

THE RADIOCARBON CHRONOLOGY OF SHAN-KOBA ROCK-SHELTER, A LATE PALAEOLITHIC AND MESOLITHIC SEQUENCE IN THE CRIMEAN MOUNTAINS (UKRAINE)

This paper presents a new series of AMS dates from the rock-shelter of Shan-Koba in the Crimean mountains (Ukraine). Four bone samples were selected at the Institute of Archaeology of the Academy of Sciences in St. Petersburg (Russian Federation), and AMS-dated at Groningen Isotopic Laboratory (Holland). The results show that the shelter was not “continuously” settled, as suggested by the excavators. In contrast they indicate that it was inhabited in well-defined periods between the end of the Palaeolithic (Allerød interstadial) and the end of the Mesolithic (Atlantic). Together with other radiocarbon dates recently obtained from the same sequence, as well as from Laspi 7 and Mirne, they help refine the absolute chronology of the Late Pleistocene and Early Holocene peopling of the north-western Black Sea region, and contribute to the study of the environmental and cultural changes that took place in the same territory at the boundary between the end of the Palaeolithic and the Atlantic climatic periods.

Key words: Crimea, Shan-Koba, Late Palaeolithic, Mesolithic, Rock-shelter sequence, AMS dates

RADIOKARBONSKA KRONOLOGIJA PRIPEČKA ŠAN-KOBA, KASNOPALEOLITIČKA I MEZOLITIČKA STRATIGRAFIJA U KRIMSKIM PLANINAMA (UKRAJINA)

Ovaj rad predstavlja novu seriju AMS datuma iz pripečka Šan-Koba u krimskim planinama (Ukrajina). Na Arheološkom institutu akademije znanosti u Sankt Peterburgu (Ruska Federacija) izabrana su četiri uzorka kosti koja su datirana AMS-om u izotopskom laboratoriju u Gröningenu (Nizozemska). Rezultati pokazuju da pripečak nije bio „neprekidno” naseljen, na što su ukazivali istraživači. Suprotno tome, pokazuju da je bio nastanjen u precizno utvrđenim razdobljima od kraja paleolitika (interstadijal Allerød) do kraja mezolitika (atlansko klimatsko razdoblje). Zajedno s ostalim radiokarbonskim datumima nedavno dobivenim iz istog stratigrafskog slijeda, kao i iz Laspi 7 i Mirne, pomažu bolje utvrditi apsolutnu kronologiju obitavanja ljudi u sjeverozapadnoj regiji Crnog mora u kasnom pleistocenu i ranom holocenu te doprinijeti proučavanju okolišnih i kulturnih promjena koje su se dogodile na tom području na prijelazu između kraja paleolitika i atlantskog klimatskog razdoblja.

Ključne riječi: Krim, Šan-Koba, kasni paleolitik, mezolitik, stratigrafija pripečka, AMS datumi

