Paleolithic hominin remains from Eshkaft-e Gavi (southern Zagros Mountains, Iran): description, affinities, and evidence for butchery

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ABSTRACT

Eshkaft-e Gavi is a cave located in the southern Zagros Mountains of Iran and is one of the few archaeological sites in the region to preserve both Middle Paleolithic and Upper Paleolithic occupations. Excavation of the site in the 1970s yielded an assemblage of lithic and faunal remains, including ten hominin specimens: a mandibular molar, four cranial fragments, a clavicular diaphysis, the proximal half of a metacarpal, a fragment of os coxa, the proximal diaphysis of a juvenile femur, and a patella. The bones derive from a minimum of four individuals, including two juveniles. Although many of these remains could be Epi-Paleolithic in age, one of the juvenile specimens—the mandibular molar—occurs at the base of the cave's Upper Paleolithic sequence. The remains are very fragmentary, but those that preserve diagnostic morphology indicate that they represent modern humans. The molar is taxonomically diagnostic, thus confirming the association of the Aurignacian-like Baradostian Industry with modern humans. Four of the specimens—a piece of frontal bone, the clavicle, the juvenile femur, and the patella—display clear evidence for intentional butchery in the form of stone-tool cutmarks. These cutmarked specimens, along with a fragment of parietal bone, are also burned. Although this evidence is consistent with cannibalism, the small sample makes it difficult to say whether or not the individuals represented by the hominin remains were butchered and cooked for consumption. Nevertheless, the cutmarked Eshkaft-e Gavi specimens add to a growing sample of hominin remains extending back into the Plio-Pleistocene that display evidence of intentional defleshing.

Introduction

The Zagros Mountains of Iran and Iraq were the focus of intensive archaeological research in the middle twentieth century (Garrod, 1930; Coon, 1951; Braidwood and Howe, 1960; Braidwood et al., 1961; Young and Smith, 1966; Hole and Flannery, 1967; Solecki, 1963, 1971; Piperno, 1972, 1974; Rosenberg, 1985), after which political events in Iran and instability in the Iraqi Zagros curtailed research by scientists from the United States and western Europe. Field research is now once again commencing (Roustaei et al., 2002; Heydari, 2007). While much of the initial effort targeted the transition to food production, Paleolithic studies benefited enormously. The highly dissected limestones of the Zagros (Oberlander, 1965) are riddled with caves and rockshelters, many of which were discovered to be rich Paleolithic sites. The result is that these projects produced a large sample of Paleolithic material from numerous sites.

The character of the lithic sequence of the Zagros Mountains is now reasonably well known based on systematic descriptions of the materials from Warwasi and Bisitun (Dibble, 1984; Dibble and Holdaway, 1990, 1993; Olszewski, 1993a,b; Olszewski and Dibble, 1994), Kobeh (Lindly, 2005), and Kunji (Speth, 1971; Baumler and Speth, 1993), but it is not well dated. The Middle Paleolithic in the Zagros is typically classified as the Zagros Mousterian, and to date, there is no dramatic variation found within it that justifies any formal divisions. All radiocarbon dates for the Zagros Mousterian have so far been infinite dates, and thus it is likely that the Zagros Mousterian is older than 35 ka. The succeeding Upper Paleolithic in the Zagros is represented by what has been traditionally called the Baradostian. Given its similarities with Aurignacian assemblages, Olszewski and Dibble (1994) proposed that the Baradostian be renamed the Zagros Aurignacian.

The only reasonably complete hominin remains found in association with the Zagros Mousterian are the Neandertals at Shanidar in Iraq (Trinkaus, 1983). Although hominin fragments were said to have been found at the Iranian Middle Paleolithic sites of Bisitun and Tamtama (Coon, 1951), only the Bisitun radius is hominin, most likely representing a Neandertal (Trinkaus, 2006; Trinkaus and Trinkaus, 2008).
Biglari, 2006). Upper Paleolithic human remains are more rare in this region. Hole and Flannery (1967) mentioned human remains from Gar Arjeneh, but these are undescribed, and Trinkaus et al. (2008) recently reported the recovery of an Upper Paleolithic human premolar at Wezmeh Cave, Iran. Here we describe ten Upper Paleolithic and Epi-Paleolithic hominin remains from the site of Eshkaft-e Gavi, Iran. In 1991, CWM initiated a study of several Zagros Paleolithic faunal assemblages, including the sites of Bisitun, Eshkaft-e Gavi, Kobeh, Kunji, and Tamtama (Marean, 1998; Marean and Kim, 1998; Marean and Cleghorn, 2003; Cleghorn and Marean, 2004). The analysis of the Eshkaft-e Gavi faunal assemblage resulted in the rediscovery of most of the hominin remains described here, the discovery of several new specimens, and the observation of evidence for butchery on some of those remains.

