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New data on non-human primates from the ancient Near East: The recent discovery of a rhesus macaque burial at Shahr-i Sokhta (Iran)

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Abstract

Shahr-i Sokhta (Iran) was an important urban settlement in the Near East between the end of the fourth millennium and the beginning of the second millennium BC. It entertained trade and cultural relations with ancient sites and cultures on the Indus Plain, southern shores of the Persian Gulf and of the Oman Sea, Southwest Iran, and Central Asia. The recent discovery of a rhesus macaque (*Macaca mulatta*) burial in the cemetery of site shed new light on the exploitation of monkeys in antiquity. A young rhesus macaque—around 5 years old at death—was buried in the necropolis according to the same funerary practices used for human infants. The monkey was buried in a simple pit, together with an unpainted pear-shaped beaker. Both its femurs were pathological, due to a sort of dystrophic calcification of the tendon or muscle insertion, that may suggest the macaque was kept in captivity and died due to physical stress. No non-human primate species is native of Iran; rhesus macaques inhabit parts of southern and south-eastern regions of Central Asia. A possible provenance from the Indus valley of the macaque found at Shahr-i Sokhta can be hypothesized. Although findings of monkey remains are rare, iconographic and written sources widely testify that non-human primates were imported to the Near East in the fourth-to-second millennium BC as luxury animals and symbols of power, often as gifts for

the elite. This discovery represents one of the earliest examples of monkeys being kept as pets.

1 INTRODUCTION

In recent years, zooarchaeology has begun to look at the animal-human relationship in antiquity not only in relation to diet and economy but also to aspects such as ritual and funerary practices, demonstrating its potential in shedding light on social and cultural infrastructures besides the use of animals (Morris, [2011](#); O'Day, Van Neer, & Ervynck, [2004](#)).

The burial of animals was practiced in the Near East during the third millennium BC. The animals buried were usually equids, but also dogs, cattle, caprines and, more rarely, birds and fish were found (Ramos Soldado, [2016](#) and reference therein). In the majority of cases, animals were buried together with humans or just next to human burials; these animals could have played a role as social markers, companions in the afterlife, or may represent food or sacrificial offerings.

The remains of various animals, particularly goats and dogs, which are always associated to human burials, have also been found in the necropolis of Shahr-i Sokhta. Particularly interesting was the discovery of a complete dog skeleton and two dog skulls in Grave 1003, together with 12 human skulls placed along the wall of the tomb and a complete skeleton of a man, who was about 45 years old, placed at the centre of the tomb.

More recently, was discovered the tomb of a macaque (Grave 9319), that was accorded the same funerary rites used for humans. Here, we present all the

details of this important finding, that represents one of the earliest examples of non-human primates being kept as pets.

2 THE CONTEXT: SHAHR-I SOKHTA

Shahr-i Sokhta—the so-called Burnt City—is the name of a famous archaeological site located 56 km far from Zabol, in what is now one of the most arid areas of south-eastern Iran (regions of Sistan and Baluchistan; Figure 1). The site extends for about 1.5 km² and forms a mound that is 12 to 18 m high. Its extension is unusual for a settlement dated to the Iranian Bronze Age (3,150–1,900/1,700 bc; Sajjadi, 2003). The site, whose surface is covered by millions of fragments of pottery, alabaster, lithics, and other materials and characterised by various ditches filled with sediments and debris, lies close to one of the most ancient deltas of the Helmand river (Figure 2), which nowadays is so eroded and covered with deposits to be hardly detectable. This large site was one of the most important urban settlements in the Near East between the end of the fourth millennium and the beginning of the second millennium BC; it controlled the production and distribution of all economic resources in Sistan and surrounding areas. It was completely abandoned around ca. 1,800/1,700 bc, perhaps due to an increased aridity of the region (Salvatori & Tosi, 2005).



