Indo-Persian Blades in the Collection of E. Gene Beall

Dr. Ann Feuerbach

Introduction

This collection is a fine example of the variety of styles and manufacturing techniques which were used to produce crucible steel blades (wootz, pulad) in Persia, Central Asia and India. The history of blade manufacturing is closely tied to the history of civilization. Since their inception, blades had the duel role as a tool necessary for survival as well as being a status symbol. It is not always apparent whether a blade was produced primarily for utilitarian or symbolic reasons. The collection consists of five Indo-Persian bladed objects. Two objects, the bitchwa and the dagger are attributed to Mysore India. The Choora is likely to be Afghani, the kard is likely to be from Isphahan, and the jambiya is likely Persian for an Arab or Kurdish market.

So-called "watered" or "damascus" steel objects were made of crucible steel. Crucible steel was a specific method of steel making and it was only produced in certain areas. Despite the common use of the term "damascus", there is no evidence that it was ever produced in Damascus, Syria (Elgood, 1994, 103-108), but rather in various locations in India, Sri Lanka, Central Asia and Persia. Its appearance in other locations was due to trade or booty. Among evidence for the trade in finished products, there is also evidence for trade in intermediate products including ingots and steel bars, destined to be forged into shape and decorated in different places to reflect local taste and use of the consumer.

Determining where an object was made, how, where, and why a certain technology "originated", and specifying how craft technology changes when used in another culture, can be very difficult to determine. It has become apparent that the craft techniques used to produce and decorate weapons in Central Asia and India are closely related. Contacts between the regions were ongoing for millennia, mostly due to the "silk road" trade. Craft knowledge, materials and techniques moved in all directions. Only by determining which characteristics are shared between production areas and through time, from those characteristics which are local, cultural or period specific, can the movement and change of materials, craft technology, and objects can be categorized. There is vast evidence of the trade of raw materials, usually from India to Persia, however, trade from other regions within Central Asia to Persia was also occurring. Therefore, one feature on its own does not indicate place of manufacture, but rather a combination of features. This is the reason why the opportunity to study a collection in such detail is so important. It is only by documenting manufacturing details, within and between collections, that will give us a better understanding of provenance, trade and technological traditions.

While there is some evidence that a single craftsmen could perform every task necessary (see Allan and Gilmore, 2000, 93), the textual, archaeological and ethnographic evidence indicates that most often a craftsman undertook a specific task. This would allow the craftsman to master that task and expedite production. Evidence also indicates that craftsmen were often linked by extended family ties. A 14th century traveler to Damascus, Simone Sigoli, stated, "The order they have among them is a beautiful and noble thing, for if the father is a goldsmith, the sons cannot ever have a trade other than this, and

Introduction

so they go from generation to generation so that of necessity they must be perfect masters of their arts" (Ward, 1993, 22). However, outsiders could also join via an apprenticeship. An object may be produced from start to finish in a family-run workshop or the family might only undertake part of the production process, purchasing and selling intermediate products.

In the production of crucible Damascus steel blades, there could be many different craftsmen and gilds involved with the production of a finished object. In "Al-Jahiz's essay on the Turks, there is a detailed description of the stages involved in the making of a sword. The purpose of the description is to draw a contrast between the specialized tradesmen employed by the most soldiers and the Turks who, the author claims, make their own weapons from scratch. 'The person who melts the sword's iron and liquefies it, who purifies and refines it is different from the person who hammers and forges it. The person who hammers and forges it is different from the one who fashions it, the one who gives it a straight edge and puts on the finish is different from the one who tempers and whets it. The one who whets it is different from the one who puts on the pommel and secures the silan (the tang or tongue at the end of the blade which is inserted into the hilt). The person who attaches the nails of the silan, the two knobs of the pommel and the blade is different from the one who carves the wood of the scabbard. The person who carves the wood of the scabbard is different from the one who tans its leather and the person who tans its leather is different from the one who decorates it. The person who decorates it and puts on the metal tip is different from the one who sews its belt. And so it is with the saddle, the arrow, the quiver, the spear and all arms which wound or protect.'" (Kennedy, 2001, 174). This suggests that at least nine craftsmen were involved with sword production. This does not include the many individuals involved with raw material gathering and processing such as mining the necessary metals and gems, wood cutters for the scabbard and those involved with animal husbandry for leather manufacturing, as well as those involved with charcoal production and clay processing needed for the various crafts.

The research also identified numerous problems hitherto unaddressed in the study of blades. The first problem is the general lack of technological information regarding the manufacture of daggers. While stylistic studied do exist, reliable publications of details of manufacturing techniques are scarce. Furthermore, there are numerous "ghost citations". "Ghost citations" are similar statements made by numerous scholars but without their stating the original primary source. This is dangerous because conclusions are made on casual remarks and opinions rather than facts. These compile and cloud quality research.

The second problem is the lack of information regarding terms used to describe gold decoration on blades. Often the term koftgari is used, but there is no accepted description of what material and methods constitute koftgari. The blades represented two different types of koftgari, now called cross-hatched koftgari and inlaid koftgari in addition to a type of gilding. Details of koftgari work appears at the end of the catalog.

Table of Contents

Bitchwa

Provenance	Mughal India
Date	Perhaps 16th century
Dimensions	11½" x 1" (at blade under fitting) x2"
Blade	Crucible steel?
Handle	Steel and brass
Decoration	Sunflower appliqué

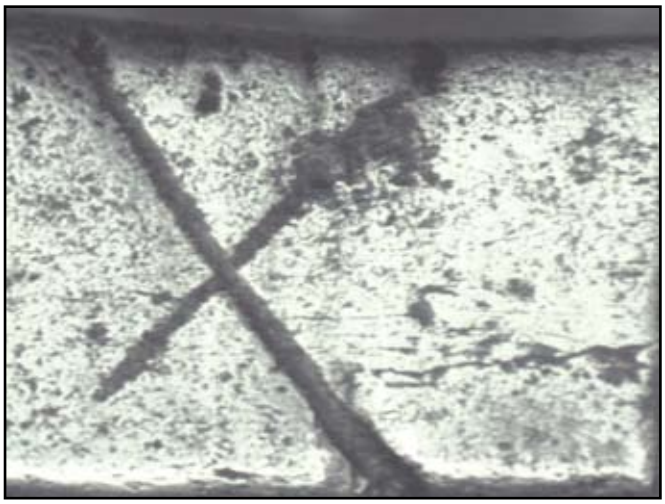
According to the seller, the bitchwa is from the 17th century. They also claim that the bitchwa has never been popular in India because Sivaji used one when he assassinated Afzal Khan. This has not been confirmed but given the number of bitchwa's in museums and collections, they are not rare nor unpopular. The bichwa is known from Mysore and Hyderabad and the word means Scorpion.

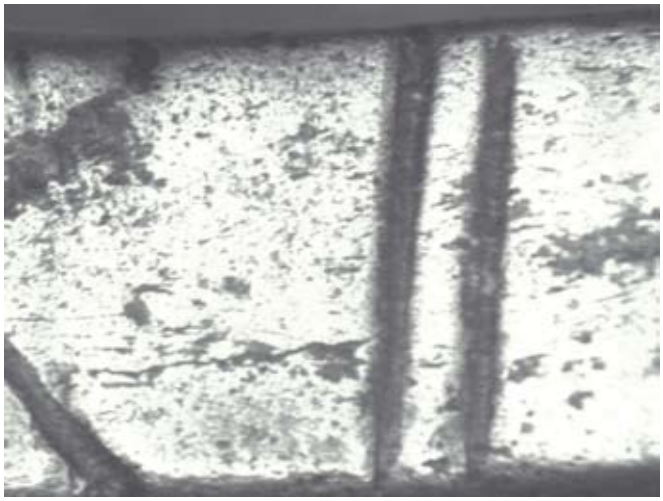
This bitchwa, however, is a rare type and may be much earlier than originally believed. The knuckle guard is decorated with a brass sunflower rosette. The enclosed grip is comparatively rare in bitchwas but does appear in katars of the 16th century.

The bitchwa is composed of 5 separate parts and seven ferrous rivets. The handle is riveted on to the blade with two rivets in the front and back.

There is a finial at the top of the handle which is also riveted on to the handle. The handle itself appears to be made of sheet metal, on the interior, one can see where the two pieces were forged together to complete the circle.

Bitchwa





The two sets of parallel lines with an x in the center may be a maker's mark, but this is unconfirmed.

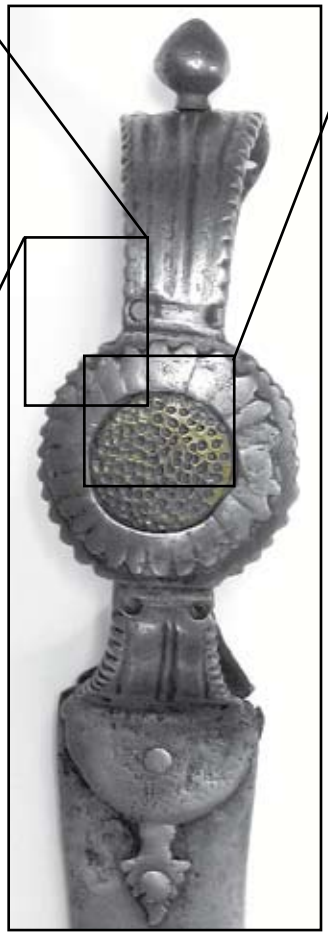
There are eight holes which may have been used to attach fabric for decoration or to secure the item to an article of clothing.

There is an sunflower applique which is attached by two rivets at 9 o'clock and three o'clock. Inside the sunflower is a brass disk attached to the sunflower leaves.

Bitchwa

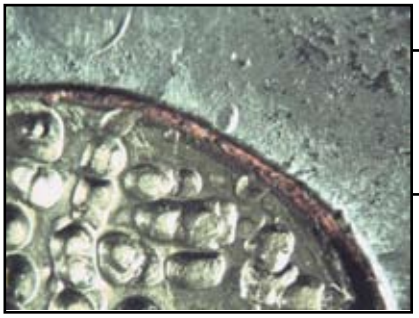
Two holes punched through the steel.

chiseled/filed to shape.

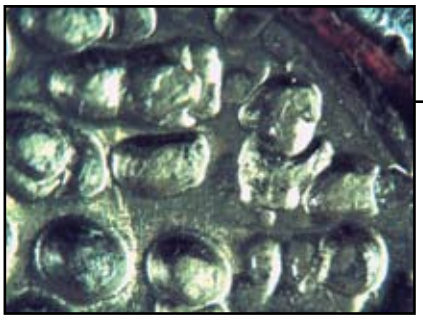


The brass disk has numerous indentations apparently made by a 2mm rounded punches in a random pattern.