**Background to the site and excavations**

Eshkaft-e Gavi is a large cave on the Marv Dasht plain on the lower Kur River Valley, about 14 km southwest of Persepolis, southernmost Zagros (29°52′19.49″N, 52°44′53.85″E) (Fig. 1). It is approximately 20 m above the plain and faces northeast, and the Kur River flows just 750 m to the northeast. The site was discovered by W. Sumner in 1969 during a survey, and M. Rosenberg investigated it in 1978 from Sumner’s lead. He found that substantial disturbance had occurred from mechanical excavation of the talus slope and partial collapse of the roof from blasting. Fortunately, the interior cave preserved an intact deposit, and Rosenberg initiated excavations for two weeks in July of 1978 (Rosenberg, 1985) as part of the Malayan Project, directed by W. Sumner and R. Dyson. Our description of the excavations and our drawings of the figures and stratigraphy are from Rosenberg (1985) and unpublished notes made available to us by Rosenberg.

All of the sediments were sieved, and all of the sieved material was retained. Recovery appears to have been excellent, as there is a sample of several thousand small animals (micromammals, amphibians, reptiles, and birds) currently under study. A histogram (Fig. 2) of the large-animal faunal fragments shows that even very small specimens (less than 2 cm in size) were recovered and that the distribution is strongly skewed to small fragments. This pattern shows that all but the tiniest fragments below 1 cm were captured by the sieving operation, and thus the sample is not strongly biased to larger fragments and is unlikely to be missing identifiable fragments through selective retention (Marean et al., 2004).

The cave has a rough figure-eight shape, with each section of the eight being about 15 m × 7 m (Fig. 3). Roof collapse from blasting in the roof rock occurred at the opening of the cave and in the middle of cave near the junction of the two chambers, leaving piles of rubble in both places. Excavations were placed to avoid this rubble and any disturbance resulting from modern activities, as well as to sample both the front and rear chambers. The rear test excavation (Operation A, including Squares G, M, and N) was 3 m² and was excavated to a depth of 1.5 m. The front test excavation (called Operation B, including Squares C and D) was a 2 m² excavation that reached a depth of 2 m. Excavations were carried out within 10-cm arbitrary levels within natural stratigraphy. The excavators used a lot numbering system in which the smallest individual unit of excavation, usually a square/10-cm-level combination, was assigned a unique ascending lot number, with each operation having its own set of numbers. The associations of the lots to the strata are indicated in Figs. 4 and 5 with shading and connecting lines.

A schematic of the sequence in Operation A was reconstructed from the excavation notes and information provided by Rosenberg (Fig. 4). The excavators noted that the stratigraphy in Operation A was not always clear, and it was particularly challenging in the lower part of the sequence where light was very poor and the sediments were rocky and complex. Overall, Operation A had more dramatic signs of disturbance than Operation B, most of it being concentrated near the top of the sequence, but with the lower part likely having some ancient rodent burrowing. Starting at the bottom, the deposits have high quantities of limestone rock fall, some Middle Paleolithic artifacts, and fossil bone. The latter deposits are overlain by hard, yellow clay that is cross-cut with possible rodent burrows that occur from roughly 120 cm to 80 cm below datum. Next is a concentration of archaeological finds, including lithic artifacts and fauna. The lithic artifacts are Upper Paleolithic in form, and probably Baradostian in affinity. This is followed by a rocky, orange sediment (described as “soil” by Rosenberg), and then finally, at the top, an organic sediment with significant amounts of dung and few archaeological finds.
Operation B has a much cleaner sequence with few signs of disturbance (a schematic of this sequence is given in Fig. 5). The lowest deposits are an organic, orange sediment with several lenses containing relatively high concentrations of charcoal flecks. The lithic artifacts are Middle Paleolithic and bone is well preserved. The bottom of the deposit was not reached, and it is likely that the Middle Paleolithic deposits penetrate much deeper. Above, the Mousterian archaeological finds become less abundant, and then, at approximately 150 cm below datum, lithic and faunal densities increase and there is a clear transition to the Upper Paleolithic Baradostian by 125 cm below datum. Six 14C dates clustered between 90 cm and 125 cm of the deposit range from 18,000 to >28,000 yrs BP; they do not occur in stratigraphic order (Rosenberg, 1985). The top 15 cm of sediments resemble those in Operation A and are rich in organics, recent pottery, and ground stone.