Figure 1

[Open in figure viewerPowerPoint](#)

Location of Shahr-i Sokhta (Iran)

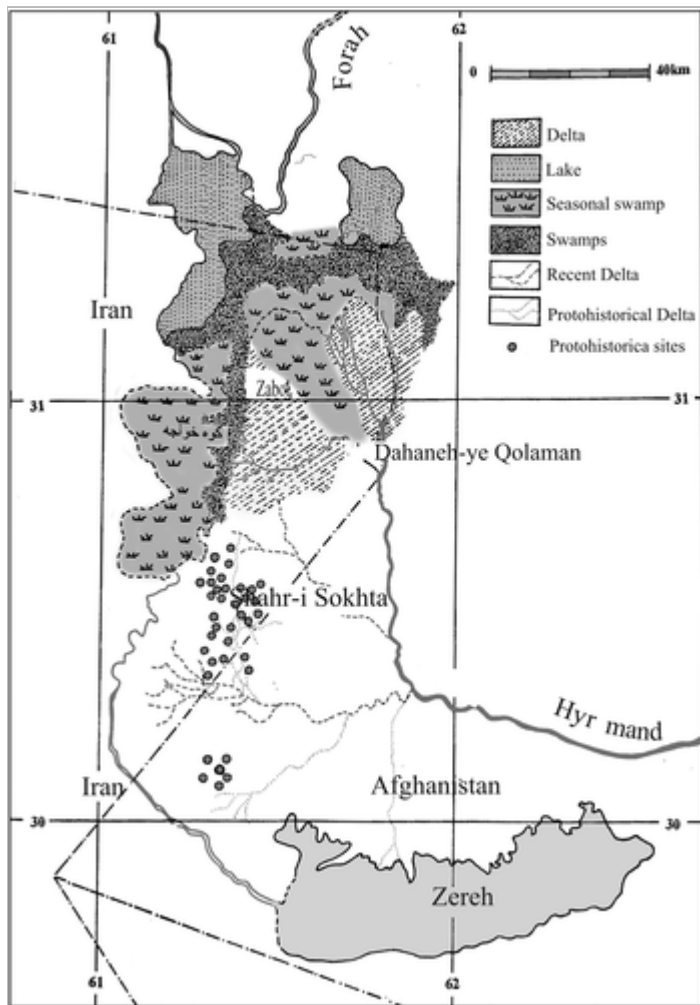


Figure 2

[Open in figure viewerPowerPoint](#)

Location of Shahr-i Sokhta in relationship to bodies of water and to surrounding region

After its discovery by Sir A. Stein in 1916, first archaeological researches were carried out at Shahr-i Sokhta between 1967 and 1978 by the Italian

Archaeological Mission directed by M. Tosi (Tosi, [1968](#), [1969](#); Tosi, [1983](#); Vv.Aa., [1977](#)); they were resumed in 1997 by the Iranian Archaeological Mission directed by S. M. S. Sajjadi and still continue by then (Sajjadi, [2003](#), [2005](#)).

Among material (pottery, glyptic, stone objects, clay objects, metals, etc.), large animal assemblages were collected from both archaeological campaigns; only material coming from the old excavations has been already studied (Bökönyi & Bartosiewicz, [2000](#); Caloi, [1978](#); Caloi & Compagnoni, [1977](#); Caloi & Compagnoni, [1981](#); Caloi, Compagnoni, & Tosi, [1978](#); Cassoli, [1977](#); Compagnoni, [1978a](#), [1978b](#); Compagnoni, [1980](#); Compagnoni & Tosi, [1978](#); Gala & Tagliacozzo, [2014](#); Tortonese, [1977](#)).

