Epigravettian Human Remains and Artifacts from Šandalja II, Istria, Croatia

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ABSTRACT

The Šandalja II site has yielded skeletal remains of at least three individuals found in association with numerous Late Upper Paleolithic (Epigravettian) stone tools and animal bones. It is the only Epigravettian site in Croatia that has yielded human remains. Analyses of the Šandalja discoveries add to our understanding of the morphological and behavioral patterns of the Late Upper Paleolithic inhabitants of this region. They provide us with a basis for comparison with not only contemporary humans of the Italian coastal region, which in the Late Pleistocene formed a single ecological zone with the Croatian coast, but also with Upper Paleolithic humans from other adjacent regions, which belonged to different ecological zones. Based on dental, cranial and postcranial metrics, the Šandalja II people were rather small compared to the comparative Upper Paleolithic samples and specimens. The associated late Epigravettian industry from the B/s layer of the site shows similarities in basic tool types with other comtemporaneous sites of the Adriatic region, while some noted differences are most likely a result of variation in site function. Continuing research on the Šandalja materials focuses on better understanding of morphological and behavioral variation, as well as contact patterns in the Late Upper Paleolithic of south Central Europe.

INTRODUCTION AND SITE HISTORY

The site of Šandalja II is a part of a larger cave structure in a quarry near Pula, Istria, Croatia (44° 52′ 57′′ N, 13° 53′ 48′′ E, at about 72 meters at above today's sea level) (Figures 1 and 2). The site is located on the hill of St. Daniel and served as a quarry in Roman times when the Colloseum was built in today's Pula, and was reopened in 1954. The first cave was discovered during mining in 1961 (Malez and Vogel 1969), while a larger cavern was unearthed the following year. The two caves were given the names of Šandalja I and II respectively, although later analyses showed that both localities are a part of a single, larger cave (Karavanić 1999; Malez 1979; Miracle 1995). Therefore the name "Šandalja I" refers to a Villafranchian breccia from which only one artifact (a chopper), of presumably Lower Paleolithic age, was extracted (Malez 1975), while Šandalja II refers to the Upper Pleistocene and Holocene sediments of the site. It is in these sediments that an Upper Paleolitihic sequence was found. Two additional localities, Šandalja III and Šandalja IV are most likely also a part of the cave complex. In the vertical crevice (Šandalja III), a deer skull and several faunal fragments were found in 1963. While Malez and Vogel (1969) mention the existence of the Šandalja IV site, no detailed data on the site exists (Brajković 1998).

The Šandalja II site is one of the most important archaeological and paleontological localities in Croatia. The cave is an oval cavern 13.5 meters in length and 18 meters in width, that was filled with over 8 meters of Upper Pleistocene sediments. The entrance to the cave was to the north. Excavations under the direction of Mirko Malez between 1962 and 1989 yielded numerous stone and bone tools, human and animal bones, and other traces of human habitation and activity.

The stratigraphic sequence is divided into units A – H, with further subdivision of complex C and B (Layers C/d, C/s, C/g, and B/d, B/s, B/g, respectively). Several radiocarbon dates were obtained for the sequence (Figure 3)

All the material from the strata B to H can be attributed to the Upper Paleolithic, while the uppermost layer A is of

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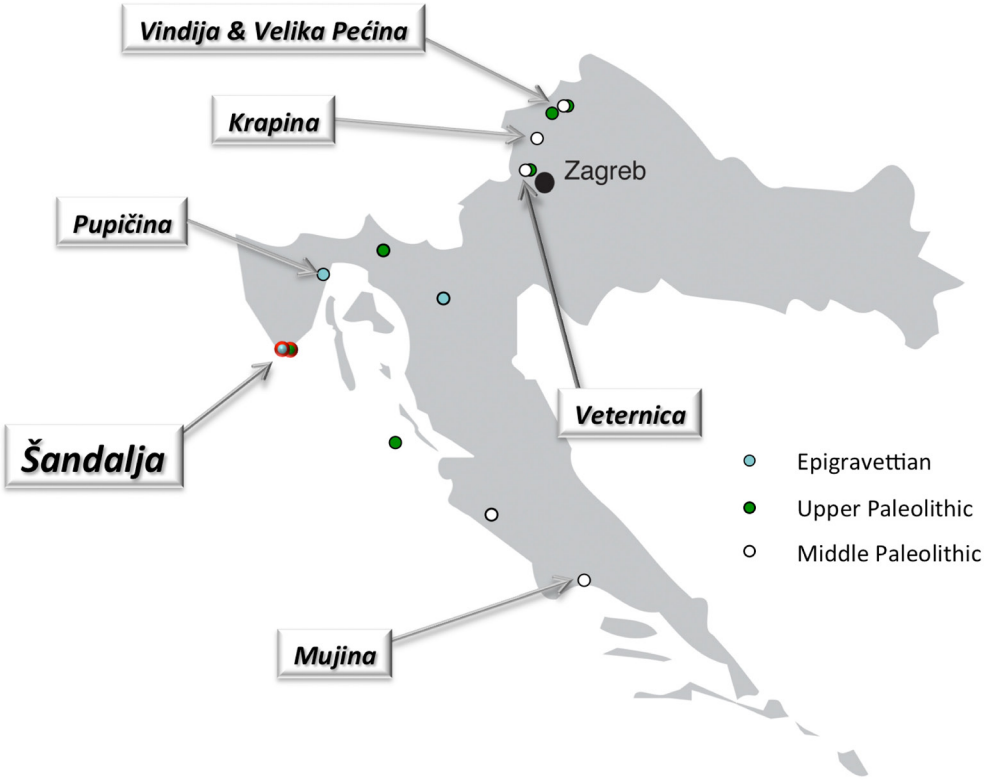

Figure 1. Map of Croatian Paleolithic sites, including Šandalja.

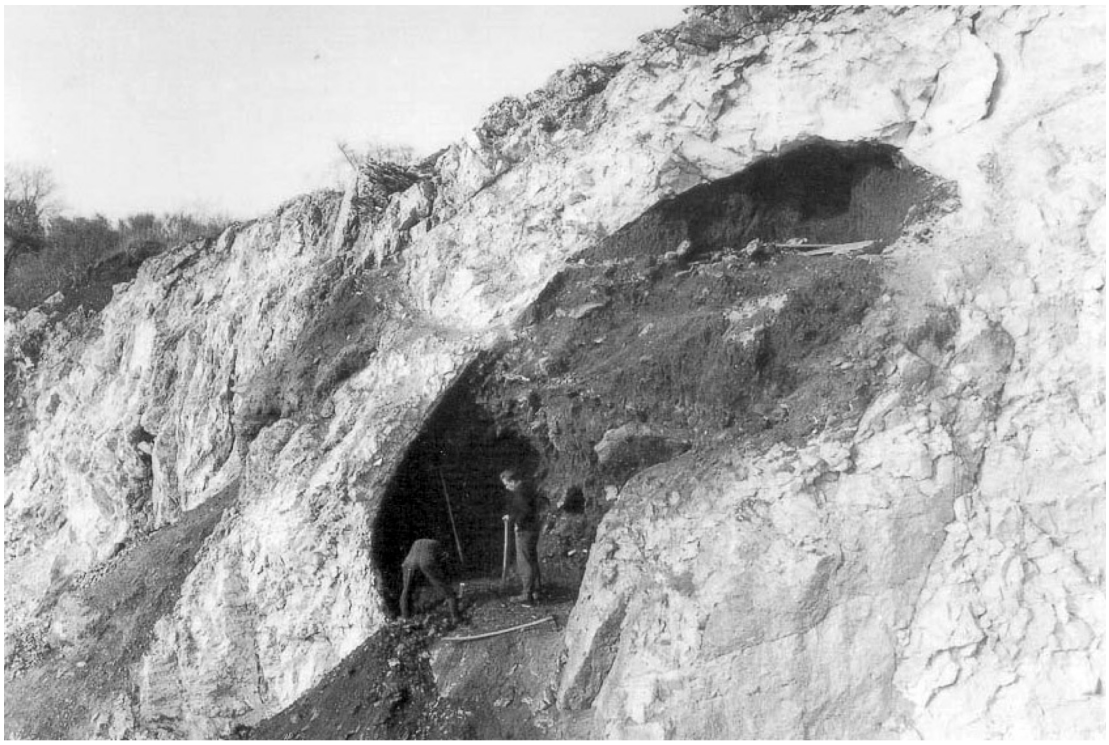

Figure 2. Photo of Šandalja cave during the 1962 field season.

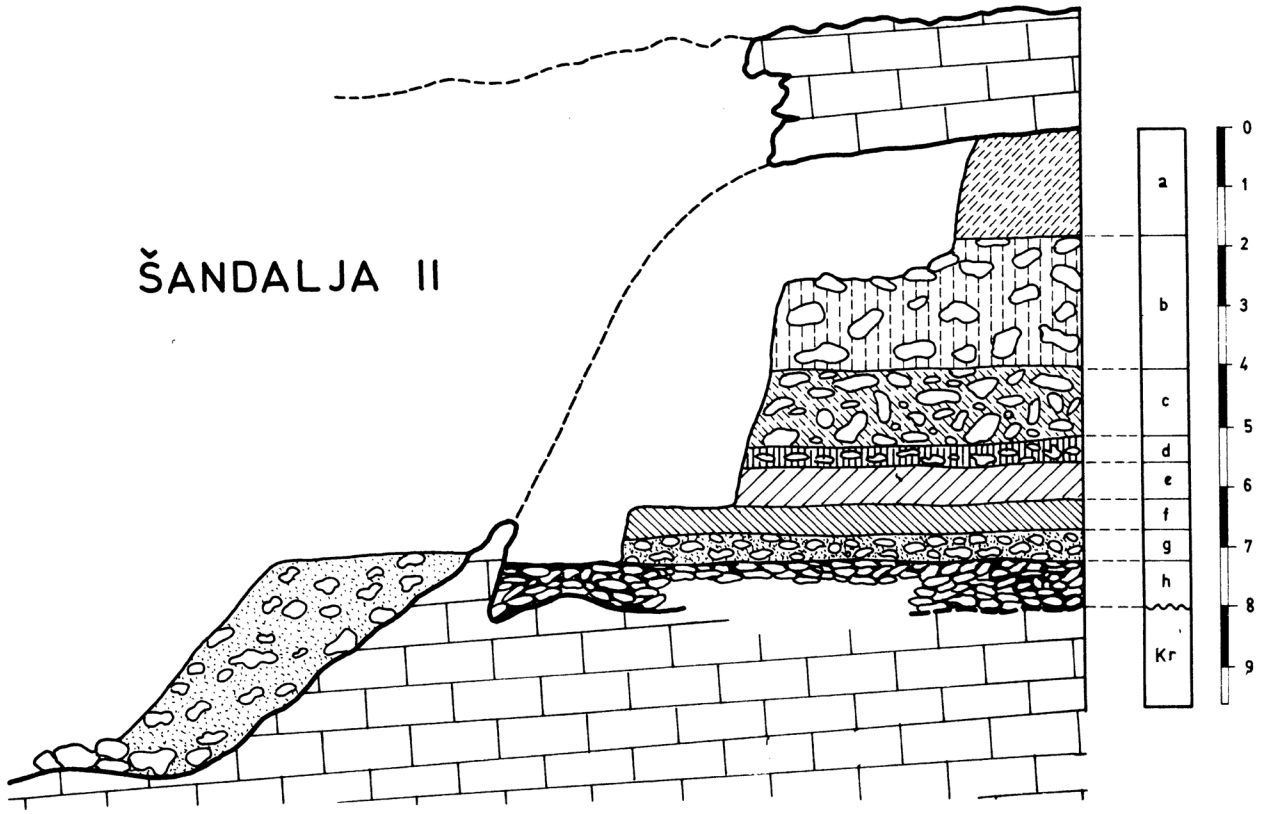

Figure 3. Stratigraphic profile.

Holocene age and yielded Bronze age pottery (Karavanić 1999). Lithic material was attributed to the Aurignacian (Layers G-D) and the Gravettian (Layers C and D) by Malez (Malez 1979; Malez and Vogel 1969). Later, detailed studies of the lithic finds published by Karavanić (1999; 2003; Karavanić and Janković 2010) confirmed the presence of Aurignacian layers, and ascribed the material previously attributed to the Gravettian, to the Epigravettian. Typical lithic types from the Epigravettian layers include short endscrapers, microgravettes, backed bladelets, circle segments, and Azilian points. Interestingly, on one of the tools, there is an incised diamond lattice pattern. A revision of the faunal sequence was done by Miracle and Brajković (Brajković 1998; Miracle 1995). Overall, the most important large mammalian fauna at Šandalja are aurochs and horse (see Miracle 1995).

Human remains attributable to anatomically modern humans (*Homo sapiens sapiens*) were found between 1963 and 1973 in the Epigravettian layer B (B/s) that is dated to 12,320±100 B.P. (charcoal; GrN-4978, see Malez and Vogel 1969). This layer has recently been redated and results are in agreement with previously suggested age (M. Richards, personal communication). Human remains were partially described by Malez (1972) and Smith (1976) but a complete analysis of these remains is lacking. Furthermore, a revision of the archaeological industries and faunal remains further indicates a need for reassessment and a more detailed analysis of the human skeletal material from the site.

THE ŠANDALJA II HUMAN FOSSIL SAMPLE

CRANIAL REMAINS (TABLE 1)

Ša 14013-14016-14024 (Level B/s, Figure 4).
This specimen comprises a partial right calotte consisting of a parietal fragment (14024), a partial lateral frontal with a small piece of attached parietal that articulates with 16024 (14016) and a right, lateral supraorbital segment (14013). Ša 14016 and 14013 were both previously described by Malez (1972), while the third (14024) has not yet been published. Together, these three pieces make up the most complete of the Šandalja human remains. Malez (1972) identified 14016 as a parietal instead of the frontoparietal that it is. Furthermore, he suggested that 14016 might be from the same individual as 14013 although he made no mention of their articulation.

The three individual pieces from the middle of stratigraphic complex B articulate well and are undoubtedly from the same calotte. Ša 14016 and 14024 articulate along the 47.1mm of coronal suture as well as along a short break on their shared portion of parietal. Although 14016 is darker in color, squamal thickness, surface texture, temporal line, and impressions of the meningeal vessels all confirm the articulation between 14016 and 14024. Ša 14016 and 14013 articulate along a 27.4mm break. The edges of the break on both specimens are slightly eroded, however the shared temporal line morphology and the internal surface impres-

TABLE 1. CRANIAL REMAINS FROM ŠANDALJA II.

Specimen	Provenience	Description
Ša 14013-14016-14024	B/s	Partial right calotte
Ša 14015	B/s	Posteroinferior frontal squama
Ša 14017	B/s	Right parietal fragment
Ša 14018	B/s	Parietal or frontal fragment
Ša 14019	B/s	Left temporal glenoid fragment
Ša 14020	B/s	Right temporal petrous fragment
Ša 14021	B/s	Left frontal squama fragment
Ša 14022	B/s	Right frontal squama fragment
Ša 14023	B/s	Right anterior parietal fragment
Ša 14025	B/s	Frontal or parietal fragment
Ša 14026	B/s	Left temporal mastoid
Ša 14027	B/s	Frontal or parietal fragment

sions of meningeal vessels, confirm the articulation. Some of the other Šandalja specimens, such as 14015, are likely from the same individual but none directly articulates.

