is possible to see influences from other art forms, it is very difficult to date them.

In contrast to traditional kilims these tapestry-kilims have been dated quite confidently to the period between the late 16th and the mid 17th century. As has been demonstrated by the late Şerare Yetkin[1], Charles Grant Ellis[2] and May Beattie[3], as well as by Yanni Petsopoulos[4] and myself[5], their designs relate very closely those of Ottoman tiles, textiles, embroideries and other media of the same period. Ottoman documents and the accounts of contemporary travellers also help us to confirm the dates of these tapestry-kilims. It is interesting to find that radiocarbon dating results for some of these tapestry-kilims are consistent with an origin in this period. Of the six tapestry-kilims from the *Ulu Cami* (Great Mosque) in Divriği two have been radiocarbon dated at the ETH Zurich. The kilim with three round medallions (Fig. 1) has been dated to the period between 1500 and 1673[6] while the other kilim of this group (Fig. 2), which shows the serrated edged saz leaf design of Ottoman tiles and textiles, was dated later than 1675[7]. Another tapestry-kilim from this group which was found in the mosque of Gümüş in Amasya province and brought to the Vakıflar Museum can be dated more accurately than others and helps to understand the others (Fig. 4).

At the third International Conference on Oriental Carpets (ICOC), in Washington in 1980, I pointed out the connection between the designs of these tapestry-kilims and the appliquéd or embroidered designs seen on the *otağ* tents used by the members of the Ottoman court and the army. The same topic was discussed by me in HALI in 1983[8] where I suggested that this kind of large kilims must have been woven especially to be used on the floor of these ornamented tents. I came to this conclusion for two reasons: Firstly because of the similarities between the designs used in these tapestry-kilims and those of the Ottoman tent walls, and the fact that the geometric designs of traditional kilims would clearly not fit in with the Ottoman taste for rich floral ornamentation, and secondly because their light weight, compared to pile carpets would make them a more suitable floor covering for these large military tents. In 1979 I visited the Osmanisch-Türkisches Kunsthandwerk exhibition in Bayerisches Armeemuseum Ingolstadt. The exhibition contained a complete tent belonging to the Ottoman Grand Vizier, Kara Mustafa Paşa, who lost it after being defeated at the battle of Mohac in 1683. The floor of Kara Mustafa Paşa's tent was covered with a very large tapestry-kilim very similar to the one found in the mosque of Gümüş (Fig. 4). The tapestry-kilim from Kara Mustafa Paşa's tent has a white field design, similar to that of the red field of the piece from Gümüş. Both show flowers on stems growing out from a root but where the Gümüş piece has carnations, Kara Mustafa Paşa's kilim has palmettes on longer stems. Interestingly Kara Mustafa Paşa was born in Merzifon, which is not far from Gümüş where the red-ground tapestry-kilim was discovered. Also interesting is the fact that he was responsible for founding a number of charitable organisations, *vakıf,* and a mosque in his home town.

The side and end borders of the two kilims are almost identical except for the colours (Figs. 5, 6); even the widths of these borders are the same. The only difference is in the minor border which has a chain motif in the Amasya kilim. If the borders were not copied from the same cartoon, they seem to be, at least, copied from kilim to kilim. We can conclude that both kilims must have been woven shortly before 1683.

If we examine the common features of those tapestry-kilims which contain designs seen also on the interior wall of an Ottoman



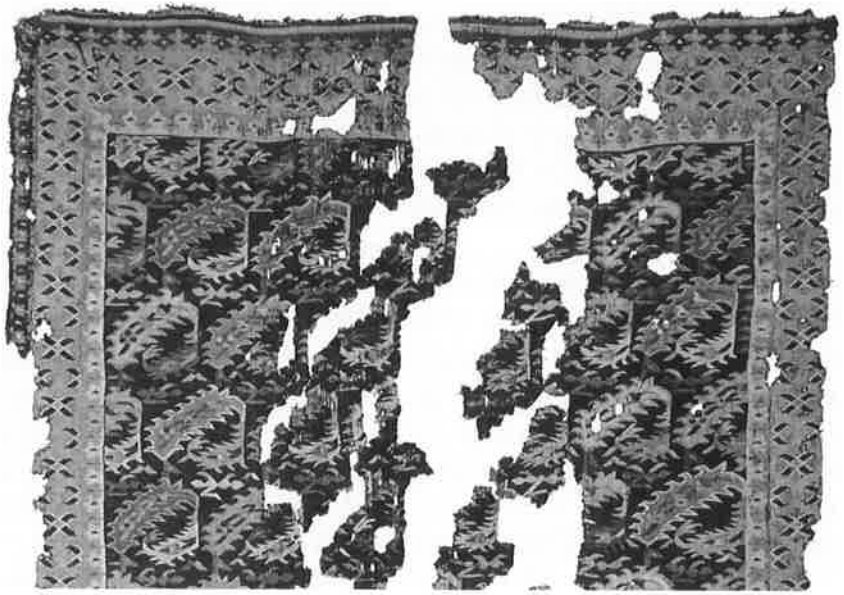


Fig. 1
Ottoman tapestry-kilim, 433 × 142 cm, collected in Divriği from the Ulu Mosque, Vakıflar Carpet Museum Istanbul, inv. no. A.158.
Radiocarbon age: 280 ± 35 y BP
Calibrated age (95% confidence limit)
AD 1500–1602 (46.7%)
AD 1615–1673 (47.3%)

Fig. 2
Ottoman tapestry-kilim, 500 × 400 cm, collected in Divriği from the Ulu Mosque, Vakıflar Carpet Museum Istanbul, inv. no. A.328.
Radiocarbon age: 135 ± 40 y BP
Calibrated age (95% confidence limit)
AD 1675–1777 (41.3%)
AD 1798–1944 (58.5%)

tent from the Military Museum in Istanbul, we can see that the ribbon-like bands which form or frame the motifs, and which are the main characteristics of the decorations of Ottoman tents (Figs. 7, 8), exist mainly because of technical necessities of appliqué work. Ribbon-like bands of similar width to those tent appliqué designs, are also used in these tapestry-kilims.

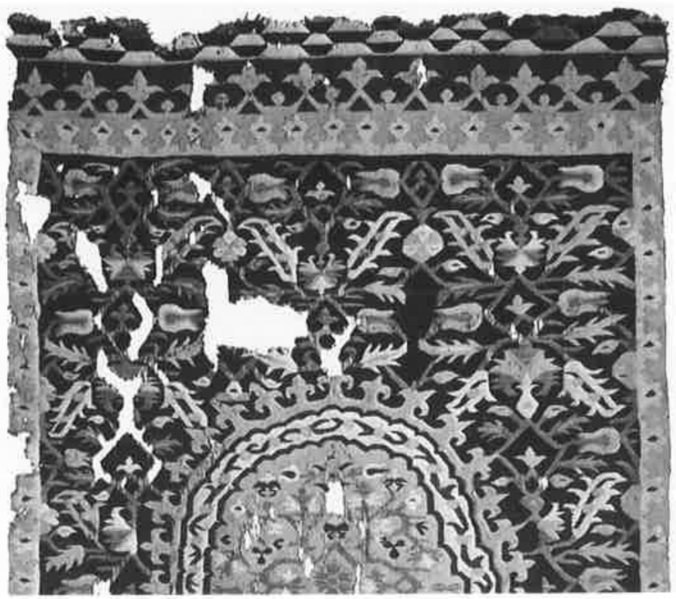
Another shared feature is the reciprocal palmette design on the end borders of both the tents and the tapestry-kilims (Figs. 1–8). Although this type of palmette framing is common in other media found in other Islamic countries, here the similarity extends even to their proportions. In the composition of the designs used in both the tents and the tapestry-kilims, so-called Ottoman flowers, such as carnations, tulips, hyacinths, and lotus-palmettes are used in a similar way (Figs. 1–8). Other design features are also used in similar ways. For instance, round medallions framed with palmettes, medallion and pendant compositions, cartouche borders, small circles within the flowers, chain like minor borders and, as individual motifs, multiple stems emerging from a common root, and small medallion-like cartouches, and serrated leaf motifs. All these common features show the direct relationship between the imperial tents and these tapestry-kilims.

The design-cartoons of the tapestry-kilims might have been drawn by the designers *(nakkaş)* working in the Tent Department *(Mehterhane-i Hayme)* who were responsible for the imperial tents. Ottoman Art displayed a remarkable unity especially in the 16th and the 17th century.

In the Ottoman Army many types of objects were used to show rank and status, and hence power and also a uniformity in style. Even the most diverse objects contained many of the same decorative elements. Appliqué work or woven textile hangings or floor covers in these tents shared this common vocabulary.

In the Badisches Landesmuseum in Karlsruhe there is a small rug, a mosaic of broadcloth, which was part of the booty captured from the Turkish army in the second half of the 17th century (Fig. 9). I am certain that this has come from a military tent. A similar hanging in another Ottoman tent, also captured in 1683 and now in the National Museum in Budapest has cartouches and palmette borders which are very similar to those in the borders of the Divriği kilim Fig. 1. It can also be shown that these features are continued in the so-called Transylvanian prayer rugs.

A large round leather applique floor cover in the Topkapı Saray



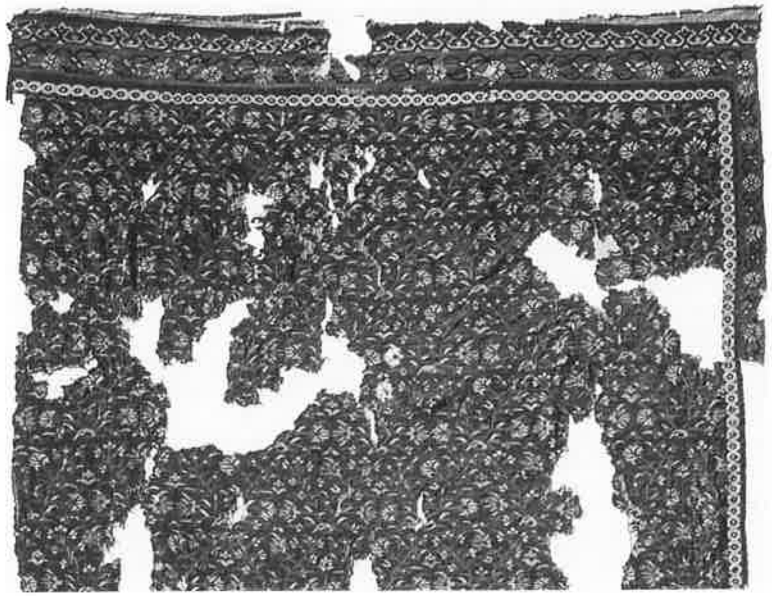


Fig. 3
Ottoman tapestry-kilim,
395 × 235 cm, collected in Divriği
from the Ulu Mosque, Vakıflar
Carpet Museum Istanbul,
inv. no. A.316.

Fig. 4
Ottoman tapestry-kilim,
618 × 385 cm,
collected in Gümüş from the
Yörgüç Paşa Mosque. Vakıflar
Carpet Museum Istanbul,
inv. no. A.G.1.
One of the striking design
similarities of both the tapestry-
kilims and the military tents is the
reciprocal palmette design on
the end borders.

Museum Istanbul which has been dated to the 16th century also shows a remarkable resemblance to the border of this Divriği kilim. Even the round small medallions between the cartouches and the flower fillings are the same.

The technical weaving features used in the tapestry-kilims are quite different from those of traditional kilims. Although they too were woven in weft-faced slit tapestry weave, dovetailing (warp sharing) technique is used to eliminate the long slits in the vertical lines (Fig. 10). In this technique, the weaver takes every weft yarn around the common warp between the two adjacent colour areas and returns it to its own colour area. In this way the different coloured wefts are dovetailed on the same warp and slits are eliminated. Dovetailing may have a ratio of 1/1 – i.e., one weft from each colour shares the common warp at each junction – 2/2, or higher. In our tapestry-kilims 2/2 and 3/3 wefts are also commonly used to form dovetails.

Another technical feature of the weave-structure of the tapestry-kilims is their curved wefts, which were used to help to form curvilinear lines, although this is not as uncommon in traditional Anatolian kilims as dovetailing. In most of the Divriği and Amasya kilims, the warps are natural ivory and brown in colour and are made from very long, thick fibres. The warp yarn is loosely Z spun and S plied. The wefts, which form the design yarns, are single and S spun, a feature which is not generally seen outside Egypt and some other north African countries, and Spain. In the Divriği and Amasya kilims, the wool is very different from that usually found in Anatolian Kilims. In the catalogue of the Vakıflar Kilim Museum, I attributed the dull appearance of these pieces to their being woven from camel hair, although I now believe that they were made in sheep's' wool of a darker colour. All these technical features can be seen on fragments of Byzantine tapestries as well as on tapestries dating from as far back as 1500 BC in Egypt, from the Greek and Roman periods through the Coptic and early Islamic periods. These tapestries were woven mostly of linen, but some made of wool have also been found. Although there is a variety of mostly large size kilims or fragments which have been influenced by different types of Ottoman Art, there are only three further kilim fragments, two from the same piece, which I would include in the same group as the Divriği and Amasya pieces.

Fig. 11 is one of two small fragments, which I discovered in the

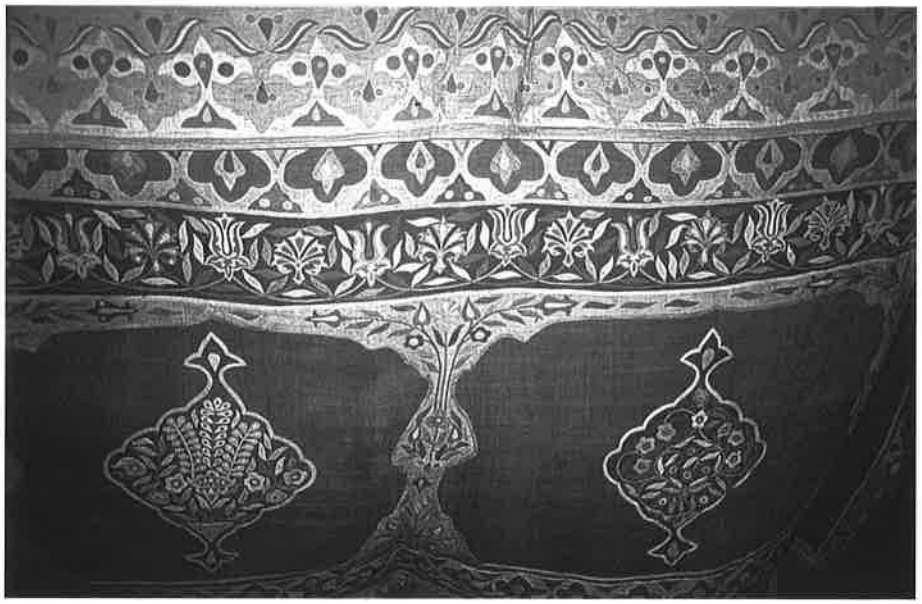


Fig. 5
Detail of the end borders of the tapestry-kilim from Gümüş (Fig. 4). Vakıflar Carpet Museum Istanbul, inv. No. A.G.1.
The side and end borders of the two kilims (Figs. 5 & 6) are almost identical except for the colours; even the widths of these borders are the same. The only difference is in the minor border which has a chain motif in the Amasya kilim (Fig. 5). If the borders were not copied from the same cartoon, they seam to be, at least, copied from kilim to kilim. We can conclude that both kilims must have been woven shortly before 1683.

Fig. 6
Detail of the end borders of the tapestry-kilim from Kara Mustafa Paşa's tent, lost at the battle of Mohac in 1683. Bayerisches Armeemuseum, Ingolstadt.

Fig. 7
Ribbon like bands in appliqué work, the main characteristics of Ottoman military tents, are very similar in design to those in tapestry-kilims.
Interior of an Ottoman military tent, Military Museum Istanbul.

depot of Stockholm National Museum. As soon as I saw it, I became excited as I recognised it as Ottoman. The curator was surprised because it was registered in the inventory as a fragment from the 9th or 10th century and had been thought to have come from Fustat (Old Cairo). Although there were later pile carpet fragments from the same source in the Stockholm museum, before the Divriği tapestry-kilims had become known, the various kinds of tapestries which were thought to have come from Fustat were all dated to between the 8th to 11th century. Another fragment which can be compared with these tapestry-kilims is in the Caroline & H. McCoy Jones Collection in the Fine Art Museum of San Francisco (Fig. 12, Cootner 1990, Plate 25). Although there are no Ottoman flowers to be seen on this fragment, it does show remnants of such ornaments in the three spots in the centre of the original piece (in the top left corner of the fragment), and it also shows similarity with the reciprocal design of the Ottoman tent designs. This fragment has been radiocarbon dated to the 15th century[9]. Another fragment (Fig. 13) which can be included in this group is in the Mevlana Museum in Konya. This was found in the Eşrefoğlu Cami (mosque) in Beyşehir and has a design of rows of palmettes framed with bands, a design common on 16th and 17th century Ottoman tiles and especially on textiles. A very similar design can be seen in paint on the marble tombs dating from 1603, of the son and daughter of Damat Ibrahim Paşa in Istanbul. This unique decoration may well be an exact copy of the design found on a textile which originally covered the tomb in the same manner as the designs on the dust covers of books are often repeated on the book cover beneath.

It is interesting to note that the same Damat Ibrahim Paşa returned to Istanbul from Egypt with a large number of gifts for Sultan Murad III. A few months after his return in 1585, Murad III ordered a named master *haliçe* weaver together with the necessary yarn to be sent urgently from Cairo to his Palace. It seems likely that this idea was the result of Damat Ibrahim Paşa's recent visit there. In the glossary of the same book the word *haliçe* or *kaliçe* is translated into modern Turkish as small *halı, seccade* or *kilim*.

The word *haliçe* or *kaliçe* has always been taken to mean a pile-carpet, but it may also mean *halı*(carpet)-like, or a kind of tapestry-kilim. This term, like "carpet" and "rug", was not necessarily used to cover only one specific structure. From the 15th century onwards a number of *haliçe* weavers were mentioned in palace documents and

Fig. 8
Ribbon like bands (and cartouches) in appliqué work, the main characteristics of Ottoman military tents, are very similar in design to those in tapestry-kilims. Interior of an Ottoman military tent, Military Museum Istanbul.

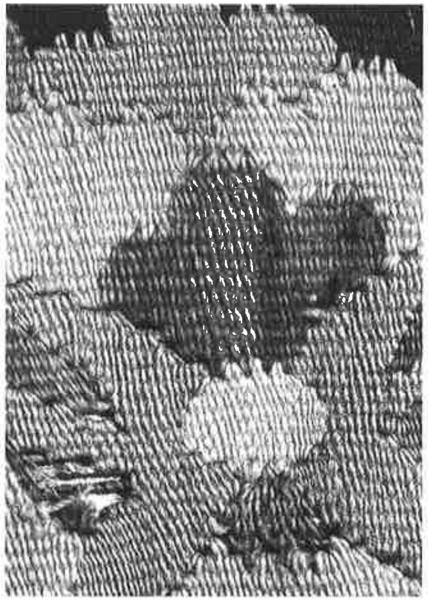
Fig. 9
Small rug in appliqué work from a military tent, part of the booty captured from the Turkish army in the second half of the 17th century, Badisches Landesmuseum Karlsruhe.
A similar hanging in another Ottoman tent, also captured in 1683 and now in the National Museum in Budapest has cartouches and palmette borders which are very similar to those in the borders of the Divriği kilim Fig. 1. It can also be shown that these features are continued in the so-called Transylvanian prayer rugs.

beautiful carpets from Iran and Egypt were sent as gifts to the Ottoman palaces in Istanbul, Manisa and Amasya. It is also known that Medallion Uşak carpets were also woven for the Topkapı palace. With this in mind we may think that there would not be any urgent need for carpet production at the Topkapı palace itself.