Together with the residential and artisan quarters, the necropolis represents an important area of the site, being located on its south-western part and with an extension of about 0.2–0.25 km². It was discovered by chance by the Italian Archaeological Mission in September 1972 (Piperno, [1977](#): p. 115; Sajjadi, [2003](#); Piperno & Salvatori, [2007](#); Sajjadi, Foruzanfar, Shirazi, & Zaruri, [2007](#); Sajjadi, Foruzanfar, Shirazi, & Zaruri, [2009](#); Sajjadi, [2014](#)). It is currently one of the largest known Bronze Age necropolises, with an estimate of about 22,000 to 37,500 graves (Sajjadi, [2003](#): p. 117). The total number of tombs excavated until now amounts to about 1,150; they refer to all chronological phases documented at the settlement. Ten different burial types were identified: simple pit, bipartite pit, pseudo-catacomb, catacomb, rectangular tomb with mud brick wall, quadrangular tomb with mud brick wall, quadrangular tomb with two little mud brick walls, round tomb with mud brick wall, circular pit with an entrance closed by a mud brick wall, and ceramic bowl shaped tomb (Sajjadi, [2014](#)).

No precise rules about the orientation of graves or the placement of the deceased within them were identified. Similarly, no patterns were observed for any of the burial types, for the two sexes, and for the chronological phases. The skeletons are found in the foetal position, huddled on the right or left side with the lower limbs flexed and the upper ones stretched out or reached in front of the skull or in a supine position; in one case, the skeleton is prone with the face on the ground and the arms folded under the body. The majority of burials (54%) contains only one skeleton and was used only once; of these tombs, 41% belongs to males, 30% to females, and 30% to children and infants. Preliminary anthropological studies have shown that most of the pathologies displayed by the skeletons were caused by heavy work or difficult living conditions (Sajjadi & Foruzanfar, 2001).

The state of preservation of the objects from the tombs is generally good. In the northern part of the necropolis, the humidity and salinity of the soil caused the formation of salt crystals that corroded all the objects and almost completely destroyed the skeletons. The grave goods usually include glass objects, bowls, and jars containing food, stone vases, semi-precious stone grains, and, occasionally, reed baskets.

The forms and harmonious arrangement of the objects are so repetitive in the burials to suggest the existence of a single funerary rite. Bowls and jars, clearly never used and therefore presumably produced specifically for the event, but also broken and repaired objects, representing the working tools used in life, generally form the funerary equipment.

Differences in tombs do not seem to reflect social stratification but rather a coexistence of people belonging to ethnic groups with different ideological and

social schemes, divided into tribes and clans and not controlled by any central political and socio-economic system (Sajjadi, 2014: p. 676).

3 THE RHESUS MACAQUE BURIAL

The grave of the macaque (Grave 9319) was discovered at western edge of trench NFA in the central part of graveyard, where were discovered 46 graves, mainly dated to the second period of occupation at Shahr-i Sokhta (Figure 3).

The grave of the macaque lay just below the surface; archaeologically, it can be dated to third chronological period (2,500–2,200 bc) or more likely to the second (2,800–2,500 bc) period of Shahr-i Sokhta.