We attempted to date unidentifiable shaft fragments with radiocarbon dating, but in all instances, these attempts were unsuccessful due to a lack of collagen. This failure is unfortunate because this site is one of the few in the Zagros that includes both Middle Paleolithic and Upper Paleolithic assemblages. It is important to note that the stratigraphy is rather complicated, and there are several forms of evidence that suggest disturbance from either animals or people. The lack of stratigraphic order to the six radiocarbon dates reported by Rosenberg (1985) may result from a combination of being near the limits of radiocarbon dating and bioturbation.

The hominin remains

The Eshkaft-e Gavi hominin sample consists of ten craniodental and postcranial specimens (Table 1). Nine of these specimens were recovered from the uppermost layers of Operation A, Square G (Lots 11, 14, and 19; see Fig. 4). The other specimen, a mandibular molar crown, was recovered from Operation B, Square D, between 100 cm and 125 cm below datum (Lot 21; Fig. 5). The specimens from Operation A almost certainly represent modern humans—these specimens are stratified above Rosenberg’s (1985) 14C dates and could therefore be quite young, perhaps Epi-Paleolithic in age. On the other hand, the molar crown occurs at the base of the Upper Paleolithic sequence within the carbon-dated sediments. Early Upper Paleolithic assemblages (as opposed to the initial Upper Paleolithic “transitional” industries) are generally attributed to modern humans (reviewed in Churchill and Smith [2000]), and although the strength of the association in Europe has been questioned (e.g., Conard et al., 2004), a recent study conducted by Bailey et al. (2009) has affirmed this connection. Thus, the Baradostian’s similarity to the Aurignacian (Olszewski and Dibble, 1994) suggests that human remains associated with this industry will be anatomically modern.
Nevertheless, because Neandertal remains have been found in association with industries that contain Upper Paleolithic–like elements (e.g., Lévêque and Vandermeersch, 1980; Hublin et al., 1996; Bailey and Hublin, 2006), we evaluated the morphology of the molar crown with the goal of determining if it can be unequivocally assigned to modern humans and to test the hypothesis that the Baradostian does signal the presence of modern humans. The Zagros Mountains could represent a barrier to early modern humans exiting Africa, and their rugged mountainous character holds out the possibility that they could have harbored late-occurring Neandertal populations. Moreover, given reports of the persistence of Neandertal features in early modern humans in Europe, interpreted by some researchers as evidence of admixture between these two groups (e.g., Trinkaus et al., 2003; Trinkaus, 2005, 2007; Soficaru et al., 2006, 2007; Rougier et al., 2007; but see Harvati et al., 2007), we examined the remaining Eshkaft-e Gavi specimens for evidence of the presence of Neandertal traits.
Mandibular molar

Eshkaft-e Gavi B21-5615 (Fig. 6) is a left mandibular molar. The root is in the initial stages of formation (less than 2 mm long) and the crown surface is unworn, indicating that the tooth had not yet erupted. Because the tooth was still in its crypt, interproximal wear facets are absent, making it difficult to ascertain its position along the tooth row. A hypoconulid is present, though small (a grade 3 cusp 5 under the Arizona State University dental anthropology system; see Turner et al. 1991), and it is centrally positioned. The occlusal morphology of the tooth is not irregular (i.e., there are five distinct cusps), suggesting that the tooth is probably an M1 or an occlusal morphology of the tooth is not irregular (i.e., there are five cusp 5 under the Arizona State University dental anthropology system; see Turner et al. 1991), and it is centrally positioned. The occlusal morphology of the tooth is not irregular (i.e., there are five distinct cusps), suggesting that the tooth is probably an M1 or an M2. The hypoconid and metaconid contact each other, forming the Y fissure pattern. Depending on the position of the tooth, the estimated age at death of the individual from whom the specimen derives was as follows: M1, 3–5 years; M2, 6–10 years (Bass, 1995).