Brass applique set into steel

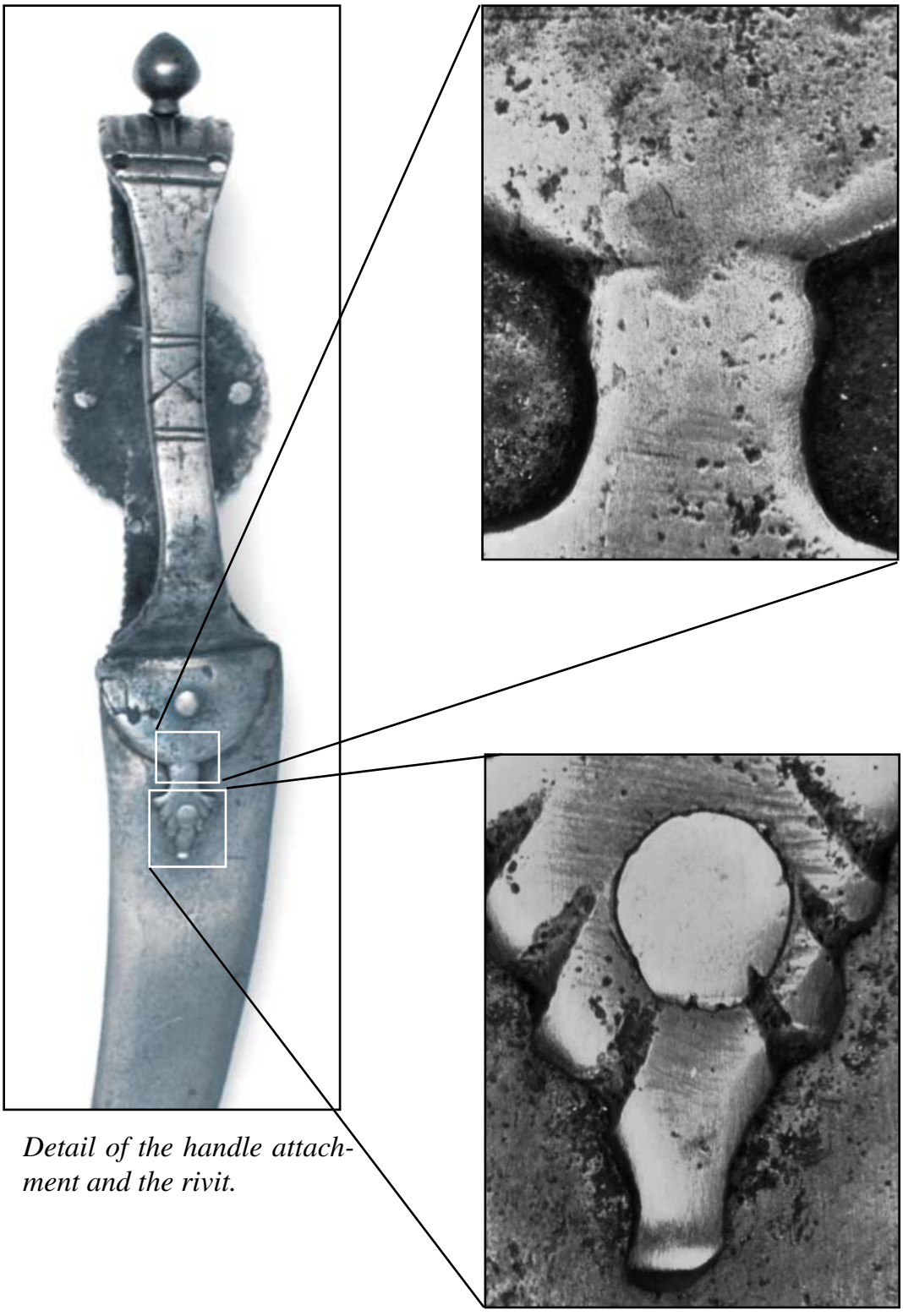


Note the red substance used to bind the brass applique to the steel surface.



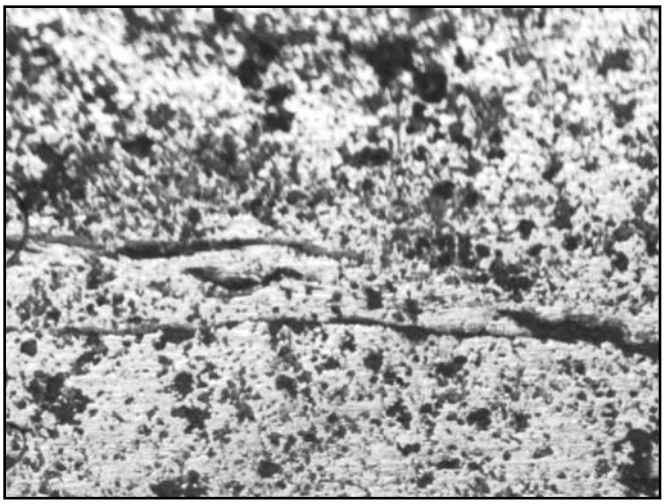
The brass sunflower emblem is a type of applique work known as swami or nagas work. It is a method of decoration favored by Hindus of South India. It was still practiced in Tanjore in the 1960's and may continue today. Swami objects often contain numerous different types of decorative techniques, each created by specialized craftsman. Each craftsman undertakes one part of the process. According to Untrect, the material used to bind the medallion to the base metal is composed of 3 parts dried animal or fish glue, ¾ part powdered brick dust, and 1 ¼ parts gingeli oil. The mixture is heated and poured into the depression behind the medallion and it is fixed to the backing. The red material seen between the edges of the medallion and the pedals is likely to be this binder. The "leaves" around the sunflower, as well as the edges of the leaves, are chiseled out of the steel and perhaps filed to finish.

Bitchwa

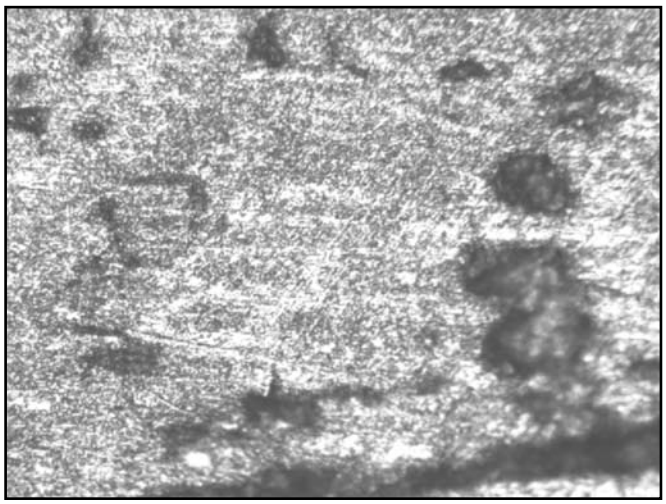


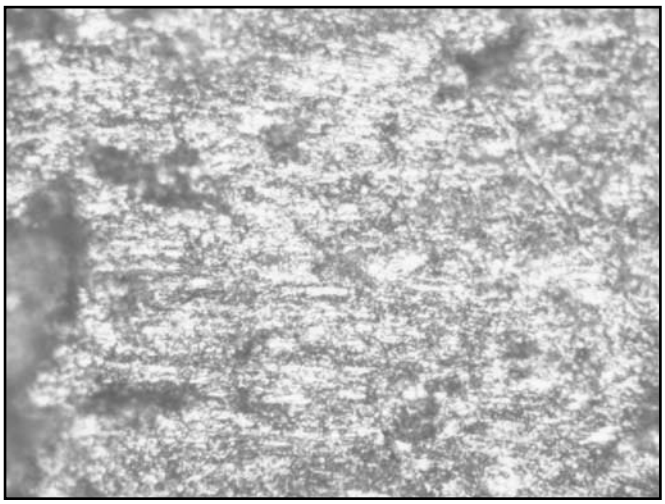
Detail of the handle attachment and the rivit.

Bitchwa



The blade was said by the seller to be made of crucible steel but no characteristic wavy pattern is apparent. However, as this is a typical South Indian Hindu weapon, this is consistent with archaeological and historic evidence which indicates that crucible steel without a pattern was produced in South India.





It is difficult to confirm or refute that the blade is crucible steel. The surface exhibits pitted corrosion and there are elongated areas which resemble slag stringers. Sampling is not recommended as the piece is virtually undamaged, so a metallurgical examination of the surface was undertaken. A small area was polished and etched. The microstructure is very fine and hard to discern, but appears to be a very fine spheroidal cementite. No inclusions were observed, however, that may be due to the small sample size and/or they corroded out in the areas of the corrosion pits.

Mysore Dagger Background

Provenance	Mysore, Southern India
Date	Late 17th- early 18th century, perhaps earlier
Dimensions	18 ½" x 1½ (at widest part of blade)
Blade	Crucible damascus steel
Decoration	Owner and inventory number
Handle	Amalgam gold over copper alloy
Decoration	Floral chasing, with inlaid gems and glass
Scabbard	Fabric over wood

Apparently the inscription reads "sri Krishna" and is then followed by a series of number and a description written in Kannada. The blade is said to be from the collection of Krishnarajha Wodeyer 3rd (Mummadi Krishnaraja Wodeyer) Mummadi means 3rd in kannada. With the help of the British, he succeeded the thrown in 1799 in the fourth battle of Mysore. Mummadi was reported to be multi-talented scholar.

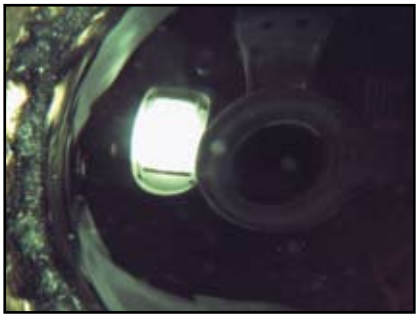
Mysore Dagger

According to Elgood (2004, 30) Krishnarja Wodeyer III ruled from 1799 to 1868, and had the armory collection inventoried. He had each piece engraved with his name, Sri krishna, an inventory number, and the items description. The armory was thought to have been established around 1635 or after (Elgood, 2004, 30). Thus the date of inscription does not indicate the date of manufacture but rather indicates that it was in the possession of Krishnarja Wodeyer III during his inventory of the collection. However, it does suggest a date range between the mid 1600's and the mid 1800's, most likely late 17th- early 18th century. In the 1980's the Maharaha of mysore sold off some of the collection, and this is one of the pieces.

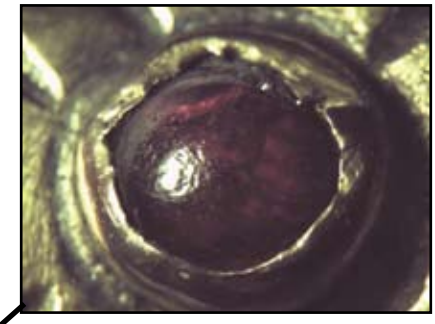
The profile of the blade changes towards the tip to create a weapon capable of piercing armor and chain-mail. This type of tip is also common on katars.

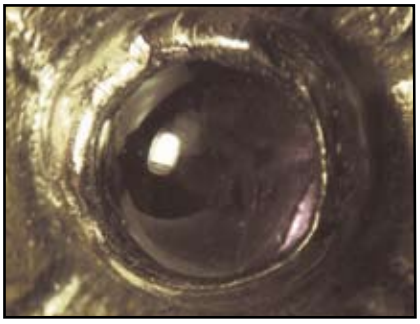
There is a distinct line reflecting a change in microstructure between the blade itself and the tip. It appears to be due to a difference in tempering rather than the application of a different metal. This difference also appears on katars.