During the extensive military campaigns of that time, the lightness of tapestries compared to pile carpets made them a more suitable material for the floors of large military tents. Thus there may well have been a more urgent need for tapestry-kilims in the Ottoman fashion than for Persian or Cairene carpets. For this reason it is possible that those master *haliçe* weavers were actually tapestry weavers and worked there only for a short period after 1585. This would explain why there is no later mention of such a workshop. In 1500 the tent department or *Mehterhane-i Hayme* in the Topkapı Palace employed 38 people. By 1650 their number had risen to 2000, later falling back to 800. Their job descriptions are described quite clearly as: tailoring, stitching, repairing, pitching, taking down, and storing of tents, as well as furnishing and decorating them. At the same time, there is no mention of weaving of any kind of floor coverings. While, it is impossible to come to precise conclusions about the dates of the tapestry-kilims, there are cases in which the historical material can come to our help. Although the red ground tapestry-kilim (Fig. 4) found in Gümüş (Amasya) has not been radiocarbon dated, it can be dated in connection with a very similar piece which was captured in 1683 with the tent of the Grand Vizier Kara Mustafa Paşa who was born and lived in a town near Gümüş where this kilim was found.

According to Ottoman records, after the death of the owner of an *otağ* tent, it would be returned to the Tent Department from where it would be given to another official of the same rank. We can assume that the furnishings, including the tapestry kilims, would also change hands in the same way. In the Military Museum in Istanbul there are some tents from the 18th century which are known to have been in use at the beginning of the 20th century. This shows that tents and their furnishings were kept for a long time and it is therefore quite possible that a kilim which was captured in 1683 may have been woven much earlier and that the similar red ground tapestry-kilim could have been woven around 1683.

If we look again at the radiocarbon dating results, the kilim from Divriği with three round medallions (Fig. 1) and a more intricate and



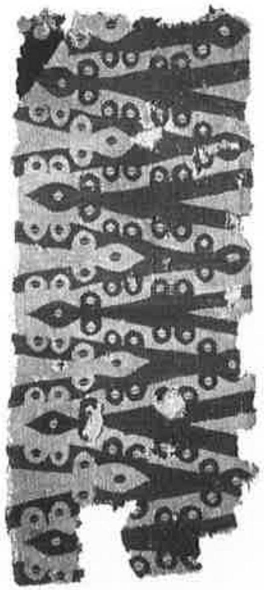


Fig. 10
Detail of Fig. 1, showing dovetailing technique. The technical weaving features used in the tapestry-kilims are quite different from those of traditional kilims. Although they too were woven in weft-faced slit tapestry weave, dovetailing (warp sharing) technique is used to eliminate long slits in the vertical lines.

Fig. 11
Ottoman tapestry-kilim fragment, National Museum Stockholm. This interesting little fragment was registered in the inventory as from the 9th or 10th century and had been thought to have come from Fustat, Egypt.

Fig. 12
Tapestry-woven fragment, The Caroline and H. McCoy Jones collection, inv. no. L8812.2a. Although there are no Ottoman flowers to be seen on this fragment, it does show remnants of such ornaments in the three spots in the centre of the original piece (in the top left corner of the fragment), and it also shows similarity with the reciprocal design of the Ottoman tent designs. ^{14}C-dated to the 15th century.

curvilinear design is dated as from the time period between 1500 and 1673 while the less colourful piece from the same group with the saz leaves (Fig. 2) is dated later than 1675. Although the first one is dated earlier than the second, I believe that they might have been woven in the same workshop which existed for a short time for producing tents for the court and military circles. Although it is possible that a large number of such pieces were destroyed in various fires which occurred in the imperial tent stores, or during battle, the fact that so very few pieces have survived, nevertheless suggests that only a small number of tapestry-kilims were produced. The survival of these pieces in mosques indicates that they were donated to these mosques, probably after they had been used during a military campaign, or after the death of their owner. Both the latest possible date from the radiocarbon dating results of the first piece, and the earliest possible date of the second, predate 1683, the year when Grand Vizier Kara Mustafa Paşa's tent was captured. There are two possible explanations: either this group of kilims was woven in Istanbul, in the Egyptian style of tapestry weave by experienced weavers from Egypt, especially for use in Ottoman tents. Or, and this is more likely, they were woven in Egypt and still in relation to the manufacture of tents. In fact, in the Ottoman palace registers, there are several mentions of *otağ* tents made in Egypt. It is also interesting to note that Egyptian (Mamluk) textiles dating from just before the Ottoman occupation of 1517, were decorated with oval medallions, lotus palmettes, and reciprocal palmette bands. The popular or available colours were yellow and blue similar to most of the Divriği kilims. Other types of tapestry-kilims woven in the Ottoman art style, are beyond our present scope.

A piece from a private collection (Fig. 14) belonging to the latter group has also been radiocarbon dated[10] and another, a large kilim from this group which I found in the Maksem mosque in Bursa and brought to the Vakıflar Museum is probably from the town of Selendi or Kula in Manisa-Uşak province. There are many references to kilims in the registers of contested inheritances from the Ottoman provinces. However because of the very low valuations given to kilims by the officials we can assume that they were traditional kilims woven for domestic use and have no commercial value.

In another set of documents relating to devaluation in the Ottoman currency in 1600 and 1640, we can see fixed price indexes which were declared for a whole range of goods. In these lists it is

Fig. 13
Ottoman tapestry-kilim fragment, Mevlana Museum Konya.
This fragment can also be included in this group of tapestry-kilims. It was found in the Eşrefoğlu mosque in Beyşehir and has a design of rows of palmettes framed with bands, which is common on 16th and 17th century Ottoman tiles and especially on textiles.

Fig. 14
Tapestry-kilim woven in the Ottoman art style, Kula, Western Anatolia.
The design elements of this group of kilims have some relationship with Kula prayer rugs in the shape of the ornaments but also their arrangement, scale and colours.
Radiocarbon age: 135 ± 45 y BP
Calibrated age (95% confidence limit)
AD 1673–1779 (41.5%)
AD 1797–1945 (58.1%)

Fig. 15
Prayer rug, Kula, 19th century, Western Anatolia. Private collection

interesting to find prices for a number of kilims, including very large kilims, some as much as 5 m long and more than 3 m wide, from the towns of Kula, Gördes and Selendi in the Manisa-Uşak province. Prices for these large kilims are almost 10 times higher than for the traditional kilims mentioned in the contested inheritances, i.e., even higher than some carpets. Because of their size, these kilims which were included in the fixed price lists would have been suitable for the large wooden *konak* houses in large towns as well as in military tents, appear to have had a good market.

An urgent order for 200 large kilims which was issued by the Ottoman court in 1552 is interesting in this connection. The order was for 200 large kilims from Uşak province and the large number involved as well as the urgency, again suggest an order for military tents used during this peak period of successful Ottoman military campaigns. Evliya Celebi also mentions the famous variegated kilims of Kula.

There is a relatively large number of this type of large kilims in private and museum collections. Their design elements have some relationship with Kula prayer rugs (Fig. 15) in the shape of the ornaments but also their arrangement, scale, proportion and colours. There are also smaller kilims which have a finer weave but use the same design elements in bands. They might have originated from the same design source. If the first group are related to Ottoman court circles, this last group can be considered to be more commercial products for the wealthier large houses in the urban centres. In contrast to Egyptian S-spun weft yarn of the first group these large kilims were probably woven by weavers from Kula and Selendi, with Anatolian Z-spun yarns. Their design could have started with the Ottoman designs and in time by being memorised, become more rectilinear and repetitive single motifs. The existence of quite large numbers of this type of kilims and the number of variations, indicates that their production continued for a long time.

1 Yetkin 1963, 1968, 1971.
2 Ellis 1978.
3 Beattie 1976.
4 Petsopoulos 1979.
5 Balpınar 1983.
6 For the complete radiocarbon dating result see p. 244.
7 For the complete radiocarbon dating result see p. 244.
8 Balpınar 1983.
9 See Cootner 1990, p. 76, note 37.
10 For the complete radiocarbon dating result see p. 245.

Udo Hirsch

On the History of Tapestry Weaving in the Near East

The historical development of the various forms of tapestry weaving has to be studied in connection with the history of textiles. Therefore, the development of tapestry weaving will be presented here in a wider context with references to different types of textiles.

In European languages, the terms tapestry weave, tapis and Gobelin are synonymous; in Central Asia this technique is-called Pallas, in Morocco Senafi and Pardagi in the Caucasus, Gelim in Persia and Kilim in Turkey. Tapestry weaving can be defined as follows: it is worked in warps and wefts; the coloured wefts are the patterning element. Each weft is interworked back and forth within the area of a particular motif. The next motif in a different colour is only worked when the previous one has been largely completed. There are a number of different techniques to connect laterally adjacent areas of motifs in order to produce a solid weave and to avoid rather long slits. In tapestry weaving, the wefts are always closely packed so that the warp is hardly visible. In the past, sheep wool, goat hair, camel hair, silk, cotton and linen were mainly used in various weavings, but the hair of other animals and plant fibre can also be found.

The most ancient textiles from the Near East known to us at present, date from the Neolithic (8/7th millennium BC). They were discovered during excavations in Palestine[1], Northern Syria[2] and Anatolia[3].

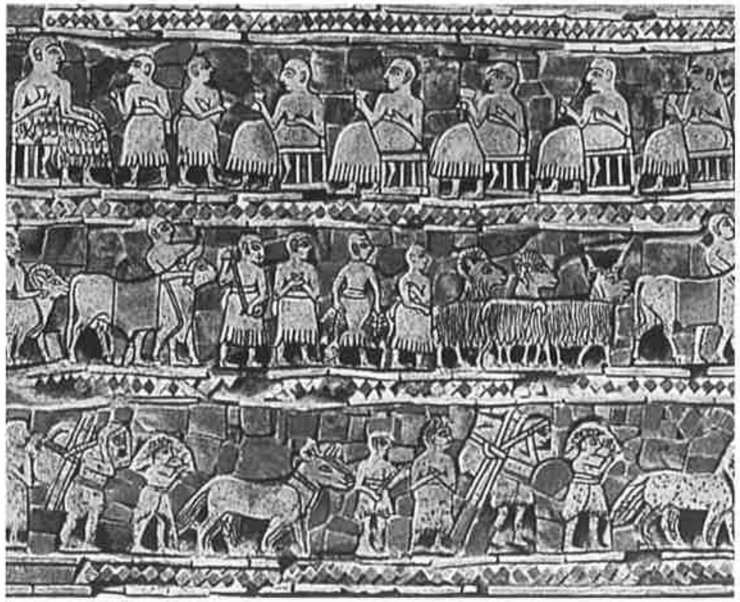
The earliest illustration, to my knowledge, of a person wearing patterned clothing (Fig. 1) originates from the excavations of the Neolithic settlement of Çatal Hüyük in Central Anatolia. However, we do not know what material the illustrated garment was made of or how the lozenge pattern was constructed. Ceramics from the 6th and 5th millennium BC clearly illustrate various textiles as well as the process of their production[4]. After all, we know that the number of weaving weights and spindles increased during the 5th and 4th millennium[5]. Illustrations of looms[6] were rather scarce, though.

Even with the help of archaeological finds, we can only vaguely estimate the extent of textile production at the time, and we have very little evidence of the texture and composition of the fabrics produced in those days[7].

Towards the end of the 4th millennium the first illustrations of wool-sheep and long-haired goats appear, equally depicting goddesses, priestesses and rulers clothed in woven imitations of long-haired hides[8]. The report by Wooley on the excavations at Ur suggests that the illustrations show mainly imitations of hides. Wooley found a fragment of a textile with long curls knotted into the fabric, dating from approximately 2600 BC. He described his find as the woven imitation of a hide. Unfortunately, the fabric disintegrated a short time later[9]. Such fabrics are only known to us from illustrations, for example in the so-called banner of the Royal cemetery at Ur in Mesopotamia (Fig. 2, about 2600 BC). Most of the illustrated persons are wearing so-called shaggy coats. Besides, there are representations of wool-sheep and long-haired goats; a short-haired meat-sheep is portrayed in the second row on the left. In the famous portrait of the billy goat with tree of life which also originates from the king's burial place at Ur and dates from the same time, the long curls of the goatskin were depicted similarly[10].

Clothing decorated with long curls of goat hair was still in fashion 800 years later. A wall-painting from Mari describing the scene of a sacrifice shows several persons wearing three-coloured gowns with long curls. Beside the dresses with small coloured sections there are also illustrations of long striped garments[11]. Following the debate on these textiles during the 30's and 40's[12] we may well assume that in ancient Mesopotamia skirts, dresses and blankets were produced in much the same way as the so-called *filikli* (Fig. 3) of today's Central Anatolia. *Filikli* are rugs used as bedding. The pile is knotted of the unspun hair of Angora goats.

There is an enormous number of illustrations of textiles from the 3rd and 2nd millennium BC indicating the rapid development of the Mesopotamian city states and their wealth of creative forms and powers. Moreover, well-preserved descriptive texts and economic reports impart a distinct picture of textile production[13]. Today, it is assumed that the need for textiles began to grow with the upturn in the economy of these first cities. A high demand for raw materials for varied uses eventually led to selective breeding of wool-sheep and long-haired goats in Mesopotamia. Before, there had probably been



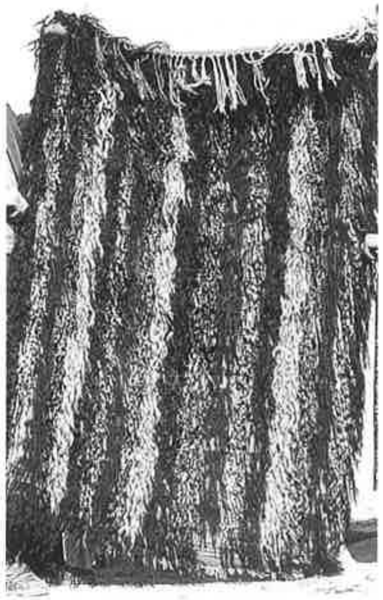


Fig. 1
Wall-painting (detail) ca. 5800 BC, Çatal Hüyük, Central Anatolia. Earliest representation of a person wearing patterned clothing (loincloth with diamonds).

Fig. 2
The so-called banner of the Royal cemetery at Ur, Mesopotamia (detail), ca. 2600 BC.

Fig. 3
We may well assume that in ancient Mesopotamia dresses were produced in much the same way as the so-called *filikli* of today's Central Anatolia.

short-haired meat-sheep only. From early written records we learn that the city temple employed a special shepherd for wool-sheep who earned twice as much as the shepherd looking after ordinary sheep[14]. At first, only priestesses and rulers used to wear wool or hair products. According to the economic reports at hand, various fabrics as well as wool-sheep were exported to the East and to western countries later on[15].

The women working in the temple workshops were employed as clothes weavers, tapestry weavers, pile weavers, etc. The material the women processed into textiles was generally taken to describe their jobs. Various illustrations of knotted, woven, brocaded and embroidered fabrics have been carved out of stone, painted onto walls, sculptured as statuettes, and also described in written form.

In the following, we are quoting a vivid descriptive text from the inventory of the temple of Kar Tukulti Ninurta (Ninive) dating from the second half of the 2nd millennium BC:

Fabric in one piece, rug like, from a knotter's and a …? workshop. Pomegranate tree, which…? also a female animal of prey, an ibex and a…? make up the illustration. Fringes, rosettes…? The strand is of purple coloured wool, 30…?[16]

If we put a fallow deer in the place of the ibex this description could apply to the pattern of an Anatolian knotted pile rug from the Vakıflar Museum in Istanbul[17] and also to a rather plain kilim from the Caucasus (Fig. 4).

Another unfortunately incomplete text from the same temple inventory reads:

Fabric in one piece, rug-like, with 5 …? From a tapestry weaver, spotted…?, people, wild animals and …? different towns, fortifications and …? illustration of a Royal on a pedestal???

This seems to be the description of a tapestry weave that depicts a popular Mesopotamian image of the ruler with his towns and countries. The wall hanging from Western Georgia in Fig. 5 demonstrates that similar tapestries are still woven today. The weaver gives us an idea of the landscape and portrays animals living in her neighbourhood.

The climate in Mesopotamia and in most countries of the Mediterranean and Near East is rather unsuitable for the preservation of textiles from the 3rd and 2nd millennium BC. An exception is Egypt where only linen was used in textile production and was processed on horizontal looms. Wool was regarded impure.

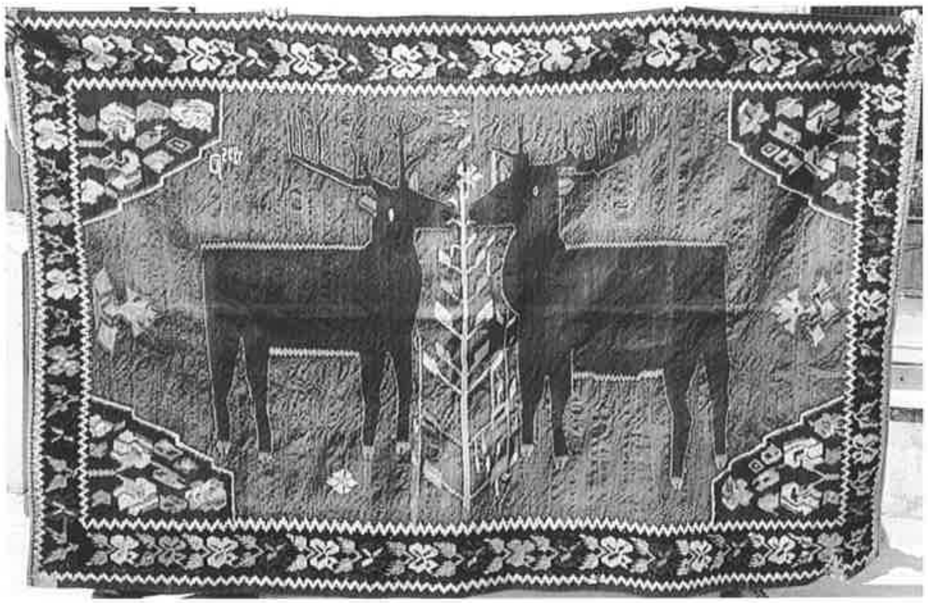


Fig. 4
Kilim from the Caucasus, showing a tree of life and two confronted stags in red on a green ground.

Fig. 5
Kilim (wall-hanging) in a house in Georgia showing different animals on a red ground.