There are five small pits, each no larger than 0.5 mm in diameter, on the occlusal surface of the molar: one on the hypoconid, near this cusp’s border with the hypoconulid; one on the tip of the hypoconulid; one on the tip of the entoconid; and two on the mesial marginal ridge—one near the midline of the tooth and the other located more buccally. These features represent pit-form enamel hypoplasias, enamel defects indicative of developmental stress (e.g., Hillson and Bond, 1997). Such defects are common in the remains of late Pleistocene humans (e.g., Trinkaus et al., 2006, 2008). In addition to the hypoplasias, a small buccal pit is present in the buccal groove between the protoconid and hypoconid. Buccal pits have also been observed on other Upper Paleolithic hominins (e.g., Dolní Věstonice 13 and 15; Trinkaus et al., 2006).

The mesiodistal and buccolingual dimensions of the tooth are 11.6 mm and 10.5 mm, respectively. The buccolingual diameter of the Eshkaft-e Gavi specimen is fairly typical of late Pleistocene hominins, falling very close to the sample means presented by Bailey and Hublin (2006) for Upper Paleolithic modern humans (M1 mean = 10.8; M2 mean = 10.6) and Neandertals (M1 mean = 10.8; M2 mean = 10.8). Although molar size is uninformative with respect to group affinity in this case, nonmetric traits can be used to distinguish between Neandertal and modern human molars (Bailey, 2002a,b; Bailey and Hublin, 2006; Souday, 2008; Bailey et al., 2009). One such feature is the midtrigonid crest, a ridge of enamel that connects the protoconid and the metaconid (Bailey, 2002a,b; Bailey and Hublin, 2006; Bailey et al., 2009). While this feature is present in some modern humans, it is rare (<10%), whereas in Neandertals, it is present on over 90% of mandibular first and second molars (Bailey, 2002b; Bailey and Hublin, 2006). Notably, specimen B21-5615 does not possess the midtrigonid ridge, suggesting that it is probably not Neandertal. Another feature that has been used to discriminate between Neandertal and modern human mandibular molars is the shape of the crown outline (Souday, 2008; see also Bailey et al., 2009), with modern humans having more rectangular molars and those of Neandertals being more oval. The rectangular shape of the Eshkaft-e Gavi molar aligns it more closely with modern humans (C. Souday, pers. comm.).

Frontal bone

Eshkaft-e Gavi A19-1230 (Fig. 7) is a fragment of frontal bone preserving the superolateral corner of the right orbit and the surrounding region. Its maximum dimensions are as follows: 33.4 mm wide (medial to lateral), 21.0 mm tall (superior to inferior), and 22.0 mm deep (anterior to posterior). The lateral half of the superior orbital margin is preserved (ca. 20 mm), along with a small portion of the frontal squama (the trigonum supraorbitale, following the terminology employed by Cunningham [1908]) and the anterior margin of the orbital plate. The zygomatic process is broken off. The anterior part of the frontozygomatic suture is present on the specimen, but posteriorly, the break invades the root of the zygomatic process. Posterior to the root of the zygomatic process, a small flange of bone with a segment of temporal line (measuring 9.2 mm in length), which is very distinct, and a small portion of the temporal surface of the frontal are present. The overall size of the bone and the development of the temporal line indicate that specimen A19-1230 is from an adult individual.

Although there is a slight bulge directly superior to the superolateral corner of the orbit, it is evident that the specimen does not possess a supraorbital torus. The bulge is roughly teardrop-shaped, with the tail of the teardrop running along the superior orbital margin. The transition between the supraorbital region and the frontal squama, which was apparently quite steep, is smooth, and there is no sulcus. The lack of a clear separation between these elements is most evident in medial view—the anterior-most extent of the preserved anterior cranial fossa is almost in the same coronal plane as the anterior-most extent of the superior orbital margin; only about 5.0 mm separates the endocranial surface from the eocranial surface at this point. The medial cross section of the supraorbital margin is sharp and triangular, not rounded or rectangular, as would be expected if a torus were present. Thus, Eshkaft-e Gavi A19-1230 possesses the autapomorphic frontal morphology that is characteristic of modern humans (e.g., Cunningham, 1908; Smith and Ranyard, 1980; Minugh-Purvis, 1988; Minugh-Purvis et al., 2000; Sládek et al., 2002).