Mysore Dagger

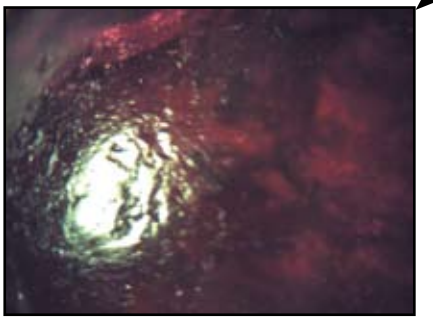


This black stone is likely to be onyx.





The purple stone is likely an amethyst .



The red inset is made of a different material than the others. The marks in the metal, along side the inset, suggest that the original inset was removed and replaced with the red glass. Note the rough surface, and the chipped area. There are also air bubbles (seeds), further evidence that it is glass and not stone. Presumably the original red stone was a ruby.

Mysore Dagger

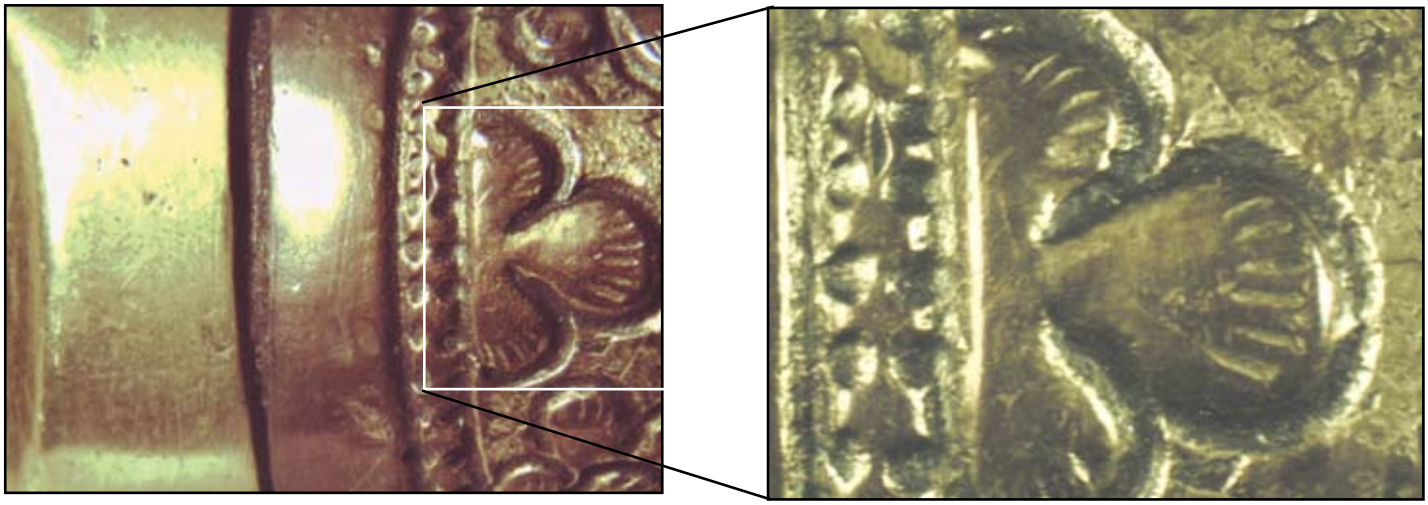
Gemstones were combined in a way so that their beneficial effects would be felt. They also had astronomical implications and were associated with specific planets. The Hindu text, the Garuda Purana, describes the origin of gemstones and the slaying of the demon Vala. Ruby was his blood. Ruby is also associated with the goddess Lakshmi (fortune) and is symbolic because it is lotus colored (see Elgood 2004, 131).

Black was considered an inauspicious color. “The crow is an unlucky bird associated with the unlucky planet Saturn and the inauspicious color black. It symbolizes dead ancestors and is depicted on the banner of the south Indian goddess Jyesth or Alaksmi, who represents awful and opposite qualities to those of her younger sister Lakshmi the goddess of fortune.” (Elgood, 2004, 296). Black also keeps away evil spirits and perhaps was there to evoking ancestor spirits to help with the users success.

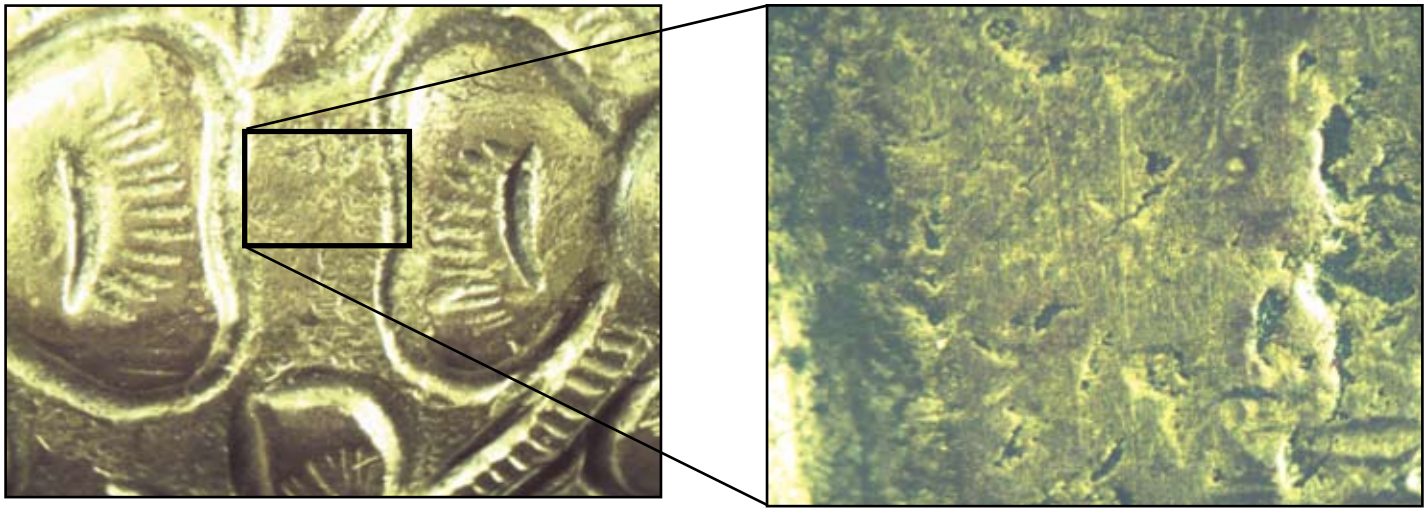
Mysore Dagger

Baden Powel decribes the setting of gems as follows: the handlemaker will leave a hollow cup for the gem to sit. The jeweller will then place a little lac in the hollow, and on that will press down a bit of foil. The gem is placed on the foil and the foil is then pressed to hold the gem in place. The term “kundan” means to press.

Mysore Dagger

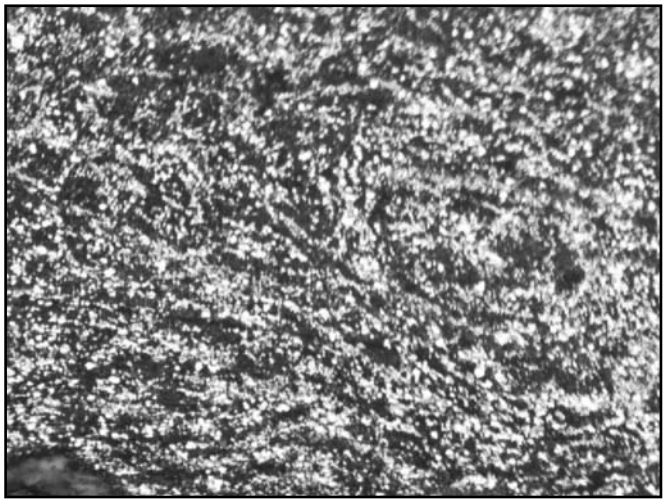


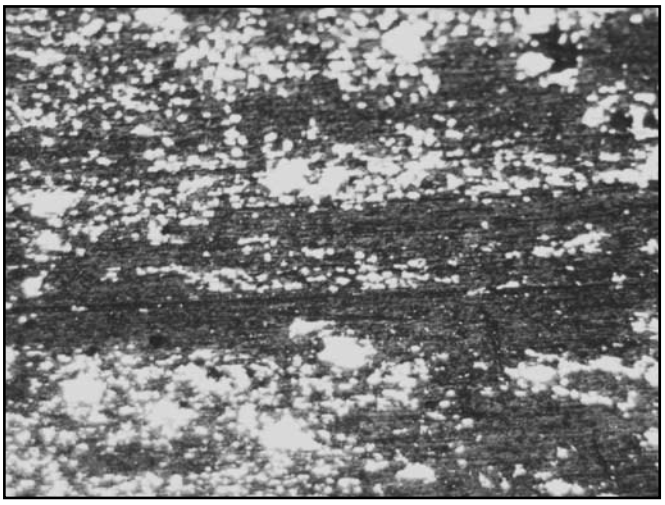
This high quality handle is made of a copper-alloy decorated by hammering, chasing, and engraving. Amristar was a large producer of this type of ware. The decoration is floral pattern of leaves and vines, perhaps representing stylized lotus.

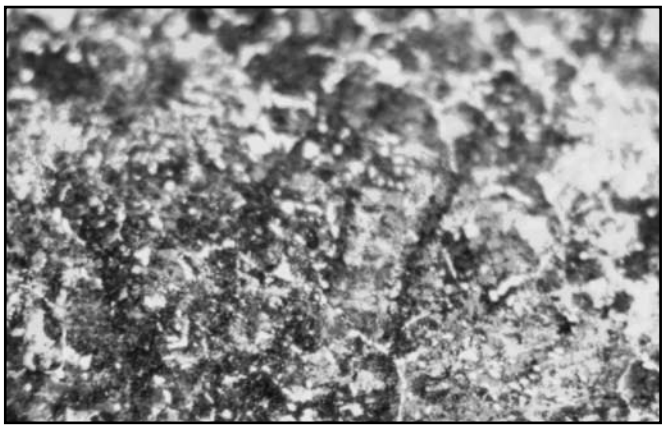


The handle is made of copper alloy with a layer of gold. This process is called "thanda mulamma".The process involves coating the copper with mercury and then gold leaf. Refer to the section on koftgari below for more details.

Mysore Dagger







The blade is made of crucible steel with a medium fine water pattern. Due to the excellent condition of the blade, no sample was removed but a small (~1-2 mm) area was polished and etched. The white areas are spheroidal cementite and the dark background areas are very fine pearlite in a ferritic matrix. Note the alignment of the cementite. The microstructures were difficult to photograph due to the shape of the blade.