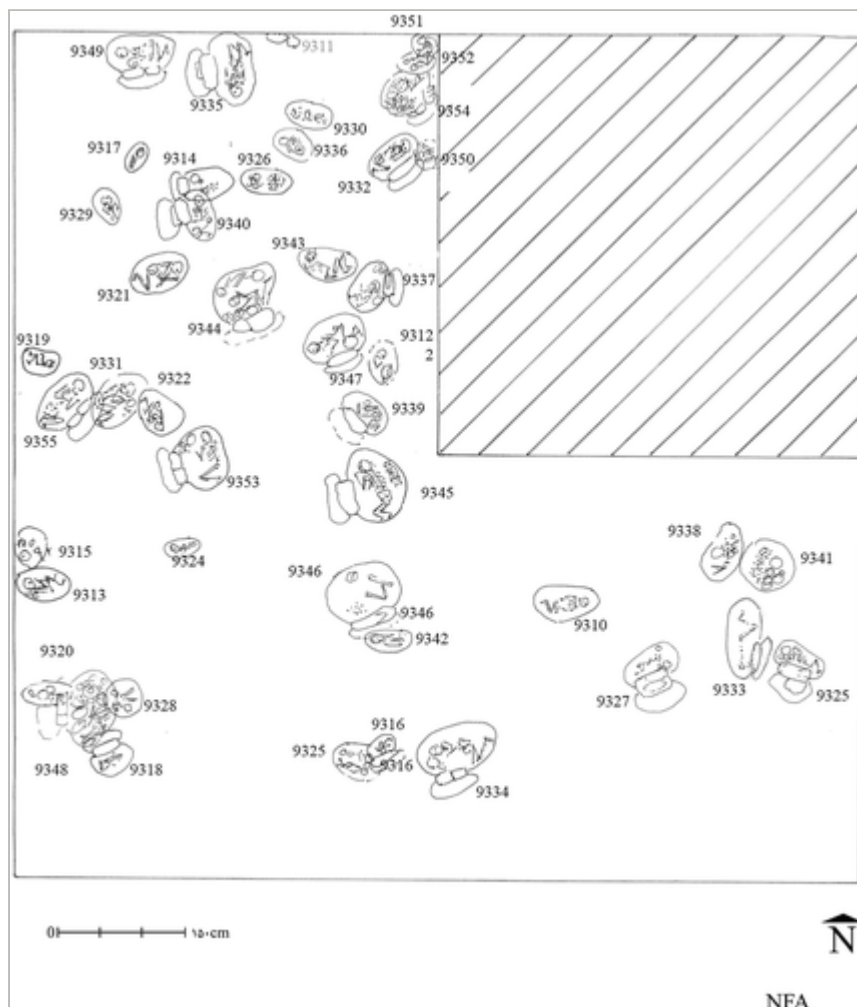


Figure 3

[Open in figure viewer](#) [PowerPoint](#)

Location of the grave of rhesus macaque (Grave 9319) in the necropolis

The animal was identified as belonging to the Asian species *Macaca mulatta*, Zimmermann, 1780. The identification was attempted on the basis of the morphology of the upper and lower dental arches, according to Swindler's (2002) criteria and by comparison with photographs of skulls and mandibles of various species of macaques that are part of the reference collection kept at the National Museum of Natural History of Pretoria, South Africa (Figure 4 and Figure 5). The most widespread species of macaque in antiquity in the Near East is the very short-tailed Barbary ape (*Macaca sylvanus* L.), that lives in North-West Africa. According to Russo's (2015) criteria, the presence of some post-sacral vertebrae (four proximal and four transitional or distal vertebrae were recovered) allows to exclude the identification of the macaque buried at Shahr-i Sokhta as belonging to *M. sylvanus*.