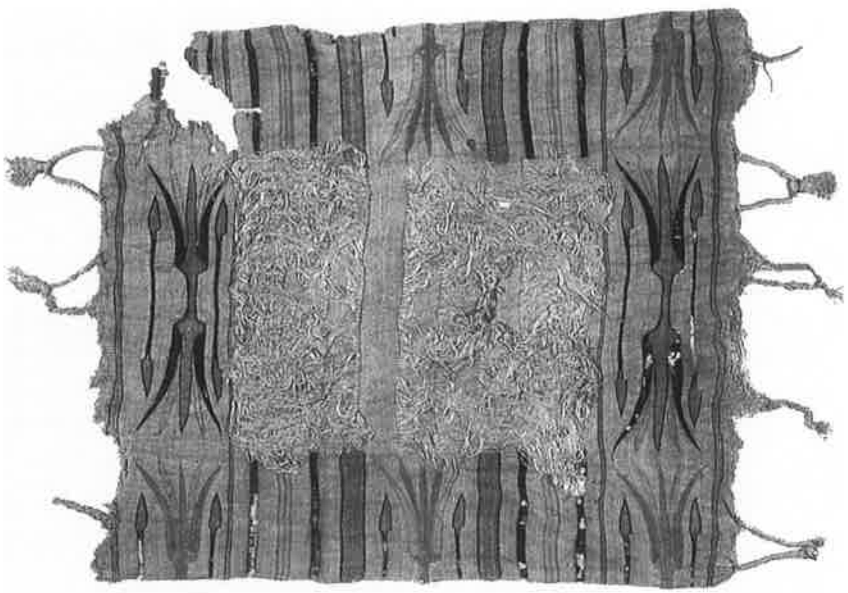
During the 16th century BC, however, domestic and foreign affairs as well as the economic situation gave reason for particularly close contacts with Western and Northern Mesopotamia which at the time were the main centres of wool processing. As a result of these contacts, Egypt adopted not only the Mesopotamian weaving and pile weaving techniques and the necessary tools such as the vertical loom but also – to a certain extent – traditional Mesopotamian motifs and patterns[18].

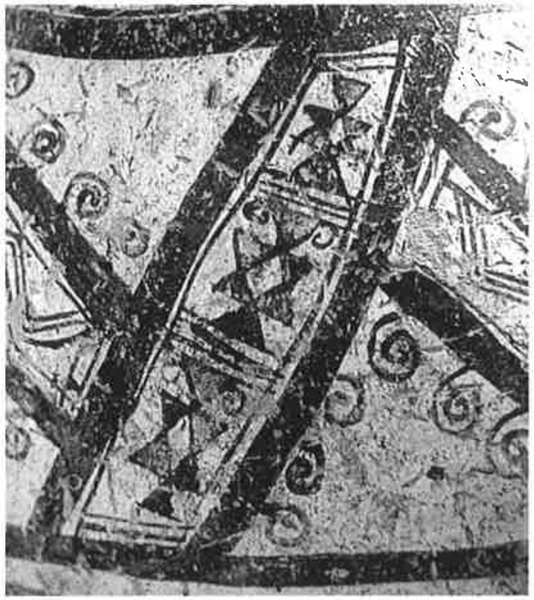
The oldest preserved tapestries we possess are from the tomb of Thutmose IV[19]. They once belonged to his grandfather Thutmose III (1479–1426 BC). Thutmose III brought a large number of textiles back to Egypt when he raided Palestine. The fact that these textiles were discovered in the tomb of the grandson proves that they must have been highly valued. A number of motifs in these tapestries are curved and they are woven of very fine dyed linen in red, yellow, blue, brown and black.

One of many textiles from the tomb of the Kha is a cover with tapestry woven borders and long pile (Fig. 6). Kha was a high official under Pharaoh Amenophis III who succeeded Thutmose IV. Therefore the cover probably dates from approximately 1400 BC. A reproduction of Kha's burial chamber has been put up in the Egyptian Museum of Turin (Italy). Many textiles of all kinds were found there. The above mentioned cover with tapestry woven borders and long pile was special in two respects. Until then, Egyptian weavers had always worked pile by using different kinds of loops. The pile in this cover, however, was worked in symmetrical knots, so-called Turkish or Ghiordes knots[20]. Thus, the cover found in Kha's burial chamber certainly represent the earliest example of the symmetrical knot. The pile is about 15 cm long and each row of knots is separated from the next by 6–8 cm, similar to the Anatolian *filikli*. The borders of the cover in Fig. 6 are curved weft woven. They are decorated with lotus blossoms and buds whose outlines are delicately drawn. The colours are red, blue, green (faded) and black.

More tapestry woven textiles were found in the tomb of Tutankhamun. They date 1354–1343 BC[21]. However, such finds were rare even in Egyptian tombs. Textiles are rather delicate objects which disintegrate far too quickly. That is the main reason why only very few of the early fragments have survived until today.

The following five centuries in the Mediterranean were marked by political disturbances and radical changes. Empires rose and





passed. This period of time went down in history as that of the seafaring peoples and as the "dark" time.

I do not know if any textiles from those centuries have remained. Only illustrations can convey some impressions of the development of textile art in those days. It is generally assumed that the illustrated textiles were mainly tapestry weaves, embroideries and knotted pile fabrics. Such illustrations were found during excavations in Mesopotamia. They date back to the period of approximately 700–200 BC. Fig. 7, a fine example of Mesopotamian textile illustration, represents a saddlecloth from Ninive belonging to King Asurbanipal.

There are numerous early representations of "textile motifs" from Anatolia. A lot of them are finds from the Kültepe (2300–2000 BC) excavations (Fig. 8)[22]. The first branches of Assyrian trading organisations were founded in the area of Kültepe which meant trading not just metals but also textiles in both directions. During the excavations at Acem Höyük near Aksaray several small fragments of textiles were found dating from approx. 1800 BC[23].

The large Hittite rock relief of Ivriz in Central Anatolia shows King Urpalla praying, on the right of the god of storms. The hem of his gown is decorated with a rather exceptional form of a swastika[24] (730 BC). Similar swastika motifs decorate the altars from Gordion in Phrygia. Comparable motifs as well as certain ornaments known from the so-called Holbein-carpets are inlaid in many other tables[25]. One of the tapestry weaves from the Gordion excavations was obviously used as funeral kilim. It is ornamented with red swastikas on a cream coloured ground[26]. Other fragments were parts of wall hangings in the burial chamber. Their patterns are just like those in today's *Raşvan* kilims from the southeast of Anatolia[27]. In one section of the excavated palace, 2300 weaving weights were found within a 30 metre radius. More than one hundred women weavers are reported to have worked for King Midas in this place. From the 7th century BC onwards, tapestry woven clothes (Fig. 9, centre left) and also funeral kilims[28] – in illustrations of funeral ceremonies – were depicted on Greek vases. In some parts of Anatolia, tapestry woven jackets, capes and shawls were still popular in the late 19th century (Fig. 10). Even today, some characteristic geometrical forms known from Caria, the region of Aydın in Western Anatolia, can frequently be seen in Anatolian tapestry weaves[29].

Greek law texts tell us about the importance of kilims at that

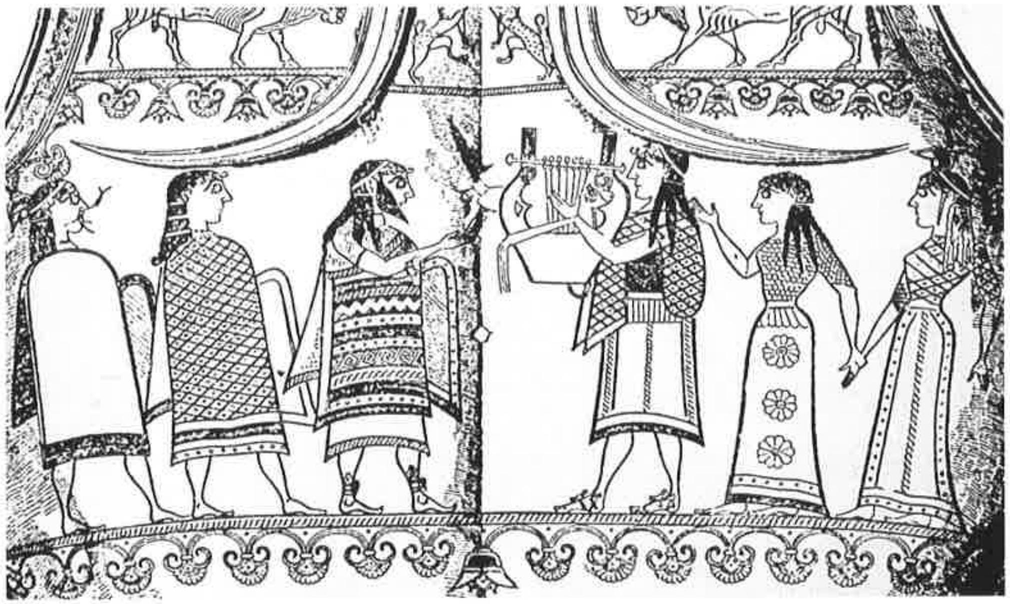
Fig. 6
Cover from the tomb of Kha with tapestry-woven borders. Egypt, ca 1400 BC.

Fig. 7
Mesopotamian textile illustration, representing a saddle-cloth from Ninive.

Fig. 8
Early representation of a "textile motif" (ca 2000 BC), Kültepe, Anatolia.

Fig. 9
Illustration of tapestry-woven clothes on a Greek vase.

Fig. 10
Tapestry-woven jacket, Southeast Anatolia, 19th c.



time: only two kilims were allowed for the funeral, one was for the bier and the other covered either the coffin or the body of the deceased[30]. In those days, the funeral kilim was probably a status symbol as it is still today. The tradition of the funeral kilim recalls the story of Penelope who spent many years weaving a lavish funeral kilim for Laertes, her father-in-law[31].

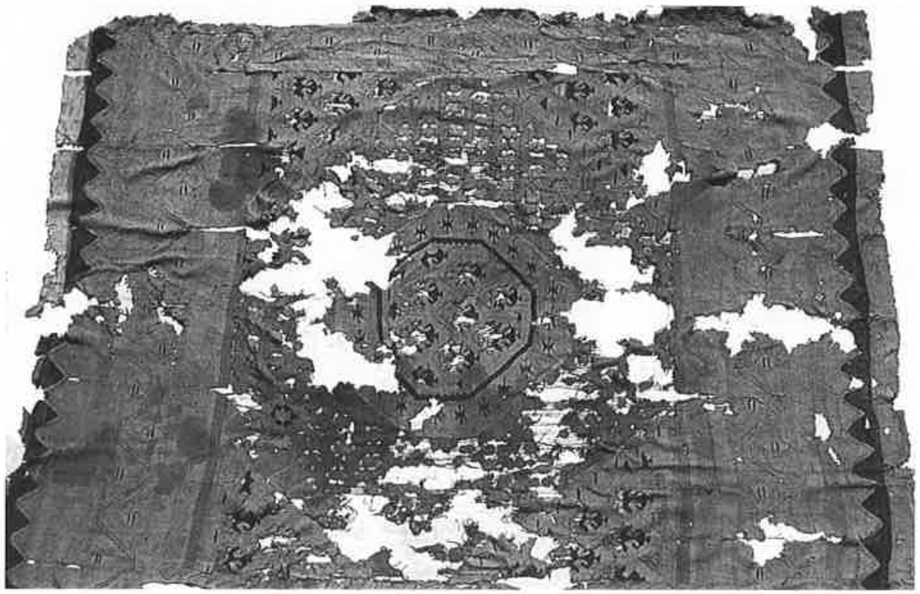
A small tapestry woven fragment[32] from the At Thar cave south of Baghdad, dating from BC 300–300 AD, looks much the same as a fragment from Anatolia that will later on be described in detail. Another fragment[33] from the same cave reminds us of the so-called floral kilims[34] from the urban workshops of western Anatolia.

There are a number of famous tapestries with naturalistic motifs dating back to the late antiquity. They are known to us from the Abegg-Stiftung at Riggisberg, Switzerland, and from other large museums. Fig. 11 presents an example of Coptic textile production, a fragment with a particularly decorative medallion, from the 5th century.

A large tapestry-woven rug from the collection of the Vakıflar Museum in Istanbul (Fig. 12) has been dated to the 7/9th century by a radiocarbon test carried out in 1981[35]. The colour scale of this early woollen tapestry weave (S-spun) found in Turkey consists of a faded red, natural brown, blue and yellow.

In 1995, a Byzantine watch-tower and a cave were investigated in a narrow part of the valley of the river Kızılırmak, near Kayseri. In the front part of the cave, a number of storage vessels were found sunk into the ground. Obviously the niches at the back of the cave had occasionally been used as burial places. Several different remnants of textiles were discovered in a heap of rubble at the entrance to the cave[36]. I first had a chance to look at these fragments in the summer of 1996. In the run-up to the Liestal Kilim Symposium in 1997, a small Z-spun woollen tapestry fragment (Fig. 13) was radiocarbon dated between 779 and 984 AD (95% confidence limit)[37]. The comparison with the fragment from the At Thar cave near Baghdad suggests the same pattern as the one in the small Anatolian fragment.

Besides these small pieces of tapestry woven textiles there is a group of fragments assigned to the early Islam period (8/10th century) and to the Egyptian culture. One of the apparently best preserved specimens from this group is kept in the David Collection in Copenhagen[38].



A further piece of early tapestry weaving is the fragment of a silk weave from the turn of the first millennium AD which is today part of the treasure of Halberstadt cathedral and has been repeatedly published[39]. The silk of this fragment is S-spun while the motifs in the tapestry are reminiscent of forms in Anatolian kilims.

Another example of the kind is the so-called Gereon carpet from Cologne[40] dated to the 11th century. The motifs applied in this textile are also called Byzantine or Near Eastern[41]. Both the linen warps and woollen wefts are Z-spun. The Age as well as the origin of these pieces are still disputed. I would suggest two possible classifications:

1. They might be tapestries from the time of the Tulunides (between 868 and 905 AD). At the time, Ahmet Ibn Tulun founded the first independent Islamic dynasty in Egypt and Syria. By the time the dynasty became extinct after only 37 years, Ahmet's son had had 600 weavers come into the country from Anatolia[42].
2. Because of the different directions of spin (some pieces are S-spun, others Z-spun) the textiles ought to be assigned to the region of Egypt as has already been suggested, or to the area of Northern Syria or Anatolia. Colours and motifs are generally orientated towards Syrian/Anatolian forms and colours and have only very little in common with those in Egyptian/Coptic tapestries. Therefore I presume that the textiles or at least the weavers came from northern Syria or Anatolia. The demand for reliquary cloths was obviously so great at the time that the women produced them in special weaving centres. Such textiles were presumably made in the period between the 8th and 12th century AD.

Another rich source of early textiles is Swanetia, a remote mountainous region of the Great Caucasus in Georgia. Important valuable objects from monasteries and churches in the lowlands were hidden in this part of the high mountain area when the Mongols and Turks marched through the country. Families from Ushguli, which at an altitude of 2200 metres is the highest permanently settled place in Europe, gave shelter to relics, crosses and icons in their fortified towers. Some of these objects remained with them and were eventually regarded as some sort of patron saints. Even today, they are said to guarantee the survival of the family. The tapestry-woven silk textile in Fig. 14 is a particularly precious example from the Swanetian finds. The cloth was used for wrapping up and protecting an icon and was worshipped because of its function. One of the Fathers of

Fig. 11
Tapestry-woven textile fragment, Egypt, Coptic, 5th century AD.

Fig. 12
Large tapestry-woven rug, Vakıflar Museum Istanbul.
A radiocarbon test caried out in 1981 dates this large rug to the 7/8th century AD.

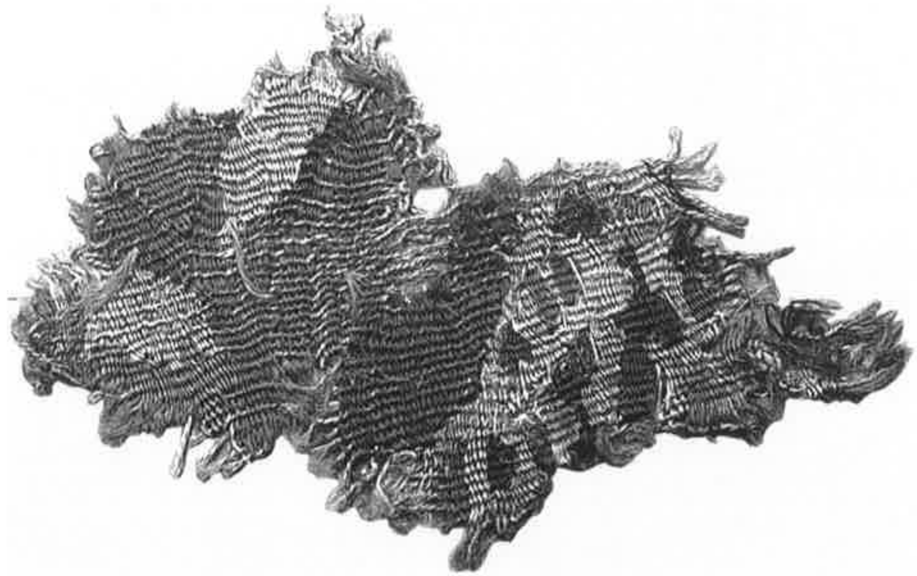
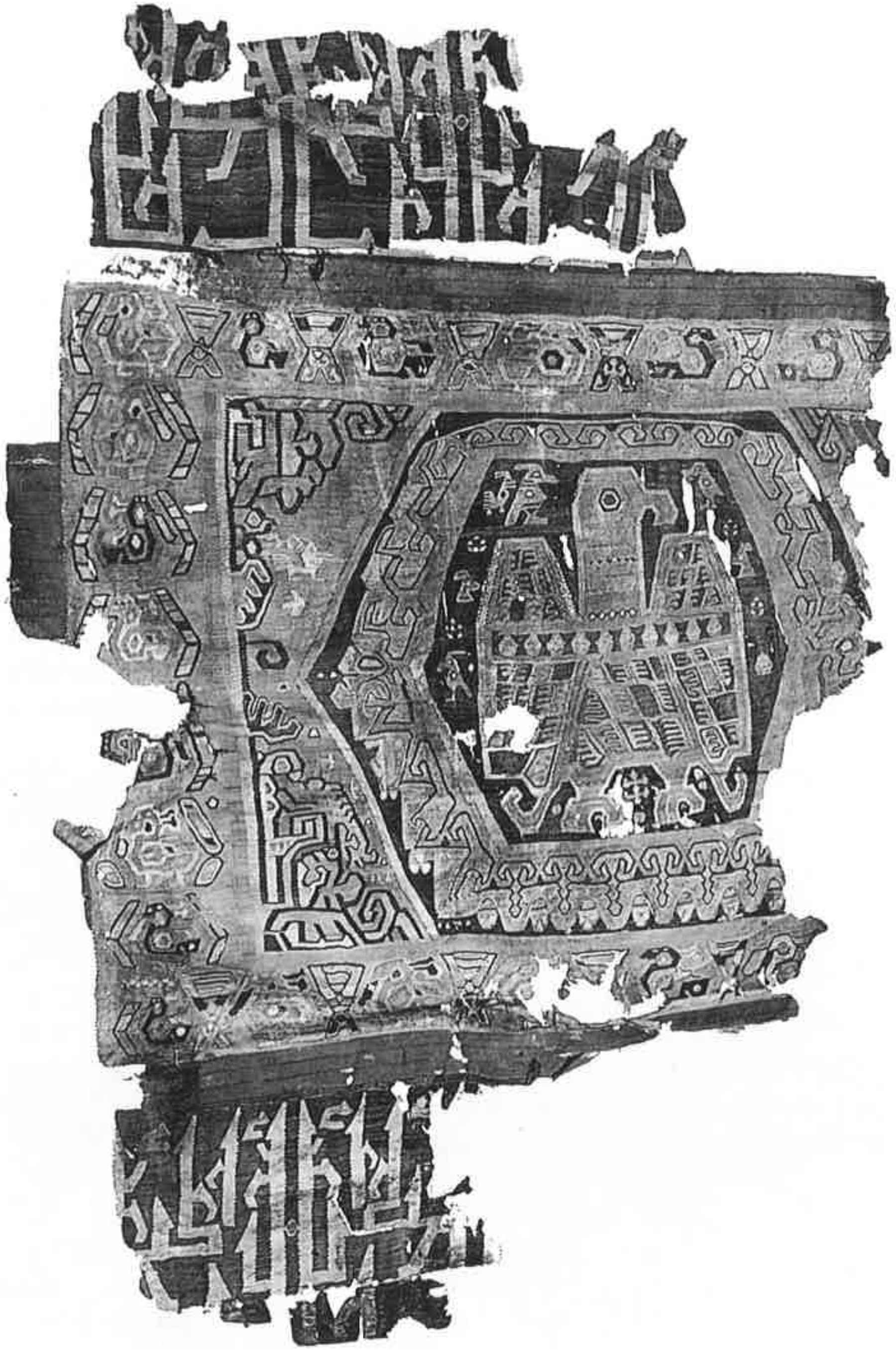