Ša 14013 is roughly rectangular fragment of a right, lateral supraorbital segment with partial squama. Most of the frontozygomatic suture is preserved. The medial break is just medial of midorbit (cf. Smith and Ranyard 1980 for definition of the midorbit point). The lateral supraorbital of 14013 is similar to the Holocene frontal from Velika Pećina. The frontozygomatic sutural surface of 14013 is greater than in the latter, but the thickness of the anterior face is slightly less. The form of the supraorbital is similar in shape to other recent modern humans in that there is a well developed supraorbital sulcus dividing the lateral segment from the medial segment and a distinct supraorbital trigone. The lateral supraorbital segment, although similar in form to recent modern humans is more projecting (Table 2). Vermiculate patterned bone is expressed on the entire preserved browridge surface but does not extend on to the squama or more superiorly than *frontotemporale*. The lacrimal fossa is well excavated, the superior orbital margin is rounded, and the browrigdges are thick and projecting, suggesting an adult, perhaps a young, male. There are small vessel impressions on the superior orbital plate. No *cribra orbitalia* is present.

The frontozygomatic suture is large and exhibits a lateral shelf overhang but without browridge devlopment lateral to the suture. Posteriorly, the suture continues for 8.8mm. Although some frontosphenoid suture could be present, the anterosuperior to posteroinferior orientation of the preserved suture seems to be consistent with the frontozygomatic suture. Inferiorly, the suture runs medially into the orbital roof (see Figure 4). On the endocranial surface, small meningeal vessel imprints are present. No portion of the frontal sinus is preserved.

Malez describes 14016 as a "left parietal with part of the frontal" but it is mostly a right frontal with only a small piece of anterior parietal and is easily seen as such by its articulation with 14024. The specimen preserves stephanion and a 47.1mm portion of coronal suture. Externally, the inferior and superior temporal lines are observable on the frontal piece but only the superior is visible on the parietal portion. Above the superior temporal line on the parietal is a pitted, rough tabular bone area. On the frontal, the inferior temporal line lies below a torus-like bend which, in turn, lies below the superior temporal line. The torus-like structure is palpable on the parietal but not readily visible, while the inferior temporal line itself is absent. There is a moderately large notch cut out of the endo-superior margin of 14016. Malez (1972) reports that a small part was removed for flourine analysis. Internally, grooves for the branches of the middle meningeal artery are present on the parietal piece, while impressions of smaller meningeal vessels are present on the frontal piece. The path of the fused part of the coronal suture is observable internally but is partially obliterated.

Overall, this specimen is robust with thick parietal and frontal squama, a projecting lateral supraorbital segment, and a rugose temporal line, especially anteriorly. This robusticity of the specimen's anatomy are consistent with

Figure 4. Ša 14013-14016-14024. A) lateral, B) 14013 anterior, C) medial, and D) endocranial surface of 14013.

male determination. The deep lacrimal fossa, vermiculate pattern bone on the browridge, unfused frontozygomatic suture balanced by the browridge, squamal, and temporal line robusticity suggest that the individual was likely a young adult. However, a more definite determination of sex and age is limited by the specimen's and sample's degree of preservation.

Ša 14015 (Level B/s, Figure 5)

This piece comprises the left posteroinferior frontal squama preserving stephanion and 78mm of coronal suture. It measures 74.9mm (along the coronal suture) by 74.4mm (along the anterosuperior break). Originally, it consisted of two separate fragments found 170cm apart that were subsequently glued together and described as a single specimen by Malez (1972). The most superoposterior corner has been removed for isotopic sampling (Richards and Pettitt in prep.). The specimen appears to be from a comparably sized/robust individual as 14021, which has similar preservation. Squamal thickness at stephanion is 7.2mm. Ša 14015 is thicker than 14021, but the latter has more pronounced frontal bossing. The temporal line is torus-like without being a distinct line and is clearly palpable on the specimen's surface. There is extensive pitting (most likely perotic hyperostosis) on the posterosuperior portion of the squama. The coronal suture is preserved from 28.7mm below stephanion. Below stephanion the suture is beveled while above stephanion the suture would have overlapped the parietal. Internal-

TABLE 2. SUPRAORBITAL METRICS.

Specimen/Sample	Lateral SO Projection[1] (mm)	Midorbit SO Projection[1] (mm)	Lateral SO Thickness[1] (mm)	Midorbit SO Thickness[1] (mm)	Mid/Lat Thickness Index[1]	Mid/La Projection Index[1]
Ša 14013-14016-14024	**16.0**	**12.0**	**8.3**	**3.9**	**47**	**75**
Neandertals[2]	24.2	22.6	12.2	10.6	86.5	93.8
	(*s*=2.2, *n*=22)	(*s*=2.9, *n*=26)	(*s*=1.6, *n*=26)	(*s*=1.7, *n*=28)	(*s*=8.6, *n*=26)	(*s*=8.7, *n*=22)
Upper Paleolithic[3]	19.7	16.3	8.9	6.3	70.5	82.6
	(*s*=4.0, *n*=11)	(*s*=4.0, *n*=11)	(*s*=1.6, *n*=16)	(*s*=1.8, *n*=16)	(*s*=11.0, *n*=16)	(*s*=13.2, *n*=11)
Mesolithic[4]	17.3	14.8	6.9	4.9	67.0	84.9
	(*s*=4.1, *n*=6)	(*s*=3.4, *n*=10)	(*s*=1.6, *n*=14)	(*s*=1.1, *n*=13)	(*s*=10.1, *n*=13)	(*s*=18.8, *n*=6)
Neolithic[5]	17	12.5	8.0	6.5	82.2	72.5
	(*s*=3.1, *n*=32)	(*s*=3.5, *n*=32)	(*s*=1.5, *n*=50)	(*s*=1.2, *n*=50)	(*s*=13.9, *n*=50)	(*s*=11.1, *n*=32)
Recent Europeans[6]	16.2	11.0	5.1	4.3	83.9	68.0
	(*s*=2.2, *n*=44)	(*s*=2.8, *n*=44)	(*s*=1.2, *n*=45)	(*s*=1.3, *n*=45)	(*s*=17.3, *n*=45)	(*s*=14.8, *n*=44)

[1]Measurement methods from Smith and Ranyard (1980).
[2]Adults, only. Sample comprises: La Chapelle, La Ferrassie I, La Quina V, Gibraltar, Spy I & II, St. Césaire, Feldhofer, Krapina (Kr) 3, Kr 4, Kr 6, Kr 28, Kr 37.1, Kr 37.3, Kr 37.4, Kr 37.5, Kr 37.6, Kr 37.7, Kr 37.8, Kr 37.10, Kr 37.11, Vindija (Vi) 202, Vi 260, Vi 261, Vi 262, Vi 284, Vi 305, Guattari 1, Saccopastore 2.
[3]Adults, only. Sample comprises: Cro-Magnon 1, Cro-Magnon 2, Cro-Magnon 3, Cro-Magnon 4, La Madeleine 1, Abri Pataud 1, Engis (1) 2, Oberkassel F, Oberkassel M, Podbaba, Kelsterbach, Paderborn, Mladec 1, Mladec 2, Mladec 5, Brno 2, Dolni Vestonice 3.
[4]Adults, only. Specimens from Hoedic (*n*=9) and Teviec (*n*=5).
[5]Adults, only. Specimens from Altendorf.
[6]Adults, only. Sample comprises Euroamericans from the Cleveland Museum of Natural History and the University of Wyoming.

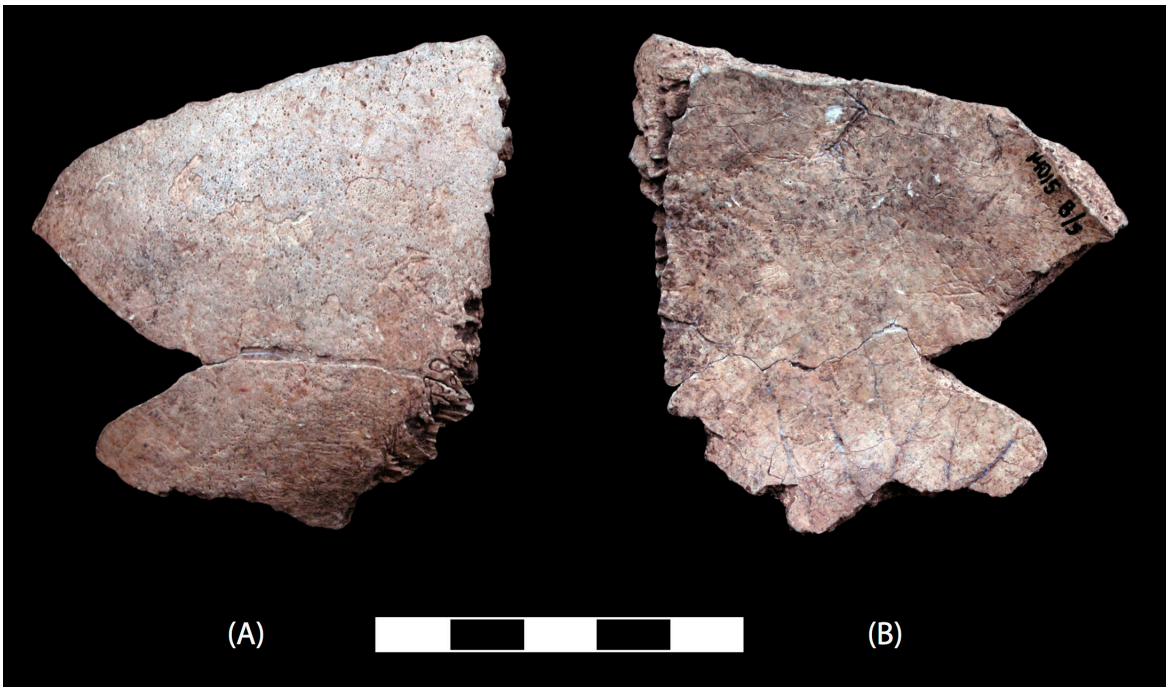

Figure 5. Ša 14015. A) external and B) internal (scale is in centimeters).

Figure 6. Ša 14017. A) external and B) internal (scale is in centimeters).

ly, what appears to be a pacchionian depression is present near the superior break and ca. 33mm anterior to the coronal suture. There is a characteristic vascular groove that lets out a few terminal branches outside the depression (typical arachnoid depression). Vascular impressions run superiorly from the inferior break of the specimen.

Ša 14017 (Level B/s, Figure 6)

This specimen is a right posterior mid-lateral inferior parietal fragment with a section of lambdoidal suture (lambdoidal suture preserved is from the lateral half of the lambdoidal suture). The specimen measures 35.5mm wide by 60.2mm long. The squama is fairly thin with the maximum thickness being only 5mm. Malez reports that the notch cut into the superolateral surface was made for flourine analysis. Palpable on its anteromedial portion is the posterior waning parietal boss and superior temporal line. Internally, there are two medium sized meningeal grooves for branches of posterior meningeal arteries. The lambdoidal suture measures 32.6mm long, and there is pitting along its length. Given how open the lambdoidal suture is and the thinness of the squama, this fragment is most likely from a younger individual.

Ša 14018 (Level B/s, Figure 7)

This small (33.3mm by 33.6mm) fragment is either a portion of right parietal (cf. Malez 1972) or possibly posterior frontal. A pacchionian/arachnoid depression appears to be present internally and externally there is some bossing present. The bone is almost all tabular with little diplöe and is smooth externally. Its thickness ranges from 3mm to 6mm. Given this and the minimal diplöe, it may be subadult.

Ša 14019 (Level B/s, Figure 8)

Ša 14019 is a left temporal fragment with postglenoid pro-

Figure 7. Ša 14018. A) external and B) internal (scale is in centimeters).

Figure 8. Ša 14019. A) external and B) internal (scale is in centimeters).

cess, glenoid, and articular eminence. Maximum length of the specimen (anteroposterior in approximately anatomical position) is 37mm. Maximum preserved breadth of the specimen is 24.7mm. Maximum superoinferior height of the specimen is 22.5mm. A small portion (20.4mm long) of sphenotemporal suture is present anteromedial to the glenoid fossa. The suture angles rather obliquely (relative to the sagittal plane). The preauricular eminance is robust and very concavely curved mediolaterally. The glenoid fossa is deeply excavated and is wide anteroposteriorly with a well-developed postglenoid process. Maximum depth of the glenoid fossa as measured from the tip of the postglenoid process is 8.6mm. The postglenoid process is large. The distance from entoglenoid to postglenoid is 18.8mm. A lateral portion of external auditory meatus is present and a small piece tympanic (10.3mm broad x 6.8mm anteroposteriorly) adheres to the meatus portion of the glenoid piece. Ecto-endo cranial thickness at the deepest point of the glenoid fossa is 1.5mm. A small portion of inferior temporal squama is present. Posteriorly it measures 9mm high from the zygomatic arch root, 11.1mm high anteriorly (what is preserved). Squama thickness at the superiormost break is 2mm. The root of the zygomatic arch is present. The broken face of the base of the arch is 20.1mm long. Endocranially, some small meningeal grooves are present.

Malez (1972) describes this specimen as "gracile and fully adult" and probably female. Given the width and depth of the glenoid fossa, the robusticity of the postglenoid process and articular eminence, it is probably from an adult male.

Ša 14020 (Level B/s, Figure 9)

The specimen is a petrous portion of the right temporal preserving a posterosuperior portion of tympanic plate with petrous crest, lateral half of carotid foramen, and all of the styloid pit with what appears to be the broken or unfused base of the styloid process. A small piece of mediosuperioanterior external mastoid is present. Superior mastoid air cells are observable as well. Maximum preserved anatomical height (lateral aspect) is 45mm, and maximum anatomical mediolateral breadth is 49.6mm.

Superiorly, the specimen preserves a small portion (17.8mm anteroposteriorly by 15.2mm inferosuperiorly from the middle of the supramastoid ridge) of inferior temporal squama bounded inferiorly by the supramastoid ridge. The supramastoid ridge is prominent and robust at its anterior break above the external auditory meatus but is even more robust, exhibiting a prominent tubercle (perhaps where the temporals and retramens auricularis muscles/fascia met), at its posterior break. The tubercle consists of a moderate ridge running from anteroinferior to posterosuperior on the supramastoid ridge. The supramastoid element is preserved for 14mm anteroposteriorly. No lateral surface of the mastoid process is preserved, although mastoid air cells are observable on the posterolateral break of the specimen. The external auditory meatus is very tall (17.1mm) but appears narrow (approximately 7–8mm) although most of the anterior wall is missing. Maximum thickness of the preserved anterior external auditory meatus wall is 3.4mm.

Inferiorly, the petrous crest is prominent and the petrous crest is enlarged to a point (pseudo-vaginal process) where the styloid once was positioned. The preserved portion of the tympanic plate, including the petrous crest, is markedly concave and thus was the portion centered posteriorly to the entoglenoid process. The stylomastoid foramen's diameter is approximately 2.5mm. Just medioanterior to the stylomatoid foramen lies the styloid pit. The anteroposterior length of the carotid foramen is 7.1mm. Its medial margin is missing. In anterior aspect, absent tympanic bone reveals the external auditory meatus. The middle and inner ear area is observable, although the ear ossicles are not present. The posterior ridge for attachment of the ear drum is present.

On the endocranial surface, the internal auditory meatus is preserved as are some other smaller details of endocranial anatomy. The internal auditory meatus is 5.5mm in width and 5.8mm in height. The *aquaductus vestibuli* lies 7.2mm from the inferolateral margin of the internal auditory meatus. The groove for the lateral sinus lies 17.8mm lateral of the internal auditory meatus. The lateral sinus runs for 24mm, and almost all of it is present, missing only the very inferior-most portions. On the anterior aspect of the endocranial petrous, the eminence for the semicircular canal is present. The *hiatus fallopii* is partially preserved with its anterior wall missing, exposing the bony canal. Most of the depression for the Gasserian ganglion is present. The tip of the petrous pyramid is missing.