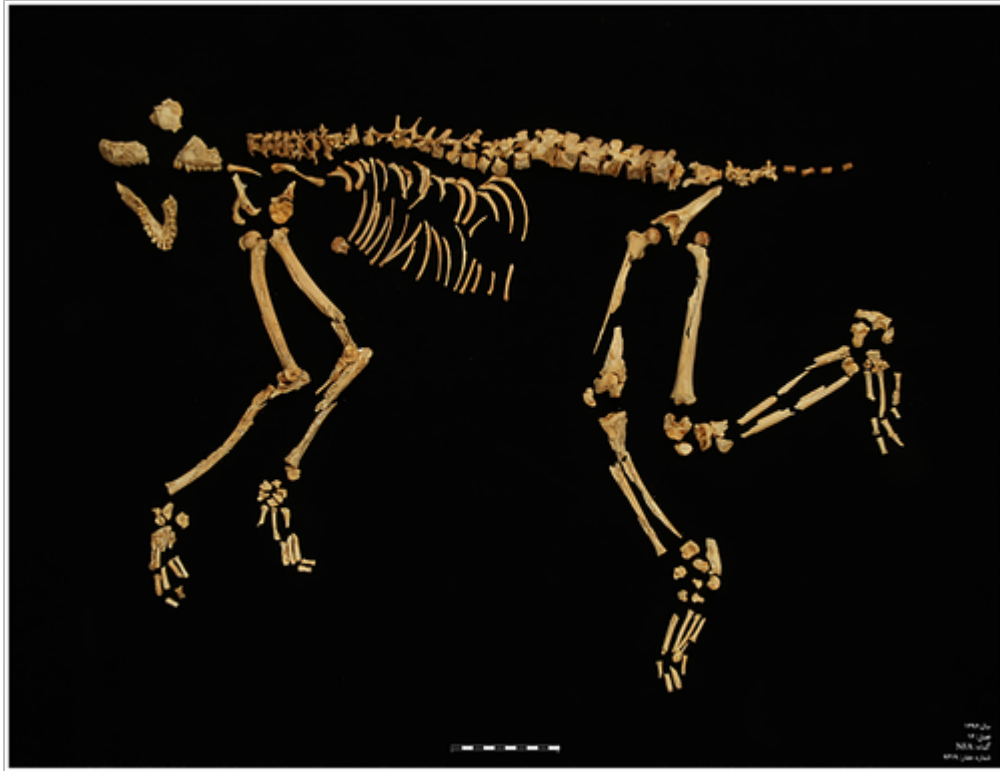


Figure 4

[Open in figure viewer](#)PowerPoint

The skeleton of rhesus macaque (photo by Media Rahmani) [Colour figure can be viewed at wileyonlinelibrary.com]



Figure 5

[Open in figure viewer](#)PowerPoint

Detail of the mandibles of macaque (photo by Media Rahmani) [Colour figure can be viewed at wileyonlinelibrary.com]

The macaque was buried in a simple oval-shaped pit, which was 85 cm deep, 70 cm long, and 52 cm wide. The skeleton of the macaque lied on the right side with

extended body and legs and with the arms stretched forward, in an east-western direction (Figure 6). An unpainted pear-shaped beaker had been placed close to the skull (Figure 7). This form is widely documented at the site, maintaining a standard and uniform shape throughout all the periods. However, there are some difference of paste, shape, and temper used to fabric this type of beakers (Buson & Vidale, 1984). Unpainted buff ware beaker of Grave 9319 mostly corresponds with those of second period.



Figure 6

[Open in figure viewerPowerPoint](#)

The grave (9319) of rhesus macaque (photo by Media Rahmani) [Colour figure can be viewed at wileyonlinelibrary.com]



Figure 7

[Open in figure viewer](#)PowerPoint

The pear-shaped beaker found close to the skull of rhesus macaque (photo by Media Rahmani) [Colour figure can be viewed at wileyonlinelibrary.com]

Although the skeleton was found complete and the bones were still articulated, preservation was poor due to the salt crystallization that usually forms on the bone surface. The skull and bones from limb extremities were much damaged; some bones of the sternum and most probably some caudal vertebrae were lost. No evidence of burning was noted.

Interestingly, the macaque was buried in a single pit, a burial type that was generally used for infants (Sajjadi, [2014](#): p. 670), perhaps due to the young age of the animal. The age at death is suggested by epiphyseal fusion and dental eruption patterns. The distal humerus, proximal radius, and the acetabulum of the pelvis were all fused, whereas the proximal femur was fusing. The proximal and distal clavicle, proximal humerus, distal radius, proximal ulna, distal femur, proximal and distal tibia, distal metapodials, the tuber calcis of the calcaneum, and proximal phalanges were all found unfused, as were the vertebrae (Table [1](#)).