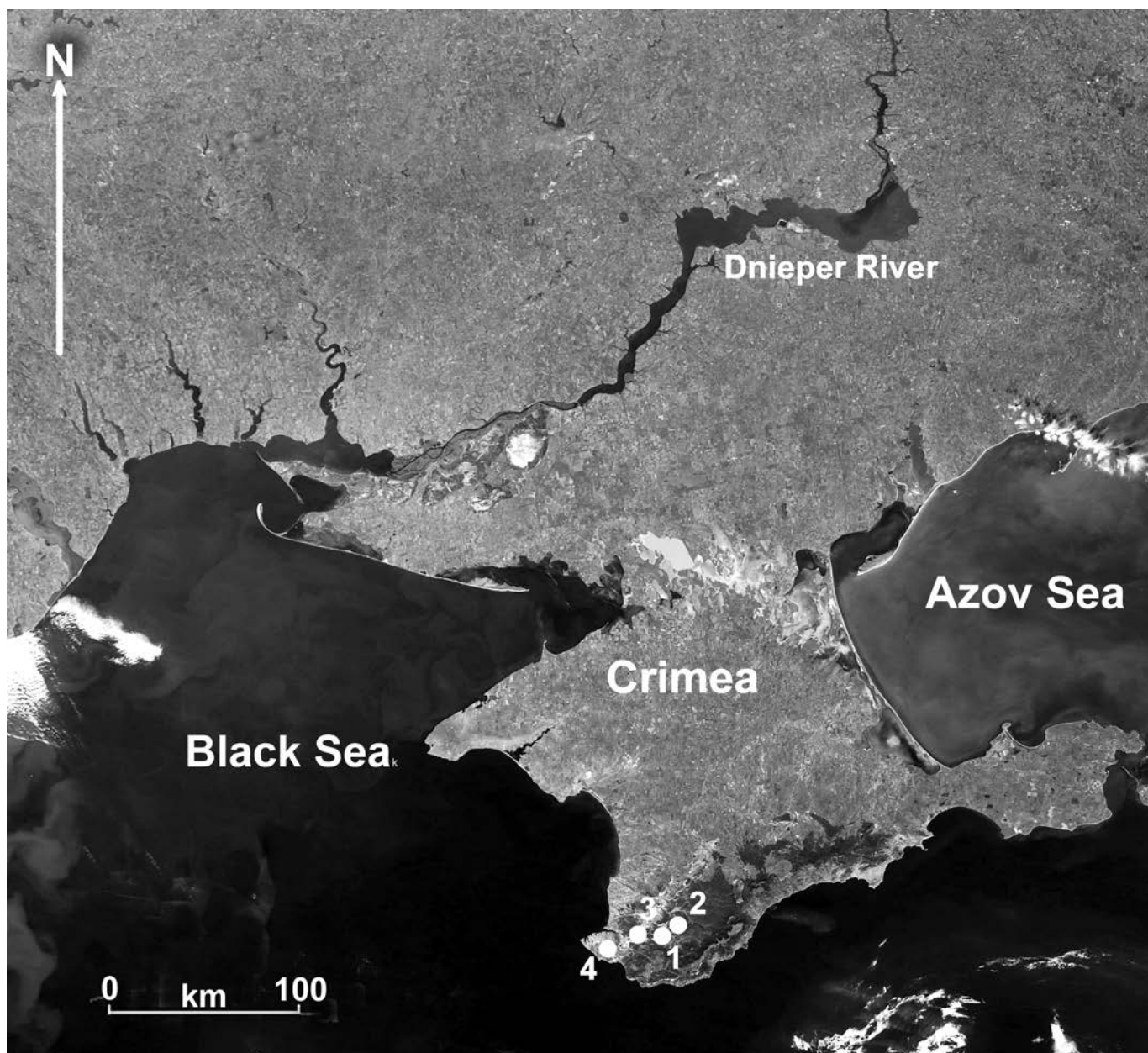


Figure 1. Approximate location of Shan-Koba (1), Murzak-Koba (2), Fat'ma-Koba (3) caves and rock-shelters, and BBB2 pollen profile (4)

Slika 1. Približni položaj špilja i pripećaka (1) Šan-Koba, (2) Murzak-Koba, (3) Fat'ma-Koba, te peludni profil BBB2 (4)

drawing / crtež: P. Biagi

1. Preface

Crimea plays an important role in the archaeology of south-eastern Europe, and the Black Sea region in particular, because of its Greek, Roman and Medieval antiquities that, since the middle of the Eighteenth century, attracted the attention of both amateurs, and professional archaeologists.¹ The discovery of the first prehistoric sites in the

1. Predgovor

Krim igra važnu ulogu u arheologiji jugoistočne Europe, a posebno u crnomorskoj regiji, zbog svojih grčkih, rimskih i srednjovjekovnih starina koje su od sredine osamnaestog stoljeća plijenile pozornost amatera i profesionalnih arheologa.¹ Otkriće prvih prapovijesnih nalazišta na poluotoku dogodilo se 1871. godine, kada je K. Merežkovski otkrio cijepane kamene alatke iz pećine koja se otvara uz istočne padine planinskog lanca, kasnije pripisane paleolitičkim i mezolitičkim razdobljima.²

Najdeblji i najduži kaspaleolitički i mezolitički stratigrafski slijedovi ikada iskopani u bivšem SSSR-u su oni krimskih pripećaka i špilja. Oni otkrivaju cijepani litički

1 Тункина, 2002.