Fig. 13
Tapestry-woven fragment, S-spun wool, probably Anatolia, ca 10 cm long, 8th–10th century AD.
In 1995, a Byzantine watch-tower and a cave were investigated in a narrow part of the valley of the river *Kızılırmak*, north of Kayseri. In the front part of the cave, a number of storage vessels were found sunk into the ground. Obviously the niches at the back of the cave had occasionally been used as burial places. Several different remnants of textiles were discovered in a heap of rubble at the entrance to the cave. In the run-up to the Kilim Symposium, this small Z-spun woollen tapestry fragment has been radiocarbon dated.
Radiocarbon age: 1165 ± 45 y BP
Calibrated age (95% confidence limit)
AD 779–984 (100.0%)



the Church is reported to have brought the icon and cloth to Georgia on his way from Cappadocia via Syria. Radiocarbon dating of a sample showed that the textile originates from between 1164–1291 AD (95% confidence limit). The question whether the fabric really comes from Cappadocia or from one of the monasteries in northern Syria, cannot be answered here. Certain Byzantine representations of birds do compare with the eagle illustrated here. Moreover, the composition of colours and patterns seems to suggest Cappadocian origins.

The composition is made up of borders on a blue foundation and yellow pseudo kufic forms[43], with a plain red band surrounding the central field. This consists of another border with illustrations of birds and a big eagle in the centre. The patterns of this tapestry compare favourably with those in coarsely knotted woollen Anatolian rugs dating from the same period. The border in a large fragment of a so-called Seljuk rug in the collection of the Museum for Turkish and Islamic Art in Istanbul is similar although the forms in the central field are geometrical and filigree (cf. Figs. 11 & 13, p. 179).

Because of its close relation to Byzantine Anatolia as well as to eastern countries, Georgia still holds quite a few textile surprises.

Fig. 14
Tapestry-woven textile fragment, silk, ca 68 × 60 cm. Probably Anatolia.
State Museum of Art, Tiblisi, Georgia.
The silk tapestry is a particularly precious example from the Swanetian finds.
The cloth was used for wrapping up and protecting an icon and was worshipped because of its function. One of the Fathers of the Church is reported to have brought the icon and cloth to Georgiaon his way from Cappadocia via Syria.
Radiocarbon age: 805 ± 45 y BP
Calibrated age (95% confidence limit)
AD 1164–1291 (100.0%)

Numerous precious textiles from different parts of the Near East and Asia served as lining material for valuable icons and high crosses, being between the silver and wood. The textile in Fig. 15 was used for wrapping up relics. The illustration represents two birds and a tree of life. In the majority of related illustrations we know of, the birds turn towards the tree of life, but here they turn away from it. A similar arrangement can be found in a 13th century silk tapestry weave from Cologne[44] which was also used as a reliquary cloth. Presumably, the remains of a saint or an important person were kept in the cloth. Today, the tapestry is part of the treasure of Cologne cathedral.

In today's Anatolia the coffin of a deceased is often covered with a kilim on the way to the cemetery and the kilim is donated to a mosque after the funeral. This tradition is, in a broader sense, much the same as the wrapping up of relics in precious tapestries in former times. An example of this tradition is the burial kilim of Mehmet Bezgen (Fig. 16) who died August 8th, 1967.

1 Bar-Yosef 1985 (9000 year old finds).
2 Hijara 1978, pp. 125–128.
3 Helback 1963, pp. 39–46.
4 Cf. note 2.
5 Mellaart/Hirsch/Balpınar 1989, Vol. III, 1989, pp. 86–87.
6 Mellaart/Hirsch/Balpınar 1989, Vol. III, 1989, pp. 86–87.
7 See notes 1, 3, 6.
8 Mortgat 1982, Fig. 65.
9 Woolley 1934, p. 238 ff.
10 loc. cit.
11 Parrot 1958; Mortgat 1959.
12 Barrelet 1977.
13 Mayer, and many others.
14 Charpin.
15 Mellaart/Hirsch/Balpınar 1989, Vol. III, 1989, pp. 51–54.
16 Barrelet 1977, Köcher 1957/58, P. 300.
17 Illustrated in: Balpınar/Hirsch 1988, Plate 7.
18 Mellaart/Hirsch/Balpınar 1989, Vol. III, 1989, p. 54; Riefstahl 1944.
19 Carter et al. 1904, see also: Barber 1991, p. 157 and colour Plate 1.
20 Hirsch 1991.
21 Pfister 1937; Riefstahl 1944, pp. 25–26, see also: Barber 1991, p. 159.
22 Akurgal/Uygarliklari, 1987.
23 Akurgal/Uygarliklari, 1987.
24 Akurgal/Uygarliklari, 1987, p. 168, Fig. 132. See also: Mellaart/Hirsch/Balpınar 1989, Vol. III, p. 102, pl. XXVII, Fig. 9.

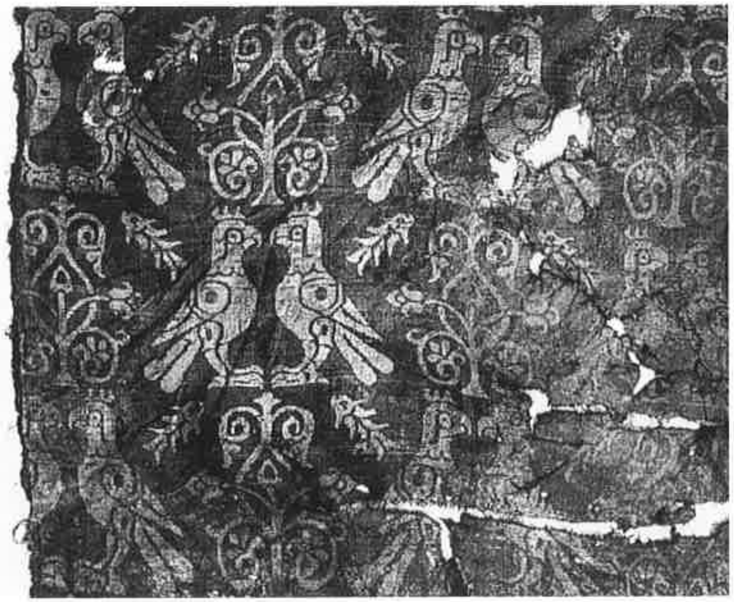


Fig. 15
Textile fragment, found in Swanetia, Georgia. The textile fragment was used for wrapping up relics. The illustration represents two birds and a tree of life.

Fig. 16
In today's Anatolia the coffin of a deceased is often covered with a kilim on the way to the cemetery and the kilim is donated to a mosque after the funeral. This tradition is, in a broader sense, much the same as the wrapping up of relics in precious tapestries in former times. An example of this tradition is the burial kilim of Mehmet Bezgen who died August 8th, 1967.

25 Akurgal/Uygarliklari, 1987, p. 168, Fig. 132. See also: Mellaart/Hirsch/Balpınar 1989, Vol. III, p. 102, pl. XXVII, Fig. 10.
26 Young 1975; Ellis 1981.
27 Bellinger 1962; see also: Mellaart/Hirsch/Balpınar 1989, Vol. III, p. 101, pl. XXVII, Fig. 6–7.
28 Barber 1991, pp. 377–380.
29 Balpınar 1984, p. 43, Fig. 25 and colour Plate 6.
30 Kurtz/Boardman 1971, pp. 200–201.
31 A picture on the famous vase from Ciusi, beginning of 5th century BC, shows Penelope in front of the completed textile, cf. Furtwängler 1932, Plate 142; Barber 1991, Fig. 3.26, p. 108.
32 Fujii 1982/83, Plate 10, pp. 89–96.
33 Fujii 1982/83, Plate 10, pp. 89–96.
34 Cf. Vok 1997, Plates 1, 2.
35 The radiocarbon dating was carried out according to the so-called gas tube counting method which is no longer applied today. With this method, a thousand times of the amount of sample material is needed than it is the case if the up to date AMS (Accelerator Mass Spectrometry) method is applied. A sample of wool was measured by Prof. Dr. M. A. Geyh at Niedersächsisches Landesamt für Bodenforschung in Hannover on May 30, 1981. The measuring results were as follows:

lab. Han.	name of sample.	conventional ^{14}C-age [years before 1950]	$\delta^{13}C$	[calib. age [BC/AD]
10693	Istanbul Kilim	1285 ± 55	−21.5	620–730 AD

Unfortunately, it has not been possible to achieve a recent dating by means of the AMS method because there was no other sample of wool of the kilim available at the time. However, Dr. Bonani has kindly offered to convert the previously taken ^{14}C-results into units of age by the calendar with the help of a modern calibration programme:
(95% confidence limit) 661–876 AD (100%).
36 Private Information from a local dealer.
37 For the complete radiocarbon dating result see p. 245.
38 The David Collection, Copenhagen, inv. no. 1/1989. A colour illustration of the item can be found in: The HALI Annual no. 1, p. 21, Fig. 11. Several other fragments of this group from the collection of the Egyptian Museum in Cairo are illustrated in: Cassin 1990. According to Cassin two fragments are Z-spun.
39 The fragment (inv. no. 318) from the treasure of Halberstadt cathedral is mentioned and illustrated in: von Wilkens 1997, p. 157, Fig. 84. Von Wilkens dates the piece to the 2nd half of 10th century. A colour illustration of a detail of this fragment can be found in: Museum Nienburg 1990, p. 43, Fig. 3.
40 Legner 1985.
41 Legner 1985.
42 Encyclopaedia Britannica.
43 In my view, this purely symmetrical motif must be an ancient symbol for a deity. Slightly varied forms of the same motif are known from 14th century BC, Egypt and 2nd century BC, Northern Mesopotamia and Anatolia.
44 Legner 1985, Vol. II, p. 444.

Harald Böhmer

Chemical-Physical and Biological Investigations and Notes on the Aesthetics of Colours

Colours in Flatweaves

All cats are grey at night and so, of course, are all kilims. In order to see and enjoy colours we need light. When light shines on an Anatolian kilim it has all the colours of a rainbow (Fig. 1, Plate 31). Indeed, it is even more colourful since it contains one colour which the rainbow does not have: namely violet.

The rainbow is a spectrum (Fig. 2), which is seen when sunlight is separated by a glass prism and impinges on a white screen. In an actual rainbow raindrops play the part of the prism. The colour scale of the spectrum ranges via continuous transitions from blue over green, yellow and orange to red. Two numbers are given on the horizontal scale: 380 and 680. These stand for nanometers (nm), and represent the wavelengths of the electromagnetic radiation which call forth colour impression. Light of short wavelengths begins at 380 nm and gives the colour impression of blue, long wave light ends at 680 nm and activates the colour impression of red. Thus, a certain wavelength is responsible for a certain colour impression, or put in another way, a certain colour impression, e.g., yellow, is associated with a specific wave with a specific wavelength[1]. However, it is also possible to fool the eye: the combination of two different light rays, one from the green spectrum region, the other from the red spectrum region, give the impression of yellow. The eye can not distinguish whether a particular colour impression is created by rays of a single wavelength or by a mixture of rays of different wavelengths. Let us return to the impression of the colour violet: there is no light ray with a specific wavelength which creates the colour impression of violet. This is formed by two different rays which individually give the colour impressions blue and red, but which together create the colour impression of violet.

In order to represent the many different colour impressions possible to the human mind, we must bend the spectrum in such a way that the two ends – red and blue – overlap. This creates the colour circle

(Fig. 3). At the overlap we find the place of the colour violet. Our kilim contains the colours red, orange, yellow, green, blue and violet from this colour circle. But accurately expressed this is wrong: the colours are not contained in the kilim. They only exist in our brain as colour impressions; they can not be reached, they have no material existence. The "pigmentary reality of colour" to which textile experts occasionally refer does not exist, neither in the object nor elsewhere.

The colour red as an example

Let me explain this more closely with the colour red. You consider a red motif in the kilim. The schematic drawing in Fig. 4 represents the naive explanation how we obtain the impression of "red": white light falls on the kilim, a portion of this is absorbed, another portion is reflected. Red light falls on the retina of the eye. In the brain is formed the colour impression "red". That is the naive conception of colour, coloured light and colour impression, with which we all approach the phenomenon colour. This explanation is not only naive, it is false. Fig. 5 is closer to the correct relationships. There is no red light, no white light or light of any other colour. There are only electromagnetic waves which can be accurately described physically and mathematically, and some of which set in motion physiological processes in the retina which are transferred by means of nerves to the brain where they finally give rise to colour impressions, in our example "red". In order to make life easier we attribute "red" in our brain to the light which reaches our eyes and speak of red light. Finally we also attribute the colour "red" to the object from which the red light emanates. We speak of the colour red which adheres to the object. We speak of red dyestuffs. This simplifies the linguistic understanding about colours. But this way of speech – represented in Fig. 4 – is far away from reality. We should always remind ourselves of this: Colours do not belong to the objects. How often do we hear: "I must see this kilim in daylight to see its true colours." The impression of a colour in daylight is, so to speak, taken as a standard, as the true colour. But there are no true colours. There are only colour impressions and these are different in daylight, in neon light, in halogen light and in candle light, etc.

Harald Küppers gives a short and apt formulation of these concept in his new theory of colour: "The external world is colourless. It is composed of colourless materials and colourless energy. Colour exists only as a sensory experience of an observer[2]."

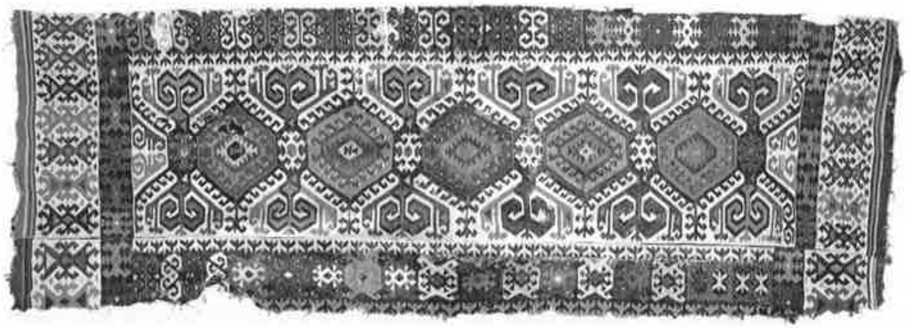


Fig. 1
Kilim, woven in two panels, 435 × 152 cm, Central Anatolia, private collection (illustrated in colour on Plate 31).
Radiocarbon age: 290 ± 25 years BP.
Calibrated age (95% confidence limit):
AD 1516–1591 (50.4%)
AD 1622–1663 (49.6%)

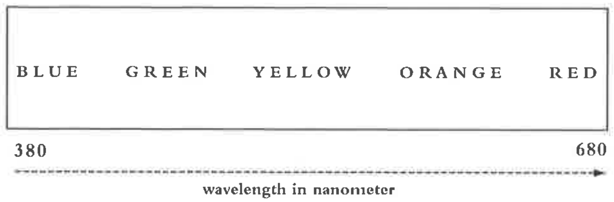


Fig. 2: Spectrum of sunlight.

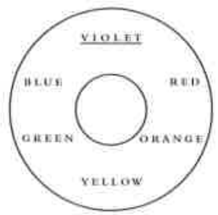


Fig. 3: Colour circle.

Colours are sensations, i.e., subjective, and therefore also relative. In this way, it is surprising that we can speak about colours and understand one another. This has a biological explanation: apparently the colour perception apparatus in the brain of many people, perhaps in all, is genetically similar and therefore structured similarly. All of us, after all, according to the results of the DNS-researchers, stem from the same Adam and Eve, who, many thousands of years ago – I do not remember the exact number – escaped from the savannah in Africa and whose children and children's children conquered the whole world. In passing down this genetic code for colour vision there occurred small faults which, in the case of 8% of men resulted in an inability to distinguish between red and green. It would be interesting to know how many red-green colour defectives there are among textile enthusiasts.

Introduction of a kilim

After so much theory – and perhaps also confusion – we return to the familiar subject: the kilim (Fig. 1, Plate 31): It has a total of five hexagons in the field. It was woven in two pieces. One consists of the field and one border, the other of only one border. Whether the separately woven border was intended for this kilim is doubtful. The design is different, on the other hand, the colours are almost identical with those of the larger piece which includes the field and border.