Ša 14021 (Level B/s, Figure 10)

This specimen is a portion of left posteror frontal squama with 78.4mm of coronal suture preserving the temporal line. The piece measures 77mm anteroposteriorly. Maximum squamal thickness 9.8mm occurs at stephanion, and approximate thickness on the frontal boss is 9mm. Externally, the coronal suture is beveled for much longer than on 14015. It is beveled from the inferior break to 33mm above stephanion, where it becomes overlapping with the parietal. The temporal line is torus like and slightly larger than on 14015. The superior temporal line is barely visible. Near the anterior-most point of the specimen is what appears to be a distinct frontal boss. There is a small compression break (3.5mm in diameter) anterior to stephanion and inferior to the temporal line. This damage is most likely postmortem. The specimen's thick squama is consistent with a robust, adult attribution, likely male. As in Ša 14015, there is pitting on the bone (most likely periotic hyperostosis). It is possible that this piece is from the same individual as 14013-14016-14024, however, as no direct connection exists and given that 14015 could alternatively be from 14013-14016-14024, an association of 14021 and the latter is far from clear. A portion of diplöic bone was removed along the inferior break for isotopic and radiocarbon analysis (Richards and Pettitt in prep.).

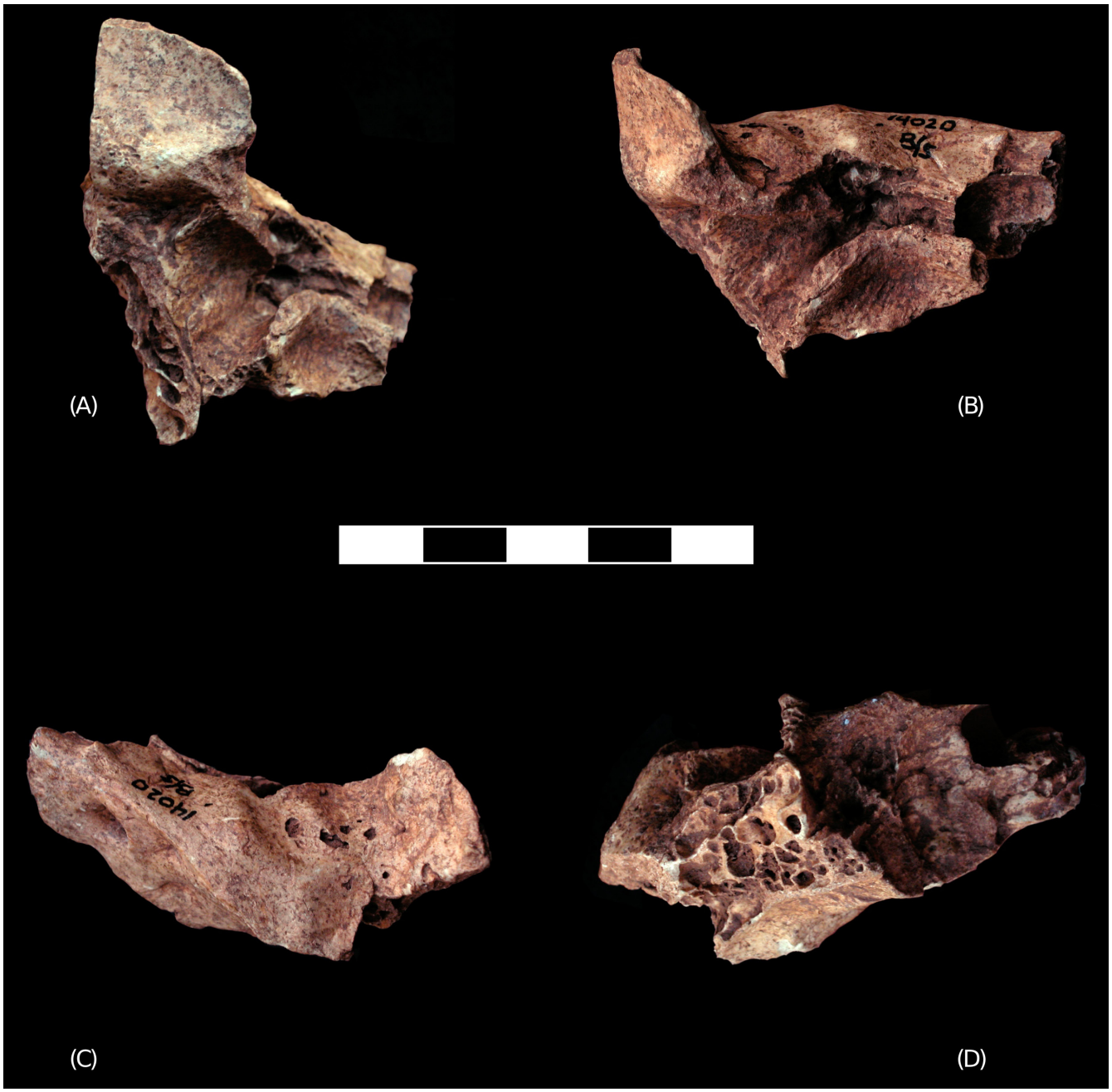

Figure 9. Ša 14020. A) lateral, B) anterior,C) superior, and D) inferior (scale is in centimeters).

Ša 14022 (Level B/s, Figure 11)

This is a right superocentral frontal squama. Its shape is roughly triangular (55mm x 53.6mm x 45.9mm) with 55mm of coronal suture preserved. Maximum squamal thickness is 9mm (near coronal suture), while the minum thickness is 7mm. The external surface is slightly eroded and flaked (similar to Ša 14015 and Ša 14021), while the internal surface is very vascularized. The specimen is a right superomedial piece based on the pattern of overlap and beveling of the suture. This specimen overlaps in anatomy with 14013-14016-14024 and is much thicker. Thickness is comparable to 14015 and is thinner than 14021.

Ša 14023 (Level B/s, Figure 12)

Ša 14023 is a right anterior parietal with a well expressed middle meningeal groove, internally. It measures 50.5mm x 50.5mm. A weak temporal line is present. Thickness at the comparable point to stephanion is 5.8mm. The coronal suture is preserved for 47mm. Internally the strong middle meningeal groove runs superiorly with smaller branches going from it posterosuperiorly. The strong notch in the coronal suture corresponds to the area of transition from inferior frontal beveling to superior parietal beveling. There are a series of striations running anterioposteriorly, most likely a result of postmortem damage.

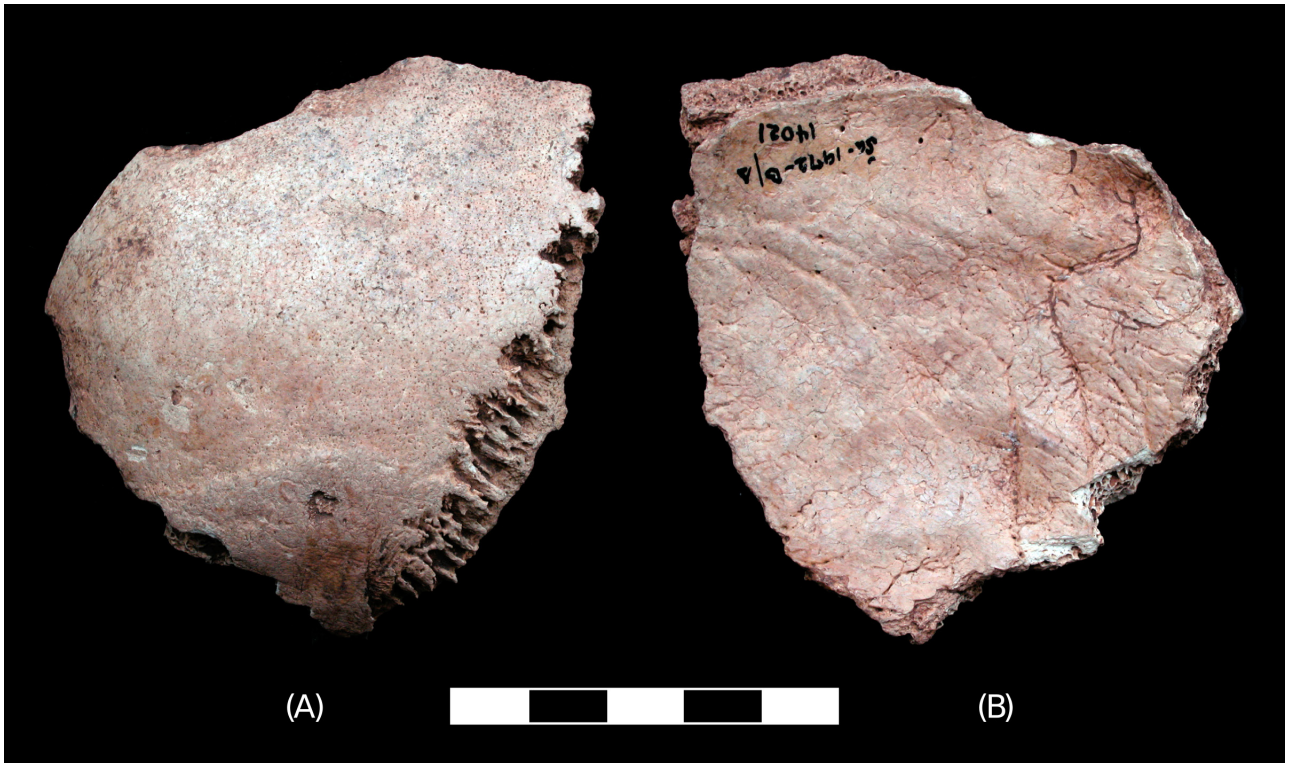

Figure 10. Ša 1402.1 A) external and B) internal (scale is in centimeters).

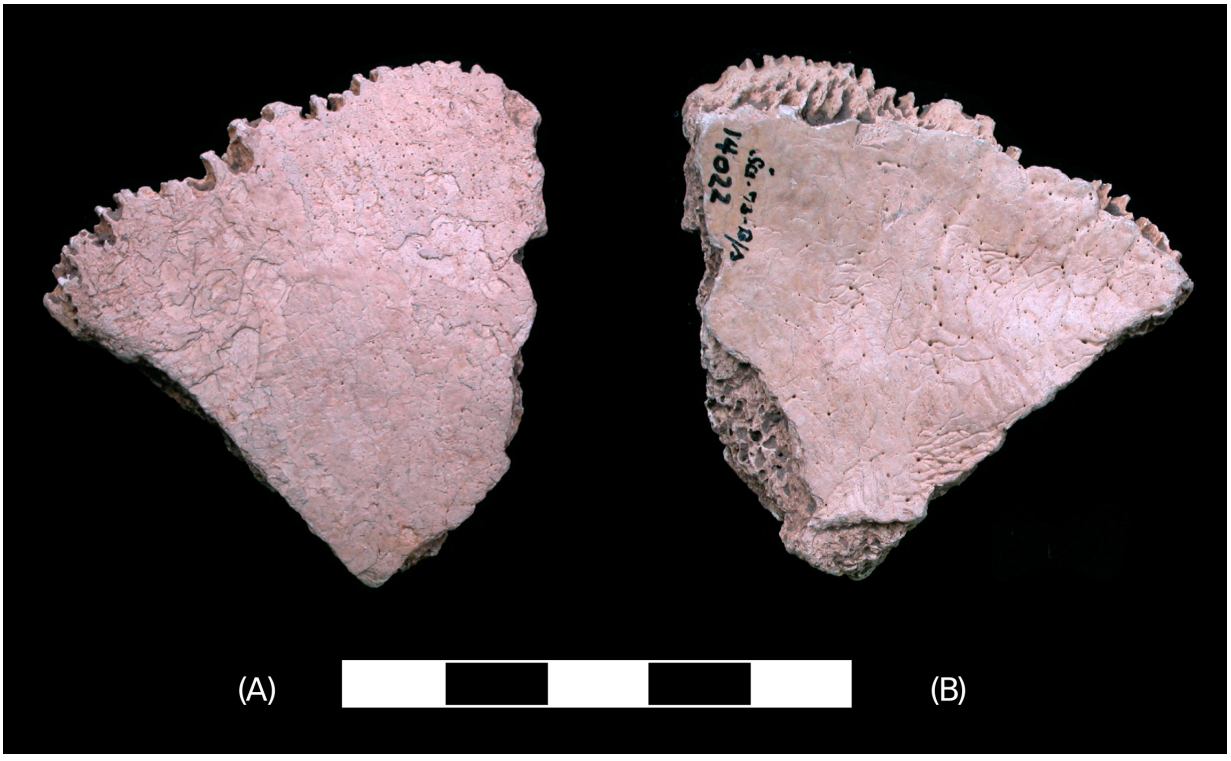

Figure 11. Ša 14022. A) external and B) internal (scale is in centimeters).

Figure 12. Ša 14023. A) external and B) internal (scale is in centimeters).

Ša 14025 (Level B/s)

Ša 14025 is a small (39.5mm by 35.9mm) frontal or parietal fragment with thickness ranging from 4.5 to 7mm. There is a depression on the external surface. Although this depression does not exhibit any reactive tissue/vascularization, its shape is consistent with a healing or healed depression fracture. There are many fine pits on the external surface much like that seen in the superoposterior parts of 14015 and 14021. Internally there is also a pacchionian or arachnoid-like depression along with some vascular grooves.

Ša 14026 (Level B/s, Figure 13)

This mastoid portion of a left partial temporal includes a small portion (the posteroinferior corner) of the temporal squama, including the supramastoid crest/torus. Maximum anatomical height is 59.1mm, while the maximum length is 50mm. Maximum mediolateral breadth on mastoid is 24mm, while maximum preserved thickness of the squama is 16mm. Maximum squama thickness at the superior break is 2mm. A 17.1mm portion of squamosal suture is present as is the entire 27.5mm long parietomastoid suture. The vertical portion of the occipitomastoid suture is 24.5mm high, and continues for 36.5mm until the anterior break which is approximately at the juncture between the mastoid and petrous portions of the temporal (the petrous portion is entirely absent). Externally, a small portion of posteroinferior corner of squama is present. A robust, torus-like posterior continuation of the supramastoid crest is present. The anterior margin and the tip of the mastoid process are missing. The mastoid foramen is large with a maximum (approximately anteroposterior) diameter of 7.3mm. The digastric groove is deep but not wide, even at its posterior terminus. The occipital groove is about equal in size and depth to the digastric groove. Mastoid width (cf. Howells 1973) is 14.4mm, while a minimum estimate of mastoid height is 30mm. Internally, there is a large opening for the mastoid canal. The sigmoid sinus is preserved for a length of 23.7mm. Based on size as well as rugose sternocleidomastoid and digastric muscle attachments and supramastoid crest, the specimen is most likely from an adult male.

Ša 14027 (Level B/s)

This piece is most likely a frontal or parietal fragment with perhaps a 11.1mm long portion of what might be a temporal line. The specimen measures 27.6mm by 31.4mm. Squamal thickness ranges from 5.8 to 7mm.