1 Тункина, 2002.
2 Мережковский, 1880.

peninsula took place in 1871, when K. Merezkovsky discovered chipped stone tools from a cave that opens along the eastern slopes of the mountain range, later attributed to the Palaeolithic and Mesolithic periods.²

The thickest and longest Late Palaeolithic and Mesolithic sequences ever excavated in former USSR are those of the Crimean rock-shelters and caves. They yielded chipped stone assemblages with characteristic tools that the authors not only compared to those of the classical series of central France, but also systematically described following a French terminology.³ This is the reason why rock-shelters and caves like Shan-Koba⁴, Murzak-Koba⁵ and Fat'ma-Koba⁶ (Fig. 1) were of basis importance for the Mesolithic archaeology of the Soviet period,⁷ as pointed out in a seminal volume on the Late Paleolithic and Mesolithic of the Crimean Mountains.⁸

The scope of this paper is to present the new AMS dates obtained from three layers of Shan-Koba, discuss their role in the Final Pleistocene and Early Holocene prehistory of south-eastern Europe, and point out their importance for the study of the environmental and cultural events that took place in the northern Black Sea region at the Boreal/Atlantic boundary. The new results improve and complete the sequence recently established from the radiocarbon dating of animal teeth samples from the same site.⁹

The Shan-Koba dates are part of a programme of AMS dating of the south Ukrainian Late Palaeolithic and Mesolithic sites promoted by Ca' Foscari University, Venice since 2006.¹⁰

2. The rock-shelter of Shan-Koba

Shan-Koba rock-shelter opens in the Kubalar-dere valley, a small tributary of the Baidar River. The rock-shelter, 25m long, 6m wide and 2.70m high, looks like a long, horizontal tunnel excavated inside the limestone deposits. It was discovered by S. A. Trusova and S.N. Bibikov in 1927, and excavated by G. A. Bonch-Osmolovsky in 1928, and S.N. Bibikov in 1935-1936, over a surface of some 100 sqm.¹¹

The stratigraphy described along "line 20" of the 1935 excavations (Fig. 2) is as follows: 1) grey soil containing few stones; 2) yellow clayey layer rich in sub-angular stones; 3) layer less clayey and darker than layer 2, with much skeleton and many *Helix* shells; 4) grey, stony layer without snails; 5) light brown, slightly stony, clayey layer; 6) dark,

materijal s karakterističnim alatima koje su autori ne samo usporedili s klasičnim serijama središnje Francuske, nego i sustavno opisali slijedeći francusku terminologiju.³ To je razlog zašto su pripećci i špilje kao Šan-Koba⁴, Murzak-Koba⁵ i Fat'ma-Koba (Sl. 1)⁶ bili od temeljne važnosti za mezolitičku arheologiju iz sovjetskog razdoblja⁷ kao što je istaknuto u značajnoj publikaciji o kasnom paleolitu i mezolitu krimskih planina.⁸

Predmet ovog rada je predstaviti nova datiranja AMS tehnikom dobivena iz tri sloja Šan-Kobe te raspravljati o njihovoj ulozi u prapovijesti kasnog pleistocena i ranog holocena jugoistočne Europe, kao i ukazati na njihovu važnost za proučavanje okolišnih i kulturnih događaja koji su se odvijali u sjevernoj regiji Crnog mora na granici borealnog i atlantskog klimatskog razdoblja. Novi rezultati poboljšavaju i dovršavaju stratigrafski slijed koji je nedavno utvrđen radioaktivnim datiranjem uzoraka životinjskog zuba s istog nalazišta.⁹

Datumi iz Šan-Kobe su dio programa datiranja AMS tehnikom nalazišta iz kasnog paleolitika i mezolitika u južnoj Ukrajini koje provodi Sveučilište Ca' Foscari iz Venecije od 2006.¹⁰