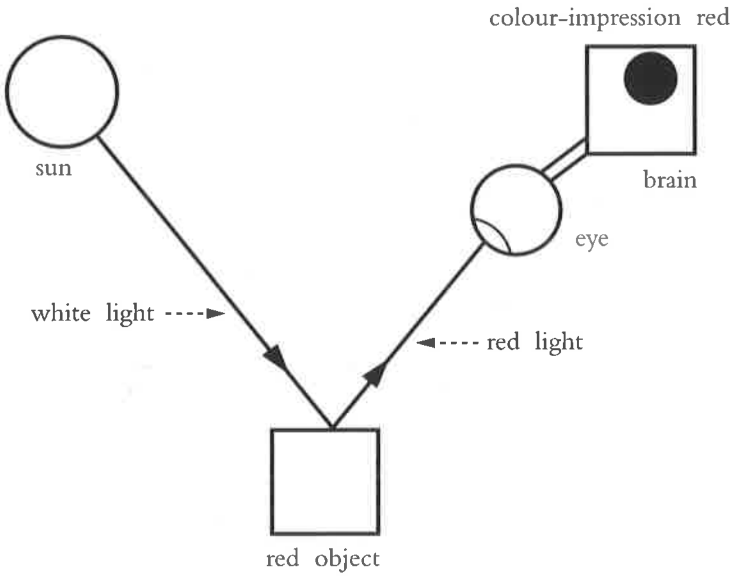
The place of origin is probably Central Anatolia. I avoid the term "Cappadocia" because it easily suggests that the kilim was woven as domestic product of a weaver who was part of the Greek population which lived together with the Muslims until the ethnic population exchange in 1923. I believe this kilim to be the work of a Turkish nomad woman. I shall not discuss the design or ornaments and I shall not search the tangled branches for a hidden "Goddess of Anatolia". I only offer my opinion that the weaver or weavers did not steal from an Ottoman carpet. My cautious estimate of its age is first half 19th century or earlier. The subject of the following discussion are the colours of this kilim.

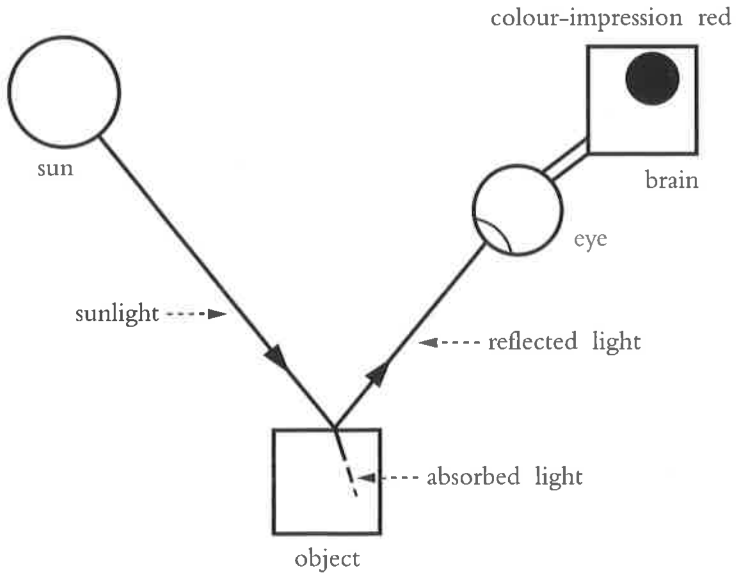
Dye analyses of the Anatolian kilim (Fig. 1, Plate 31) **and their interpretation**

I intend to name the analytical methods but not to discuss them in detail. They are two: thin layer chromatography (TLC), in which

Fig. 4
Colour vision, schema 1 (incorrect, far from reality).

Fig. 5
Colour vision, schema 2 (correct, nearer to reality).





my Turkish colleagues and I have twenty years experience, and spectrophotometry in the region of visible and ultraviolet light, in which we can also call on many years experience. A modern computerised spectrophotometer, is available to us on loan from the DFG (Deutsche Forschungsgemeinschaft). Radiation of continuously variable wavelengths in the visible and ultraviolet regions pass through solutions of dyestuffs. Simple absorption curves look, e.g., like Fig. 6. These are the curves for dye stuffs of three dye insects. They appear rather similar but one click on the mouse forms the first derivations (Fig. 7). Their course already shows marked differences so that the red colour with kermes – the broken curve – can be easily distinguished from the red colours obtained with lac and Ararat-kermes.

Red

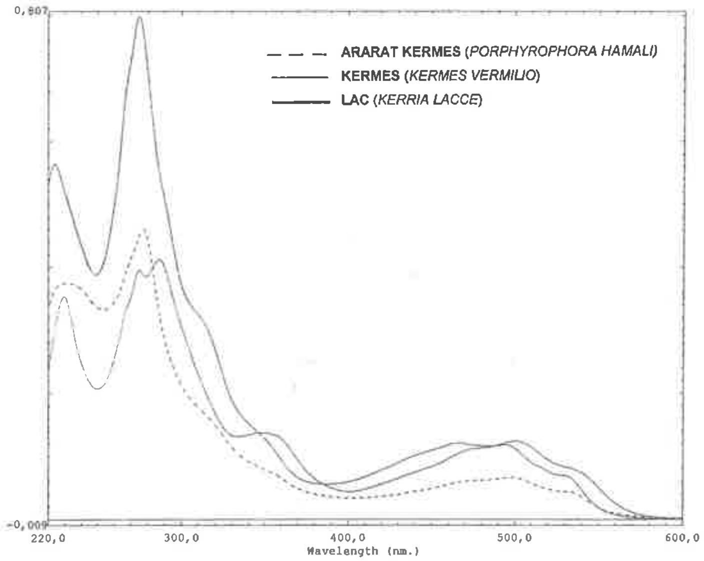
The kilim has three different shades of red: dark red, red and light red. First the results of the analysis of the red. As was to be expected, this was dyed with madder. It shows the three main dyestuffs characteristic for madder: alizarin, pseudopurpurine and purpurine. It is also possible to conclude something about the method of dyeing. The dye was applied hot. The pseudopurpurine is converted to purpurine at elevated temperature. Fresh madder roots contain hardly any purpurine. Purpurine is formed slowly during storage. This chemical process is accelerated by heat, particularly when the dyeing is carried out warm or even hot.

$$\text{pseudopurpurine} \xrightarrow{\text{Heat}} \text{purpurine} + \text{carbon dioxide}$$

The madder plant, *Rubia tinctorum* is a dye plant with phenomenal characteristics. Up to eighteen different dyestuffs may be contained in old roots.

Dark red

The dark red is a cool shade similar to cochineal red. The analysis also shows how this cool effect, i.e., the blue constituent, is achieved: the madder dye used in this case contains small amounts of indigo! I.e., either before or after dyeing with madder, the wool was dyed with indigo.



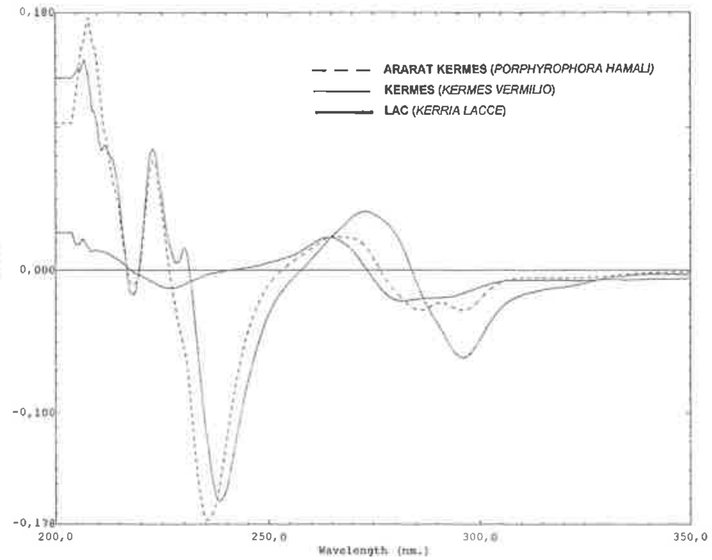


Fig. 6
Absorption curves from three different insect dyes: kermes *(Kermes vermilio)*, Cochineal *(Dactylopius coccus)*, lac *(Kerria lacca)*.
All curves have a similar course.

Fig. 7
First derivation of the absorption curve of dyestuffs from three different dye insects: kermes *(Kermes vermilio)*, Cochineal *(Dactylopius coccus)*, lac *(Kerria lacca)*.
The course of the kermes curve is clearly different from the others.

Light red

Of the three madder dyes mentioned, this dye had a low alizarin content and a higher content of purpurine and pseudopurpurine. About the dyeing method it is possible to say the following: dyeing was carried out in a used dye bath. In the first, darker red dyeing, alizarin is taken up by the wool fibres in preference. The subsequent dyeing was apparently carried out very hot, perhaps at boiling point. This would explain the high proportion of purpurine.

Almost twenty years of experience with madder dyeing has taught us that red from such a second dye bath changes from an orange red to a light red, that is, thus it lightens without a yellow content to pink ("altrosa" in German). This is due to the high content of purpurine and pseudopurpurine and of by-products which are not quite as lightfast as alizarin, most of which had already been drawn onto the fibre in preceding dye process.

When this kilim was taken off the loom, this red probably looked different: a little darker and more toward yellow-red. The light red or pink which is known on many old kilims is therefore the result of an ageing effect or patination.

Violet

The brilliant violet too is a pure madder dyeing. It contains large amounts of alizarin, less pseudopurpurine and hardly any purpurine. Here too the analysis gives us information about the dyeing process: it was performed cold or at an only slightly elevated temperature, up to approximately 30 degrees Celsius at which there is hardly any conversion from pseudopurpurine to purpurine. Alizarin and pseudopurpurine are the main components on the fibre. The mordant contains iron.

Since 1982 we have known how to dye violet with madder on an iron mordant[3]. It is unnecessary to heat the dye beyond 30 °C. However it is necessary to use large amounts of madder, up to three times the weight of the wool. The dye bath should be in the acid range. Our own dyeing experiments show that of the three important dye constituents of madder, only alizarine without addition of acid yields violet on iron mordant. On the other hand, if acid, e.g., sour milk, is added to the mordant solution, violet is obtained with all three constituents - alizarine, pseudopurpurine and purpurine.

Let me finally add two byways to violet dyeing: This simple and

Fig. 8
DC-analysis of a red dyeing with madder, schematic.

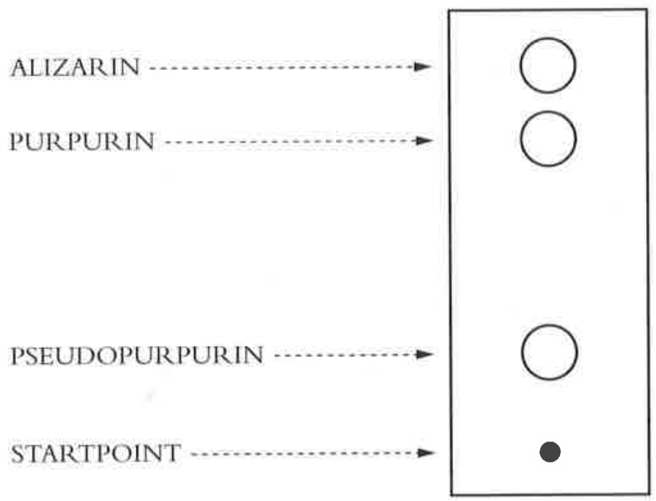
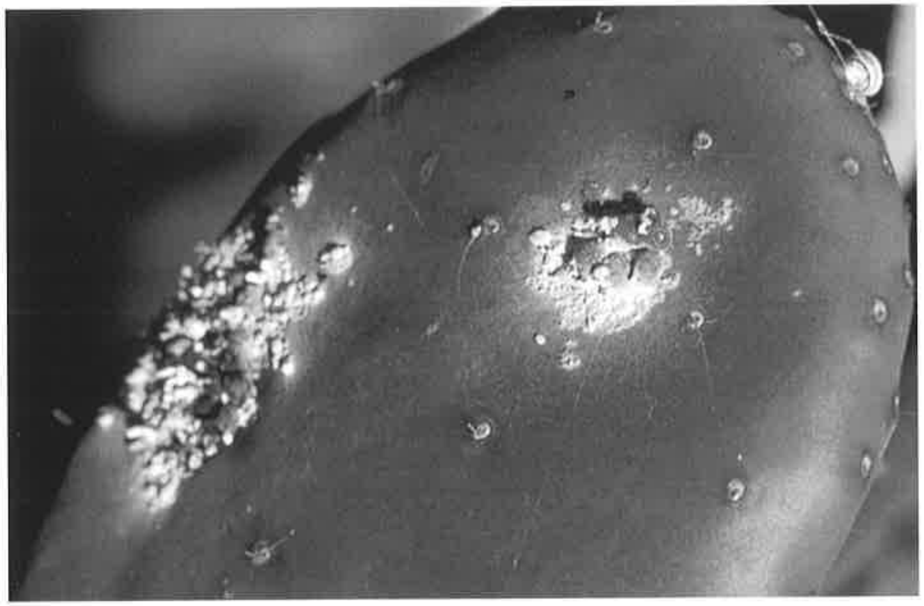


Fig. 9
Cochineal lice *(Dactylopius coccus)*, on a fig cactus.



inexpensive violet – a "people's purple" – looks almost the same as the expensive purple from the purple-snail. In fact, the "real" purple is not a red, but a violet. The purple dye is chemically related to the blue indigo. That is already clear from the scientific name for the dyestuff: dibromindigo. A violet which is occasionally found in kilims is a mixture of indigo and cochineal. It has a kind of abrash, the colour shade varies in a narrow range between violet and blue-red. This is the result of a non-homogeneous distribution of the indigo dye. Fig. 9 shows parasitic cochineal shield-lice upon a fig-cactus on the island of Lanzerote.

Orange

This is a mixture of madder dyes and yellow dyes. The combination of three yellow dyes found here only occurs, to our knowledge, in "dyers" camomile (Anthemis tinctoria). This is a camomile plant whose blossoms are a pure yellow. The camomile plant needs warmth but does not make much demand on the soil. It is found in many areas of Turkey (Fig. 10). Of the typical red dyestuffs in madder, purpurine is missing in this orange. That is the composition is similar to that of violet. Apparently it was produced without much heat. The mordant cannot be iron since, in that case, the result would not be orange, but an ugly brown.

Blue

The blue contains indigo and no indigosulfonic acid. When indigosulfonic acid is dyed on unmordanted wool it can be recognised by the fact that it easily runs and often that it has already run. When it is applied onto wool mordanted with alum, it does not run but yields a blue without abrash.

The Crivelli-star of a Kırşehir carpet of the 19th century (Fig. 11) contains a light blue, an indigosulfonic acid blue. The reader may note: not every carpet with the Crivelli-star must be from the 15th century. This star has survived in Turkish carpets until well into the 19th century.

Yellow

In the case of yellow, which had not shown fading, I was fairly sure what to expect from the result of the dye analysis. It had to contain a lightfast dye, the one with the best lightfastness is luteolin from "dyers" weld, *Reseda luteola*. Here comes the dye analysts declaration

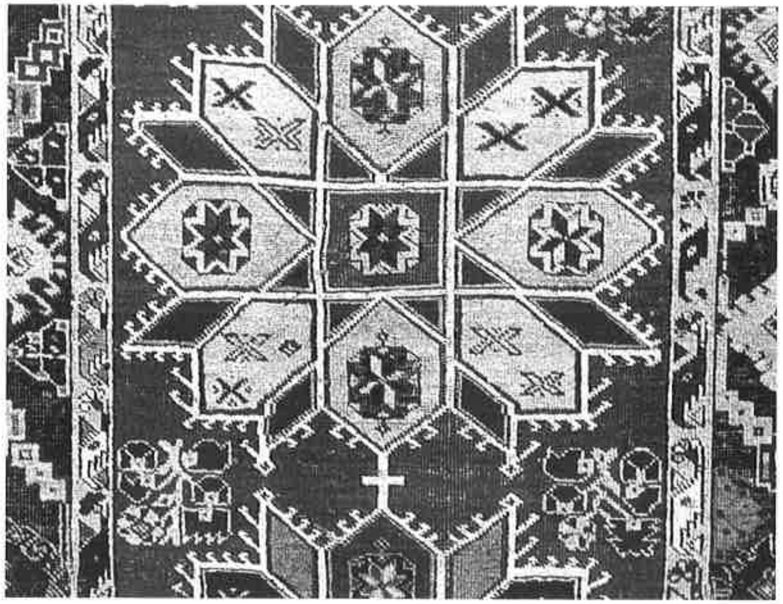


Fig. 10
Dyer's camomile *(Anthemis tinctoria)*.

Fig. 11
Kırşehir rug, last third 19th century with indigosulphonic acid blue in the Crivelli-star.

of bankruptcy: no luteolin was to be found! Indeed, we were unable to find any of the known dyestuffs and not even an unknown one. My colleagues and I searched indefatigably, even for instance for *Crocetin* from Saffron. It is a yellow dyestuff x which is apparently destroyed as soon as it is dissolved from the fibre. Even my experienced mentor, Helmet Schweppe cannot offer any clue.

I have twice before been confronted with a yellow which has not been possible to isolate and identify; namely in so-called Konya carpets. They remain as unsolved puzzles – mysteries – in the analysis of natural dyes.

Green

What began in the yellow continues in the green. Here too we failed to insulate and identify the yellow component. The unknown dye material for yellow was therefore used also for the green. The blue component is, of course, indigo, not indigosulfonic acid.

Green → brown

If indigosulfonic acid had been present, something could have occurred, in fact, the conversion of green via olive into a brown which resembles undyed camel hair. Through dye analysis we have known for some time, how this type of "camel hair" is produced. The original green contains as blue component indigosulfonic acid and as the yellow component emodine, which is extracted from the root of types of sorrel (Rumex) (Fig. 12 and 13). If over the years the kilim is washed several times the blue component is washed out. Traces will often remain in the white warp where they will be visible to the naked eye as a blue film. A characteristic of the sorrel dye is that it changes in the course of time from yellow to brown. This brown remains and is very similar to the shade of actual camel hair.

If the kilim enthusiast is offered a "real nomad piece with brown camel hair", he should remain sceptical and look for a blue residue in the warp – or even better – send a yarn for analysis to the Laboratory for Natural Dyes at Marmara University[4]!

Brown-Black

During the analysis tannins are dissolved from the fibre and their existence can be demonstrated. The fibre remains dark brown. In this case, natural black or brown wool was lightly overdyed with

Fig. 12
The root of sorrell *(Rumex)*, cross-section. It contains the yellow dyestuff emodine.

Fig. 13
Sorrel *(Rumex)*.

tannic acids and iron as mordant. Tannic acids and iron yield black. Ink too used to be produced in this way.

Options for dyestuffs for such black colourings are gall-nuts and acorns. Both contain large amounts of tannins, and for this reason are also used for tanning leather. In the presence of light, a combination of tannic acids and iron may result in corrosion of the wool, a phenomenon which is familiar to all connoisseurs of kilims and carpets. In the present kilim the corrosion effect, i.e., the breakdown of the black wool, is slight. That does not mean that the age of the kilim is low. It indicates that a weak dyeing was performed and this is confirmed by the analysis. The wool was already a natural black. The aim was to retouch, in the knowledge that natural black wool is not lightfast and changes to brown in the course of time.

This at least is true for Anatolian fat-tailed sheep as it is for sheep of the Navajo Indians of the U.S.A. Dr. John Sommer (San Francisco) has kindly sent me a photograph of a Navajo sheep which was protected with a blanket for a whole summer against direct sunlight. After the blanket was removed the black wool remained on the back and sides of the sheep, while that on unprotected parts as the neck and head, had been bleached.

Colour aesthetics – colour harmony

After examining the individual colours we can return to a consideration of the kilim as a whole. In asking, finally, "is the kilim beautiful?" and "has the kilim harmonious colours?" I shall progress some little way into aesthetics, especially into the aesthetics of colour, and with that onto dangerously thin ice.