DENTAL REMAINS (TABLE 3)

Ša 14028 (Level B/s, Figure 14)

This left I_1 is small (see Table 3) with a narrow crown and very slight lingual tubercle development. Wear is moderate to extensive, and one-third of the original crown surface is missing to attrition. There is a slight mediodistal crack across crown extending onto the root. A shallow linear enamel hypoplasia is visible on the labial crown 1.9mm from the cementum-enamel junction. A wear facet on the

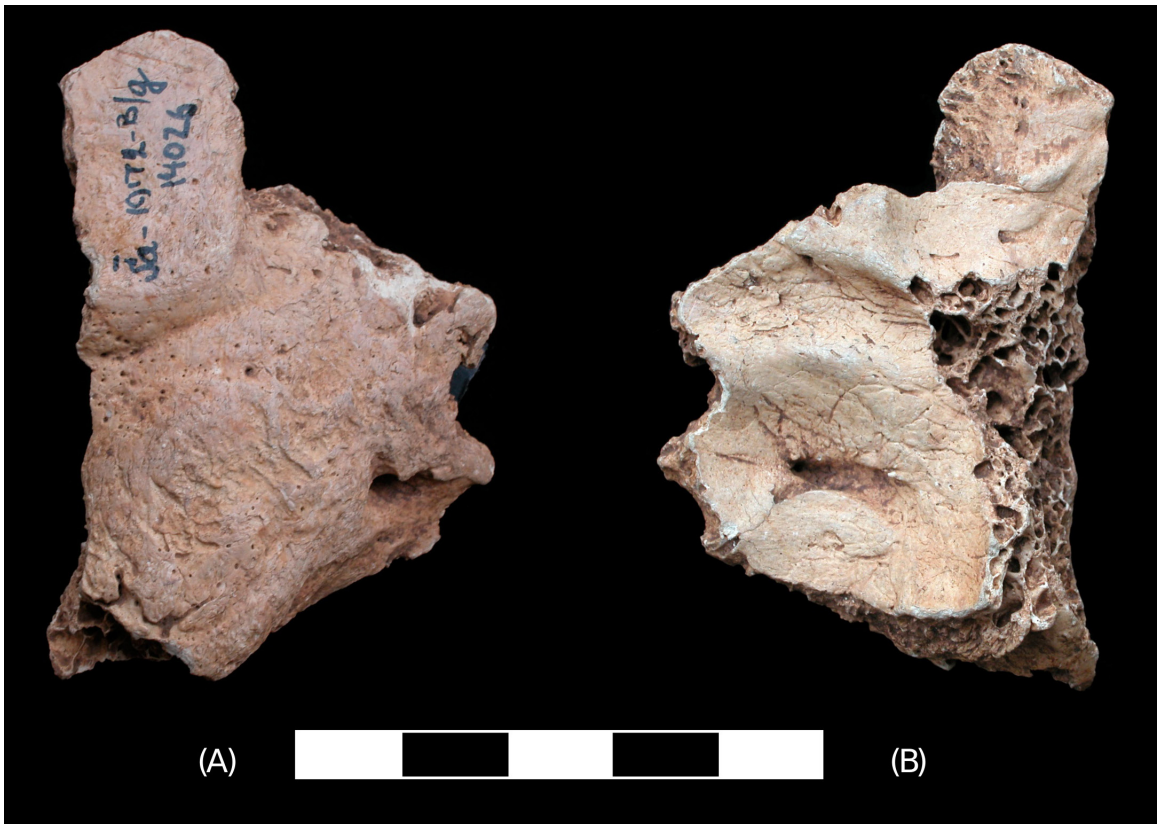

Figure 13. Ša 14026. A) external and B) internal (scale is in centimeters).

mesial side of the crown is flat with slight labiolingual bevel and a more pronounced distal inclination. A small enamel chip is missing from the labiodistal corner of the crown and extends to within 1mm of the cementum-enamel junction on the distal surface. The root shows strong mesiodistal compression and is fairly straight but the apex angles strongly distally. The root is pierced completely by a hole (2.9mm from apex). This hole is not pictured in Malez (1972), and thus is of more recent origin. No record of when and why this drilling was done is available. No caries or calculus are present.

TABLE 3. DENTAL REMAINS FROM ŠANDALJA II.

Specimen	Provenience	Element	Side	M-D Length (mm)	B-L Breadth (mm)
Ša 14028	B/s	I_1	Left	3.7	5.5
Ša 14030	B/s	I_2^*	Left	-	-
Ša 14031	B/s	I^2	?	6.5	6.2
Ša 14032	B/s	P_3 or P_4	Left	-	-
Ša 14033	B/s	M^1	Left	8.4	11.0
Ša 14034	B/s	M^2	Left	9.0	11.0
Ša 14035	B/d	M_2	Right	10.2	9.7

*Malez (1972) designated 14030 as a left I_2. We were unable to confirm this and, given the current preservation of the specimen, it could be a lower right canine.

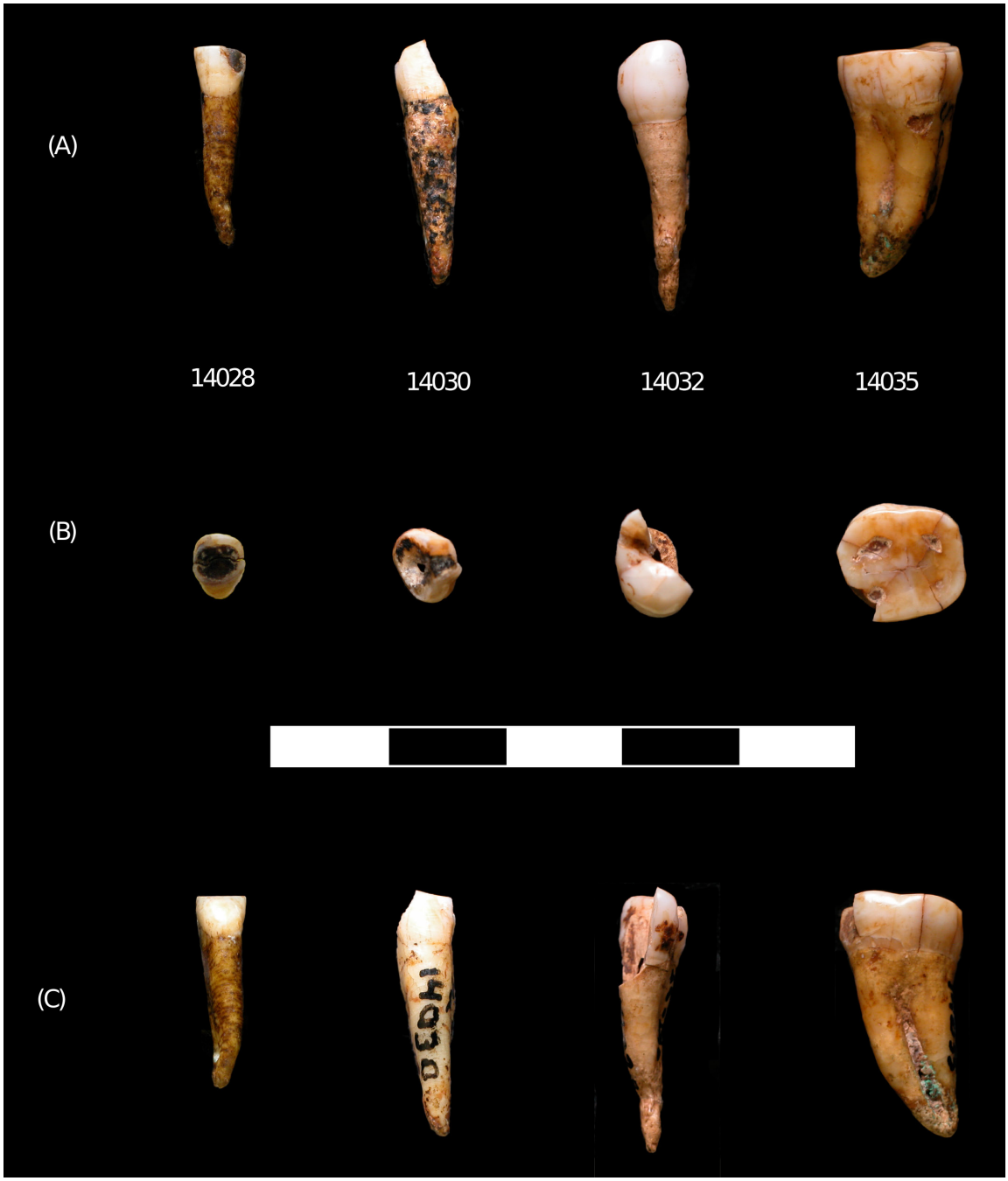

Figure 14. Mandibular dentition: Ša 14028, 14029, 14030, 14032, 14025. A) labial/buccal, B) occlusal, and C) lingual (scale is in centimeters).

Ša 14030 (Level B/s, see Figure 14)

Malez (1972) describes this specimen as a left I_2 with a full crown. Since Malez's publication almost half of the crown has gone missing (Malez [1972: Plate II Figure 4a,b,c]). In Malez's (1972) Figure 4b there is an observable hairline fracture on the crown, and at a later date a portion of the crown was lost. Based on the present preservation this tooth could be a lower right canine. The crown has an oval outline and a triangular shaped wear facet (but only half is preserved). Half of the crown is missing but a basal tubercle is visible. The root is complete with a drill hole that lies 3.8mm from the apex and is 1.3mm in diameter. There is dark staining on the tooth, and the revealed dentin is black. Wear is moderate (less than a quarter of the crown is worn away). The wear facet bevels labio-lingually. There is what appears to be a linear enamel hypoplasia defect within approximatey 1.0mm of the cementum-enamel junction. The root is mesiodistally compressed with a cementum deposit running along the labial surface. Neither calculus nor caries are observable.

Figure 15. Maxillary dentition: Ša 14031, 14033, 14034. A) labial/buccal, B) occlusal, and C) lingual (scale is in centimeters).

Ša 14031 (Level B/s, Figure 15)
This upper incisor (probably I^2) is complete. The crown is cracked through the center of the crown in a superoinferior direction. The root is complete with an apical foramen present. There is a small drill hole at apex as in the other anterior teeth. This tooth is not as brown as the other teeth in the sample, perhaps because of different taphonomic conditions. The crown shows moderate shoveling and basal tubercle development. The right marginal ridge is well developed (maximum breadth=2.0mm). The left marginal ridge is represented by only a thickening of enamel. The lingual fossa is also moderately well developed. There is a chip on the occlusal surface that appears antemortem. The enamel shows wear, but no dentin is exposed. The root is slightly compressed mesiodistally.

Ša 14032 (Level B/s, see Figure 14)
This specimen is most likely a left lower premolar. It has a single root that is wider buccolingually than mesiodistally. As the buccal cusp is missing it is difficult to determine whether the tooth is a P_3 or P_4. The labiodistal portion of the labial cusp is preserved, and thin portions of the distal margin of the crown are present. A single pillar of lingual cusp remains. Most of the root is intact except for a small area just below the crown (1.5mm below the cementum-enamel junction) on the mesial-lingual surface. The tip of the root has been broken (4.0mm from the apex) and reglued, thus altering the natural curvature. No caries are observable on the remaining portion of crown. Slight linear enamel hypoplasia is present on the crown close to the cementum-enamel junction. There are also three or four

additional slight linear hypoplasias visible half way up the crown and each of these also continues to the distal crown surface. Wear is present but is not extensive; the distal extent of the fissure between the labial and lingual cusps on the occlusal surface is present as a small pit.

Ša 14033, Left M^1 (Level B/s, see Figure 15)

This left maxillary molar is an M^1 whose distal wear facet clearly articulates with Ša 14034, a left M^2. There are three separate roots, but the buccal roots are almost coalesced. The distal wear facet is approximately 5.4mm broad while the mesial facet is 5.75mm broad. The occlusal wear is extensive in that the cusps are no longer identifiable and there is some dentin exposure, mostly on the lingual side. The crown is rectangular in its occlusal outline and exhibits a very prominent paracone. Wear is moderate but with slight dentin exposure. Dentin is exposed on the protocone with very little on the paracone.

The wear plane is flat mesiodistally, but slightly concave from paracone to hypocone diagonally. Some matrix is adhering to the crown and it is therefore difficult to determine the presence of possible hypoplastic defects, but if any are present, they are very minor. The lingual root is pillar-like with a shallow lingual depression and has a moderate and even distal inclination. The buccal roots are not fused but are almost coalesced near their apices. Both are mesiodistally compressed with a strong distal inclination. The mesiobuccal root is larger and buccolingually flatter than the distobuccal root. There is a thin connection between the lingual and mesiobuccal roots for about two-thirds of length of the roots.

Ša 14034, Left M^2 (Level B/s, see Figure 15)

This complete upper second molar has slightly less wear than 14033, to which it articulates. The protocone has the most wear with dentin exposure, while the paracone has very little with only a pinprick-sized exposure of dentin. The crown fissures are more visible than on 14033, but are mostly obliterated except at the confluence in the center of the crown. The crown has been worn flat with the buccal cusps remaining more prominent than the lingual ones. The occlusal outline is more evenly rectangular than 14033's. The mesial interproximal wear facet is buccolingually long (5.3 by 2.3mm), while the distal facet lies on the lingual half of the distal crown surface and is ovoid (3.3 by 2.1mm). Unusually for an upper molar, there appear to be only two discernable roots and they are fused. However, Malez (1972) wrote that there had been four original roots that had fused into one. No caries or linear enamel hypoplasias are observable, although small defects could be obscured by the adhering matrix and small deposits of calculus.

Ša 14035, right $M_{(2?)}$ (Level B/s, see Figure 14)

The presence of a distal wear facet precludes this specimen from being an M_3, while the size of the mesial wear facet, the crown morphology, and the coalescence of the roots strongly suggests that this tooth is not an M_1. The crown is largely complete with a 3.1mm strip of enamel chipped away from the mesiolingual corner of the metaconid on the occlusal surface to within 1mm of the cementum-enamel junction. The roots are complete. The occlusal wear is moderate and flat with slightly more prominent lingual cusps. Buccally, the wear is flat from mesial to distal; lingually, the metaconid is more prominent than the entoconid. The occlusal outline is rectangular to square with very little to no development of a hypoconulid. Dentin is exposed most on protoconid, followed by metaconid, then hypoconid, and then the entoconid. The entoconid has just a pin prick of dentin exposure. The fissures between the cusps are obliterated. The proximal wear facet seems to be more elongate than the distal facet. The roots incline distally and slightly buccally. The roots are completely coalesced buccally but with a prominent groove. They are partially coalesced lingually with the inferior half of a canal-like opening filled with matrix. The tooth does not exhibit hypoplasia, caries or calculus.

POSTCRANIAL REMAINS (TABLE 4)

Ša 14036, cervical vertebral centrum (Level B/s)

Although Malez (1972) reported this specimen as cervical vertebra 3, its identification can only be narrowed down to the centrum from C3 – C6. Maximum height is 14.8mm, maximum depth is 20.7mm, and maximum width 29.5mm. There is damage to the left lateral aspect of the body, while on the right lateral superoposterior surface, the beginning of the pedicle is preserved. There is a pathological osseous development (osteophytic growth) on the anterolateral aspect of the inferior anterior part of the body. Also, pathological porosity on the inferior right part of the body can be observed.

Ša 14037, thoracic vertebral centrum (Level B/s)

Malez (1972) reported that this specimen was a sixth cervical vertebra. Mediolateral breadth is 28.4mm, minimum anteroposterior depth is 16.8mm, and its height is 17.1mm. However, what is preserved is more consistent with an upper thoracic designation. This specimen comprises a thoracic vertebral body fragment, preserving the superior demi-facet for rib articulation on the left lateral surface. The left posterolateral part is broken off. The centrum rim (lip) is elevated from the body on both surfaces.