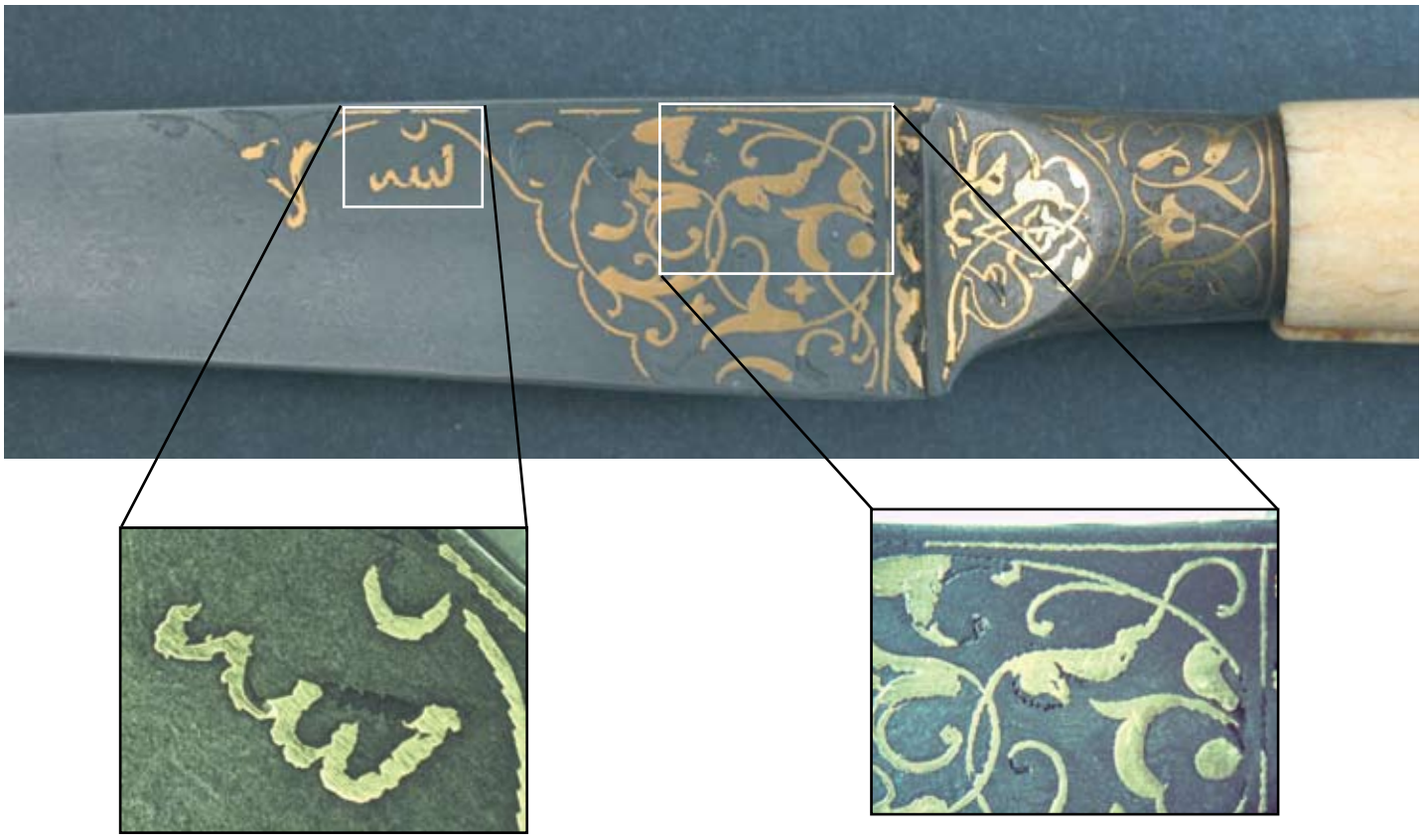
Kard

Provenance	Persia, Likely Isfahan,
Date	Late Safavid
Dimensions	14” x1 ¼”
Blade	40 step pattern crucible damascus steel
Decoration	Inlayed koftgari floral scrolls and makers mark (?)
Handle	Walrus Ivory

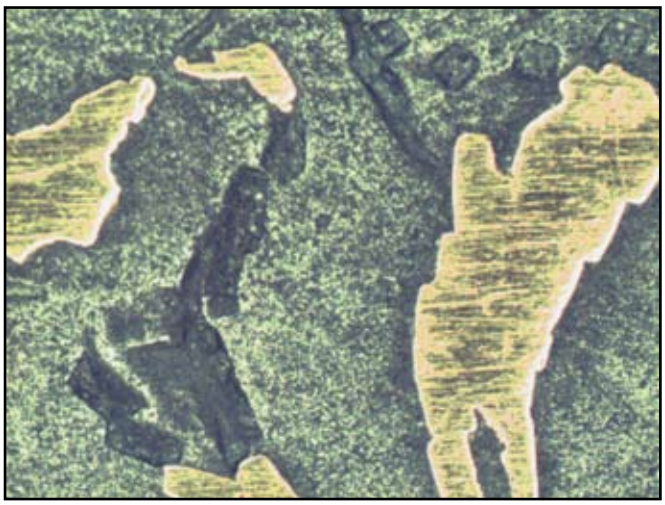
Allan and Gilmore define the kard as “straight, single-edged pointed knife, worn on the left side” (2000, 146). This kard is strikingly similar to a group of daggers discussed by Allan and Gilmore (2000, 150-153), particularly dagger A.8 in the Tanavoli collection, and one in the Khahili collection apart from the fact that the decoration on the Tanavoli blade is chiselled, whereas the Beall kard is decorated by koftgari. It is highly likely that this blade was made in a workshop in Isphahan.

The kard is a Persian knife and used in various areas which had a Persian influence. Kards hang from belts of rulers and were often given as gifts. The hilts are usually bone, elephant or walrus ivory, semi-precious stones or metal. This handle of this fine kard is walrus ivory.

Kard Blade

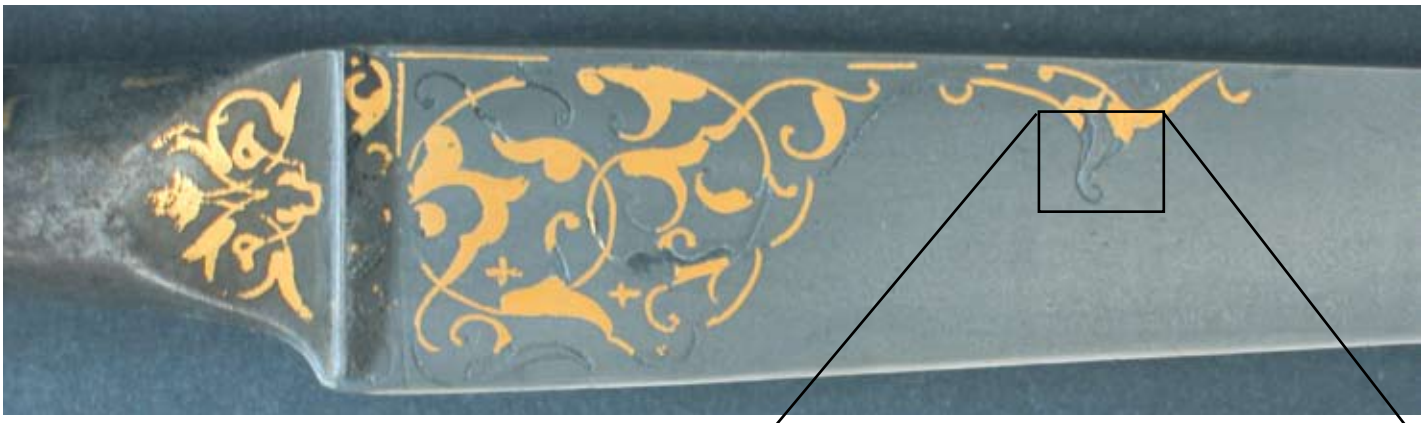


This area of koftgari poses some interesting questions. On other kards, the name of the maker (or perhaps owner?) is often presented here. The inscriptions are in Farsi but it is confusing. It was expected to be a proper name but as it stands it appears to read “Allah”. Initially, the empty recessed area appears to be where the gold has been lost. However, it may have been a mistake on the part of the engraver, According to Sahim, if the area was filled, the inscription would not make sense. According to Allan and Gilmore, there was a swordmaker in Isfaphan “Asad Allah”.
Translation performed by Prof. Haideh Sahim, Hofstra University.

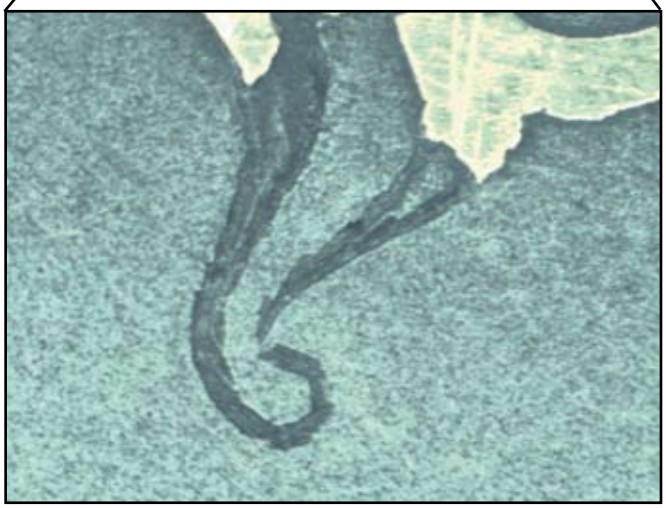


The fine parallel scratches on the inlay are due to the burnishing of the gold flush with the surface during the finishing process.