I have recently read a series of more or less modern works on the theory of colour, among them the works by Johannes Pawlik[5], Johannes Itten[6], Harald Küppers[7], and Hideaki Chijiiwa[8]. In all these works one would look in vain for clearly formulated and rational rules of harmony. None of the German speaking authors writes "such and such colours in combination are in harmony", or "such and such colours are not in harmony". For the Japanese author Hideaki Chijiiwa the number of colour combinations which are indicated as harmonious by such terms as "striking", "exciting", "young", "feminine", etc., is inflationary. Harald Küppers, whom I respect greatly is very cautious, and although he called one of his books "Harmonielehre" (theory of harmony) it is more of a theory of the order of colours. Küppers writes: "There are people whose sensitivity and taste for colours is highly developed, and others with no sensitivity for colours and colour harmony whatever. However, most people have a perfectly normal sensitivity for colour. This is more or less developed according to the degree to which the concern with colours is professional or from his own interest. For one person this talent may have been stunted, for another strongly sensitised. In any case it may be assumed that every human being with a normal colour sense, possesses the potential to unfold his individual colour taste." Thus Küppers. The word "taste" turns up many times, but nothing is said about "laws" – their recognition or formulation. We are moving over a very difficult terrain. The human eye can distinguish up to a million nuances of colour. The chemistry of colours continuously bestows new dolorous ones. Consider the shrill red and glaring yellow warning colours on the clothes of the motorway workers. The intensity of these new colours breaks through every colour circle.

Goethe had it easier. In his time the kingdom of colours was not so rich as today. When Goethe arranged the colours in his paint box in a colour circle, the result was not a shrill coexistence but always tolerable. It is easier to create laws of harmony with such muted colours. Goethe did this in his colour theory[9]. Today's authorities often return to this. In Goethe's colour theory, which includes a theory of harmony, the term "totality" plays a central role. A single colour can not satisfy our striving for harmony. Two are enough, but not two colours which are adjacent in the colour circle, only colours in opposite positions or separated by at least one other colour. Concerning adjacent colours, Goethe writes: "Yellow and green together always has something in the vulgar sense cheerful in common; but blue and green always something in the vulgar sense repulsive."

I have been told that the combination of blue and green is actually fashionable. Thus Goethe's statement on the subject of harmonic colour combination have no general validity, or they can be cast out by the trendsetting fashion dictators.

Let us return to Goethe's assertions about the different harmonious colour combinations and name them: The first group of harmonious colour combinations are those which in the colour circle (Fig. 2) are separated by another colour: yellow/blue, yellow/red, blue/red and orange/green, orange/violet, green/violet. The second group are the opposite colour pairs, which are also called complementary colours: yellow/violet, green/red, blue/orange. Three colours in combination can have an even more harmonious effect, these can only be the three colours which in the colour circle can be joined by equilateral triangles, i.e., yellow, blue and red; or green, orange and violet. The zenith of colour harmony – the totality – is reached if all colours are present. The rainbow is not sufficient for this, since it lacks violet. It must be the whole of the colour circle. To quote Goethe: "In this way the actual harmony can be achieved only when all colours together are brought into equilibrium." In this case, however, we arrive near a motley. Goethe says to this: "Nature men, vulgar peoples, children, have a strong tendency toward colour in its highest energy state, and particularly to yellow-red. They also have a tendency toward the multicoloured. However a motley comes into existence when colours are combined in their highest state of energy without harmonious equilibrium. If, though, the harmonious equilibrium is achieved through instinct or by accidental observation, a pleasant effect is achieved."

If, then, I consider this kilim (Fig. 1, Plate 31) again, I experience the effect of its six colours, which correspond to the six main colours of the colour circle, as pleasant. They stand in an harmonious relationship to one another. Also the colours do not jostle each other randomly. They are often separated by the colour brown-black which softens the contrasts. Between the hexagons in the field lie huge forms, which can be regarded as flower calyxes. In each, two colours oppose each other separated by brown-black. The colour pairs are:

- blue with dark red and blue with light red
- orange with green and orange with black
- violet with orange and violet with green
- light red with green
- and finally, blue with violet

The pair blue/violet are neighbouring colours, whose combination, according to Goethe should not be harmonious. All the other pairs of colours are harmonious according the Goethe's colour rules. Goethe stands behind my positive judgement about the colour harmony of the whole of this kilim. Totality is reached, almost the richest possible colour scale is achieved and with it the highest stage in the harmony of colours. However, I am not sure whether all my readers, have followed me, or wish to follow me. Once again I cite Goethe: "Educated people have a dislike of colours. This can happen partly from the weakness of the organ, partly from an uncertainty of taste, which likes to escape into complete nothingness. The women now go almost totally in white; the men in black." Thus Goethe. What he says about the men, is still generally true today. The fashion designer Armani has recently spoken about black for men. He says: "Moreover, black is the 'colour' of power. Power without frivolity: with notaries and grave diggers, who mostly wear black, we do not make jokes."

In contrast to men, women acknowledge colours more than in Goethe's time. In the Orient women always took more pleasure in colour than in Europe.

Anatolian kilims – the work of Anatolian women – are mainly attractive because of their colours. This concept informs almost all the kilim books, those written in connection with the exhibitions in Liestal I, San Francisco, Munich, Hamburg, Berlin and Schloss Lembeck. Now the kilim community met once more in Liestal and enjoyed the exhibition Liestal II and will once more enjoy the colour catalogue. It consists quite obviously of cultivated people, who very obviously, in contradiction to Goethe's statement, show no aversion to colours.

Are they all nature men? Have they all, as Goethe says, retained their childlike joy in colour and the love for colours of vulgar? Did they not grow and become civilised?

The answer I would give to this question – my hypothesis – is: They all went through a longer or shorter vision school. They have seen many Anatolian kilims and many Anatolian carpets and have come to hold similar judgements about kilims, which, after all, are primarily judgements about the colours of kilims. In the circle of kilim connoisseurs, there are hardly any discrepancies in the aesthetic judgement of kilims according to their colours. In the catalogue of the kilim exhibition in Schloss Lembeck in Westphalia[10], we read that the kilims were selected by Mr Hirsch, Mr Pelz and Mr Türck – that is by connoisseurs of kilims – not as a team with much discussion, but independently of one another. The judgements mainly coincided – I believe to 80% – and this is not surprising.

However, the measure as to how the aesthetic judgement can change in the course of time, the effect of the vision school, about this there are many stories that can be told. I am tempted to tell one briefly: In my incursions through the Istanbul bazaar in 1963 shortly after I became infected by the carpet virus, I found my first yellow-ground Konya-Memling runner. I was immediately fascinated. The hairs rose on my neck. I carried the heavy high-piled piece away with me so that I could show it at once to my closest and trustiest carpet friends. The reaction was: "Impossible to live with such a canary!" I was ashamed of my naive, untutored and apparently excessively childish joy at the Anatolian colours and withdrew in confusion. Fate decreed that years later, in another place and under totally different circumstances, the "canary" was seen by the same trusted friends, was greeted with enthusiasm and finally landed in their collection, where it remains today.

I would like to conclude with two questions: Did the kilim weavers, perhaps, have their own laws about colour harmony and colour combinations? or were all colours combined at random?

Although I have only just begun with counting out different colour combinations in Anatolian kilims, I believe that I can already say that one combination occurs less frequently than others that would be expected by random choice: green and yellow occur more rarely together, and in the kilim which has been the subject to our discussion, it does not occur at all.

The colour combination of green with yellow is the one which Goethe called "in the vulgar sense cheerful" and whose use by BP (British Petrol) in its signs does not add to the company's appeal at all.

May you all succeed in retaining or regaining the love of colours of "vulgar people and children": Liestal II will have helped.

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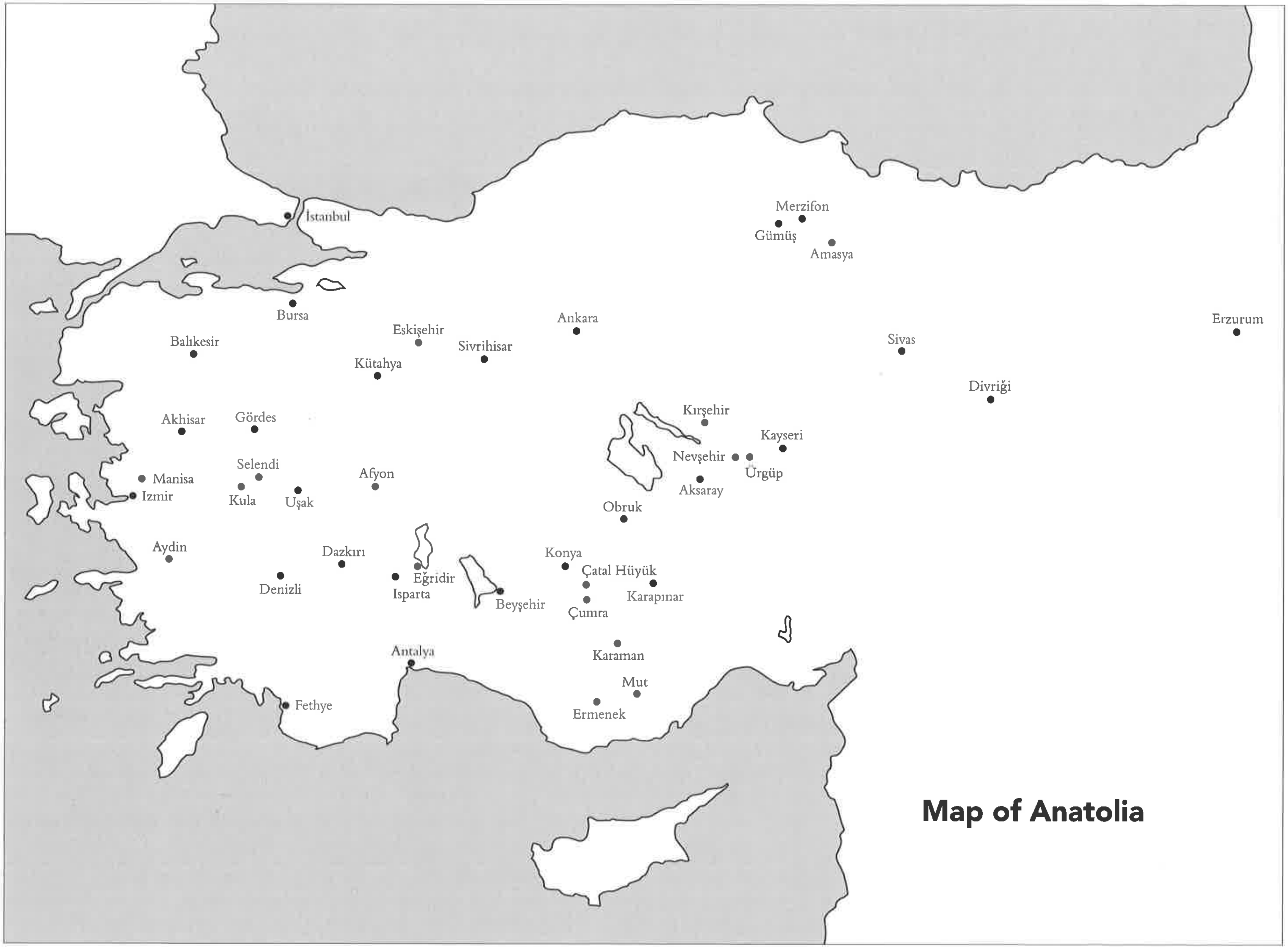
1 The physical term is monochromatic light.
2 Readers interested in the latest stand of the science of colour are recommended to read this and other works by Harald Küppers. Subsequent citations from this author are also taken from the cited volume.
3 The deciding stimulus for the rediscovery of violet dyeing with madder alone came from Mrs Josephine Powell.
4 Marmara University, Güzel Sanatlar Facultesi, Laboratory for Natural Dyes (Böhmer-Enez-Karadag) Kücük Camlica Acibadem Cad., 81018 Kadiköy-Istanbul, Turkey.
5 Pawlik 1987.
6 Itten 1983.
7 Küppers 1986, 1987, 1987 bis, 1989.
8 Chijiiwa 1987.
9 Goethe 1980. All quotations are from vol. 1.
10 Türck 1995.



Map of Anatolia

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Radiocarbon Dating Results

The calibrated (dendrocorrected) ages are 2σ ranges (95% confidence limit) and were calculated using the program CalibETH published by Niklaus et al. 1992.

Due to the shape of the calibration curve in the region of interest, several true age ranges are possible. The figures in brackets are the probabilities for each single age range.

For radiocarbon dating only those kilims were selected which were thought to have been woven before 1800. This selection is primarily based on the knowledge of colours (dyes), in second instance also on the comparison of designs. For all of these pieces, a 20th century origin can be excluded with certainty. This allows to exclude as well the 20th century probabilities of the radiocarbon dating results.

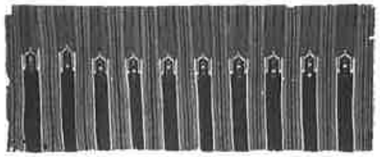

Plate 1: Kilim, 356 × 140 cm
Western Anatolia, Dazkırı area
Georgie Wolton collection

Lab. no.:	ETH-19458.1, 19458.2
Sample no.:	Ra 112
Sample collected by:	Longevity (18502)
Radiocarbon age:	(110 ± 55, 165 ± 45)
Weighted mean:	**145 ± 35** y BP
$\delta^{13}C$ [‰]:	–19.7 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1673–1780 (45.8%)**
	AD 1796–1895 (36.9%)

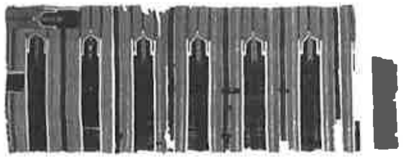

Plate 2: Kilim, fragment (A: 93 + B: 211) × 128
Western Anatolia, Dazkırı area. A: Vakıflar Museum
Istanbul, inv. no. 102. B: Private collection

Lab. no.:	ETH-16185.1, 16185.2
Sample no.:	Ra 33, fragment B
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(155 ± 45, 180 ± 50)
Weighted mean:	**165 ± 35** y BP
$\delta^{13}C$ [‰]:	–21.5 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1665–1823 (68.9%)**
	AD 1831–1884 (12.8%)

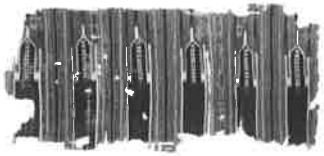

Plate 3: Kilim, fragment, 265 × 128 cm
Western Anatolia, Dazkırı area
Private collection

Lab. no.:	ETH-18901.1, 18901.2
Sample no.:	Pe 1
Sample collected by:	Collector
Radiocarbon age:	(330 ± 50, 260 ± 50)
Weighted mean:	**295 ± 35** y BP
$\delta^{13}C$ [‰]:	–20.2 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1487–1607 (63.3%)**
	AD 1612–1665 (36.6%)

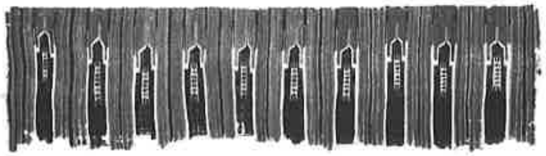

Plate 4: Kilim, 392 × 108 cm
Western Anatolia, Dazkırı area
Al-Thani collection

Lab. no.:	ETH-19255.1, 19255.2
Sample no.:	Ra 107
Sample collected by:	Longevity (16039 fln)
Radiocarbon age:	(175 ± 50, 165 ± 55)
Weighted mean:	**170 ± 35** y BP
$\delta^{13}C$ [‰]:	–20.6 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1663–1710 (18.2%)**
	AD 1710–1822 (52.8%)
	AD 1833–1882 (10.3%)

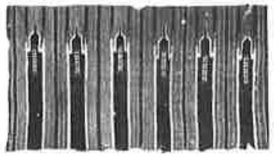

Plate 5: Kilim, measurements unknown
Western Anatolia, Dazkırı area
Vakıflar Museum Istanbul, inv. no. 320

Lab. no.:	
Sample no.:	
Sample collected by:	
Radiocarbon age:	
$\delta^{13}C$ [‰]:	
Calibrated age ranges:	
95% confidence limit	

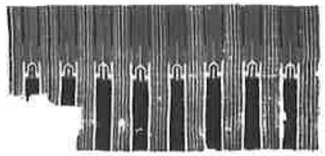

Plate 6: Kilim, fragment, 302 × 141 cm
Western Anatolia, Dazkırı area
Vok collection

Lab. no.:	ETH-19476.1, 19476.2
Sample no.:	Ra 111
Sample collected by:	Jürg Rageth
Radiocarbon age:	(150 ± 50, 215 ± 50)
Weighted mean:	**185 ± 35** y BP
$\delta^{13}C$ [‰]:	–22.2 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1655–1706 (20.2%)**
	AD 1714–1820 (55.7%)
	AD 1838–1873 (4.5%)

Plate 7: Kilim, fragment, 92 × 152 cm
Western Anatolia, Dazkırı area
The Fine Arts Museums of San Francisco

Lab. no.:	ETH-19720.1, 19720.2
Sample no.:	Ra 115 / 1988.11.560
Sample collected by:	Diane Mott
Radiocarbon age:	(135 ± 40, 170 ± 55)
Weighted mean:	**150 ± 35** y BP
$\delta^{13}C$ [‰]:	–22.3 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1671–1783 (48.2%)** **AD 1794–1892 (34.5%)**

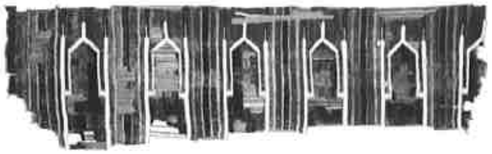

Plate 8: Kilim, fragment, 260 × 79 cm
Western Anatolia, Dazkırı area
Galveston collection

Lab. no.:	ETH-16184.1, 16184.2
Sample no.:	Ra 32
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(300 ± 45, 265 ± 50)
Weighted mean:	**285 ± 35** y BP
$\delta^{13}C$ [‰]:	–20.7 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1490–1603 (53.2%)** **AD 1614–1670 (43.4%)**

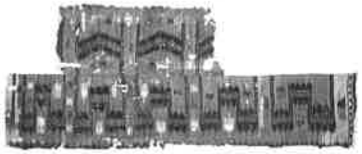

Plate 9: Kilim, fragment, 363 × 147 cm
Central Anatolia, Karapınar area
Vok collection

Lab. no.:	ETH-15257
Sample no.:	Ra 15
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**400 ± 50** y BP
$\delta^{13}C$ [‰]:	–14.5 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1435–1530 (57.4%)** **AD 1534–1635 (42.6%)**

Plate 10: Kilim, fragment, 350 × 75 cm
Central Anatolia, Karapınar area
Private collection

Lab. no.:	ETH-17053
Sample no.:	Ra 105
Sample collected by:	Collector
Radiocarbon age:	**210 ± 35** y BP
$\delta^{13}C$ [‰]:	–21.5 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1644–1694 (27.4%)** **AD 1726–1816 (53.0%)**