Parietal bone

Eshkaft-e Gavi A14-1500 (Fig. 8A) consists of two pieces of a left parietal bone that fit together and have been reassembled. It is likely that the break occurred during excavation, as there are other

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1 The mesiodistal diameter of the Eshkaft-e Gavi molar was not compared to data from other Paleolithic hominins due to the confounding influence of interproximal wear in the latter group.
apparently fresh breaks. The sagittal suture and sulcus are preserved, as well as the parietal foramen, indicating that the fragment is a posterior portion of parietal, from just superior to the lambdoidal suture. The break that divides the two pieces runs nearly parallel to the sagittal suture. The medial fragment of the specimen is larger and trapezoidal in shape. Its maximum anteroposterior length is 42.7 mm. The greatest mediolateral dimension of this fragment of the specimen is 30.4 mm. The smaller (lateral) fragment is bell-shaped, with the base of the bell oriented medially (i.e., articulating with the larger specimen). The length of the medial border is 33.4 mm and the mediolateral width of the specimen is 18.4 mm. The maximum thickness of the bone is 4.9 mm. The bone possesses no diagnostic features.

Other neurocranial fragments

Eshkaft-e Gavi specimens A11-2094 (Fig. 8B, right) and A11-2095 (Fig. 8B, left) are fragments of cranial vault that cannot be securely identified with regard to position or side. Eshkaft-e Gavi A11-2094 has been broken into three pieces, which fit together and have been reassembled. The breaks are fresh and are likely the result of excavation damage. Some of the edges display further excavation breaks suggesting that it was once larger and more complete. The largest piece accounts for approximately 75–80% of the total specimen. Eshkaft-e Gavi A11-2095 also exhibits a fresh, probably excavation-related break, and it is possible that it derives from the same individual as specimen A11-2094, given their similarities in bone thickness and preservation, as well as their close proximity. The endocranial and ectocranial surfaces of these two specimens are extensively abraded and some surfaces are covered with a hard matrix, obliterating and/or obscuring any features that might aid in identification or siding (e.g., arachnoid foveae, meningeal grooves, parietal foramina, parietal striae, temporal lines). The thickness of the bones indicates that they may be parietal or occipital fragments from an adult individual. The preservation of these fragments, particularly the adhering matrix, prevents accurate measurement of.
their thickness, but these specimens are noticeably thicker than specimen A14-1500 (stratified directly below specimens A11-2094 and A11-2095), indicating that they probably do not derive from the same individual as the parietal fragment.

Clavicle

Eshkaft-e Gavi A11-2098 (Fig. 9) is the shaft of a left clavicle. The sternal end is broken just medial to the attachment site for pectoralis major. The lateral end is broken at the medialmost extent of the trapezoid line. The specimen is otherwise relatively complete, with the following features preserved: the conoid tubercle, subclavian sulcus, and the attachment sites for the deltoideus and trapezius. The conoid tubercle and the attachment site for the deltoideus are prominent; however, the other muscle attachment sites are indistinct. The shaft is very slender, measuring 9.7 mm superoinferiorly and 11.0 mm anteroposteriorly at the middle of the preserved shaft. At the medial break, the latter measurements are 9.2 mm and 8.8 mm, respectively. The cortical thickness at the medial break is 2.4–2.9 mm. The medullary cavity is oval in cross section at the medial break, with the long axis oriented posteriosuperiorly. The specimen could be from a juvenile, as juvenile clavicles are morphologically similar to those of adults (Scheuer and Black, 2000). Without the sternal epiphysis it is difficult to determine age; however, the length of the preserved portion (ca. 92.2 mm) indicates that the individual was likely at least 12–13 years of age at death (based on modern human aging standards presented in Scheuer and Black [2000]).

Neandertal clavicles are similar to those of modern humans in midshaft circumference, but differ in overall length, with the Neandertal clavicle being longer, and thus appearing more gracile in comparison to modern human clavicles (Trinkaus, 1983). Unfortunately, the missing medial and lateral portions make it impossible to accurately estimate the complete length of the Eshkaft-e Gavi clavicle. While specimen A11-2098 is very gracile, it does fall within the range of variation exhibited by modern humans.