2. Pripećak Šan-Koba

Pripećak Šan-Koba nalazi se u dolini Kubalar-dere, malog pritoka rijeke Baidar. Pripećak je dug 25 m, širok 6 m i visok 2,70 m, a izgleda poput dugog, vodoravnog tunela iskopanog unutar vapnenačkih naslaga. Otkrili su ga S. A. Trusova i S. N. Bibikov 1927. godine, a iskopavali ga G. A. Bonč-Osmolovski 1928. godine, i S. N. Bibikov 1935. - 1936. godine, na površini od oko 100 m².¹¹

Stratigrafija opisana po „liniji 20“ iz iskopa 1935. (Sl. 2) je kako slijedi: 1) siva zemlja koja sadrži nekoliko kamenova 2) žuti glinasti sloj bogat subungularnim kamenjem 3) manje glinasti sloj i tamniji od sloja 2, s puno skeleta i mnogo ljuštura puževa 4) sivi, kameniti sloj bez puževa 5) svijetlosmeđi, malo kameniti, glinasti sloj 6) tamni, vrlo vlažan sloj s mnogo malog subungularnog kamenja 7) sterilna žuta glina. Svi slojevi su lagano nagnuti prema istoku.¹² Isti autori opisali su sličnu naslagu po „liniji 15“ iz kampanje 1936. godine (Sl. 3).¹³

Slijed koji predstavlja A. Bonč-Osmolovski sastoji se od šest slojeva: slojevi 6, 4 i 3 su nazvani „pepeljastim slojevima“ i bogati su ostacima materijalne kulture i strukturama; sloje-

2 Мережковский, 1880.

3 Bordes, 1968.

4 Биби́ков, 1946.

5 Биби́ков, 1940a.

6 Биби́ков, 1959; 1966.

7 Бадер, 1961; 1965.

8 Биби́ков et al., 1994.

9 Venecke, 2006.

10 Biagi et al., 2007; Біаджі et al. 2008; Biagi and Kiosak, 2010.

11 Биби́ков et al., 1994.

3 Bordes, 1968.

4 Биби́ков, 1946.

5 Биби́ков, 1940a.

6 Биби́ков, 1959, 1966.

7 Бадер, 1961, 1965.

8 Биби́ков i sur, 1994.

9 Venecke, 2006.

10 Biagi i sur, 2007; Біаджі i sur. 2008; Biagi i Kiosak 2010.

11 Биби́ков i sur., 1994.

12 ві́ді Биби́ков i sur., 1994, 8; sl. 10.

13 Биби́ков, 1940b; Биби́ков i sur., 1994, 9; sl. 11.

Shan Koba
Profile along line 20 (1935)

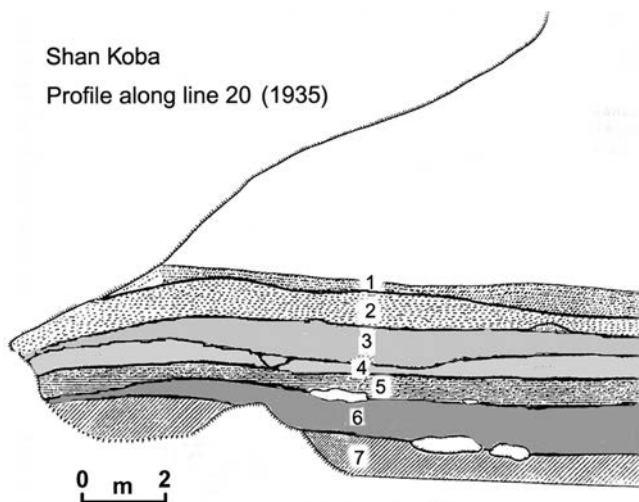


Figure 2. Shan-Koba: sequence along "line 20" (after Биби́ков et al., 1994: Fig. 10, with variations)

Slika 2. Šan-Koba: slijed po „liniji 20“: (prema: Биби́ков i sur., 1994., Slika 10, s varijacijama)

redrawn by / precrtao: P. Biagi

very moist with much small sub-angular stones; 7) sterile yellow clay. All layers are slightly inclined towards the east.¹² The same authors described a similar deposit along "line 15" of the 1936 season (Fig. 3).¹³

The sequence presented by A. Bonch-Osmolovsky consists of six layers: 6, 4 and 3 were called "ashy layers", rich in material culture remains and structures; layers 5 and 2 "intermediate" because of the presence of just a few finds, and no structures. Following the classical French terminology, layers 6-4 were attributed to the "Azilian", while layer 3 was described as "typical Tardenoisian".¹⁴ A few years later S.N. Bibikov discovered a Neolithic layer (1a) in the western part of the shelter,¹⁵ while layer 1 was attributed to the Bronze Age.