Ša 14038, lumbar vertebral centrum (Level B/s)

This partial vertebral body was identified as thoracic 10 or 11 by Malez (1972), but the anterior curvature of the centrum indicates that it is a lumbar vertebra. Its maximum height is 26.8mm, its maximum width is 33.1mm, and its maximum depth is 24.4mm. The right half of the body is preserved but is lacking the transverse process. The posterior surface of the body is missing, and the right pedicle is broken off at the root on the superior aspect. Slight lipping on superior surface is visible.

TABLE 4. POSTCRANIAL REMAINS FROM ŠANDALJA II.

Specimen	Provenience	Description
Ša 14036	B/s	Cervical vertebral centrum
Ša 14037	B/s	Thoracic vertebral centrum
Ša 14038	B/s	Lumbar vertebral centrum
Ša 14039	B/s	Lumbar vertebral centrum
Ša 14040	B/s	1st sacral vertebral segment
Ša 14041	B/s	Left rib fragment
Ša 14042	B/s	Vertebral end of right rib
Ša 14043	B/s	Left scapular glenoid
Ša 14045	B/s	Right ulnar shaft
Ša 14046	B/s	Left proximal radius
Ša 14047	B/s	Right metacarpal II
Ša 14048	B/s	Right proximal hand phalanx I
Ša 14049	B/s	Intermediate hand phalanx
Ša 14050	B/s	Right proximal femur

Ša 14039, lumbar vertebra centrum (Level B/s)

This is partial body of a lumbar vertebra, and according to Malez (1972) it is either L4 or L5. The anterior surface is missing. While the superior surface of the body is mostly missing, the inferior surface is more complete (except for its anterior and both lateral parts). The left pedicle is mostly preserved, while the right pedicle has its medial part preserved. Maximum height is 24.7mm (Table 5). Maximum width, although not completely preserved, is approximately 34.6mm, and the minimum preserved depth of the centrum is approximately 27mm.

Ša 14040, First sacral vertebra segment (Level B/s, Figure 16)

This specimen is the sacral 1 vertebral body with a partial left ala. The lack of fusion with S2 indicates an age of less than 32 years (Buikstra and Ubelaker 1994), while the developed epiphyseal rings on the inferior surface suggest that the individual was at least 18–25 years old (Bass 1985). The inferior surface of the body is well excavated and the epiphyseal ring is distinct from the central part of the body. No pathologies can be observed on the specimen.

Ša 14041, rib shaft (Level B/s)

This specimen is a left rib shaft fragment preserving the angle. Total specimen length is 80.8mm. The distance from the vertebral end to the beginning of the intercostal muscle attachment is 26mm. There is slight damage of the inferior border close to the angle. The morphology is consistent with a typical rib (3–9 or 10?). There is a well developed attachment for intercostal muscles on the external (dorsal) aspect.

Ša 14042, proximal rib (Level B/s)

This is the vertebral end of a right rib with head, neck and tubercle preserved. There are two articulate facets, and it is broken off just behind the tubercle. Although Malez (1972) suggested that it was either rib 10 or 11, the presence of two articular facets suggests that it is a typical rib (3–9). The head is fused suggesting adult age. The superoposterior part of the head's superior articular facet is slightly damaged, as is the area on the posterioinferior surface of the head, just lateral to the articular facet. Maximum height of the head is 11.6mm and its width is 9.9mm. Maximum specimen length is 40mm, and its neck length is 18.9mm.

TABLE 5. LUMBAR VENTRAL HEIGHTS.[1]

Specimen/Sample	L4 (mm)	L5 (mm)
Ša 14039	**24.7[2]**	
Early U.P.	26.3 (*s*=2.5, *n*=8)	22.7 (*s*=2.1, *n*=8)
Late U.P. (excluding Epigravettian)	25.7 (*s*=0.8, n=4)	24.5 (*s*=0.7, *n*=4)
Epigravettian (all)	24.8 (*s*=2.0, *n*=6)	24.7 (*s*=2.1, *n*=4)
Epigravettian (Italian only)	25.1 (*s*=2.8, *n*=3)	25.5 (*s*=1.5, *n*=3)
Mesolithic	27.1 (*s*=3.6, *n*=3)	25.5 (*n*=1)

[1]Comparative data from Holliday (1995) and Sladek et al. (2000).
[2]Specimen could either be Lumbar 4 or Lumbar 5.

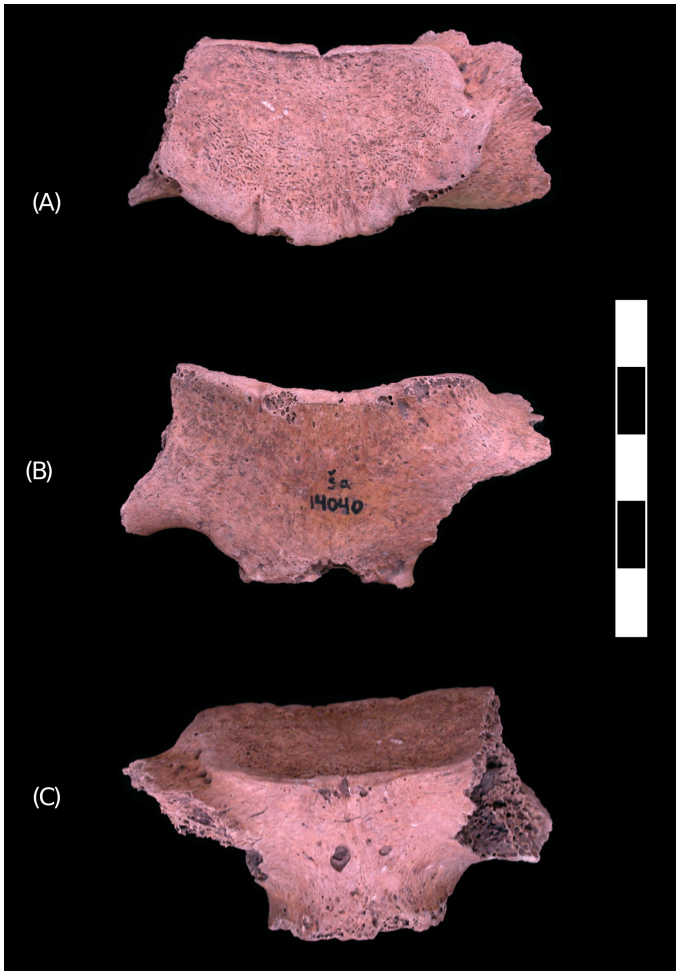

Figure 16. Ša 14040. A) superior, B) ventral, and C) dorsal (scale is in centimeters).

Ša 14043, left scapular glenoid (Level B/s, Figure 17)

This specimen is a partial scapula comprising the complete glenoid fossa. The superior part (attachment. of *m. biceps brachii*) is missing, but the inferior part (attachment of *m. triceps brachii*) is preserved. Dorsally, the neck is preserved, while on ventral aspect most of the neck is broken off. Some pitting on the inferior part of the articular surface can observed. Maximum height of the specimen is 40.5mm, and maximum width is 26mm (same as the maximum width of the glenoid fossa, see Table 6 for metrics and comparisons). Height of the glenoid fossa is 34mm, and the maximum mediolateral preservation is 20mm. The glenoid surface is fused suggesting an age of older than 15 years (Bass 1985). The glenoid notch is not deep but is a continuously curved line.

Ša 14045, right ulnar shaft (Level B/s, Figure 18)

This piece preserves most of a right ulnar shaft. The proximal portion of the bone is broken off at the base of the coronoid process (the notch and olecranon are missing). The brachial tuberosity is preserved. The shaft is broken mediolaterally into two parts at about midshaft and glued together (approximately 87mm from the proximal-most part of the fragment). Another piece of bone (144mm proximodistally and 8.2mm anteroposteriorly) was broken off for use in isotopic analysis (Richards and Pettit in prep.) Maximum length of the specimen is 166mm. Maximum height at proximal-most break is 19.6mm. Maximum anteroposterior thickness at midshaft is 11.9mm, while width at the midshaft is 15mm. A nutrient foramen located on anterior surface at about 52.3mm from the most proximal break.

Ša 14046, left proximal radius (Level B/s, Figure 19)

Ša 14046 is a left radial head and portion of proximal shaft preserving the radial tuberosity. This specimen is from an adult, as the head is fused. There is some damage to the lateral part of radial head (a part is broken off). The articular surface of the head is smooth with no pathologies observed. Maximum preserved length of the fragment is 31mm. Maximum neck width is 13.3mm, and neck depth is 13.2mm. Maximum head width is 18.3mm although the specimen is damaged on the lateral surface. Maximum depth of the head is 20mm. Height of the head is 8mm. About 8.3mm of incomplete radial tuberosity is preserved.

Ša 14047, right metacarpal II (Level B/s, Figure 20)

This specimen is a right second metacarpal (Malez 1972). Most of the shaft and proximal end is preserved while the distal end is missing. There is a slight damage on the palmar surface of the bone. Maximum length of the specimen is 44mm. The base measures 13.8mm wide by 13.2deep.

TABLE 6. SCAPULAR GLENOID DIMENSIONS[1].

Specimen/Sample	Articular Length (Sup. – Inf.) in mm	Articular Breadth (Ant. – Post.) in mm	Glenoid Index 100*(Breadth/Length) in mm
Ša 14043	**34**	**26**	**76.5**
Early U.P.	34.6	26.0	74.6
	(*s*=3.4, *n*=4)	(*s*=1.8, *n*=5)	(*s*=6.4, *n*=4)
Late U.P.	32.0	20.3	67
(excluding Epigravettian)	(*s*=2.7, *n*=5)	(*s*=1.9, *n*=5)	(*s*=4.9, *n*=3)
Epigravettian	32.9	21.9	66.8
(all)	(*s*=1.2, *n*=3)	(*s*=1.3, *n*=3)	(*s*=5.7, *n*=3)
Mesolithic	29.0	24.1	83.1
(Gramat 1)			

[1]Comparative data from Holliday (1995), Pearson (1997), and Sladek et al. (2000).

The midshaft measures 6.6mm wide by 7mm deep (see Table 7 for comparative metrics). Based on the size of the specimen, it is likely from an adult. A small nutrient foramen is present on the superior surface of the shaft located 26.2mm from the proximal end.

Figure 17. Ša 14043 scapular glenoid, lateral (scale is in centimeters).

Ša 14048, right proximal hand phalanx I (Level B/s, see Figure 20)

This right pollux is adult, based on the fused epiphysis. It exhibits slight damage on the medial part of the proximal palmar surface and on the medial part of the proximal dorsal surface. No pathologies are present. Maximum length is 27.7mm. The base measures 15.4mm wide by 10.6mm deep. The midshaft measures 8.7mm wide by 5.6mm deep, and the distal end measures 10.1mm wide (see Table 8 for comparative metrics).

Ša 14049, intermediate hand phalanx (Level B/s, see Figure 20)

Malez (1972) suggested that this was a fifth intermediate hand phalange, although digits 2–4 remain possibilities. On the palmar surface, two rugose ridges are present for attachment of *m. flexor digitorum superficialis.* Maximum length is 20.2mm. The base measures 11mm wide by 8.1mm deep, while the midshaft measures 6.9mm wide by 6.9mm deep. The distal end is 8mm wide by 5mm deep.

Ša 14050, right proximal femur (Level B/s, Figure 21, see Table 9 for comparisons)

This specimen comprises a proximal femur including head, neck and lesser trochanter. The superior part of the neck was broken off but glued together (the break is in superior to inferior direction and angles slightly medially in superior direction). Also there is some damage to the joint area of neck and head, both on the superioposterior and anterior surfaces. The head is smooth and no pathologies can be observed. The *fovea capitis* is not well excavated. The in-

Figure 18. Ša 14045 ulna. A) ventral and B) dorsal (scale is in centimeters).

tertrochanteric line on the neck is not well developed. Measurements are as follows (see Bass 1985 for measurements): maximum diameter of the head is 43mm, maximum head dimensions in anterior-posterior direction 42.4mm, in superior-inferior direction 42.6mm, neck length (posterior surface) 36.4mm, maximum height of the specimen is 83.5mm, maximum width at lesser trochanter 35.9mm, trochanter height (superior-inferior direction) is 20.1mm, neck height (superior-inferior direction) is 30.2mm, neck width (anteror-posterior direction) 23.8mm, neck diameter is 95mm, head diameter is 137mm.

Figure 19. Ša 14046 radius. A) ventral and B) dorsal (scale is in centimeters).

Figure 20. Hand bones. Ša 14047, 14048, 14049. A) dorsal and B) ventral (scale is in centimeters).

TABLE 7. METACARPAL 2 DIMENSIONS[1].

Specimen/Sample	Proximal End Maximum Height mm	Proximal End Maximum Breadth mm	Midshaft Height mm	Midshaft Breadth mm
Ša 14047	**13.2**	**13.8**	**7.0**	**6.6**
Early U.P.	16.2	17.2	8.6	8.2
	(*s*=1.6, *n*=4)	(*s*=0.7, *n*=4)	(*s*=0.7, *n*=5)	(*s*=1.1, *n*=5)
Epigravettian	14.8	15.0		
(Romito, Italy, only)	(*s*=1.3, *n*=5)	(*s*=2.5, *n*=5)		

[1]Comparative data from Holliday (1995), Mallegni and Fabbri (1991), and Sladek et al. (2000).

TABLE 8. PROXIMAL POLLICAL PHALANX DIMENSIONS.

Specimen/Sample	Articular Length mm	Midshaft Height mm	Midshaft Breadth mm
Ša 14048	**27.7**	**5.6**	**8.7**
Dolní Vestonice[1]	26.0	5.6	8.6
	(*s*=7.3, *n*=4)	(*s*=1.3, *n*=4)	(*s*=1.6, *n*=4)

[1]Data from Sladek et al. (2000).

TABLE 9. FEMORAL HEAD DIAMETER (ANT. – POST.)[1].

Specimen/Sample	Head Diameter (Ant. – Post.) in mm
Ša 14050	**42.2**
Early U.P.	46.7
	(*s* = 3.6, *n* = 13)
Late U.P.	46.7
(excluding Epigravettian)	(*s* = 3.0, *n* = 9)
Epigravettian	46.4
(all)	(*s* = 2.4, *n* = 11)
Epigravettian	47.8
(Italian only)	(*s* = 1.4, *n* = 7)
Mesolithic	45.5
	(*s* = 3.8, *n* = 6)

[1]Comparative data from Holliday (1995) and Sladek et al. (2000).

Figure 21. Ša 14050 femur. Anterior (scale is in centimeters).

CULTURAL SEQUENCE OF THE ŠANDALJA II B/S LAYER

Both technological and typological aspects of the entire B/s layer lithic assemblage have been analyzed. Twenty separate categories have been recognized (0–19) for debitage, based on standard classifications such as those of Brézollon (1983), Straus and Clark (1986), Inizan et al. (1992), and Straus (1995), which are based on the technological aspects of the debitage. The typology of D. de Soneville-Bordes and J. Perrot (1953, 1954, 1955, 1956a, 1956b), which recognizes 92 tool types, was used and further modified by the inclusion of 5 additional tool types (Table 10, Nos. 92–96). It must be noted that the presence of the Azilian points (Table 10, No. 91) at Šandalja II does not define this industry as Azilian, as this type also is seen within the Epigravettian.

Bone artifacts were classified according to the standardized types of Camps-Faber (1974; 1988) and Piel-Desrusseaux (1986).