Metacarpal

Eshkaft-e Gavi A11-2209 (Fig. 8C) is the proximal half of a left fifth metacarpal. The break in the shaft follows a roughly diagonal course, with the medial half extending more distally than the lateral half. The bone is otherwise relatively well preserved, although the articular surface for the fourth metacarpal is slightly abraded, exposing the underlying trabecular bone. The greatest proximodistal dimension of the specimen (medially) measures 30.3 mm. The maximum mediolateral diameter of the base is 14.3 mm; the greatest dorsoventral dimension is 11.8 mm. At the proximalmost point of the shaft break, the bone is oval in cross section, being wider mediolaterally (8.1 mm) than dorsoventrally (7.0 mm). The thickness of the cortical bone is 1.1–1.8 mm. The missing distal epiphysis makes the specimen difficult to age, although the preserved portion is similar in size and morphology to the fifth metacarpals of modern human adults.

Trinkaus (1983) noted that the fifth metacarpals of some Neandertals are characterized by strong muscle insertion sites, particularly for extensor carpi ulnaris and opponens digiti minimi. In the case of the latter, some Neandertal specimens exhibit a distinct crest on the ulnar aspect of the metacarpal shaft, a condition that Trinkaus (1983) described as rare in modern humans. Specimen A11-2209 does not possess a distinct crest on its ulnar aspect. Moreover, the proximal articular surface of the Eshkaft-e Gavi specimen is sellar (i.e., mediolaterally concave), as in modern humans, which contrasts with the more condyloid (i.e., mediolaterally convex) condition observed in Neandertal fifth metacarpals (Trinkaus and Villemeur, 1991).

Os coxa

Eshkaft-e Gavi A11-2208 (Fig. 8D) is a right pelvic fragment. It preserves the posterosuperior arm of the lunate surface of the acetabulum, the superior tip of the ischial tuberosity, the posterosuperior border of the obturator foramen, and a portion of the
medial surface just inferior to the arcuate line (which is not preserved). The maximum proximodistal height and anteroposterior breadth of the specimen are both approximately 40.0 mm, while the maximum mediolateral dimension is approximately 37.0 mm. There is a hole through the bone that runs from the medial surface internally out through the ischium externally, just superior to the ischial tuberosity. The portion of ischial tuberosity that is preserved is fused, indicating that the individual was at least 13–16 years of age at death (Scheuer and Black, 2000).

While there are several documented differences between the pelves of modern humans and Neandertals, most of these are found in the pubis and ilium (e.g., McCown and Keith, 1939; Stewart, 1960; Trinkaus, 1976a, 1983; Rak and Arensburg, 1987; Rak, 1990). One feature of the ischium that has been discussed in relation to differentiating Neandertals from modern humans is the position of the groove for the internal obturator muscle in relation to the ischial tuberosity (Rak, 1990; Trinkaus, 1996). The Eshkaft-e Gavi specimen preserves only the very uppermost margin of the ischial tuberosity and the region superior to the tuberosity is damaged, but it appears that that the groove for the internal obturator muscle is located entirely cranial to the tuberosity. Rak (1990) argued that this configuration was typical of modern humans, whereas in Neandertals, the groove is shifted caudally, thus encroaching on the tuberosity. However, Trinkaus (1996) showed that the position of the groove for the internal obturator muscle is actually much more variable in late Pleistocene hominins and modern humans, with both forms of the groove, as well as intermediate variants, being present in modern humans and Neandertals. Consequently, this feature is uninformative with respect to the specimen’s affinities.

Femur

Eshkaft-e Gavi A11-2096 (Fig. 10) is a fragment of the left proximal femoral shaft of a juvenile individual, as indicated by its small size and unfused lesser trochanter. The fragmentary condition of the bone renders aging of the individual extremely difficult, although an estimate of 3–8 years of age at death seems reasonable based on comparisons with more complete modern human material. The maximum proximodistal length of the fragment is 56.5 mm. Proximally, the neck and the metaphyseal surface for the greater trochanter are not preserved, having been broken transversely at the level of the inferior border of the neck-shaft junction. The superior portion of the posterior half of the bone has also been broken away down to the metaphyseal surface of the lesser trochanter. Thus, the anterior surface extends farther proximally than does the posterior surface. Only about half of the metaphysis for the lesser trochanter is preserved; this feature is mediolaterally placed and visible in anterior view. Inferior to the lesser trochanter, the gluteal tuberosity and the pectineal and spiral lines are present and well defined. Distally, slightly less than 30 mm below the inferior border of the lesser trochanter, the bone is broken at the point where these muscle attachment sites converge into the linea aspera. This break is right in angle and transverse in shape, suggesting that it occurred when the bone was in a dry state (Villa and Mahieu, 1991) and therefore was not related to marrow extraction. At the break, the shaft is slightly oval in cross section, with a maximum diameter of 15.1 mm (running posterolaterally to anteromedially) and a minimum diameter (perpendicular to the maximum dimension) of 12.8 mm. The cortical bone has a maximum thickness of 4.4 mm and a minimum thickness of 3.0 mm. The medullary cavity has a maximum diameter of 6.9 mm (length) and a minimum diameter (perpendicular to the long axis) of 5.7 mm. There is no evidence of pilastry.