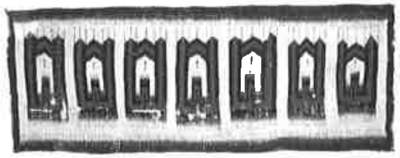

Plate 11: Kilim, 395 × 153 cm
Central Anatolia, Karapınar area
Museum für Islamische Kunst, Berlin, inv. no. I.3088

Lab. no.:	ETH-16371
Sample no.:	Ra 56
Sample collected by:	Curator of Museum
Radiocarbon age:	**255 ± 50** y BP
$\delta^{13}C$ [‰]:	–23.1 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1487–1610 (27.2%)** **AD 1611–1689 (37.6%)** **AD 1733–1813 (25.0%)**

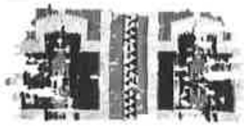

Plate 12: Kilim, fragment, 211 × 100 cm
Central Anatolia, south of Konya
Private collection

Lab. no.:	ETH-16368
Sample no.:	Ra 48
Sample collected by:	Collector
Radiocarbon age:	**240 ± 45** y BP
$\delta^{13}C$ [‰]:	–22.8 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1514–1593 (11.1%)** **AD 1620–1696 (38.2%)** **AD 1724–1817 (36.4%)**

Plate 13: Kilim, fragment, 370 × 135 cm
Central Anatolia, south of Konya
Private collection

Lab. no.:	ETH-16366.1, 16366.2
Sample no.:	Ra 46
Sample collected by:	Collector
Radiocarbon age:	(175 ± 45, 200 ± 60)
Weighted mean:	**185 ± 35** y BP
$\delta^{13}C$ [‰]:	–21.3 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1655–1706 (20.2%)**
	AD 1714–1820 (55.7%)
	AD 1838–1873 (4.5%)

Plate 14: Kilim, fragment, 310 × 160 cm
Central Anatolia, south of Konya
Private collection

Lab. no.:	ETH-15828
Sample no.:	Ra 27
Sample collected by:	Collector
Radiocarbon age:	**250 ± 55** y BP
$\delta^{13}C$ [‰]:	–22.6 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1482–1702 (59.8%)**
	AD 1718–1819 (29.0%)

Plate 15: Kilim, fragment, 43 × 102 cm
Central Anatolia, south of Konya
The Fine Arts Museums of San Francisco, T89.51.29

Lab. no.:	ETH-19721.1, 19721.2
Sample no.:	Ra 116 / T89.51.29
Sample collected by:	Diane Mott
Radiocarbon age:	(265 ± 45, 215 ± 45)
Weighted mean:	**240 ± 30** y BP
$\delta^{13}C$ [‰]:	–22.0 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1636–1682 (51.4%)**
	AD 1748–1805 (33.4%)

Plate 16: Kilim, fragment, 330 × 135 cm
Central Anatolia, south of Konya
Private collection

Lab. no.:	ETH-16367
Sample no.:	Ra 47
Sample collected by:	Collector
Radiocarbon age:	**215 ± 45** y BP
$\delta^{13}C$ [‰]:	–20.0 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1635–1709 (29.1%)**
	AD 1711–1822 (48.9%)
	AD 1834–1881 (3.9%)

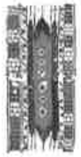

Plate 17: Kilim, fragment, 80 × 170 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15819.1, 15819.2
Sample no.:	Ra 19
Sample collected by:	Jürg Rageth
Radiocarbon age:	(125 ± 50, 170 ± 60)
Weighted mean:	**140 ± 40** y BP
$\delta^{13}C$ [‰]:	–20.4 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1673–1779 (43.0%)**
	AD 1797–1945 (56.5%)

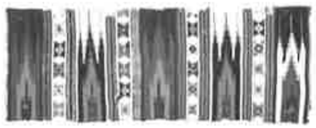

Plate 18: Kilim, fragment, 195 × 76 cm
Eastern Anatolia
Private collection

Lab. no.:	ETH-16333.1, 16333.2
Sample no.:	Ra 40
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(160 ± 45, 150 ± 60)
Weighted mean:	**160 ± 35** y BP
$\delta^{13}C$ [‰]:	–22.2 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1667–1788 (52.6%)**
	AD 1791–1824 (13.7%)
	AD 1828–1886 (15.6%)

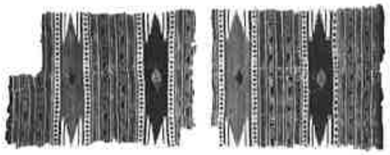

Plate 19: Kilim, 158 × 198 cm / 150 × 203 cm
Western Anatolia, Isparta area
David Lantz collection

Lab. no.:	NZA 2333/1, 2334/1
Sample no.:	R16124/3A, R16124/3B
Sample collected by:	David Lantz
Radiocarbon age:	(274 ± 92 / 319 ± 78)
Weighted mean:	**300 ± 60** y BP
$\delta^{13}C$ [‰]:	(–22.9 / –20.1)
Calibrated age ranges:	
95% confidence limit	**AD 1450–1679 (92.6%)**
	AD 1769–1802 (5.0%)

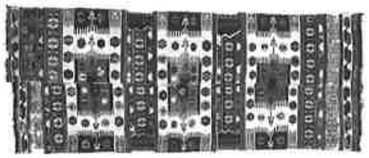

Plate 20: Kilim, with 3 double-niches, 425 × 170 cm
Central Anatolia
Private collection

Lab. no.:	ETH-14056
Sample no.:	Ra 0
Sample collected by:	Jürg Rageth
Radiocarbon age:	**205 ± 45** y BP
$\delta^{13}C$ [‰]:	–15.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1642–1708 (25.6%)**
	AD 1712–1821 (50.6%)
	AD 1835–1880 (5.3%)

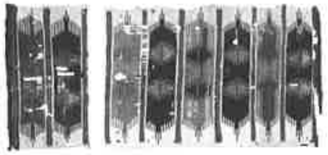

Plate 21: Kilim, fragment, 216+81 × 145 cm
Central Anatolia
Vok collection

Lab. no.:	ETH-16328
Sample no.:	Ra 35
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**205 ± 50** y BP
$\delta^{13}C$ [‰]:	–20.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1639–1824 (74.0%)**
	AD 1828–1886 (7.9%)

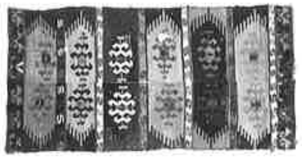

Plate 22: Kilim, 295 × 152 cm
Anatolia
Marshall and Marilyn R. Wolf collection

Lab. no.:	NZA 2331/1
Sample no.:	R16124/1
Sample collected by:	David Lantz
Radiocarbon age:	**365 ± 66** y BP
$\delta^{13}C$ [‰]:	–20.5
Calibrated age ranges:	
95% confidence limit	**AD 1438–1654 (100.0%)**

Plate 23: Kilim, fragment, 336 × 141 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15826.1, 15826.2
Sample no.:	Ra 25
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(110 ± 50, 95 ± 60)
Weighted mean:	**105 ± 40** y BP
$\delta^{13}C$ [‰]:	–24.6 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1680–1761 (31.5%)**
	AD 1803–1938 (68.5%)

Plate 24: Kilim, fragment, 322 × 182 cm
Anatolia
Private collection

Lab. no.:	ETH-15823, 16547
Sample no.:	Ra 22, 22A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(225 ± 50 / 140 ± 45)
Weighted mean:	**175 ± 40** y BP
$\delta^{13}C$ [‰]:	–15.3 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1659–1823 (70.7%)**
	AD 1832–1883 (10.9%)

Plate 25: Kilim, fragment, 318 × 160 cm
Anatolia
Caroline McCoy-Jones collection

Lab. no.:	ETH-15818.1, 18.2, 18.3
Sample no.:	Ra 18
Sample collected by:	Jürg Rageth
Radiocarbon age:	(210 ± 50, 200 ± 45, 135 ± 45)
Weighted mean:	**180 ± 25** y BP
$\delta^{13}C$ [‰]:	–23.2 ± 0.9
Calibrated age ranges:	
95% confidence limit	**AD 1660–1702 (18.5%)** **AD 1718–1819 (60.5%)**

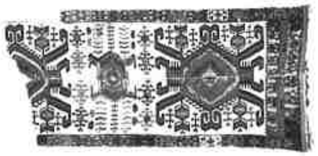

Plate 26: Kilim, fragment, 368 × 173 cm
Central or Eastern Anatolia
Vok collection

Lab. no.:	ETH-15256
Sample no.:	Ra 14
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**300 ± 50** y BP
$\delta^{13}C$ [‰]:	–11.7 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1469–1673 (96.1%)** **AD 1779–1796 (2.5%)**

Plate 27: Kilim, fragment, 300 × 64 cm
Central or Eastern Anatolia
Private collection

Lab. no.:	ETH-19447.1, 19447.2
Sample no.:	Ra 108
Sample collected by:	Collector
Radiocarbon age:	(200 ± 50, 215 ± 45)
Weighted mean:	**210 ± 35** y BP
$\delta^{13}C$ [‰]:	–23.2 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1644–1694 (27.4%)** **AD 1726–1816 (53.0%)**

Plate 28: Kilim, 392 × 156 cm
Anatolia
Vok collection

Lab. no.:	ETH-16331
Sample no.:	Ra 38
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**205 ± 45** y BP
$\delta^{13}C$ [‰]:	–20.3 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1642–1708 (25.6%)** **AD 1712–1821 (50.6%)** **AD 1835–1880 (5.2%)**

Plate 29: Kilim, 355 × 145 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15093.1, 15093.2
Sample no.:	Ra 7
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(170 ± 45, 200 ± 60)
Weighted mean:	**180 ± 35** y BP
$\delta^{13}C$ [‰]:	–25.2 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1658–1707 (19.3%)** **AD 1713–1821 (55.0%)** **AD 1836–1878 (6.4%)**

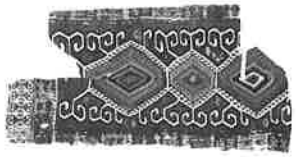

Plate 30: Kilim, fragment, 345 × 172 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15822.1, 15822.2
Sample no.:	Ra 21
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(190 ± 50, 185 ± 65)
Weighted mean:	**190 ± 40** y BP
$\delta^{13}C$ [‰]:	–21.8 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1652–1707 (21.5%)** **AD 1713–1821 (53.4%)** **AD 1836–1878 (6.0%)**

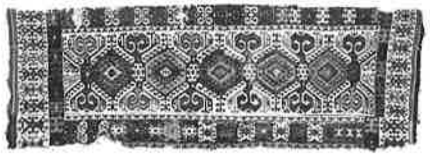

Plate 31: Kilim, 435 × 152 cm
Central Anatolia
Private collection

Lab. no.:	ETH-17052, 17714
Sample no.:	Ra 104, Ra 104A
Sample collected by:	Collector
Radiocarbon age:	(295 ± 30 / 280 ± 50)
Weighted mean:	**290 ± 25** y BP
$\delta^{13}C$ [‰]:	–21.2 ± 0.8
Calibrated age ranges: 95% confidence limit	**AD 1516–1591 (50.4%)** **AD 1622–1663 (49.6%)**

Plate 32: Kilim, fragment, 165 × 65 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15095.1, .2, 16179
Sample no.:	Ra 9.1, 9.2, 9A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(55 ± 50 / 105 ± 45)
Weighted mean:	**75 ± 30** y BP
$\delta^{13}C$ [‰]:	–20.8 ± 0.8
Calibrated age ranges: 95% confidence limit	**AD 1691–1729 (17.8%)** **AD 1814–1923 (82.2%)**

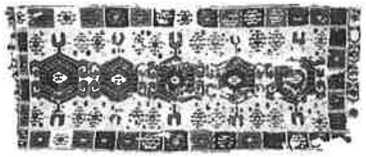

Plate 33: Kilim, 370 × 150 cm
Central Anatolia
David Lantz collection

Lab. no.:	NZA 4618
Sample no.:	R18725/3
Sample collected by:	David Lantz
Radiocarbon age:	**320 ± 88** y BP
$\delta^{13}C$ [‰]:	–21.17
Calibrated age ranges: 95% confidence limit	**AD 1427–1692 (86.4%)** **AD 1728–1815 (9.8%)**

Plate 34: Kilim, fragment, 335 × 137 cm
Central Anatolia
Private collection

Lab. no.:	ETH-16964
Sample no.:	Ra 102
Sample collected by:	Collector
Radiocarbon age:	**80 ± 30** y BP
$\delta^{13}C$ [‰]:	–24.0 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1690–1730 (19.2%)** **AD 1814–1924 (80.8%)**

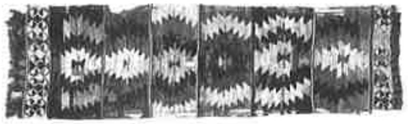

Plate 35: Kilim, 330 × 80 cm
Central Anatolia, Cappadocia
Private collection

Lab. no.:	ETH-19535.1, 19535.2
Sample no.:	Ra 114
Sample collected by:	Collector
Radiocarbon age:	(145 ± 35, 160 ± 60)
Weighted mean:	**150 ± 30** y BP
$\delta^{13}C$ [‰]:	–20.0 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1672–1781 (49.7%)** **AD 1795–1889 (33.0%)**

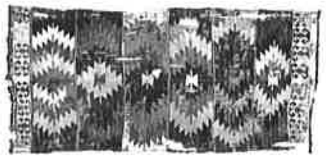

Plate 36: Kilim, 367 × 171 cm
Central Anatolia, Cappadocia
Private collection

Lab. no.:	ETH-15252.1, 15252.2
Sample no.:	Ra 10
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(200 ± 55, 185 ± 60)
Weighted mean:	**195 ± 40** y BP
$\delta^{13}C$ [‰]:	–21.7 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1649–1706 (22.7%)** **AD 1714–1821 (53.4%)** **AD 1837–1875 (4.7%)**

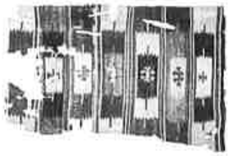

Plate 37: Kilim, fragment, 195 × 125 cm
Central Anatolia, Cappadocia (?)
Private collection

Lab. no.:	ETH-19448
Sample no.:	Ra 109
Sample collected by:	Collector
Radiocarbon age:	**85 ± 50** y BP
$\delta^{13}C$ [‰]:	–22.2 ± 1.2
Calibrated age ranges:	
95% confidence limit	**AD 1679–1764 (30.4%)**
	AD 1803–1938 (69.3%)

Plate 38: Kilim, 400 × 150 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15094
Sample no.:	Ra 8
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**205 ± 50** y BP
$\delta^{13}C$ [‰]:	–24.7 ± 1.2
Calibrated age ranges:	
95% confidence limit	**AD 1639–1824 (74.0%)**
	AD 1828–1886 (7.9%)

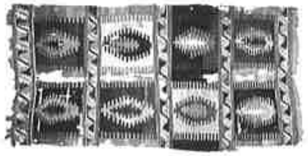

Plate 39: Kilim, 315 × 150 cm
Central Anatolia, Afyon/Kütahya area
Vok collection

Lab. no.:	ETH-16329.1, .2, 16551
Sample no.:	Ra 36.1, 36.2, 36A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(0 ± 45/5 ± 45/5 ± 45)
Weighted mean:	**5 ± 25** y BP
$\delta^{13}C$ [‰]:	–21.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1899–1901 (2.7%)**
	AD 1954–1956 (97.3%)

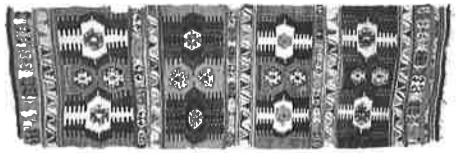

Plate 40: Kilim, 500 × 170 cm
Central Anatolia
Marshall and Marilyn R. Wolf collection

Lab. no.:	ETH-18178
Sample no.:	Ra 106
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**235 ± 50** y BP
$\delta^{13}C$ [‰]:	–22.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1514–1594 (10.7%)**
	AD 1620–1705 (34.0%)
	AD 1715–1820 (38.6%)
	AD 1839–1869 (1.9%)

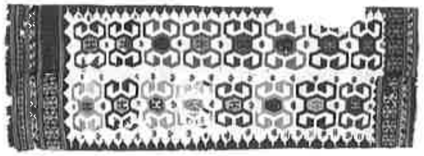

Plate 41: Kilim, 460 × 165 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15258
Sample no.:	Ra 16
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**155 ± 55** y BP
$\delta^{13}C$ [‰]:	–22.4 ± 1.2
Calibrated age ranges:	
95% confidence limit	**AD 1667–1790 (46.5%)**
	AD 1790–1895 (35.4%)

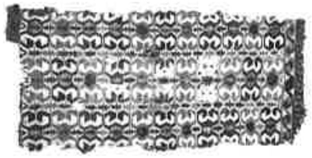

Plate 42: Kilim, 344 × 196 cm
Central Anatolia
Private collection

Lab. no.:	ETH-19475.1, 19475.2
Sample no.:	Ra 110
Sample collected by:	Collector
Radiocarbon age:	(235 ± 50, 205 ± 50)
Weighted mean:	**220 ± 35** y BP
$\delta^{13}C$ [‰]:	–21.3 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1641–1689 (32.4%)**
	AD 1732–1813 (48.9%)

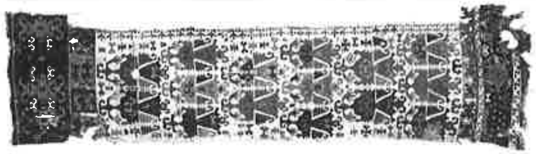

Plate 43: Kilim, 407 × 109 cm
Central Anatolia
Private collection

Lab. no.:	ETH-16963, 17359
Sample no.:	Ra 101, 101A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(275 ± 45, 265 ± 55)
Weighted mean:	**270 ± 35** y BP
$\delta^{13}C$ [‰]:	–23.3 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1511–1599 (33.3%)**
	AD 1617–1677 (53.2%)
	AD 1773–1801 (8.6%)

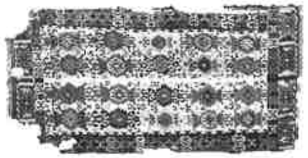

Plate 44: Kilim, 361 × 178 cm
Central Anatolia
Private collection

Lab. no.:	ETH-19893.1, 19893.2
Sample no.:	Ra 117
Sample collected by:	Jürg Rageth
Radiocarbon age:	(225 ± 50, 215 ± 50)
Weighted mean:	**220 ± 35** y BP
$\delta^{13}C$ [‰]:	–22.5 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1641–1689 (32.4%)**
	AD 1732–1813 (48.9%)

Plate 45: Kilim, 370 × 159 cm
Central Anatolia, Mut/Ermenek area
Vok collection

Lab. no.:	ETH-15255, 16372
Sample no.:	Ra 13, 13.2, 57, 57.2
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(435 ± 55 / 205 ± 55 255 ± 50 / 225 ± 50)
Weighted mean:	**230 ± 30** y BP
$\delta^{13}C$ [‰]:	–21.5 ± 0.9
Calibrated age ranges:	
95% confidence limit	**AD 1642–1682 (41.3%)**
	AD 1747–1806 (41.1%)