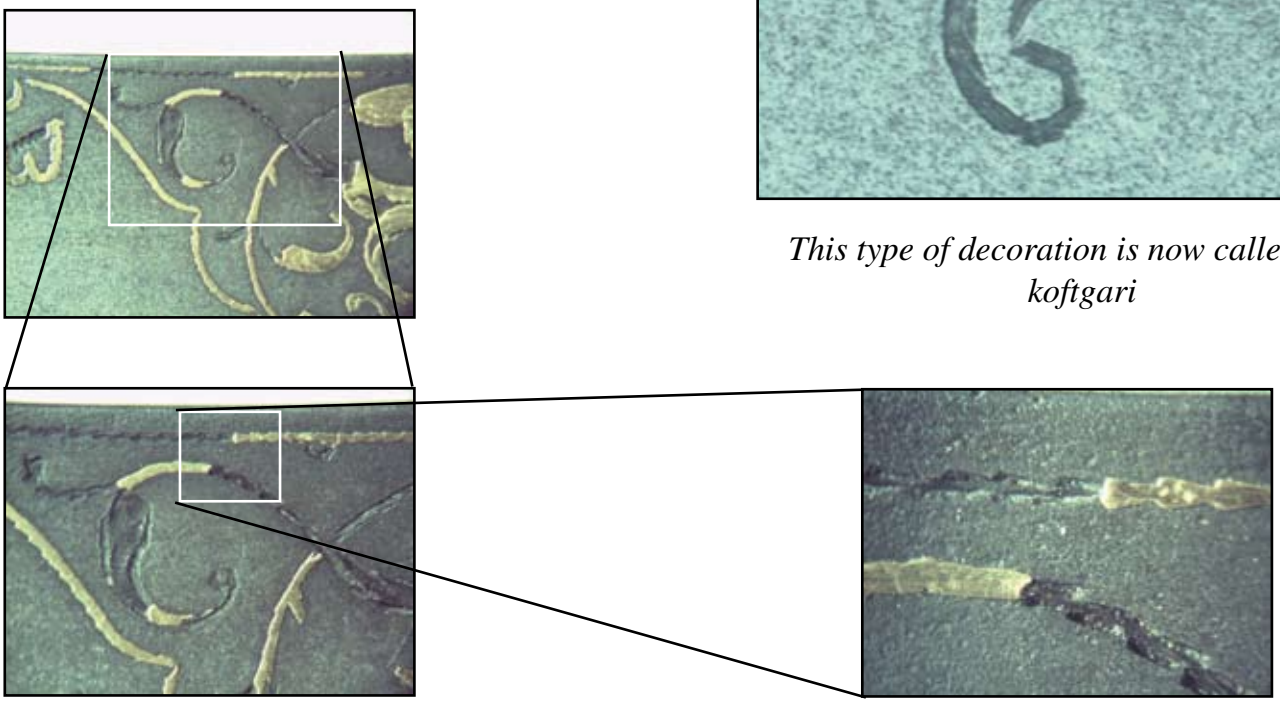
Kard Blade



The open arabesque design is not dissimilar to the work on the body armor of the Tanavoli collection (see Allan and Gilmore, 2000, 134-137). Those pieces are dated to the 1700's and also have chiselled, piercing, chasing and riveted areas.



This type of decoration is now called inlay koftgari



Punchmarks made with a square ended punch. Square ended punches were used to decorate pen boxes in other Islamic lands.

Kard Blade

On the spine of the blade, near the join with the bolster there is a delicately carved raised foral design.

The lower photomocrograph is a closeup of the engraved floral pattern which has lost the gold inlay.

Kard Handle

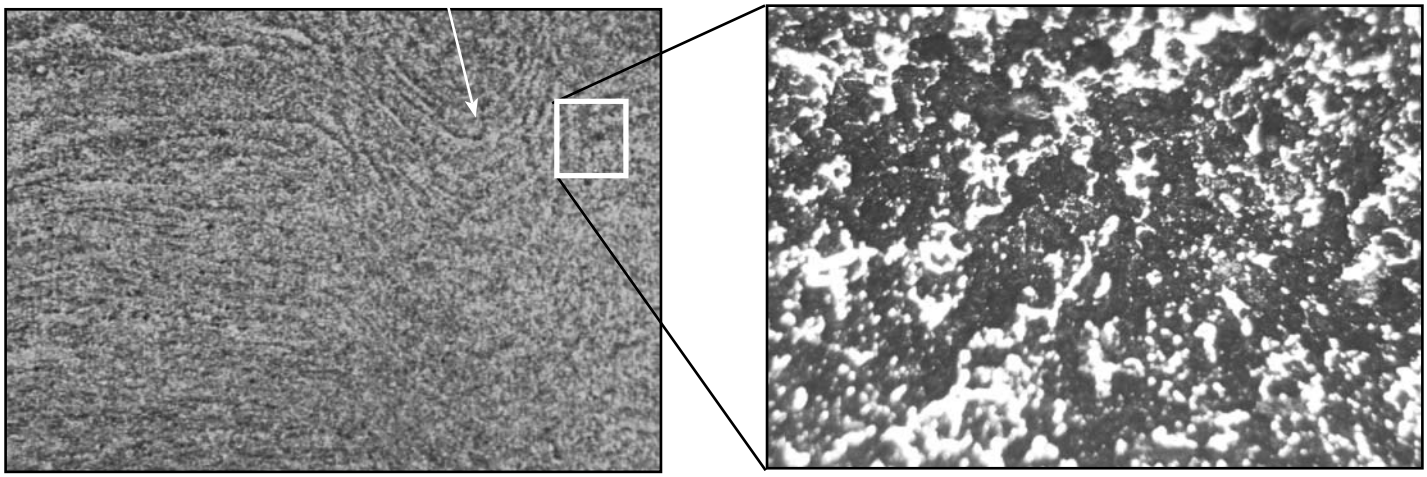
The tang runs virtually the entire length of the handle. The handle has concealed rivets.

According to Khorasani (2006, 232) and Zeller and Rohrer's bolster classification, the kard has a Type C bolster with sloping cheeks. There is a slight raised midrib along the spine of the blade, creating a slope to the edge. There is an arabesque pattern along the handle strap (ahanak).

The mottled pattern of the ivory strongly suggests that it is indeed walrus ivory. Handles with this crystalline structure were highly prized.

Walrus ivory was traded a very long distance from the Arctic north and traded though Siberia. It was greatly sought after because it wears well with time, it is smooth in the hand and less prone to slipping.

Kard Analysis



The kard is made of crucible steel with a supurb water pattern including the 40 steps, also called Mohammad's ladder pattern. The light areas of the photomicrograph are cementite, and the dark is irresolveable pearlite in a ferritic matrix (dark background).

The "steps" are made by engraving or forging a perpendicular line in the steel during forging. In effect it is pushing the aligned cementite to create the ladder effect (see arrow). The steps are symbolic of heaven and the 40 virgins awaiting a religions warrior in the afterlife. The water pattern itself represents the Waters of Paradise, which awaits the warrior. It also represent sweet, life giving water, and salty brackish water, just as the weapon can both save and take a life.

The table is taken from Verhoeven's analysis of the blade. It is composed of high carbon steel, which is to be expected given the microstructure. It also has a significant amount of trace elements (eg V, Mn, Mo) which promote the alignment of the cementite. The phosphorus would have made the blade hard but would have also made the ingot hot short. This means that the ingot would have need to be forged below red heat (austenite transition temperature). If it was heated to white heat and struck, it would have shattered. The required low temperature forging would have the additional benefit of promoting the cementite alignment and the creation of the water pattern.

Element	ppm
C	1.24
Mn	<100
P	1.430
S	110
Si	800
Ni	900
Cr	100
Mo	100
Cu	1.000
Al	<10
V	120
Nb	60
Pb	27
Sn	30
Ti	20
Zr	50
B	8

Khanjar

Provenance	Persia
Date	19th century probably Qajar
Dimensions	19 ½" x 2 ½
Blade	Crucible Steel
Decoration	Cross hatched Koftgari
Handle	Tin (or silver?)
Decoration	Floral, fish scale pattern
Scabbard	Seller reports silver, but may be tin
Decoration	Floral, fish scale, geometric patterns

According to the seller it is a Kurdistani Jambyia, from the second half of the 19th century. However, the blade should be referred to as a khanjar, because the calligraphy is written in Farsi indicating a Persian origin. If the writing was in Arabic, it could be called a jambiya. A khanjar is "a curved double edged dirk, stuck in the girdle on the right side" (Allan and Gilmore, 2000, 146).

The seller claimed the handle and scabbard are made of silver, however it appears to be tin, a well used metal in Qajar times.

The blade curves and had a prominent rib running from the cross hatched koftgari almost to the point. The khanjar is usually worn on the right side of the body.

Khanjar

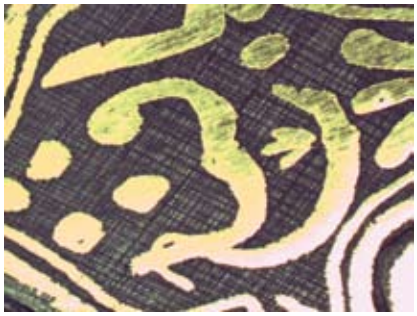
The calligraphy reads *Ya Ali" Oh Ali* on one side and *"Ya fath"* or *"Ya fatah"* which means "O Victory". The call to Ali indicates that this was made for a Shiite. The Shiite sect of islam is predominent in Iran. According to Sahim, Shiites invoke Ali in this manner whenever they do a hard task, such as lifting a heavy weight. "If you say it, you will see how your muscles contract, thus making lifting easier."

The Persian inscription reads "Ya fath" or "Ya fatah" which means "O Victory".

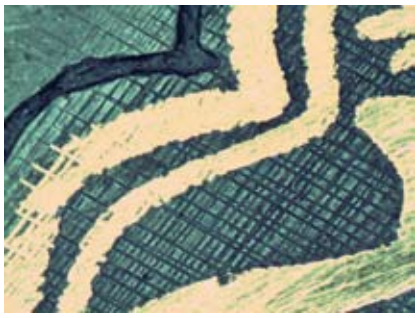
The Persian inscription reads: "Ya Ali" Oh Ali".

Khanjar Cross-Hatched Koftgari

There is a highly skillfully executed floral pattern koftgari work at the base of the blade, next to the hilt. This type of koftgari is termed cross-hatched wire koftgari. It was used in both Persia and India. In Persia it is called talakub. The processs was described by Wulff (1966, 41-42) who states that the gold-inlayer uses a the sharp short edged knife to produce a cross-hatched pattern which roughens up the surface (zabr kardan). One or more gold or silver wires are then hammered into place with a pointed hammer (Wulff, 1966, 41).

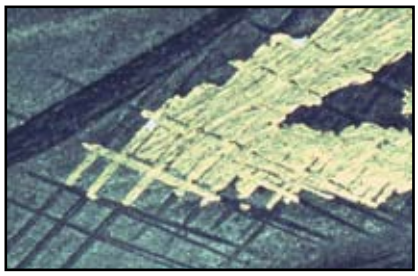


Cross-hatch koftgari detail.

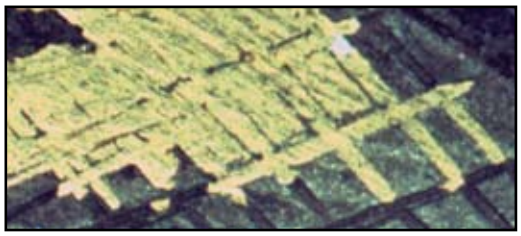


Detail of the koftgari, note the engraved line surrounding the inscription.

Detail of the cross-hatching.



Detail of the koftgari, note the striations on the gold where the agate stone burnished the gold and helped it adhere to the blades surface.



Detail of the gold inlay on top of the cross hatching and keying into the lower incised area.

Khanjar Scabbard

The scabbard was made of at least two metal pieces soldered together on the sides.

The floral and fish scale decoration is well executed and detailed. It appears to have been decorated used repouseé and chasing. The material, methods and motifs are all characteristic of Persia.

The scabbard ends in a teardrop terminal.