Table 1. Data on epiphyseal fusion of bones of the macaque found at Shahr-i Sokhta; m. = months (according to Cheverud, 1981)

	Female	Male	Unfused	Fused
pelvis a.	5 m.	5-6 m.		x

humerus d.	14-22 m.	22-35 m.		x
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radius p.	39-51 m.	49-65 m.		x
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ulna p.	39-51 m.	39-65 m.	x	
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femur p.	39-51 m.	49-52 m.		x
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tibia p.	49-56 m.	63-75 m.	x	
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tibia d.	49-56 m.	56-65 m.	x
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femur d.	58-72 m.	63-78 m.	x
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humerus p.	63-74 m.	72-82 m.	x
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ulna d.	63-76 m.	63-78 m.	x
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radius d.	64-74 m.	72-82 m.	x
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Maxillary and mandibular dental eruption patterns show that the first and second incisors, the third and fourth premolars, and the first and second molars were already erupted and in wear, whereas the canines had just erupted, and

the third molars were still in crypt (Table 2). According to Cheverud (1981), the evidence from dental eruption and epiphyseal fusion suggests that the macaque was around 5 years old when it died. ¹ Teeth erupt ca. 6 months earlier in females than in males. The timing of dental eruption and epiphyseal fusion of the skeleton found at Shahr-i Sokhta seems to coincide with that of a male (Cheverud, 1981; Swindler, 2002: p. 272), but no other indicators for identifying with certainty the sex of the animal were available.

Table 2. Data on mandibular dental eruption pattern of the macaque found at Shahr-i Sokhta; m. = months (according to Cheverud, 1981)

Tooth	Female	Male	Not erupted	Erupted
M1	14–15 m.	14–18 m.		x
I1	25–28 m.	25–35 m.		x

I2	25-28 m.	35-36 m.	x
M2	36-38 m.	37-40 m.	x
C	47 m.	63-68 m.	just erupted
P3	41-47 m.	46-52 m.	x
P4	41-49 m.	41-42 m.	x

M3

68–74 m.

63–77 m.

x

No measurements were taken, except for teeth, as the preservation state of bones was really bad, and the animal was still young with long bones still unfused. This cannot allow determining the size of animal, as the skeleton was still growing. However, we could note that the measures of lower first and second molars [2](#) well fit into the ranges estimated for rhesus macaques (Swindler, [2002](#): pp. 220–221).

4 THE PATHOLOGY OF MACAQUE

The femurs of both the right and left thighs of the macaque revealed to be pathological (Figure [8](#)). Along the middle third of the diaphyses, on the postero-lateral side, the surface presented calcified formations of cuneiform or tubular shape and growing in a proximal direction, probably representing a calcification dystrophy of the tendon or muscle insertion. This might be interpreted as a by-product of bone regeneration from skeletal injury.



Figure 8

[Open in figure viewer](#)PowerPoint

Detail of the anomalous extra osseous formation on left femur (photo by Alberto Potenza) [Colour figure can be viewed at wileyonlinelibrary.com]

The formation of such anomalous bones has been rarely reported in either humans or non-human primates. Pathology affecting the diaphysis of both

femurs has been recently observed in a 6-year-old male long-tailed macaque (*Macaca fascicularis* L.), a species native to southeast Asia; this individual had been bred in captivity and kept in a cage at the Korean National Primate Research Center. In this case, histological analyses revealed that the anomalous bone formations were produced not by the congenital deformity but by fast bone regeneration from fragments of the fractured femurs (Lee, Kim, Kim, & Hong, [2008](#); Hamada, Sawada, Cho, Won, & Hyun, [2012](#); Pritzker & Kessler, [2012](#): pp. 666). The pathological condition of the macaque found at Shahr-i Sokhta may suggest that the animal was kept in captivity and may have died due to physical stress.

Well documented are diseased mummified or simply buried non-human primates from Egypt whose signs of post-traumatic fractures and evidence of pathologies, possibly associated to arthritis, osteomyelitis, rachitis, osteodystrophia, tuberculosis, tumour, and periodontal disease, testify the tendency of keeping these animals in captivity and malnutrition state. Most famous cases were found in the animal sanctuary of Tuna-el-Gebel and in the Saqqara necropolis (Ikram, [2011](#); von den Driesch, Kessler, & Peters, [2004](#)).