3. Shan-Koba's sequence according to Биби́ков et al. (1994)

Following the above authors, layer 3 yielded many *Helix* shells and charcoals, bone fragments and ochre. S.N. Bibikov subdivided it into 4 levels, in the uppermost of which (1 and 2) he discovered a few structures, a thick fireplace, *Helix* middens,¹⁶ and a pit filled with *Helix* fragments close to a flint knapping area.

Traces of habitation were found in the lower-lying levels 3 and 4, where the excavators uncovered a fireplace with a clay surface, delimited by a semi-circle of stones, around

Shah Koba
Profile along line 15 (1936)

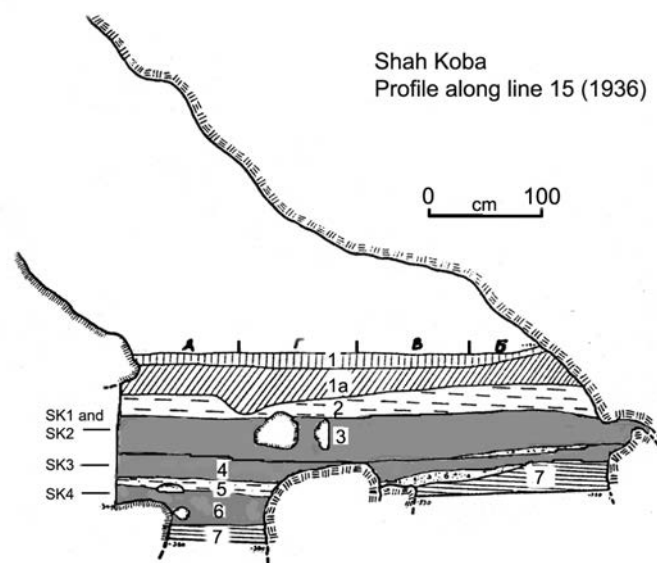


Figure 3. Shan-Koba: sequence along "line 15", with indication of the layers sampled for AMS dating (after Биби́ков et al., 1994: Fig. 11, with variations)

Slika 3. Šan-Koba: slijed po „liniji 15“, s naznakom slojeva uzorkovanih za datiranje tehnikom AMS (prema: Биби́ков i sur., 1994., Slika 11, s varijacijama)

redrawn by / precrtao: P. Biagi

vi 5 i 2 „srednji“ zbog prisutnosti samo nekoliko nalaza i nedostatka struktura. Slijeđenjem klasične francuske terminologije, slojevi 6 - 4 pripisani su „azilijanskom“, dok je sloj 3 opisan kao „tipični tardenoazijanski“. ¹⁴ Nekoliko godina kasnije, S. N. Bibikov je otkrio neolitički sloj (1a) u zapadnom dijelu pripečka,¹⁵ dok je sloj 1 pripisan brončanom dobu.

3. Stratigrafski slijed Šan-Kobe prema Биби́ков i sur. (1994.)

Prema gore navedenim autorima, sloj 3 je dao mnogo ljuštura puževa i ugljena, fragmente kostiju i oker. S. N. Bibikov ga je podijelio na 4 razine, gdje je u najgornjoj razini (1 i 2) otkrio nekoliko struktura, debelo ognjište, otpatke puževa¹⁶ i jamu ispunjenu fragmentima puževa u blizini prostora za okresivanje kremenja.

Tragovi naseljenosti pronađeni su u nižim razinama 3 i 4, gdje su istraživači otkrili ognjište s glinastom površinom, ograđeno kamenjem u polukrugu, oko kojeg su zabilježili postojanje pet velikih kamenova i jamu za pečenje puževa. Cijepani litički materijal karakteriziran je jezgrama za pločice s nagnutom udarnom plohom, kružnim grebalima, mikropločicama s hrptom, nekoliko ravnih i zakrivljenih šiljaka s hrptom, pločicama s urezom, geometrijskim mikrolitima,

12 see Биби́ков et al., 1994: 8; fig. 10.