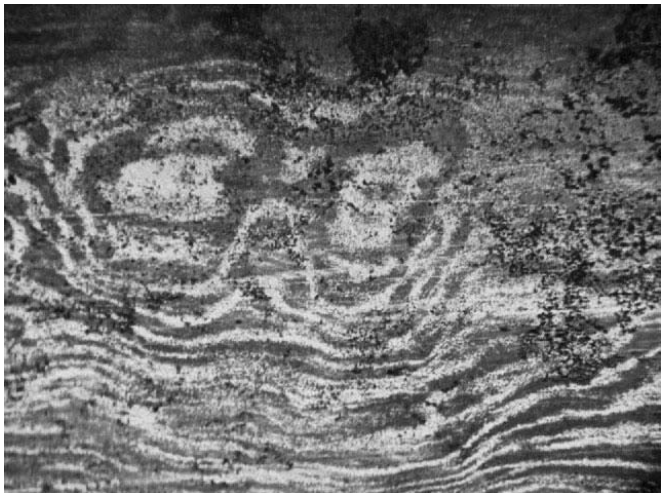
Khanjar Scabbard

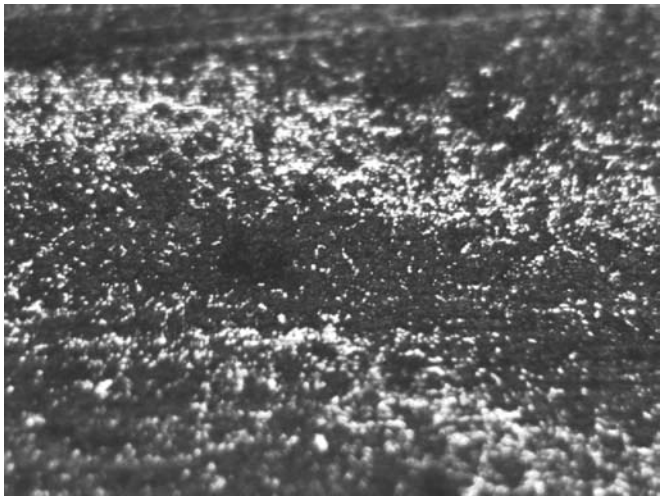
Khanjar Scabbard

The handle was made of at least two parts soldered together. The fish scale and floral pattern is executed with a great deal of mastery and detail, worthy of the fine blade and koftgari work.

The arrows are pointing to the solder which is clearly visable.

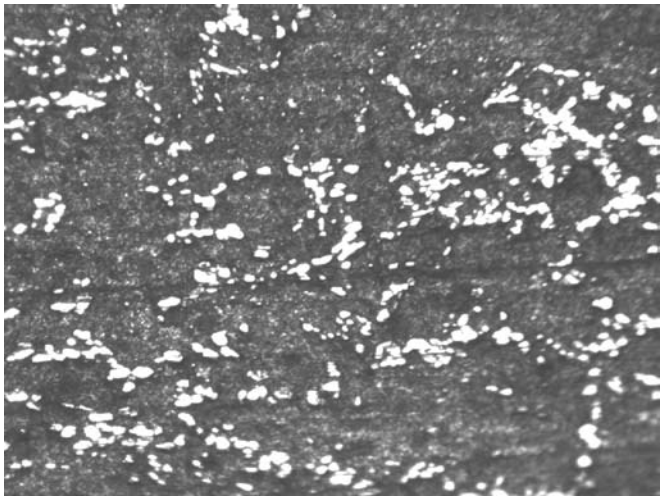
Khanjar blade





The khanjar has a beautiful coarse water pattern, typical of many khanjars.

The spheroidal cementite is beginning to align in a ferritic matrix. Prior austenite grain boundary cementite is clearly visable is the photomicrograph. The coarse pattern and prior austenite grain boundary cementite indicate a slowly cooled crucible steel ingot, a technique primarily used in Central Asia, and perhaps Persia. However, no production area have been identified in Persia.



Choora/ Chhurá

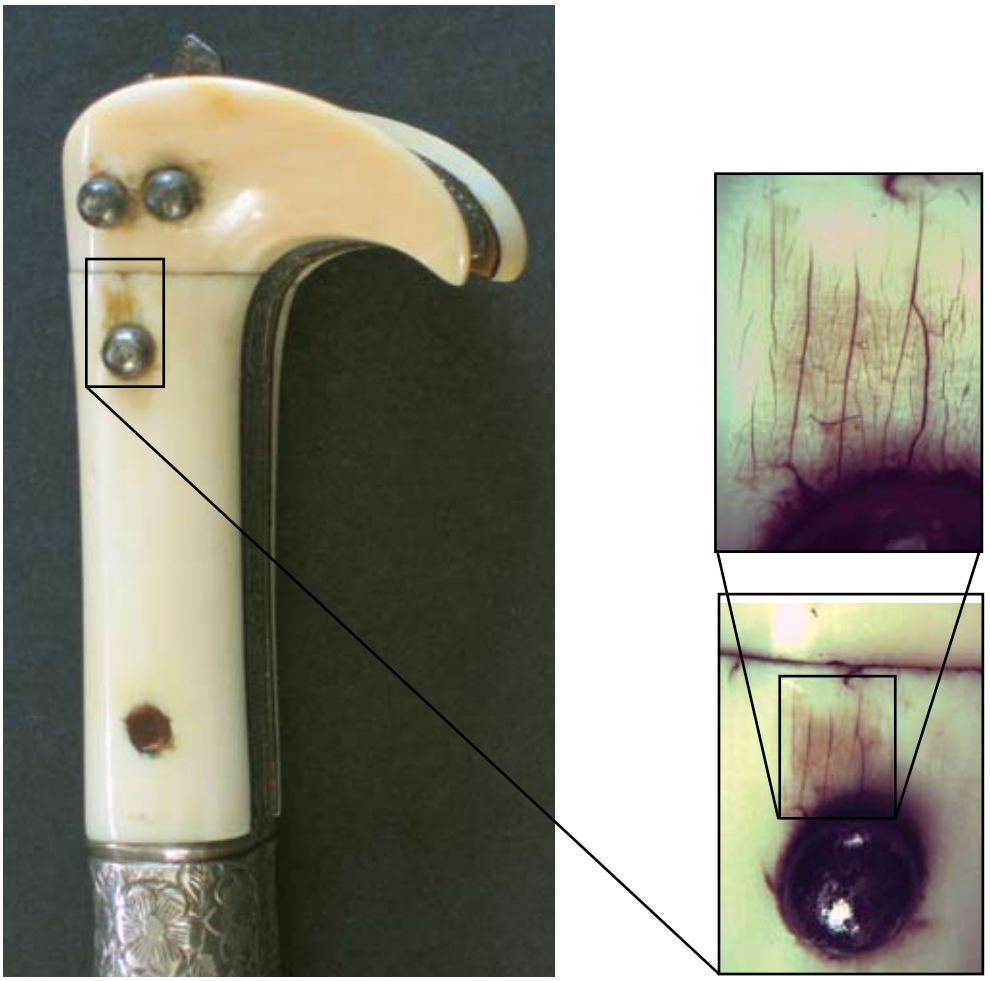
Choora / Chhurá

Provenance	Khyber pass Afghanistan
Date	Early 20th century
Dimensions	12 ½" x 1 ½"
Blade	Crucible steel
Handle	Bone, tin, copper alloys
Decoration	Floral and geometric designs
Scabbard	Leather and fabric over wood
Decoration	Geometric patterns and lozenge

The shape of the blade is common in Persia and Central Asia where it is known as a Pishqabz, but in Afghanistan this particular type from the Kyber pass is commonly known as a Choora.

According to Baden Powell, in his tome on the arts of the Punjab, the three types of daggers produced in this region are the bichúa, the katár and the peshkabz. But in this region the Afghan "chhurá" and the "babúdi" are also known. The Afghan "chhurá" is the equivalent of the Persian "kard" and these are not used for fighting. Common materials for handles are ivory, "márpech", jade, agate, or rock crystal (Baden Powell, 1872, 292).

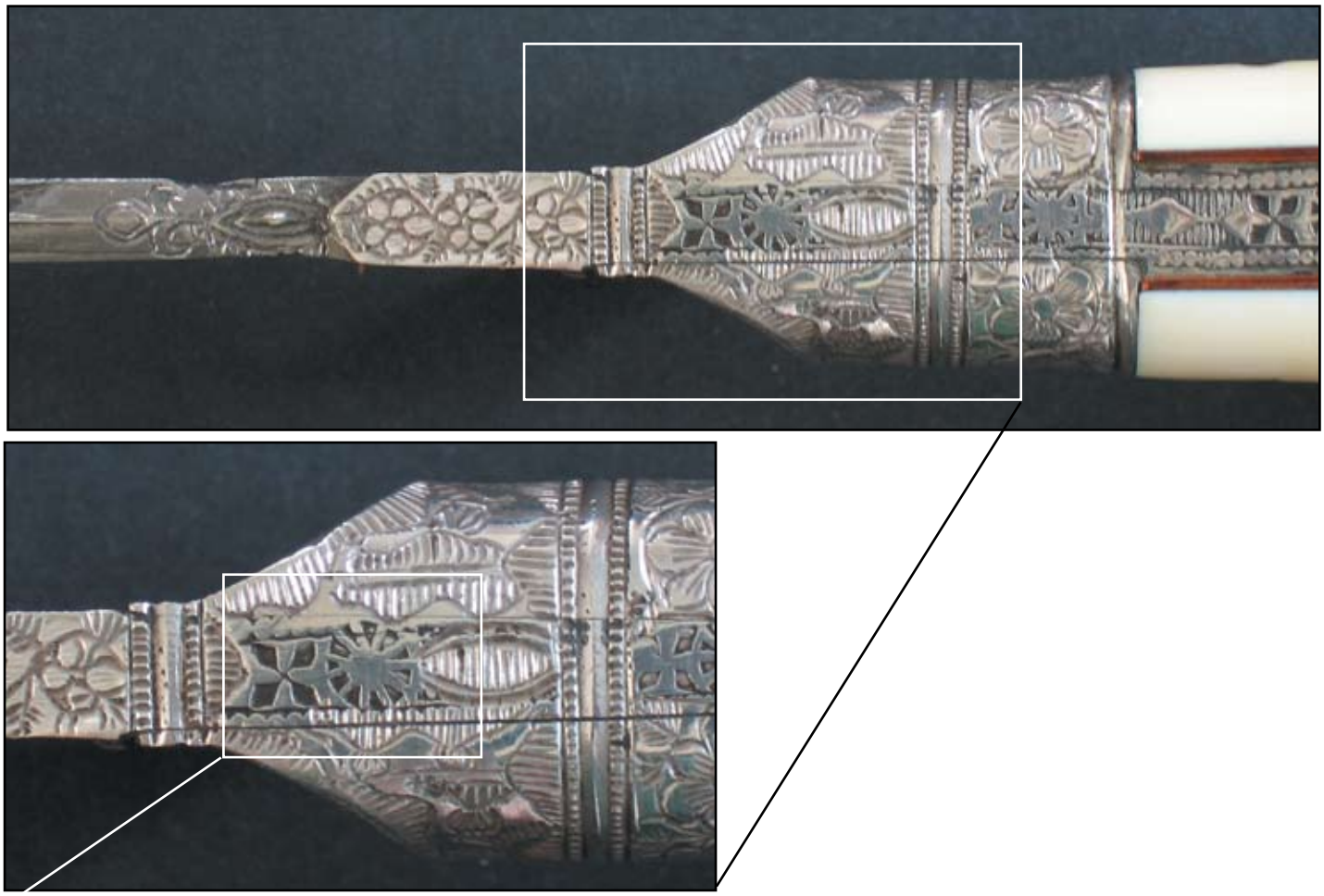
Choora / Chhurá



The blade exemplifies the type discussed by Baden Powell. “The ‘peshkabz’ (choora) has a blade quite straight at the back, and sloping at the edge to a fine point; the handle is usually of shírmahi, the white bone of a large Cetacean, spoken of by Richardson as the “seer-fish”, a sort of Tunny.”