5 MONKEYS IN ANCIENT CULTURES

No non-human primate species is native to the territory of Shahr-i Sokhta. Rhesus macaques inhabit parts of southern and south-eastern countries of central Asia, further east of Sistan-Baluchistan (Fooden, [2000](#): pp. 2–7; f. 21).

A possible provenance from the Indus valley of the macaque found at Shahr-i Sokhta can be easily hypothesized. Studies on other materials from the settlement have already shown evidence for contacts involving the Oxus

(Sarianidi, [2006](#)), Jiroft (Majidzadeh, [2003a](#), [2003b](#)) Helmand (Dales, [1972](#)), and Indus (Datta, [1996](#)) cultures during the third millennium (Cortesi, Tosi, Lazzari, & Vidale, [2008](#); Jarrige et al., [2010](#); Moradgholi & Srivastav, [2017](#)). At first, these relationships would have involved sporadic trade contacts, marriages, and isolated exchanges rather than systematic and specialised forms of long-distance trade (Cortesi et al., [2008](#)), but by the second half of the third millennium, more defined trade land and sea routes are documented in culture material through the whole of Middle Asia (Frenez, Degli Esposti, Méry, & Kenoyer, [2016](#)), suggesting the existence of more articulated relationships that gave rise to a cultural syncretism (Ascalone, [in press](#)). The rhesus macaque found at Shahr-i Sokhta represents an intriguing tesserae of the great mosaic of cultural and economic relationships that may have existed between the Sistan and other East Asian cultures. The animal could have arrived at Shahr-i Sokta through these contacts. Although we cannot exactly know his role, being buried like a human suggests that it was held as pet by the inhabitants. Maybe a special attention to the analysis of the surrounding tombs will be help in a better understanding of its presence at site.

Even if no other non-human primates inhabited the Near East or Mesopotamia, these animals seem to have been well-known in antiquity. The majority of sources that testify their occurrence in the Near East are represented by written sources, seals, plaques, and figurines dated from the fourth to the second millennium BC; the most famous of them have already been analysed in detail by several scholars (Collins, [2002](#); Cooper, [1983](#); Dothan & Regev, [2011](#); Dunham, [1985](#)). These studies have shown that monkeys were generally considered symbols of prosperity and power, as they were difficult to obtain and often given as a gift to members of the elite; in written texts, they were usually listed together with other exotic animals. Usually, they were kept as pets and

sometimes, were on a lead (Dunham, [1985](#): p. 265, f. [1](#)) and depicted with human traits (Dunham, [1985](#): p. 265, f. 10); they were often represented dancing and playing the flute (Dunham, [1985](#): p. 265, f. [8](#)). Sumerian texts mention the term monkey with pejorative meaning (Dunham, [1985](#): pp. 242–244). In other cases, they were used in specific medical practices, as monkey hair and bones were thought to have curative or magical powers (Dunham, [1985](#): p. 251).

Some monkey species may have been imported from or via Egypt; according to our current understanding of Egyptian fauna, green monkeys (*Chlorocebus sabaesus* L.), olive (*Papio anubis* L.), and sacred baboons (*Papio hamadryas* L.) respectively native to Central and East Africa, might have been imported by the Egyptians from several places south of their country and further moved, as well as Barbary apes (*M. sylvanus* L.; Masseti & Bruner, [2009](#); Osborn & Osbornova, [1998](#)).

Non-human primate representations were also certainly common in Egypt during the third millennium BC, and from here, the practice of representing monkeys spread throughout the Mediterranean. An example is given by the limestone baboon statuette found at the settlement of El Miqne-Ekron, Israel, and dated to the 13th–12th century BC (Dothan & Regev, [2011](#)); it probably represents the sacred baboon, usually associated with the deity Thoth.

However, the majority of primate representations from the Levant are not easily identifiable to species level, with some exceptions (Masetti, [in press](#)). This could be the case of a small red limestone seated monkey figurine found at Susa (Iran) and dated to the third chronological period of site (3,100–2,900 bc): according to some scholars, its features seem those of the rhesus macaque (Aruz, [1992](#): p. 97; pl. 61).