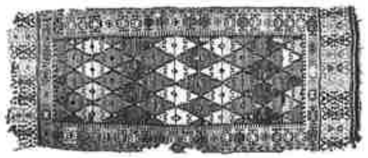

Plate 46: Kilim, 400 × 170 cm
Central Anatolia
Museum Schloss Rheydt

Lab. no.:	ETH-15088
Sample no.:	Ra 2
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**250 ± 50** y BP
$\delta^{13}C$ [‰]:	–18.1 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1488–1607 (22.7%)**
	AD 1612–1692 (37.2%)
	AD 1728–1815 (28.2%)

Plate 47: Kilim, fragment, 195 × 175 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15087, 16545
Sample no.:	Ra 1, 1A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(215 ± 50 / 180 ± 50)
Weighted mean:	**200 ± 35** y BP
$\delta^{13}C$ [‰]:	–18.8 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1647–1702 (24.1%)**
	AD 1718–1819 (55.6%)

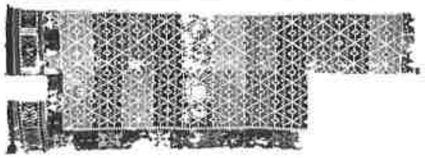

Plate 48: Kilim, fragment, 425 × 150 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15827, 16549
Sample no.:	Ra 26, 26A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(240 ± 50 / 190 ± 45)
Weighted mean:	**215 ± 35** y BP
$\delta^{13}C$ [‰]:	–18.1 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1643–1690 (29.6%)**
	AD 1730–1814 (51.2%)

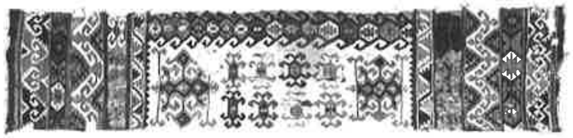

Plate 49: Kilim, 360 × 80 cm
Central Anatolia
Galveston collection

Lab. no.:	ETH-17051
Sample no.:	Ra 103
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**195 ± 35** y BP
δ^{13}C [‰]:	–20.9 ± 1.0
Calibrated age ranges:	
95% confidence limit	**AD 1650–1703 (22.5%)**
	AD 1717–1819 (56.0%)

Plate 51: Kilim, 344 × 196 cm
Western Anatolia
Private collection

Lab. no.:	ETH-16180
Sample no.:	Ra 28
Sample collected by:	Collector
Radiocarbon age:	**35 ± 45** y BP
δ^{13}C [‰]:	–22.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1688–1733 (18.8%)**
	AD 1812–1926 (79.2%)

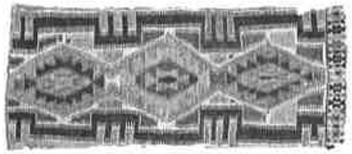

Plate 53: Kilim, fragment, 376 × 155 cm
Western Anatolia
Private collection

Lab. no.:	ETH-15254
Sample no.:	Ra 12
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**180 ± 50** y BP
δ^{13}C [‰]:	–15.4 ± 1.2
Calibrated age ranges:	
95% confidence limit	**AD 1655–1824 (68.1%)**
	AD 1827–1887 (13.8%)

Plate 50: Kilim, 399 × 158 cm
Western Anatolia, Eğridir area
Private collection

Lab. no.:	ETH-15253, 16546
Sample no.:	Ra 11, 11A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(85 ± 55 / 180 ± 45)
Weighted mean:	**135 ± 45** y BP
δ^{13}C [‰]:	–17.0 ± 0.8
Calibrated age ranges:	
95% confidence limit	**AD 1673–1779 (41.5%)**
	AD 1797–1945 (58.1%)

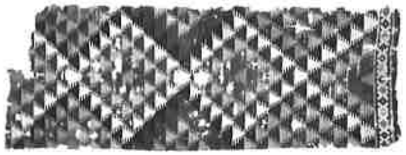

Plate 52: Kilim, 430 × 160 cm
Anatolia
Marshall and Marilyn R. Wolf collection

Lab. no.:	ETH-16332
Sample no.:	Ra 39
Sample collected by:	Friedrich Spuhler
Radiocarbon age:	**135 ± 50** y BP
δ^{13}C [‰]:	–20.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1672–1781 (41.6%)**
	AD 1795–1946 (58.0%)

Plate 54: Kilim, fragment, 213 × 137 cm
Western Anatolia, Balıkesir/Akhisar area
Vok collection

Lab. no.:	ETH-16330
Sample no.:	Ra 37
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**145 ± 45** y BP
δ^{13}C [‰]:	–24.7 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1671–1783 (44.3%)**
	AD 1794–1899 (38.1%)

Plate 55: Kilim, 368 × 155 cm
Southern Anatolia, Antalya area
Orient Stars collection

Lab. no.:	ETH-15090, 15831
Sample no.:	Ra 4, 4A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(155 ± 45 / 200 ± 50)
Weighted mean:	**175 ± 35** y BP
δ¹³C [‰]:	–22.5 ± 0.8
Calibrated age ranges: 95% confidence limit	**AD 1661–1708 (18.6%)** **AD 1712–1821 (54.1%)** **AD 1835–1880 (8.2%)**

Plate 57: Kilim, fragment, 165 × 147 cm
Western Central Anatolia, Afyon area
Private collection

Lab. no.:	ETH-15824, 16548
Sample no.:	Ra 23, 23A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(250 ± 50 / 225 ± 50)
Weighted mean:	**240 ± 35** y BP
δ¹³C [‰]:	–24.5 ± 0.8
Calibrated age ranges: 95% confidence limit	**AD 1633–1685 (46.1%)** **AD 1742–1808 (35.5%)**

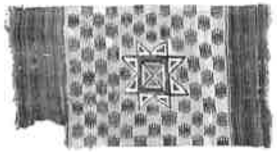

Plate 59: Kilim, 310 × 177 cm
Southwestern Anatolia, Fethye area (?)
Galveston collection

Lab. no.:	ETH-16181
Sample no.:	Ra 29
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**115 ± 45** y BP
δ¹³C [‰]:	–19.4 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1677–1773 (36.1%)** **AD 1800–1941 (63.9%)**

Plate 56: Kilim, 185 × 145 cm
Southern Anatolia, Antalya area
Private collection

Lab. no.:	ETH-16183, 16550
Sample no.:	Ra 31, 31.2, 31A, 31A.2
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(275 ± 60 / 110 ± 45 110 ± 45 / 130 ± 45)
Weighted mean:	**140 ± 35** y BP
δ¹³C [‰]:	–22.0 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1674–1777 (43.5%)** **AD 1798–1898 (39.4%)**

Plate 58: Kilim, fragment, 192 × 125 cm
Central Anatolia
Private collection

Lab. no.:	ETH-15089
Sample no.:	Ra 3
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**185 ± 50** y BP
δ¹³C [‰]:	–14.5 ± 1.2
Calibrated age ranges: 95% confidence limit	**AD 1652–1824 (69.5%)** **AD 1828–1886 (12.3%)**

Plate 60: Kilim, 340 × 140 cm
Central (?) Anatolia
Private collection

Lab. no.:	ETH-15820, 15821
Sample no.:	Ra 20, 20A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(195 ± 50 / 165 ± 50)
Weighted mean:	**180 ± 35** y BP
δ¹³C [‰]:	–23.7 ± 0.8
Calibrated age ranges: 95% confidence limit	**AD 1658–1707 (19.3%)** **AD 1713–1821 (55.0%)** **AD 1836–1878 (6.4%)**

Plate 61: Kilim, fragment, 196 × 83 cm
Eastern Anatolia
Private collection

Lab. no.:	ETH-15092
Sample no.:	Ra 6
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**190 ± 50** y BP
$\delta^{13}C$ [‰]:	–24.9 ± 1.2
Calibrated age ranges: 95% confidence limit	**AD 1649–1824 (70.8%)** **AD 1828–1886 (11.1%)**

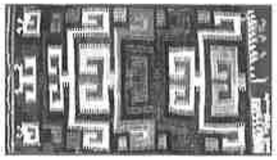

Plate 63: Kilim, 173 × 96 cm
Central Anatolia
Galveston collection

Lab. no.:	ETH-16182
Sample no.:	Ra 30
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**115 ± 45** y BP
$\delta^{13}C$ [‰]:	–19.4 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1677–1773 (36.1%)** **AD 1800–1941 (63.9%)**

Fig. 2.1 / Plate 2
Kilim, fragment, 82 × 55 cm
Western Anatolia, Balıkesir area, Orient Stars col.

Lab. no.:	ETH-15091
Sample no.:	Ra 5
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**225 ± 50** y BP
$\delta^{13}C$ [‰]:	–20.1 ± 1.2
Calibrated age ranges: 95% confidence limit	**AD 1627–1710 (31.2%)** **AD 1711–1822 (43.4%)** **AD 1834–1882 (3.9%)**

Plate 62: Kilim, fragment, 160 × 90 cm
Central Anatolia, Obruk
Private collection

Lab. no.:	ETH-15825, 16186, 16340
Sample no.:	Ra 24, 24A, 24A.2, 24B
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(280 ± 50 / 180 ± 45 / 220 ± 45 / 170 ± 45)
Weighted mean:	**210 ± 25** y BP
$\delta^{13}C$ [‰]:	–19.7 ± 0.9
Calibrated age ranges: 95% confidence limit	**AD 1654–1683 (27.1%)** **AD 1745–1806 (52.8%)**

Plate 64: Zili/Cicim, fragment, 193 × 120 cm
Anatolia
Private collection

Lab. no.:	ETH-16327
Sample no.:	Ra 34
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	**370 ± 45** y BP
$\delta^{13}C$ [‰]:	–21.4 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1450–1636 (100.0%)**

Fig. 31.1 / Plate 31
Kilim, fragment, 490 × 125 cm
Central Anatolia, private collection

Lab. no.:	ETH-19894.1, 19894.2
Sample no.:	Ra 118
Sample collected by:	Collector
Radiocarbon age:	(150 ± 50, 130 ± 50)
Weighted mean:	**140 ± 35** y BP
$\delta^{13}C$ [‰]:	–21.2 ± 1.0
Calibrated age ranges: 95% confidence limit	**AD 1674–1777 (43.5%)** **AD 1798–1898 (39.4%)**

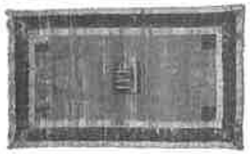

Fig. 59.1 / Plate 59
Pile woven rug, 115 × 68 cm
Central Anatolia
Private collection

Lab. no.:	ETH-16339, 16552
Sample no.:	Ra 53, 53A
Sample collected by:	G. Bonani, ETHZ
Radiocarbon age:	(135 ± 45, 125 ± 40)
Weighted mean:	**130 ± 30** y BP
$\delta^{13}C$ [‰]:	–23.5 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1679–1767 (38.6%)** **AD 1802–1939 (61.4%)**

Fig. 8 / p. 28
Double-weave, 140 × 270 cm,
Northern Africa(?)
Orient Stars collection

Lab. no.:	ETH-15602
Sample no.:	Ra 17
Sample collected by:	Michael Franses
Radiocarbon age:	(160 ± 35, 160 ± 50)
Weighted mean:	**160 ± 30** y BP
$\delta^{13}C$ [‰]:	–21.0 ± 1.2
Calibrated age ranges: 95% confidence limit	**AD 1668–1787 (54.9%)** **AD 1792–1823 (13.9%)** **AD 1831–1884 (12.9%)**

Fig. 1 / p. 106
White ground carpet, fragment, Northwest Iran
Museum für Islamische Kunst
Berlin, SMPK, inv. no. I.1

Lab. no.:	ETH-16369
Sample no.:	Ra 54
Sample collected by:	Curator of Museum
Radiocarbon age:	**375 ± 45** y BP
$\delta^{13}C$ [‰]:	–25.6 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1448–1635 (100.0%)**

Fig. 1 / p. 24
"Pazyryk carpet", wool, 200 × 183 cm,
The Hermitage Museum, St. Petersburg
Inv. no. 1687/93

Lab. no.:	ETH-18906
Sample no.:	0. H.M.6
Sample collected by:	Ludmila Barkova
Radiocarbon age:	(2250 ± 55/2240 ± 50)
Weighted mean:	**2245 ± 35** y BP
$\delta^{13}C$ [‰]:	–20.4 ± 1.0
Calibrated age ranges: 95% confidence limit	**BC 383–332 (25.4%)** **BC 328–200 (74.6%)**

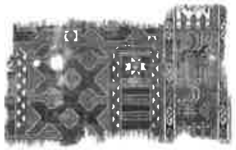

Fig. 11 / p. 101
Animal carpet fragment
George and Marie Hecksher collection,
San Francisco

Lab. no.:	ETH-16397.1, 16397.2
Sample no.:	17562 can
Sample collected by:	Longevity, London
Radiocarbon age:	(720 ± 45, 710 ± 45)
Weighted mean:	**715 ± 30** y BP
$\delta^{13}C$ [‰]:	(–25.0 ± 1.1, –18.5 ± 1.1)
Calibrated age ranges: 95% confidence limit	**AD 1249–1309 (89.6%)** **AD 1356–1382 (10.4%)**

Fig. 2 / p. 106
Tapestry-woven fragment, Egypt
Museum für Islamische Kunst
Berlin, SMPK, inv. no. I.6360

Lab. no.:	ETH-16370
Sample no.:	Ra 55
Sample collected by:	Curator of Museum
Radiocarbon age:	**430 ± 50** y BP
$\delta^{13}C$ [‰]:	–22.3 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1412–1527 (74.4%)** **AD 1554–1633 (25.6%)**

Fig. 4 / p. 111
Tapestry-woven fragment, possibly Anatolia
The Metropolitan Museum of Art, New York
Rogers Fund, 1927 (inv. no. 27.170.82)

Lab. no.:	ETH-16358
Sample no.:	27.170.82
Sample collected by:	Curator of Museum
Radiocarbon age:	**935 ± 60** y BP
$\delta^{13}C$ [‰]:	–24.5 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1005–1229 (100.0%)**

Fig. 6 / p. 112
Tapestry-woven fragment, possibly Egypt
The Metropolitan Museum of Art, New York
Rogers Fund, 1927 (inv. no. 27.170.74 & 75)

Lab. no.:	ETH-16355
Sample no.:	27.170.74 & 75
Sample collected by:	Curator of Museum
Radiocarbon age:	**855 ± 55** y BP
$\delta^{13}C$ [‰]:	–20.7 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1043–1106 (18.8%)** **AD 1111–1148 (11.1%)** **AD 1151–1279 (70.1%)**

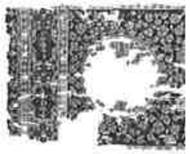

Fig. 1 / p. 206
Ottoman Tapestry Kilim, 433 × 142 cm
Vakıflar Museum Istanbul, inv. no. A.158
Balpınar/Hirsch 1982, Plate 112

Lab. no.:	ETH-16336, 16398
Sample no.:	Ra 43, 43A
Sample collected by:	Udo Hirsch/Belkıs Balpınar
Radiocarbon age:	(265 ± 45, 290 ± 45)
Weighted mean:	**280 ± 35** y BP
$\delta^{13}C$ [‰]:	–23.8 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1500–1602 (46.7%)** **AD 1615–1673 (47.3%)** **AD 1780–1796 (3.6%)**

Fig. 5 /p. 112
Tapestry-woven fragment, Anatolia
The Metropolitan Museum of Art, New York
Rogers Fund, 1927 (inv. no. 27.170.81)

Lab. no.:	ETH-16357
Sample no.:	27.170.81
Sample collected by:	Curator of Museum
Radiocarbon age:	**895 ± 65** y BP
δ13C [‰]:	–22.5 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 1023–1261 (100.0%)**

Fig. 12 / p. 114
Tapestry-woven fragment, Egypt
The Metropolitan Museum of Art, New York
Rogers Fund, 1927 (inv. no. 27.170.76)

Lab. no.:	ETH-16356
Sample no.:	27.170.76
Sample collected by:	Curator of Museum
Radiocarbon age:	**950 ± 60** y BP
δ13C [‰]:	–22.9 ± 1.1
Calibrated age ranges:	
95% confidence limit	**AD 997–1222 (100.0%)**

Fig. 2 / p. 206
Ottoman Tapestry Kilim, 500 × 400 cm
Vakıflar Museum Istanbul, inv. no. A. 328
Balpınar/Hirsch 1982, Plate 114

Lab. no.:	ETH-16337, 16399
Sample no.:	Ra 44, 44A
Sample collected by: Balpınar	Udo Hirsch/Belkıs
Radiocarbon age:	(100 ± 45, 180 ± 50)
Weighted mean:	**135 ± 40** y BP
$\delta^{13}C$ [‰]:	–21.5 ± 0.8
Calibrated age ranges:	
95% confidence limit	**AD 1675–1777 (41.3%)** **AD 1798–1944 (58.5%)**

Fig. 13 / p. 211
Kilim, measurements unknown
Western Anatolia, Kula area
Private collection

Lab. no.:	ETH-16365
Sample no.:	Ra 45
Sample collected by:	David Lantz
Radiocarbon age:	**135 ± 45** y BP
$\delta^{13}C$ [‰]:	–18.2 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1673–1779 (41.5%)** **AD 1797–1945 (58.1%)**

Fig. 14 / p. 222
Tapestry-woven silk fragment, Anatolia (?)
Museum in Tiblisi, Georgia

Lab. no.:	ETH-16334
Sample no.:	Ra 41
Sample collected by:	Udo Hirsch
Radiocarbon age:	**805 ± 45** y BP
$\delta^{13}C$ [‰]:	–20.8 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 1164–1291 (100.0%)**

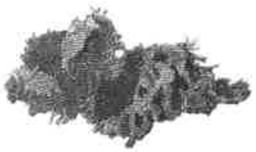

Fig. 13 / p. 221
Tapestry-woven fragment, wool, ca. 10 × 5 cm
Anatolia
Private collection

Lab. no.:	ETH-16335
Sample no.:	Ra 42
Sample collected by:	collector
Radiocarbon age:	**1165 ± 45** y BP
$\delta^{13}C$ [‰]:	–22.4 ± 1.1
Calibrated age ranges: 95% confidence limit	**AD 779–984 (100.0%)**

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Bettina Jacot-Descombes, Musée d'art et d'histoire, Ville de Genève: Fig. 44.1
Longevity, London: Plates 1, 4, Fig. 9/p. 166, Fig. 12/p. 167
Garry Muse, Santa Fee: Plates 7, 15
Niggi Seiler, Basel: Plates 17, 18, 20, 26, 32, 35, 36, 37, 38, 39, 40, 42, 44, 45, 46, 47, 48, 54, 56, 57, 58, 62, Figs. 59.1, 60.1
Staatliche Museen zu Berlin: Fig. 1/p. 172
G. Stenzel: Fig. 2/p. 172
T. C. Başbakanlık, Vakıflar Genel Müdürlüğü, Istanbul Vakıflar Bölge, Müdürlüğü Halı Müzesi: Plates 2A, 5

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