Baden Powell footnotes here that he does not know of any fish that size but believes that it is the bone of the “black-fish” which is common to the Western Coast. He then continues to describe the sheath which he said is either of leather or velvet and “is worn so as cover a part of the handle.” (Baden Powell, 1872, 292).

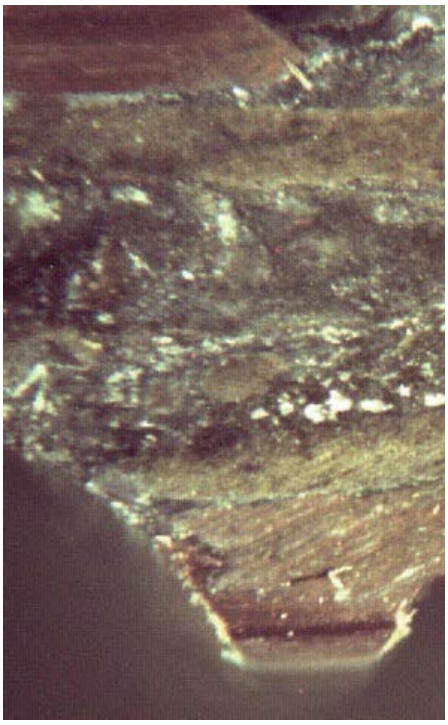
Choora / Chhurá



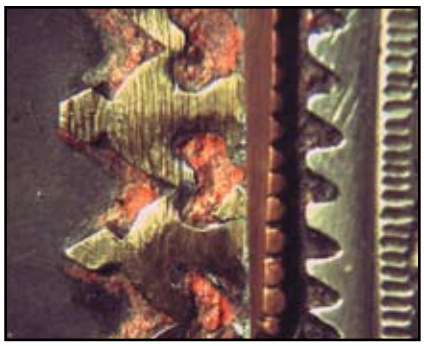
This Choora is an interesting piece. The blade is composed of crucible damascus steel with a light and fine pattern. A variety of metals are use in the decoration of the handle.

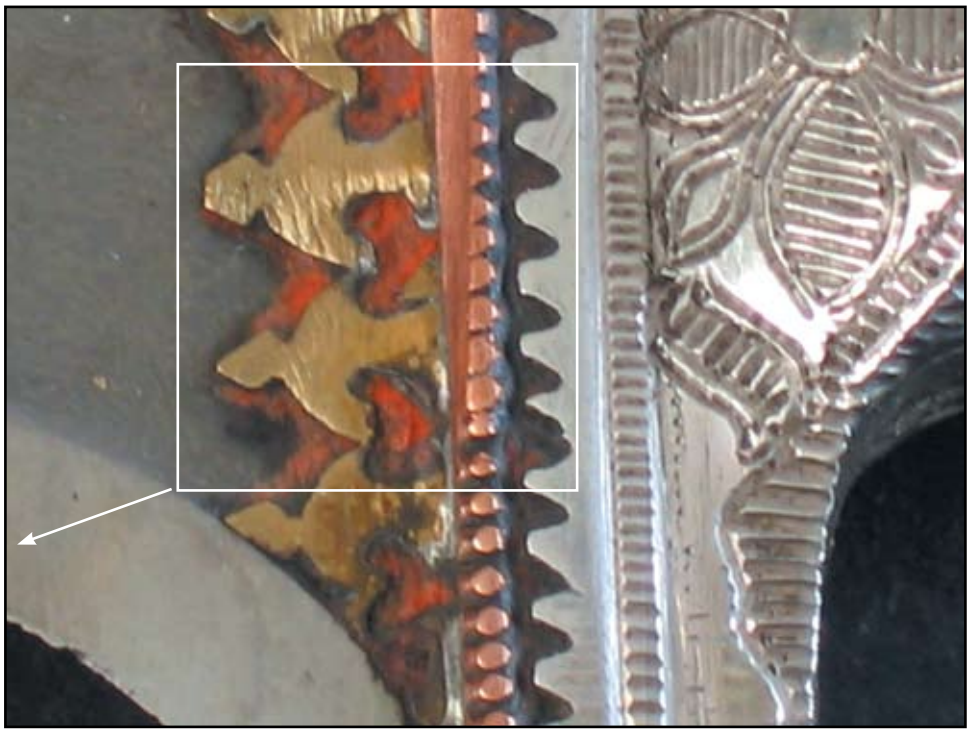
The upper area of the handle is decorated with highly elaborately chased tin sheet.

Choora / Chhurá



Copper and brass pieces are used to decorate the area between the handle and the blade. The use of a red adhesive material appears to be swami or nagas work, as was decribed in reference to the bitchwa above.

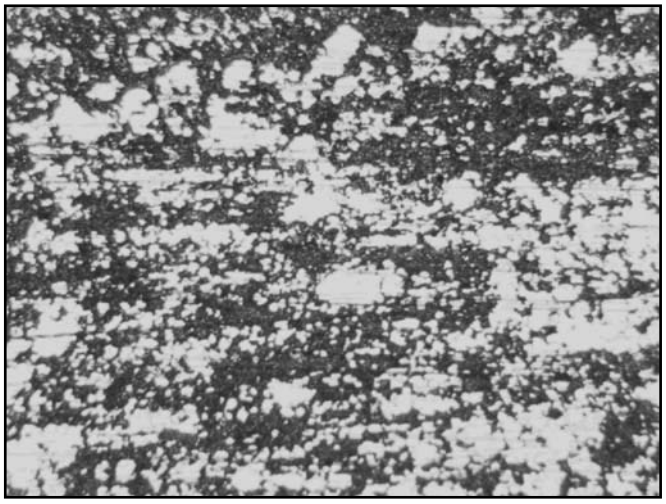


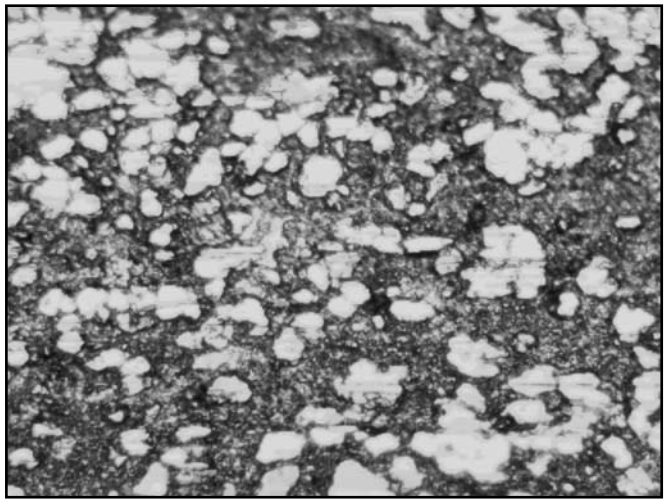


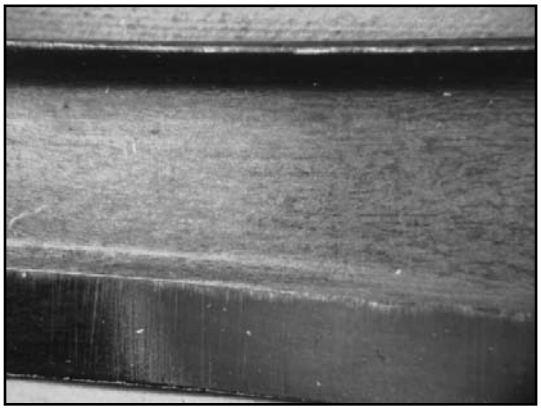
Choora / Chhurá

The underside of the handle is also highly decorated in geometric and floral patterns. The chased tin is framed with copper. The base of the handle is pleasently curved indicated a talented carver. The handle is attached with four rivits on each side.

Choora / Chhurá

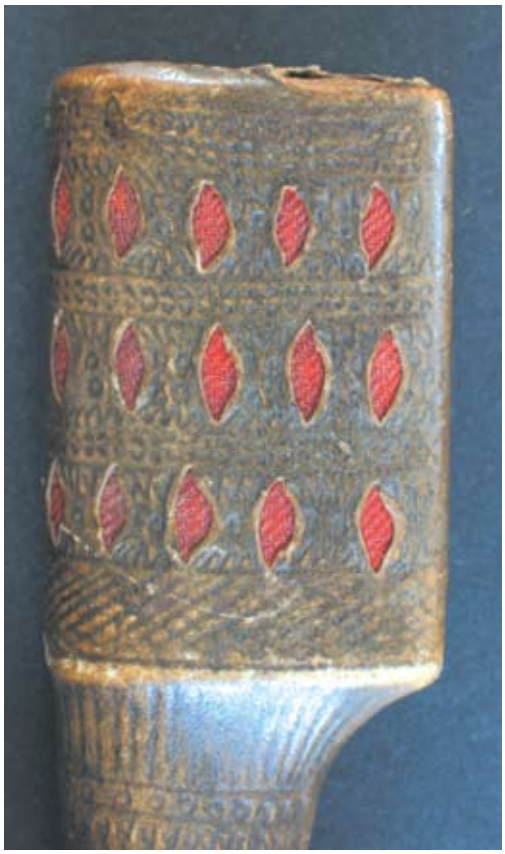






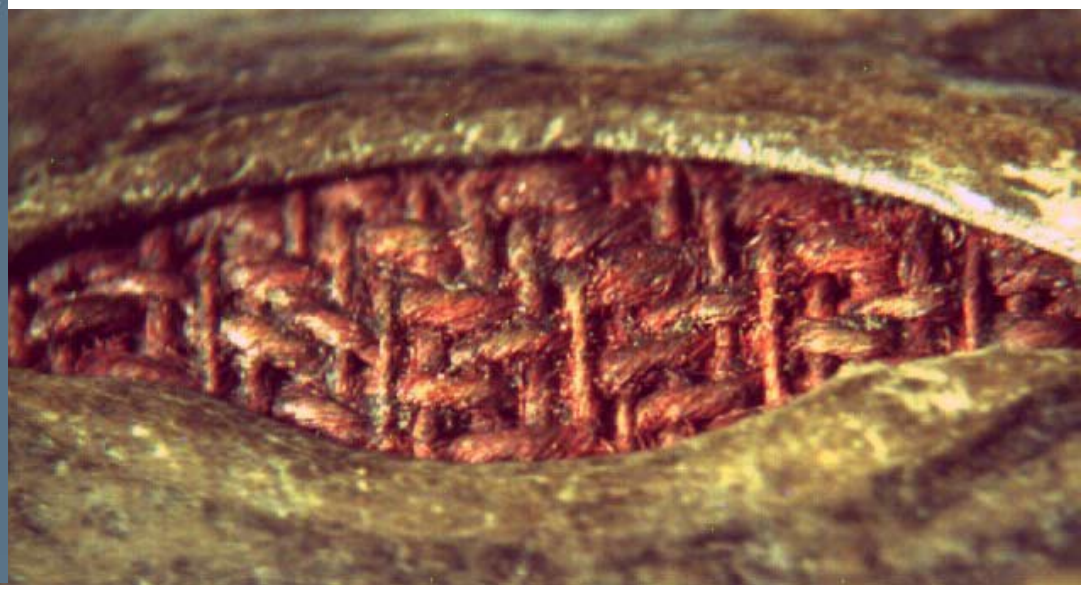
The blade of is made of crucible steel with a very fine pattern. While the spheroidal cementite is alighning, there is no distinct banding. This suggests a fast cooled or highly worked ingot.