The B/s layer is the richest stratigraphic unit at the site (Table 11) with a total of 5,331 lithic finds, 799 (15.0%) tools and 4,532 (85.0%) debitage pieces. Most abundant are regular flakes (31.31%), and chunks (18.23%), while bladelets are more frequent than blades. The use of the soft hammer in the production of blades has been established, but it has to be noted that other techniques could have been used (J. Pelegrin, F. Blazer, and J. Kozlowski, personal communication). Flakes, blades, and bladelets (both with and without cortex), cores, crested blades, and rejuvenation flakes all suggest that all the production phases were present in this layer. The percentage of retouched flakes and spalls was probably much higher than noted because the sediment was not sieved during the excavation. A high percentage of chunks can be attributed to the use of local grey chert which tends to break irregularly. In fact, most of the raw materials used in the production of the Late Epigravettian at the Šandalja II site comes from the Istrian penninsula.

TABLE 10. ŠANDALJA TOOL TYPES.

No.	Tool Type	N	Percentage
1	Simple endscraper	33	4.13
2	Atypical endscraper	8	1.00
3	Double endscraper	4	0.50
5	Endscraper on retouched flake	24	3.00
8	Endscraper on flake	21	2.63
9	Circular endscraper	4	0.50
10	Thumbnail endscraper	30	3.75
15	Nucleiform endscraper	2	2.25
17	Endscraper-burin	1	0.13
21	Perforator-endscraper	1	0.13
23	Perforator	16	2.00
24	Atypical perforator (bec)	13	1.63
25	Multiple perforator	1	0.13
26	Micro-perforator	4	0.50
28	Canted dihedral burin	2	0.25
29	Angledihedral burin	2	0.25
30	Angle burin on break	4	0.50
31	Multiple dihedral burin	1	0.13
35	Burin on oblique truncation	1	0.13
36	Burin on concave truncation	2	0.25
37	Burin on convex truncation	2	0.25
38	Transverse burin on lateral retouch	4	0.50
41	Multiple mixed burin	1	0.13
43	Nucleiform burin	2	0.25
44	Flat burin	1	0.13
48	Gravette point	9	1.13
49	Atypical Gravette point	3	0.38
50	Microgravete	16	2.00
57	Shouldered piece	3	0.38
58	Complete backed blade	19	2.38
59	Partly backed blade	4	0.50
61	Piece with oblique retouched truncation	5	0.63
62	Piece with a concave retouch	3	0.38
63	Piece with convex truncation	6	0.75
64	Piece with double truncation	1	0.13
65	Continuously retouched piece – one edge	93	11.64
66	Continuously retouched piece – two edges	36	4.51
74	Notched piece	32	4.01
75	Denticulate piece	18	2.25
76	Splintered piece	42	5.26
77	Sidescraper	16	2.00
78	Raclette	10	1.25
80	Rectangle	5	0.63
83	Circular segment	21	2.63
84	Bladelet with truncation	2	0.25
85	Backed bladelet	42	5.26
86	Backed bladelet with truncation	8	1.00
88	Denticulated bladelet	7	0.88
89	Notched bladelet	11	1.38
91	Azilian point	18	2.25
92	Partly retouched piece	33	4.13
93	Piece with marginal retouch	26	3.25
94	Retouched bladelet	21	2.63
95	Bladelet with marginal retouch	37	4.63
96	Unindentifiable pieces	42	5.26
97	Diverse	26	3.25
	Total	**799**	**100**

TABLE 11. ŠANDALJA LITHIC TYPES.

No.	Type	Unretouched		Retouched		Unretouched + retouched	
		N	%	N	%	Weight (g)	%
0	Pebble/nodule/cobble	-	-	-	-	-	-
1	Decortication flake	674	12.64	275	5.16	2898.9	16.97
2	Decortications blade	44	0.83	44	0.83	304.1	1.78
3	Decortications bladelet	102	1.91	24	0.45	112.8	0.66
4	Flake	1517	28.46	152	2.85	2666.0	15.61
5	Blade	223	4.18	118	2.21	824.4	4.83
6	Bladelet	426	7.99	152	2.85	270.4	1.58
7	Flake core	86	1.61	1	0.02	1136.8	6.65
8	Blade core	1	0.02	1	0.02	87.3	0.51
9	Bladelet core	79	1.48	2	0.04	587.1	3.44
10	Mixed core	61	1.14	-	-	636.6	3.73
11	Core fragment	9	0.17	4	0.08	45.9	0.27
12	Splintered piece	5	0.09	-	-	11.6	0.07
13	Crest	20	0.38	-	-	56.6	0.33
14	Core renewal flake	81	1.52	5	0.09	253.3	1.48
15	Small flakes	201	3.77	-	-	36.8	0.22
16	Burin spall	14	0.26	-	-	9.9	0.06
17	Chunk	959	17.99	13	0.24	7136.9	41.78
18	Shatter	9	0.17	-	-	1.6	0.01
19	Unidentified	21	0.39	8	0.15	4.9	0.03
	Total	**4532**	**85.01**	**799**	**14.99**	**17081.9**	**100.00**
	Total unretouched + retouched	**5331**					

Only a smaller percentage of the raw material, however, might be of northern Italian origin.

Tools (Figures 22 and 23) are mainly made on decortication flakes, followed by regular flakes and bladelets. The most abundant tools are pieces with continuous retouch on one edge (11.64%). An interesting example of this type of tool with an incised diamond lattice pattern has been found in this stratigraphic layer (see Figure 22, No. 40). The tool is made on chert, one of the hardest stones, therefore the incised lines must have been made by a stone of the same hardness. A similar incised pattern is seen on one flake from the Italian site of Riparo Tagliente (Guerreschi 2005: Figure 6). End scrapers are also frequent, the most abundant of which are simple end scrapers (4.13%), followed by thumbnail end scrapers (3.75%). Typical and non-typical drills are present, as well as different burin types. Both typical and atypical Gravettian points are rare (1.51%). Microgravettes, backed bladelets, truncated backed bladelets, and Azilian points also are present, as well as geometric forms such as circular segments and rectangles. Based on the abundance of short end scrapers and the presence of microgravettes, backed bladelets, and Azilian points, the industry of the Šandalja II B/s layer can be classified as late Epigravettian. This is in agreement with C^{14} dates for the B complex of the site (Malez and Vogel 1969; M. Richards, personal communication).

Raw materials used consist of various cherts that could have been collected at the sites in Southern, Central, and Eastern Istria, from the valley of the Soča river, or other Alpine rivers, or from the slopes of the Alps and from Northern Italy (Malez 1972a, Zupanič 1975, see also Montet-White 1996).

In addition to the stone industry, 12 bone pieces have been found in Layer B/s, 11 of which are bone tools and tool fragments. Good examples are a wide awl made of deer bone that is almost complete, lacking only the tip, decorated with two incised rows of parallel dashes (Figure 24, middle), as well as another awl missing only the most proximal part (Figure 24, right). Of particular interest is a bone fragment with incised lines (Figure 24, left).

DISCUSSION

THE ŠANDALJA II HUMAN REMAINS

Taphonomically, the Šandalja human remains are very fragmentary and are unlikely to have been from burials. Most were found scattered in the southwestern part of the cave, near a larger hearth in the B/s layer (Malez 1987). Based on the fragmentary state of the bones and their location near the fireplace, Malez (1972) suggested cannibal-

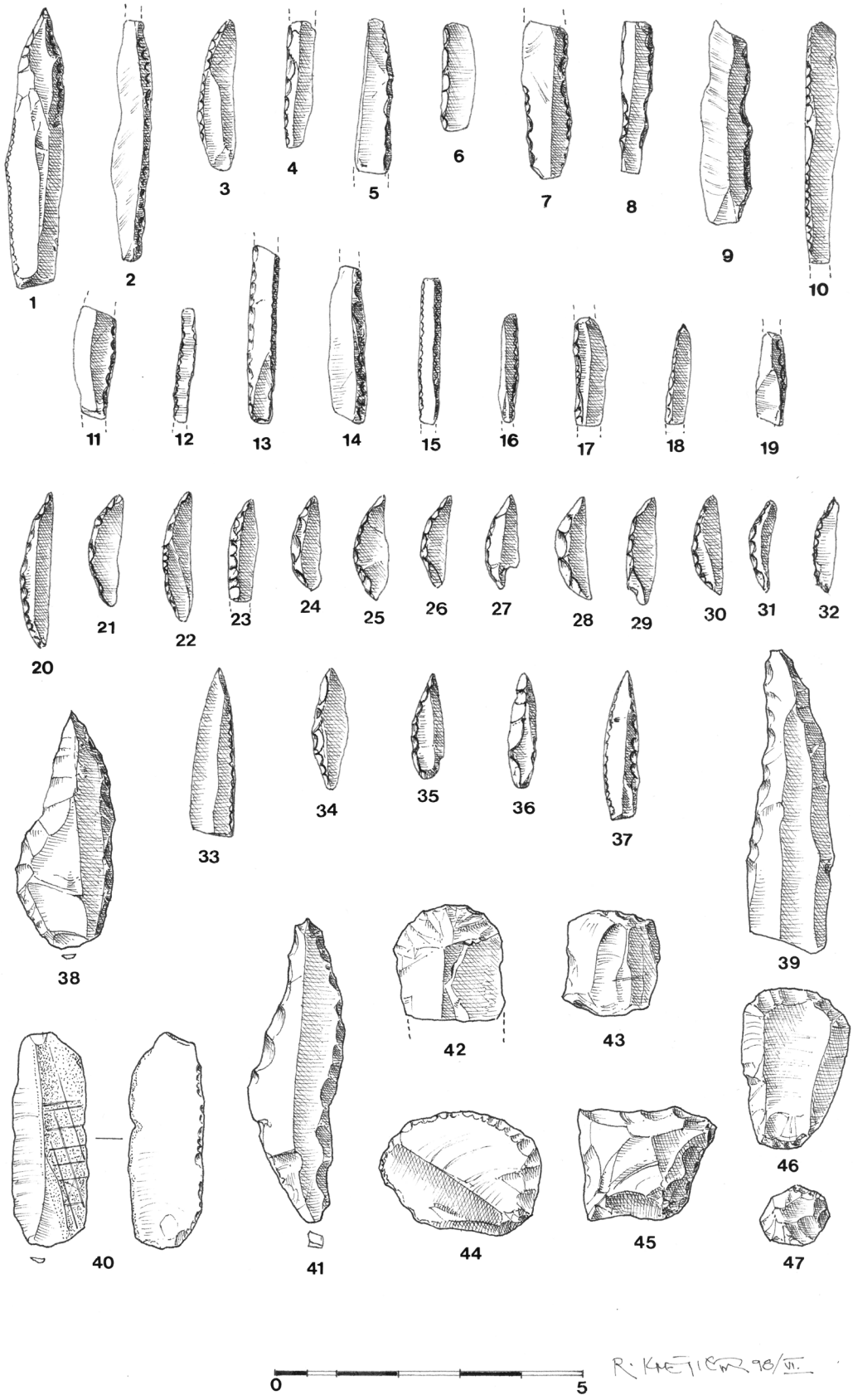

Figure 22. Stone tools from Layer B/s (scale is in centimeters).

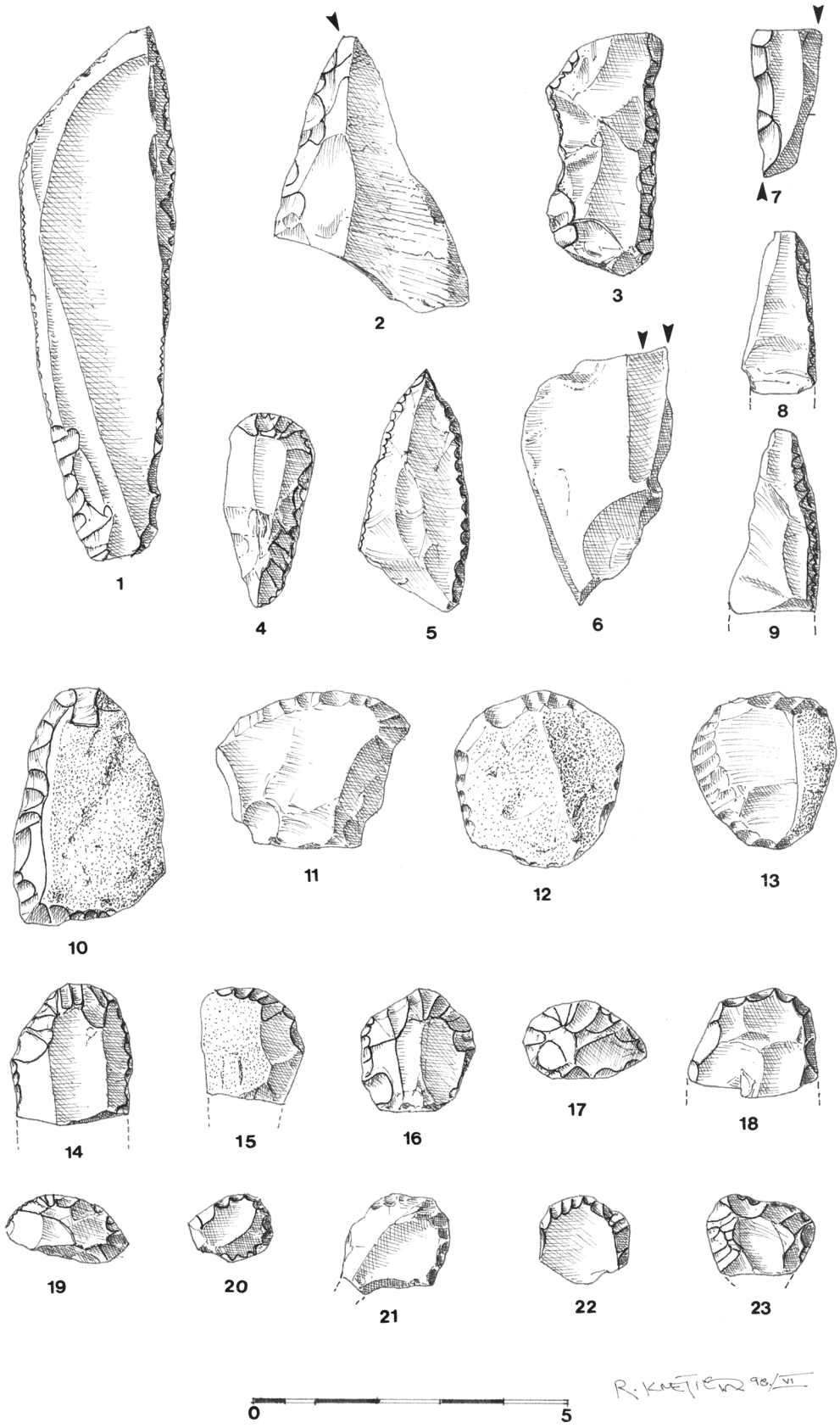

Figure 23. Stone tools from Layer B/s (scale is in centimeters).