In comparison to a small sample of modern juvenile human femora, the gluteal tuberosity of the Eshkaft-e Gavi femur is rugose and mediolaterally extensive, merging with the pectineal line medially. However, it does not take the form of a ridge. The specimen lacks features associated with strong development of the gluteus maximus seen in some juvenile Neandertals, such as a hypotrochanteric fossa and a third trochanter (Trinkaus, 1976b). The lack of a pilaster on the posterior femoral surface is
a characteristic of Neandertal femora (Trinkaus, 1976b), but the absence of this feature can also be explained by the age of the individual at death, as the pilaster usually develops after puberty (Scheuer and Black, 2000) in modern humans.

Patella

Eshkaft-e Gavi A11-2099 (Fig. 11) is a complete left patella. The surfaces of the superior, medial, lateral, and inferior edges of the bone are damaged, exposing the underlying trabeculae; the damage to the inferior edge is extensive, invading the inferior portion of the medial and lateral articular facets. The bone is completely ossified, indicating that the individual was at least 14–16 years of age at death (Scheuer and Black, 2000). The maximum superoinferior and mediolateral dimensions are 34.4 mm and 39.2 mm, respectively. The anteroposterior thickness of the bone is 18.6 mm. The widths of the femoral articular facets are highly asymmetric, with the medial articular facet (18.65 mm) being 72.0% the size of the lateral facet (25.9 mm). This degree of asymmetry is typical of early and recent modern humans, but it falls outside the range of variation (75.5–90.0%) for Neandertal patellae, which tend to be more symmetrical (Trinkaus, 2000).

Number of individuals in the sample

Based only on the lack of repetition of skeletal elements, the minimum number of individuals in the sample is one. However, it is clear that the sample is composed of individuals of different ages.
Ontogenetic ages. The femur and the molar both indicate the presence of at least one individual under the age of ten years among the remains, and their stratigraphic separation—the femur is near the top of the Upper Paleolithic/Epi-Paleolithic sequence and the molar is at the base—indicates that there are two subadults in the assemblage. On the other hand, the clavicle, patella, pelvic fragment, fifth metacarpal, and the four cranial fragments all signal the presence of at least one older individual.

The parietal fragment can be separated from the other neurocranial fragments based on overall thickness: specimens A11-2094 and A11-2095 are thick and likely from a fully adult individual, while specimen A14-1500 is thinner and probably belongs to a different individual, possibly—a subadult. The frontal fragment is most likely from an adult, given the marked development of the temporal line. The parietal and frontal fragments could represent the same individual, and their close stratigraphic proximity is consistent with this conclusion. Thus, at least four individuals are represented among the Eshkaft-e Gavi human remains.

Evidence of butchery and burning

Several of the Eshkaft-e Gavi specimens show clear signs of butchery and burning. Stone-tool cutmarks, diagnosed using published criteria (Blumenschine et al., 1996) and an extensive collection of experimentally generated surface marks for comparison, were identified on four of the bones: (1) the frontal fragment has a single cutmark on the ectocranial surface near the medial break superior to the orbit (Fig. 7); (2) the clavicle has a single cutmark in the center of the diaphysis (Fig. 9); (3) the patella has multiple cutmarks on the anteroinferior surface near the inferior margin of the bone (Fig. 11); and (4) the juvenile femur has cutmarks on the anterior aspect of the proximal shaft (Fig. 10). The cutmarks on the femur are slices (they enter the bone at an angle), and they occur in a parallel-to-subparallel manner down the shaft. This pattern is consistent with a few related slicing actions for defleshing (Binford, 1981; Nilssen, 2000).

These four bones, along with the parietal fragment, also exhibit evidence of extensive burning. The frontal fragment, clavicle, femur, and patella each exhibit a black carbonization over most of their surfaces. The frontal fragment and femur are also characterized by a white calcining, on the far left portion of the margin in the case of the frontal fragment and on the posterior surface of the femoral diaphysis. The parietal is covered with a dark-gray carbonization across the entire endocranial surface and part of the ectocranial surface, and both surfaces have a lustrous sheen.