Choora / Chhurá



The scabbard is made of leather over wood. The leather is elaboratly decorated in geometric lines, and triangles.

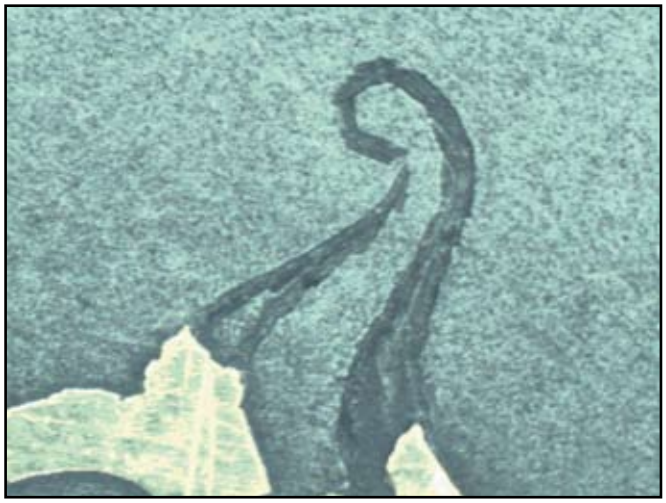
There are eighteen losenges cut out of the leather which reveal a finely woven red fabric.



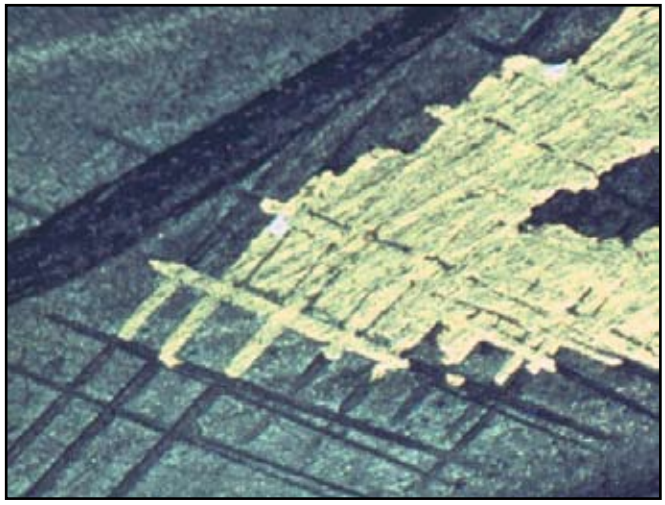
Choora / Chhurá

The leather scabbard is sewed up the reverse with a leather cord.

Koftgari



Recessed grove cut out to hold gold wire.



Cross-hatched Koftgari

Decoration on blades, handles, fittings and other items was performed by specialist groups of metal-workers. According to Floor (2003, 223- 226) in Persia during the Qajar period "the gold engravers' guilds (naqqash-e zargar) engraved and inlayed ivory bones and lion fish-teeth for the grips of daggers (khanjar).

While there are a number of apparently first hand accounts of koftgari, there is little consistence with the terms used or the level of details of the methods described. The reasons for this may be the observers lack of understanding of the subtleties between the different processes, different local traditions and use of terms, as well as differing transliterations and the misuse of terms as synonyms.

In India, Persia and regions of Central Asia, one of the most common methods of arms and armor decoration was the inlay of gold or silver wire. There are three related, yet distinct, methods of inlay used in all these regions. They are: applying wire into a grove, applying wire into perforated holes, and applying wire onto a shallow cross-hatched roughened surface. The visual appearance of the finished product is very similar but the main differences are the cost and the durability of the adhesion of the decoration to the metal. At this time there are no known characteristics which can be used to distinguish between decoration performed in one location or another, but perhaps with the examination of more objects with well documented provenances, location specific traits can be determined.

Koftgari

In Persia and India inlaying gold or silver wire into a grove is the most expensive method of decoration because it requires the greatest amount of precious metal. It is also more durable because the metal fills the grove or trough. In Persia it is called zar-neshan (zarkhondan) if the wire stands proud of the surface, whereas if the wire is burnished flush with the surface, it is called teh-nashan. The inlay process as performed in Persia was described by Olmar (translated by de Rochechourt and found in Floor, 2003, 224).

The process begins with drawing the desired decoration onto the blade. The metal is then removed using an engraving tool, thus leaving a recessed trough in which the gold or silver will sit. In Qajar Persia the tool used by the gold engravers was called a pardaz e qalam (Floor, 2003, 225). The edges are left rough which will help key in the wire. The gold or silver wire may be precut to size or cut as needed. The wire is then pushed into the recess. The wire may be polished to become flush with the surface or it can be left raised to give a relief effect. The raised wire can then be engraved to further enhance the decoration (Floor, 2003, 245; Khorsani, 2006, 183).

Steingass states that koftgari is a Persian word. In India the term koftgari (Kuftgari, Koftgari, Koft work, or kár-i-tilá) is generally used to describe gold or silver applied to steel. However, it has become apparent that there is no universally accepted description of the koftgari process. There are three types of gold or silver application which have been called koftgari. While each of the techniques are related, they are certainly not the same from a technology point of view, thus a description of each is given here, along with a descriptive term, to distinguish between the processes. The three methods are called: shallow inlay koftgari, cross-hatched leaf koftgari, and cross-hatched wire koftgari.

Baden Powell states that the shallow inlay koftgari is done in Gujrat, Sealkot, Nizamabad, Wazieabad and Multan. He describes the koftgari performed in these locations as follows: “Koft-gari is done by first drawing out the pattern on the steel surface with a hard steel needle or silái. This leaves a line sufficiently deep to catch the very fine wire laid on. The wire is of pure gold….The wire is then hammered into the iron according to the pattern and lines already drawn, the whole is then heated and again hammered, and the surface is polished with a white porous stone; whereas the soft gold is required to be spread, the rubbing and hammering are repeated with greater force. The gold used is pure and very soft” (Baden Powell, 1872, 168). Baden Powell (1872, 169) records that he was told that the technique for this type of koftgari was introduced to the area of Multan in the 1600’s by Muhamad Murád.

Baden Powell gives a more detailed discussion of the process, “The method of working is as follows: suppose a hand axe is to be inlaid. The blade of the axe is first made smooth with a tawati or file, after which it is polished with the khingri or pumice stone, on this being done a rough wooden handle is inserted in the hollow part of the hatchet; the outer end of the handle is pressed inside the arm, and the

hatchet is placed on a stool one and half feet high, and then the process of carving is done with the steel pen, according to the design which the workmen is furnished with.

The hatchet is then heated for a few minutes in a fire of charcoal, quite free from smoke, until the steel changes its natural color into azure blue. The fold wire is then also heated so as to make it soft, and is coiled on a reel. Again the hatchet is placed on the stool in the manner above described; the artist takes the wire and presses it in the lines with the iron pencil, pathraini, following the outline design engraved with the style. When one flower or the whole work is completed, it becomes necessary to cut the wire, which is done with "kath" or gold smiths' scissors. Should the wire, after being first fixed, becomes loose in any part of the hatchet, it is again heated in the coals, and the wire is beaten with a small hammer which refixes it. The hatchet is then rubbed with mohárí or stone rubber, so as to draw out its brilliancy and luster. After the above process is completed, the hatchet is well rubbed with sour lime juice, but this changes the color from azure to white, it becomes necessary again to put it on a clear fire, so that it may resume its former color of azure, together with its brightness and luster" (Baden Powell, 1872, 170).

The steps required for the process is similar to that used for cross-hatched koftgari except that instead of laying the wire in the scratched out channel, the entire area is roughened up by scratching a cross-hatched patterned onto the steel. Baden Powell refers to this process as "gilding" and describes the process as follows "If an article is to be plain gilt all over, it is first smoothened with the ráwati or file, and afterwards cleaned with khingri or pumice stone; it is then drawn over with chequers with the carving style, and sprinkled with limejuice, after which it is heated; gold or silver leaves (as the case may be) are then applied with pincers, and lightly hammered, and are rubbed with the mohárí or stone rubbers, which causes the gold to adhere to the surface roughened by the chequered lines- and then the soft gold spreads out under the rubber, and covers the whole surface" (Baden Powell, 1872, 171). He later clarifies the process and he recorded, "Where gold and silver leaf is required to be applied to an iron surface, as in the case of armor, knives, or ornamental work, the surface is scratched over with chequered lines, this process is called ('khizán'), and washed with hot solution of kishta; and then dried its is heated to what the workmen called "shitab" (corruption of siya tab, 'black heat') i.e. the greatest heat it will reach without becoming red hot. In this state leaves of gold or silver, as required are layed on, and rubbed in with a mohárí" (Baden Powell, 172).

The third method of Koftgari is termed cross-hatched wire koftgari. In Persia it is called talakub (takakub, or talakhubi). The processs was described by Wulff (1966, 41-42) who states that the gold-inlayer uses a the sharp short edged knife to produce a cross-hatched pattern which roughens up the surface (zabr kardan). One or more gold or silver wires are then hammered into place with a pointed hammer (Wulff, 1966, 41).

Koftgari

The Indians also used mercury guilding (plating). Baden Powel (1872, 172) describes the technique as follows: If the article be of copper, it is to be well scraped, cleaned and polished, and then heated in the fire to remove all oil or dirt that may have been left on the surface by polishing. After this it is dipped in an acid solution of the 'kishta', or dried unripe apricots. After this it is rubbed with the powder of half burned bricks or some other earth. The surface is then rubbed with mercury, which adheres by combining with the metal. The article is next placed in clean water for some hours, and again washed in the kishta solution, and dried with a clean cloth. Gold leaf is now applied to the surface, to which it adheres, being adjusted by the workmen by blowing it with his mouth or touching it with a cloth. The gold then, by reason of the effect of the mercury coating, appears all white. The article being subjected to heat, the mercury sublimes, and the dull yellow metallic tint returns; more gold leaf is now applied, and is all rubbed and ground into the surface by means of agate rubbers called 'mohári'…The quantity of mercury used is always double in weight that of the gold: the plating is of course done more lightly or more heavily as the work requires." This method was used to decorate the handle of the dagger from Mysore.

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