13 Биби́ков, 1940b; Биби́ков et al., 1994: 9; fig. 11.

14 Бонч-Осмоловский, 1934.

15 Биби́ков, 1940c.

16 Биби́ков, 1941.

14 Бонч-Осмоловский, 1934.

15 Биби́ков, 1940c.

16 Биби́ков, 1941.

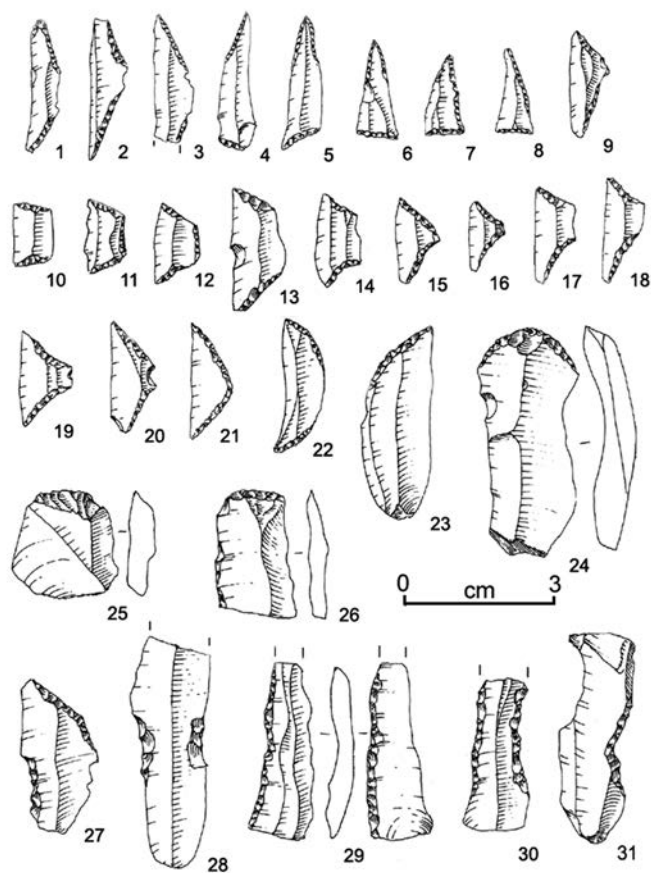


Figure 4. Shan-Koba: chipped stone tools from layer 3. Geometric microliths, nn. 1-22 [triangles, nn. 7-9, trapezes, nn. 10-20, lunates, nn. 21 and 22], backed point, n. 23, end scrapers, nn. 24-26, truncation, n. 27, notched bladelet, n. 28, and retouched bladelets, nn. 29-31. (after Биби́ков et al., 1994: Table XIX, with variations)

Slika 4. Šan-Koba: cijepane kamene alatke iz sloja 3. Geometrijski mikroliti, br. 1 - 22 [trokuti, br. 7 - 9, trapezi, br. 10 - 20, polumjesečasti mikroliti, br. 21 i 22], šiljak s hrptom, br. 23, grebala, br. 24 - 26, zarubak, br. 27, pločica s urezom, br. 28, i pločice s dodatnom obradom, br. 29 - 31. (prema Биби́ков i sur., 1994. Tabela XIX, s varijacijama)

inking / tuširao: G. Almerigogna

which they reported the presence of five large stones, and a pit for baking *Helix*. The chipped stone assemblage is characterized by bladelet cores with one inclined platform, circular end scrapers, backed microbladelets, a few straight and curved backed points, notched bladelets, geometric microliths, mainly scalene and isosceles trapezes obtained from microbladelets, although scalene triangles are also present, and dihedral flake burins (Fig. 5).¹⁷

The industry from this layer was interpreted as "Tardenois with trapezes", although the authors pointed out that