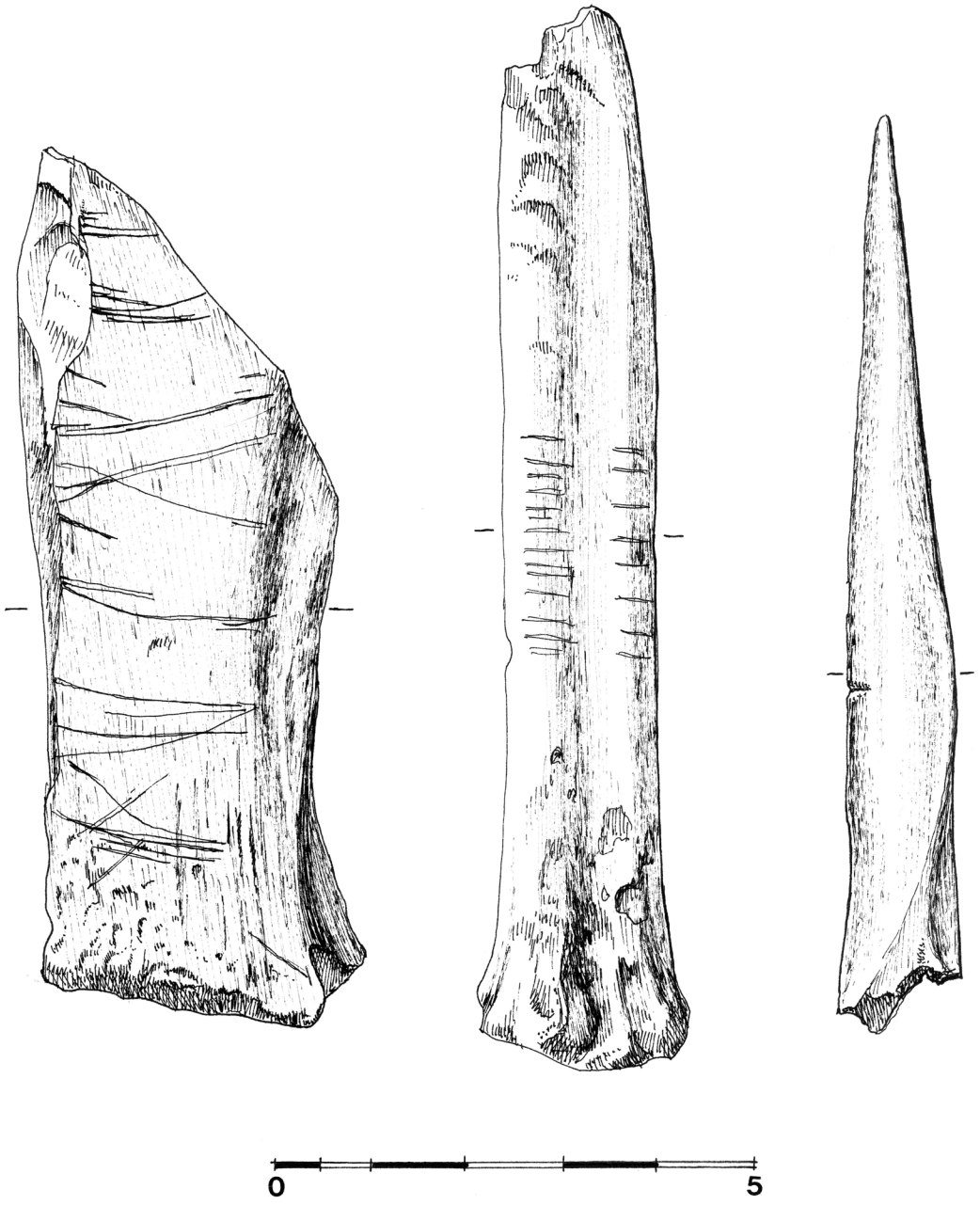

Figure 24. Incised bones from Layer B/s (scale is in centimeters).

ism was practiced at the site, or more precisely, that the inhabitants were killed and consumed by another Upper Paleolithic group. However, no evidence of defleshing can be seen on the remains themselves, nor were they burned. Thus, cannibalism seems an unlikely explanation, and fragmentation of bones most likely is a result of taphonomic processes, later use of the site, and/or cleaning of the living surface (Miracle 1995).

The skeletal remains from the B/s layer of Šandalja belong to a minimum of two adults and one subadult or adolescent (Table 12). The most complete specimen is Ša 14013-14016-14024 that comprises portions of a right frontal and parietal. The Ša 14013 supraorbital fragment, not surprisingly, is quite modern looking, and its metrics fall below both Upper Paleolithic and Neolithic averages, as do those of some of the dental remains (see Table 2).

Femoral head diameter of Ša 14050 is within the range of variation of Mesolithic, and Early and Late Upper Paleolithic samples, albeit on the low end of variation. It is smaller than the Epigravettian sample, except for one specimen (the female Grotte des Enfants 3). We have used the femoral head diameter to estimate body weight, based on formula from Grine et al (1995; also see Jungers 1990) where:

$$\text{body mass} = 2.268^{*} \text{ fhd} - 36.5$$

Based on this estimation, we obtained a body mass estimate of 59.2kg for the Šandalja 14050 individual. We also

TABLE 12. THE ŠANDALJA II HUMAN SKELETAL SAMPLE.

Šandalja II specimens (*n*=34)		**N**
Cranial (MNI=2)		
- probable N.I. is 3–4	Partial Calotte	1
- both subadult and adult	Frontal	5
	Parietal	3
	Temporal	3
Dental (MNI = 2)		
- varying wear = varying ages	Anterior (adult)	4
	Posterior (adult)	4
Postcranial (MNI=1)		
	Axial	7
	Appendicular	7

used the same formula to estimate the body mass for comparative samples according to sex and population (Table 13 for body mass values of individual specimens). Ša 14050 clusters with Epigravettian samples, as well with the Grotte des Enfants 3 Gravettian female (Figure 25). We also have found a significant difference in body mass between the male Epigravettian and female Mesolithic samples (Dunnett T3 post hoc test, t=3.488, p=0.021) and between Mesolithic females and Early Upper Paleolithic males (Dunnett T3 post hoc test, t=-29.513, p=0.016).

Ša 14050 clusters with female Epigravettians (t_s=-0.140, p=0.911). However, it does not significantly fall out of the range of any of the other sexed samples, except for the male Epigravettians (Dunnett T3 post hoc test, t=-0.829, p=0.030). Given these results, Ša 14050 most likely represents a female.

In contrast to the relatively small Ša 14050 proximal femur, the Ša 14043 glenoid fossa likely reflects a much larger, potentially male, individual (Figure 26). Of the two glenoid fossa measurements, only articular breadth shows a significant difference among the samples (ANOVA, F=13.240, p=0.003).

In paired sample comparisons, no significant difference was found in glenoid fossa articular length. For glenoid fossa articular breadth, both the Epigravettian mean (Dunnett T3 post hoc test, t=1.109, p=0.037) and the Magdalenian mean (Dunnett T3 post hoc test, t=0.019, p=0.006) are significantly smaller than the Early Upper Paleolithic mean. Given the small comparative sample sizes, Ša 14043 does not significantly fall out of the range of any of the comparative samples for any of the glenoid fossa variables.

As noted in previous studies (Ahern 1998; Ahern et al 2002; Smith and Ranyard 1980; Smith et al. 1989), Late Pleistocene Europeans show significant temporal variation in both the size and shape of the supraorbital region. With some exceptions, Holocene Europeans are more similar to each other than they are to Paleolithic populations in supraorbital size and shape. With some notable exceptions, they tend to have fairly gracile supraorbitals whose browridge development is largely limited to the medial segment. The greatest supraorbital differences are seen between Neandertals and post-Neandertal groups in Europe.

In terms of size and shape of the supraorbital projection, the Ša 14013 lateral supraorbital segment is most similar to recent, Neolithic, and Mesolithic Europeans, yet it is not significantly different from the Upper Paleolithic samples. However, in terms of supraorbital thickness, the Ša 14013 specimen is distinguished by having very thick lateral segment combined with very thin midorbit segment. This is reflected in the midorbit-lateral thickness index (see Table 2) in which the Ša 14013 specimen is significantly smaller (p<0.044) than all of the comparative samples, except for the Mesolithic and the Upper Paleolithic samples.

Although sex is not reflected in the shape of the lateral

TABLE 13. BODY MASS ESTIMATES FOR ŠANDALJA AND COMPARATIVE SPECIMENS[1].

Specimen	Cultural Assoc.	sex	Femoral Head Diameter (A-P) in mm	Est. Body Mass (kg)
Šandalja 14050	Epigravettian	?	42.2	59.2
Arene Candide 1 (I. P.)*	terminalgravettian	M	49.2	75.1
Arene Candide 1	Epigravettian	?	49.8	76.4
Arene Candide 2	Epigravettian	M	50.5	78.0
Arene Candide 10	Epigravettian	M	46.7	69.4
Arene Candide 4	Epigravettian	M	47.7	71.7
Arene Candide 5	Epigravettian	M	48.0	72.4
B. Caviglione	Gravettian	M	46.1	68.1
Barma Grande 2	Gravettian	M	52.4	82.3
Bichon 1	Azilian	M	43.2	61.5
Bruniquel 24	Upper Magdalenian	F	42.4	59.7
Cap Blanc 1	Magdalenian	F	42.3	59.4
Chancelade	Magdalenian	M	46.3	68.5
Continenza	Epigravettian	M	47.0	70.1
Cro-Magnon 2	Aurignacian	F	43.0	61.0
Dolni Vest. 3	Gravettian	F	40.5	55.4
Dolni Vest. 14	Gravettian	M	51.4	80.1
Gough's Cave	Magdalenian	M	46.3	68.5
Gr. Des Enfants 3	Epigravettian	F	40.0	54.2
Gr. Des Enfants 6*	Gravettian	?	41.8	58.3
Gr. Des Enfants 4	Gravettian	M	53.0	83.7
Gramat 1	E. Mesolithic	M	49.9	76.7
Hoedic 8	E. Mesolithic	F	41.4	57.4
Hoedic 9	E. Mesolithic	M	42.4	59.7
La Rochette	Aurignacian	?	44.8	65.1
Le Peyrat 5	Azilian	M	46.8	69.6
Le Peyrat 6	Azilian	F	44.2	63.7
Le Placard 15	Magdalenian	?	47.2	70.5
Los Azules 1	Azilian	M	50.6	78.3
Neussing 2	"Solutrean"	F	48.1	72.6
Oberkassel 1	Magdalenian	M	49.1	74.9
Paglicci 25	Gravettian	F	42.9	60.8
Parabita 2	Gravettian	F	48.8	74.2
Paviland	Aurignacian	M	48.7	74.0
Predmosti 1	Gravettian	M	41.0	56.5
Predmosti 10	Gravettian	F	48.0	72.4
Predmosti 14	Gravettian	M	47.0	70.1
Predmosti 3	Gravettian	M	48.0	72.4
Predmosti 4	Gravettian	F	48.0	72.4
Predmosti 9	Gravettian	M	42.0	58.8

TABLE 13. (continued).

Specimen	Cultural Assoc.	sex	Femoral Head Diameter (A-P) in mm	Est. Body Mass (kg)
Rastel	L. Mesolithic	M	44.8	65.1
Romito 3	Romanellian	M	48.6	73.7
Romito 4	Romanellian	F	45.8	67.4
San Teodoro 4	Epigravettian	M	44.7	64.9
St Germ. Riv. 4	Magdalenian	F	43.8	62.8
Teviec 1	L. Mesolithic	F	40.1	54.4
Teviec 11	L. Mesolithic	M	47.0	70.1
Teviec 16	L. Mesolithic	M	49.0	74.6
Veyrier 1	Azilian	M	42.1	59.0

[1]Comparative data from Matiegka (1934), Holliday (1997), Mallegni and Fabbri (1995), and Pearson (1997).
*Adolescent.

supraorbital region, it is reflected in the thickness and projection sizes of the lateral supraorbital region. The Šandalja supraorbital segment is terms of midorbital thickness is most similar to recent European females and least similar to Neolithic males. This specimen's lateral thickness is least similar to recent European females (and males) and Upper Paleolithic males, while it is most similar to Neolithic and female Upper Paleolithic samples.

The Ša 14022 frontal fragment overlaps in anatomy with Ša 14016 which articulates with Ša 14013, therefore representing another adult individual. Based on the squamal thickness it represents a more robust individual than Ša 14013-14016-14024. This suggests that Ša 14022 is even more likely to be a male than Ša 14013-14016-14024.

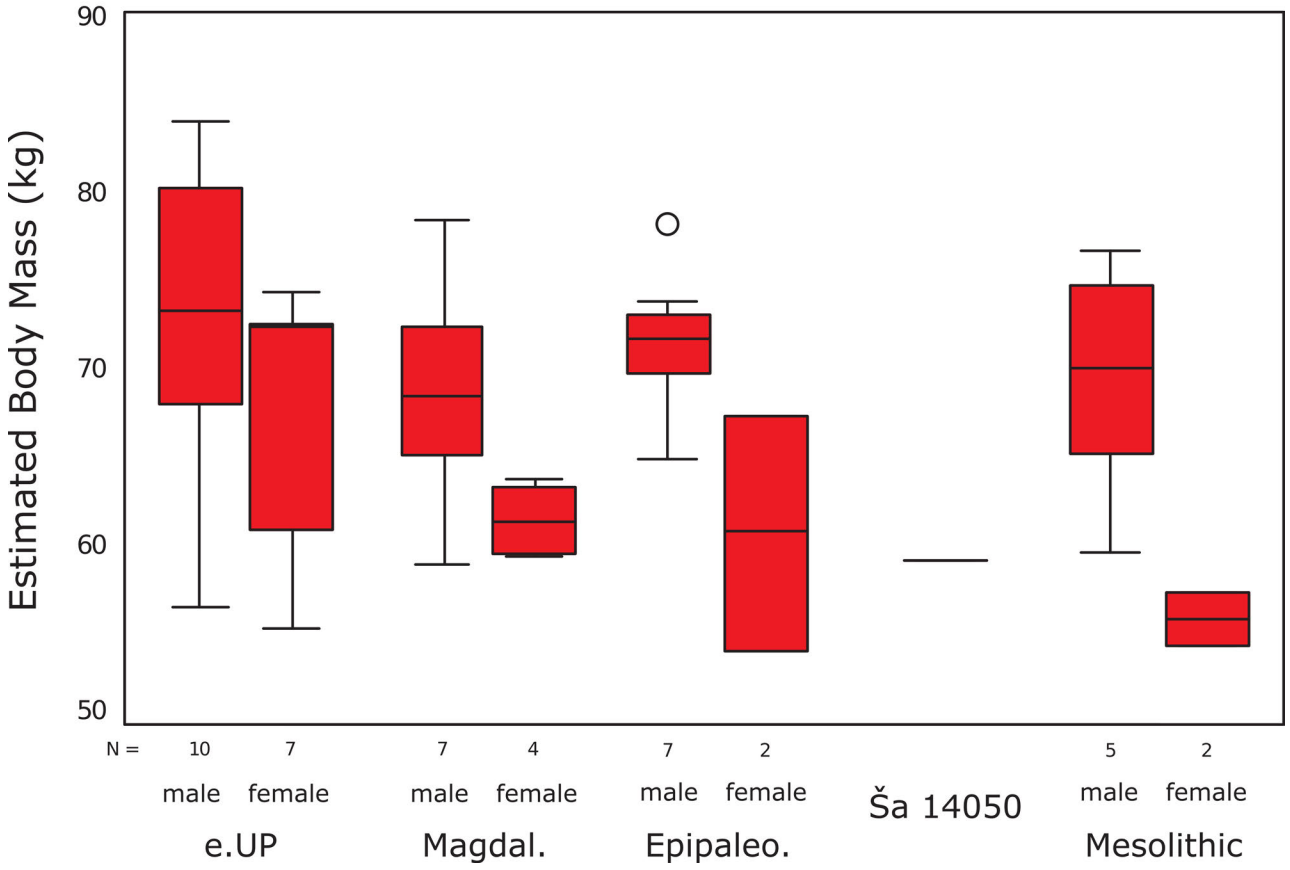

Figure 25. Box and whisker plot of body mass estimates for Ša 14050 and comparative samples (see text for further description).