Monkey and baboon skeletons and mummies are documented in Egypt and can be associated to cemeteries and temples, with ritual and/or pet meanings, as they had significant role in Egyptian cults and domestic life (Ikram, [2011](#) with reference therein). Findings of macaque/monkey bone remains from the Near East are instead rare. At present, some remains are documented at the settlement of Tell Rad Shaqrah, located in northern Syria (Piątkowska & Koliński, [2015](#)). They were found into a storeroom and are dated to the Early Dynastic period (2,500–2,300 bc). In this case, the remains were identified as belonging to Barbary ape. The skull, mandible, ribs, and upper parts of fore and hind limbs from two very young individuals were present. The two macaques found at Tell Rad Shaqrah are thought to come from Egypt.

More recently, the incomplete skull of a currently extinct species of gibbon was found in a 2,200-year-old tomb in the ancient capital city of Chang'an, China (Gabbatiss, [2018](#)).

A skull and a mandible of a young Barbary ape, dated the Byzantine period, were discovered at Constantinople during the excavation of the Theodosius harbour, Yenikapı, (Onar et al., [2013](#)).

More discoveries of non-human primate remains, generally belonging to Barbary apes, were made in Europe and Russia, devoid of non-human primate species (Brisbane, Hambleton, & Maltby, [2007](#); Green, [2018](#); Masseti & Bruner, [2009](#)). In these areas, the contexts with remains of monkeys are dated from the fifth–fourth century BC to the 16th century AD (Table [3](#)). Some of them consist of just few anatomical parts, in particular the skull, but others are represented by buried skeletons. They are generally associated with high-status sites, and some of them show clear signs of having been kept as pets and in captivity.

Table 3. Summary of monkey remains found in Europe and Russia from historical contexts, with relative reference

Site	Country	Chronology	Reference	
Navan Fort, Armagh	Ireland	Iron Age	Napier & Jenkins, 1997	Barbary ape skull
Titelberg	Luxemburg	Iron Age	Napier & Jenkins, 1997	Barbary ape remains
Cutry in Meurthe-et-Mose lle	France	Roman	Gerber & Baudry-Dautry, 2012	Barbary ape remains

Cataractonium	United Kingdom	Roman	Hodgson, 2002	Barbary ape skull
Rainau-Buch	Germany	Roman	Green, 2018	Barbary ape remains
Lemonum	France	Roman	Gerber & Baudry-Dautry, 2012	Barbary ape adult skeleton
Terme del Sarno, Pompeii	Italy	Roman	Bailey et al., 1999	Barbary ape young skeleton
Le Clos de la Lombarde	France	Roman	Gerber & Baudry-Dautry, 2012	Barbary ape skeleton

Durocibrivis	United Kingdom	Roman	Schneider, 1992	Barbary ape young skeleton
Viroconium Cornoviorum	United Kingdom	Late Antiquity	Green, 2018	Barbary ape first phalanx
Iulia Libica	Spain	Late Antiquity	Olesti et al., 2013	Barbary ape skeleton with military ornaments
London - Friars' Street	United Kingdom	Middle Ages	Pipe, 1992	Barbary ape skeleton
Arrickfergus	Ireland	Middle Ages	McCormick, 1991	Barbary ape skeleton

Cuckoo Lane	United Kingdom	Middle Ages	Noddle, 1975	Barbary ape skull and clavicle
Hitzacker	Germany	Middle Ages	Green, 2018	Barbary ape remains
Rurikovo Gorodische	Russia	Middle Ages	Brisbane et al., 2007	Barbary ape adult skull
Leiden	Netherlands	Middle Ages	van Wijngaarden-Bakker, 1980	Cercopithecus skull

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CONFLICT OF INTEREST

We have no conflict of interest to declare. We also declare that this paper is original.