The presence of cutmarks and burning raises the possibility that the human remains were cannibalized. Cannibalism is a topic that has both inherent appeal and targeted bias, and identifying it in the archaeological record requires rigorous method and documentation (Villa et al., 1988; White, 1992; Villa, 1992). To begin, two questions must be addressed: (1) Is there evidence for human butchery? and (2) Is there evidence for human consumption? Here, we use the term “butchery” to simply mean intentional dismemberment and/or defleshing by people, and no goal to that action is implied. Dismemberment and/or defleshing can be carried out with many goals in mind, including consumption and ritual preparation for burial.

The cutmarks reported here have all the features regularly used to diagnose stone-tool cutmarks (Fisher, 1995; Blumenschine et al., 1996), and they are clearly not the result of trampling—the marks are subparallel and appear to have been made by the same stone and action; most are long scraping marks, which have not been reported in trampling damage; the marks are deep and V-shaped, and one can clearly see that the sharp-edged tool cut into the bone at a steep angle (Behrensmeyer et al., 1986); and each mark occurs at a location where flesh would have been removed (femur or clavicle), or either disarticulation (patella) or defleshing/skinning (frontal) would have been the goal. These are clearly stone-tool cutmarks generated in the process of defleshing and/or dismemberment.

Three of the four cutmarked specimens (patella, clavicle, femur) come from the same feature (Lot 11). Lot 11 is a part of a stratum that occurs in the back of the cave and fills a large shallow pit. It is an ashy deposit with various ashy lenses. There are 161 other fragments of mammal bone from mostly bovids and/or cervids, and 31% of all of the fragments are burned. Lithic artifacts are common. The excavators thought Lot 11 might be a secondary burial, and they argued that it may be Epi-Paleolithic or later. However, it seems more likely that it is a secondary dump for ash and debris from hearths (explaining the ashy lenses), or, less likely, a location of in situ burning. Either way, the large quantity of burned nonhuman bone seems inconsistent with a burial, either primary or secondary, and it seems more likely that the human bone is there in the same context as the mammal bone: as food refuse from a butchery-and-cooking event. This inference is more consistent with cannibalism, and less consistent with ceremonial defleshing, but the small sample of material makes a firm conclusion impossible. Nevertheless, the cutmarks on the Eshkaft-e Gavi specimens add to a growing sample of butchered hominin remains extending back into the Plio-Pleistocene (e.g., White, 1986; Fernández-Jalvo et al., 1996, 1999; Defleur et al., 1999; Pickering et al., 2000; Ramirez Rozzi et al., 2009).

Conclusions

The hominin remains described here derive from Eshkaft-e Gavi, a cave in the southern Zagros Mountains, Iran. While the cave preserves Epi-, Upper, and Middle Paleolithic deposits, all of the specimens come from the Epi- and Upper Paleolithic deposits. Hominin remains are not common from Zagros Mountain sites, and thus Eshkaft-e Gavi is notable for having a sample, albeit rather small. However, the excavations there were not extensive, and the presence of these specimens suggests that the site may have more remains that could be revealed through expanded excavations. Consistent with their Epi- and Upper Paleolithic context, the hominin remains appear to represent anatomically modern humans. The age of the bulk of the sample is uncertain, but the molar occurs at the base of the Upper Paleolithic sequence near the boundary with the Middle Paleolithic. It lacks diagnostic Neandertal features and is morphologically similar to modern human material, and thus, like the early Upper Paleolithic industries in Europe (e.g., the Aurignacian), the Baradostian appears to be associated with modern humans. The younger specimens exhibit no evidence of archaic features; in each case where diagnostic anatomy is preserved, it is anatomically modern. Many of the hominin specimens are burned, perhaps from cooking, but the sample and contextual information is insufficient to confidently state whether this burning resulted from intentional cooking or secondary burning. Four of the hominin specimens show clear traces of stone-tool butchery by humans, and this patterning is more consistent with cannibalism, though such an inference should be regarded cautiously, given the small sample. Regardless, the Eshkaft-e Gavi hominin sample expands the record of human butchery of human carcasses into the Upper Paleolithic/Epi-Paleolithic of the Zagros Mountains.

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References