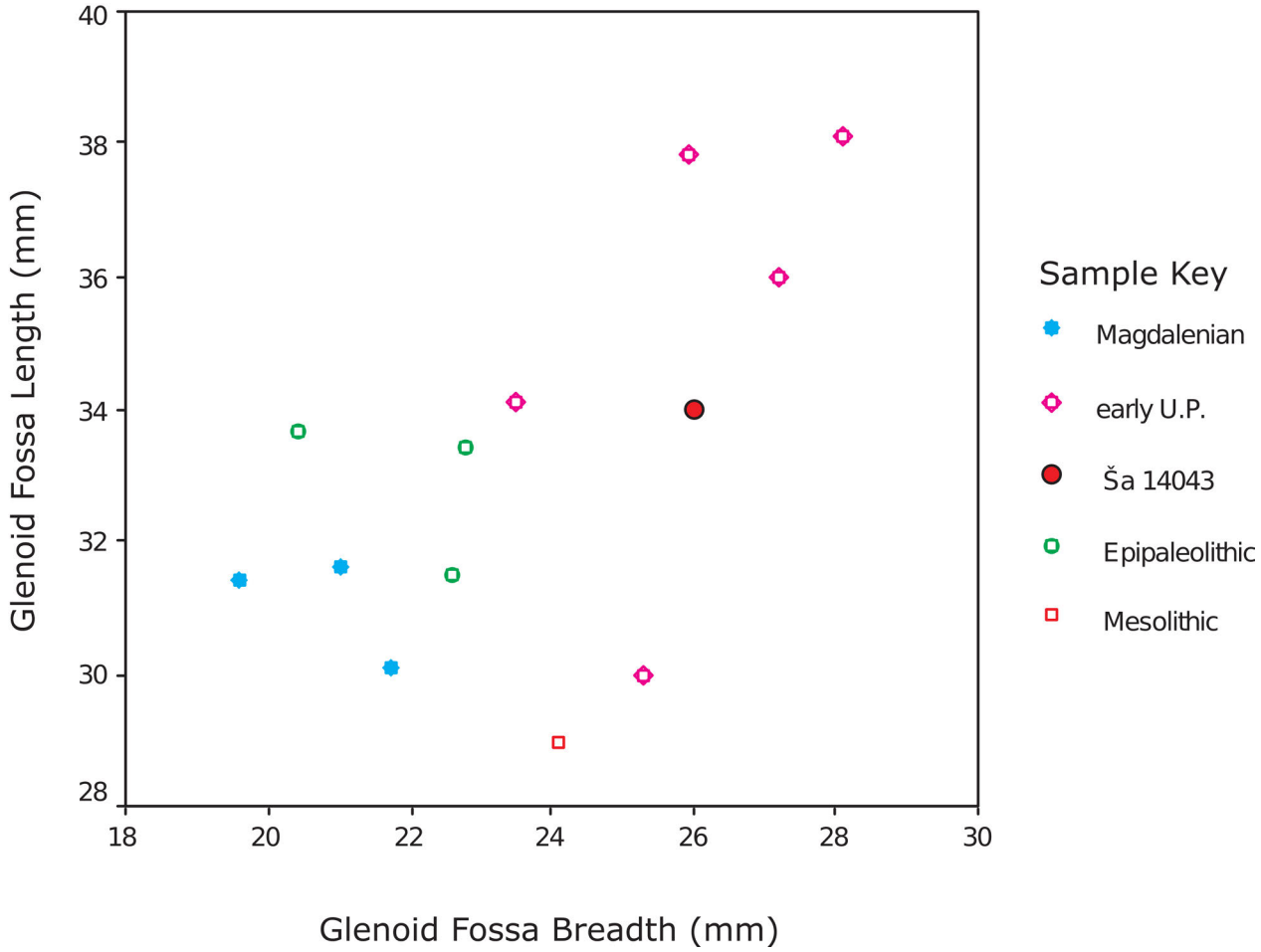

Figure 26. Bivariate plot of glenoid fossa length and breadth. Ša 14043 and comparative samples.

The Ša 14028 I_1 length is significantly smaller than any of the comparative samples (p<0.037) (Table 14 for metrics). In terms of breadth, it is significantly smaller than the Late Mesolithic (t=3.5, p=0.002) sample, while it is in the range of variation seen in recent Europeans, Neolithic, Early Mesolithic, and Early and Late Upper Paleolithic samples.

The Ša 14035 M_2 is not significantly different from any of the comparative samples and overlaps with all of them (albeit on the lower half of the variation range).

The occlusal areas of the left M1 (Ša 14033) and M2 (Ša 14034) from the same individual are small. Yet, only Ša 14033 is significantly smaller than the comparative samples (all t values being significantly smaller at an alpha of 0.05). These likely, at least in part, reflect a high degree of interproximal wear that affects the mesiodistal length of this tooth.

In terms of both length and breadth, the Šandalja 14031 I^2 is not significantly different from any of the comparative samples.

The Ša 14047 second right metacartpal proximal end height and breadth dimensions do not significantly differ from the comparative samples for which data were available (Epigravettian and Early Upper Paleolithic). The exception is the breadth of the Ša 10407 which is significantly smaller from the Dolní Věstonice sample (t=-4.351, p=0.022).

THE ŠANDALJA II ARCHAEOLOGICAL REMAINS

In all of the layers of the Šandalja B complex, flakes are most abundant technological products, while bladelets and blades also are common. The percentage of tool types is similar in Layers B/s and B/g, and somewhat different in Layer B/d (Karavanić 1999). If we compare percentages of tool types between the Early Epigravettian (Layer C/d) and the Late Epigravettian (Layer B/s), a difference can be seen. Microgravettes and backed bladelets are far more common in the Early Epigravettian Layer C/d (9.2 % and 11.4 %, respectively) compared to the Late Epigravettian Layer B/s (2.0% for microgravettes and 6.3% for backed bladelets). This difference seems to correspond to the change in faunal sequence of the site. For example, in the C/d layer, horse is more common than bovids, while the reverse is true for the B sequence (Miracle 1995; 1997). Red deer is also more abundant in the Late than in the earlier layers of the site. These differences in tool types could be a reflection of the functional demands, and may or may not reflect the change

TABLE 14. DENTAL METRICS FOR ŠANDALJA AND COMPARATIVE SAMPLES[1].

		N	Mean	Std. Deviation (mm)
I_1 Length	**Ša 14028**		**3.7**	
	Recent Euro.	278	5.3	0.5
	Neolithic	16	5.1	0.3
	E. Mesolithic	37	5.4	0.4
	L. Mesolithic	21	5.2	0.4
	Epipaleolithic	6	5.1	0.4
	E. UP	26	5.8	0.6
	L. UP	10	5.1	0.4
	Neandertal	24	5.6	0.5
I_1 Breadth	**Ša 14028**		**5.5**	
	Recent Euro.	291	5.9	0.4
	Neolithic	25	6.0	0.4
	E. Mesolithic	36	6.1	0.5
	L. Mesolithic	25	6.2	0.2
	Epipaleolithic	7	6.0	0.3
	E. UP	31	6.5	0.7
	L. UP	11	6.0	0.4
	Neandertal	31	7.3	0.6
I_2 Breadth	**Ša 14029**		**7.6**	
	Recent Euro.	348.0	6.3	0.5
	Neolithic	38.0	6.4	0.4
	E. Mesolithic	47.0	6.5	0.4
	L. Mesolithic	31.0	6.6	0.3
	Epipaleolithic	11.0	6.5	0.2
	E. UP	32.0	7.0	0.6
	L. UP	15.0	6.5	0.4
	Neandertal	40.0	7.7	0.6
M_2 Length	**Ša 14035**		**10.2**	
	Recent Euro.	478.0	10.4	0.7
	Neolithic	44.0	10.5	0.6
	E. Mesolithic	53.0	10.7	0.6
	L. Mesolithic	39.0	10.7	0.6
	Epipaleolithic	12.0	10.9	0.8
	E. UP	46.0	11.2	0.8
	L. UP	25.0	10.9	0.7
	Neandertal	50.0	12.0	0.8

TABLE 14. (continued).

		N	Mean	Std. Deviation (mm)
M_2 Breadth	**Ša 14035**		**9.7**	
	Recent Euro.	484.0	10.2	0.8
	Neolithic	44.0	10.3	0.6
	E. Mesolithic	53.0	10.7	0.6
	L. Mesolithic	38.0	10.6	0.5
	Epipaleolithic	13.0	10.8	0.8
	E. UP	46.0	10.8	0.7
	L. UP	25.0	10.7	0.7
	Neandertal	50.0	11.2	0.7
I^2 Length	**Ša 14031**		**6.5**	
	Recent Euro.	310.0	6.5	0.6
	Neolithic	16.0	6.6	0.6
	E. Mesolithic	26.0	7.1	0.6
	L. Mesolithic	15.0	7.0	0.6
	Epipaleolithic	5.0	7.0	0.9
	E. UP	16.0	7.3	0.6
	L. UP	10.0	6.8	0.5
	Neandertal	39.0	8.1	0.6
I^2 Breadth	**Ša 14031**		**6.2**	
	Recent Euro.	343.0	6.4	0.5
	Neolithic	16.0	6.3	0.6
	E. Mesolithic	30.0	6.5	0.5
	L. Mesolithic	20.0	6.6	0.4
	Epipaleolithic	8.0	6.4	0.3
	E. UP	22.0	6.9	0.5
	L. UP	8.0	6.2	0.2
	Neandertal	43.0	8.4	0.8
M^1 Length	**Ša 14033**		**8.4**	
	Recent Euro.	528	10.2	0.6
	Neolithic	44	10.1	0.5
	E. Mesolithic	53	10.4	0.6
	L. Mesolithic	34	10.4	0.5
	Epipaleolithic	10	10.7	0.3
	E. UP	44	10.7	0.7
	L. UP	17	10.4	0.6
	Neandertal	36	11.6	0.9

TABLE 14. (continued).

		N	Mean	Std. Deviation (mm)
M[1] Breadth	**Ša 14033**		**11.0**	
	Recent Euro.	531	11.4	0.7
	Neolithic	47	11.6	0.6
	E. Mesolithic	53	11.9	0.6
	L. Mesolithic	34	11.9	0.6
	Epipaleolithic	11	12.0	0.6
	E. UP	42	12.2	0.8
	L. UP	17	11.9	0.6
	Neandertal	38	12.2	0.6
M[2] Length	**Ša 14034**		**9.0**	
	Recent Euro.	517.0	9.4	0.7
	Neolithic	45.0	9.2	0.6
	E. Mesolithic	48.0	9.6	0.7
	L. Mesolithic	33.0	10.0	0.7
	Epipaleolithic	10.0	9.9	0.6
	E. UP	38.0	10.3	0.9
	L. UP	14.0	9.7	0.3
	Neandertal	41.0	10.8	0.8
M[2] Breadth	**Ša 14034**		**11.0**	
	Recent Euro.	523.0	11.3	0.8
	Neolithic	45.0	11.5	0.8
	E. Mesolithic	49.0	11.9	0.7
	L. Mesolithic	32.0	11.9	0.8
	Epipaleolithic	10.0	12.3	0.7
	E. UP	39.0	12.4	1.0
	L. UP	14.0	12.0	0.6
	Neandertal	42.0	12.6	0.8

[1]All comparative data courtesy of M.H. Wolpoff.

in hunting preferences (i.e., the faunal change).

If we compare the Šandalja II B/s cultural sequence to other comtemporaneous sites on the eastern Adriatic shore, the following can be seen. Burins and endscrapers (followed by backed pieces) are the most frequent tool category in the late Interstadial stratigraphic units of Pupićina Cave in Istria, similar to Younger Dryas occupational levels of the same site (Miracle 1997; Komšo and Pellegatti 2007). Like in Pupićina, endscrapers are frequent in Šandalja II, but the burins are rare at that site. At the site of Vešanska Peć, also in Istria, in layers roughly contemporaneous to Šandalja B/s level, common tool types include burins, short end-scrapers, microgravettes, and particularly backed bladelets (Komšo and Pellegatti 2007). This is similar to Šandalja II material, although at Vešanska Peć no geometric microliths were found. Further to the south, the Dalmatian sites of Vela Spila on the island of Korčula (Čečuk and Radić 2005), and the Kopačina cave on the island of Brač (Čečuk 1996) are of particular interest. In the Epigravettian layers at Vela Spila, most abundant are short end-scrapers, while backed bladelets and geometric microliths also are present (N. Vukosavljević personal communication; see also Čečuk and Radić 2005). At Kopačina, short end-scrapers are quite common, geometric microliths also are present, while microgravettes and backed bladelets are very rare (N. Vukosavljević, personal communication). Even further south, in the rich Epigravettian layers at the site of Badanj in Bosnia and Herzegovina, short end-scrapers are very common, while the percentage of gravettes and backed bladelets varies in different layers of the site (Basler 1976; Whallon 1989). Late Epigravetian also is present at the site of Crvena Stijena in Montenegro (Basler 1975;

Mihailović 2009; Montet-White 1996). Like at the other previously mentioned sites, end-scrapers are common and more abundant than backed tools in all levels except Level VIII (Mihailović 2009: Table 18).

In Epigravettian levels of Paglicci cave, Monte Gargano, Apulia, Italy, backed tools are very frequent, while endscrapers are present in much lower percentages (Mussi 2001: Table 7.2). In contrast, at the site of Romanelli, also in Apulia (south of the Paglicci), short end-scrapers are in high frequency in Late Epigravettian layers where backed tools and some geometric microliths also are present (Bietti 1990; Mussi 2001). Interestingly, the lithic assemblage from the site of Riparo di Tagliente (Veneto), geographically much closer to Istrian peninsula, is very different from the one at Šandalja II (Karavanić 1999; Mussi 2001). At Riparo di Tagliente, backed tools are the most common tool group (50–60%), while the same tool group in Šandalja II Level B/s is much less frequent (about 8%). However, similar to Šandalja II, in Riparo di Tagliente short endscrapers are present as well, and a few geometric microliths are evident in some levels (Mussi 2001). These differences are not surprising and are in agreement with Whallon's (2007) idealized model of territorial organization during the Late Epigravettian.

Regarding the aforementioned incised stone tool (see Figure 23), a stone piece with geometric engraving was found at Grotta Romanelli in Southern Italy (Mussi 2001) and several incised stone tools come from the site of Riparo di Tagliente, Veneto (Italy) (Guerreschi 2005), as well as at the site of Vlakno on Dugi otok in Dalmatia (Vujević et al. 2010).

CONCLUSIONS

In sum, based on dental, cranial, and postcranial metrics, the Epigravettians from Šandalja II are rather small compared to the Upper Paleolithic samples and specimens used in the analysis. The remains belong to a minimum of two adults (and likely three) and one subadult/adolescent individual. The cranial remains Ša 14022 and the composite 14013-14016-14024 overlap in anatomy and it is likely that both belong to male individuals. In contrast, the metric comparisons strongly suggest that the Ša 14050 proximal femur is from a female.

The stone tool industry from Layer B/s of Šandalja II can be defined as Late Epigravettian, showing similarities in basic tool types to other contemporaneous sites of the Adriatic region (both western and eastern shores). The movement patterns of the Šandalja II inhabitants are still unclear, but the suggested routes include the northern path via today's Republic of Slovenia and farther north to Italy (Zupanić 1975), while the other route may have been the southern one, alongside the eastern Adriatic shore (Montet-White 1996). During the formation of the B complex at Šandalja II, the sea level was between 50 and 90 meters lower than today's, exposing much of the Adriatic plain (Miracle 1995), making a natural connection between Italy and Croatia (and adjacent regions). This may, at least in part, explain the similarity in basic tool types between regions, while the noted differences in percentages of some tool types are more likely a result of variation in site function rather than of production processess and raw material selection.

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