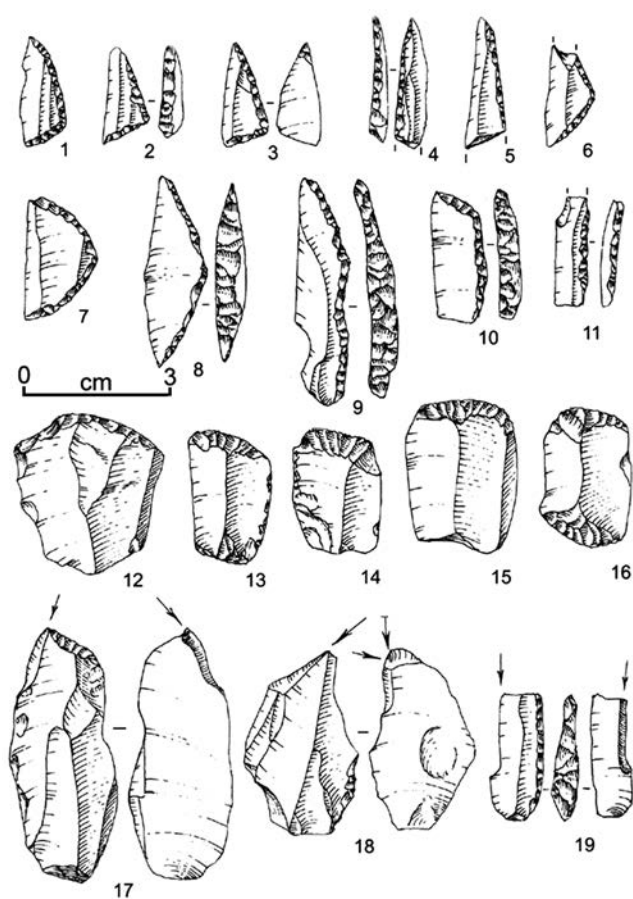


Figure 5. Shan-Koba: chipped stone tools from layer 4. Geometric microliths, nn. 1-7 [triangles, nn. 1-6, lunates, nn. 7 and 8], backed point, n. 9, backed bladelet and truncation, n. 10, backed bladelet, n. 11, end scrapers, nn. 12-16, and burins, nn. 17-19 (after Биби́ков et al., 1994: Table XVI, with variations)

Slika 5. Šan-Koba: cijepane kamene alatke iz sloja 4. Geometrijski mikroliti, br. 1 - 7 [trokuti, br. 1 - 6, polumjesečasti mikroliti, br. 7 i 8], šiljak s hrptom, br. 9, pločica s hrptom i zarubak, br. 10, pločica s hrptom, br. 11, grebala, br. 12 - 16, i dubila, br. 17 - 19 (prema Биби́ков i sur., 1994., Tabela XVI, s varijacijama)

inking / tuširao: G. Almerigogna

uglavnom raznostraničnim i jednakokračnim trapezima dobivenim od mikropločica, iako su raznostranični trokuti također prisutni, te diedričnim dubilima na odbojku (Sl. 5).¹⁷

Industrija ovog sloja se tumači kao „tardenoaška s trapezima“, iako su autori istaknuli da se trapezoidne strelice razlikuju kako od onih iz zapadnoeuropskih mezolitičkih kompleksa tako i onih iz sjeverozapadnog pontskog prostora.¹⁸ Koštana industrija je zastupljena šiljcima i perforatorima uglacanim iz kosti sisavaca.¹⁹

17 Биби́ков i sur., 1994, Tabela XVIII i XIX i Tabla 9.

18 Биби́ков i sur., 1994, 65.

19 Биби́ков i sur., 1994, Tabela XXII.

Figure 6. Shan-Koba: chipped stone tools from layer 6. Lunates, nn. 1-4, backed points, nn. 5 and 6, end scrapers, nn. 7-9, truncations, nn. 10 and 11, and notched blades, nn. 12-15 (after Биби́ков et al., 1994: Table II, with variations)

Slika 6. Šan-Koba: cijepane kamene alatke iz sloja 6.

Polumjesečasti mikroliti, br. 1 - 4, šiljci s hrptom, br. 5 i 6, grebala, br. 7 - 9, zarupci, br. 10 i 11, sječiva s urezom, br. 12 - 15 (prema Биби́ков i sur., 1994., Tabela II, s varijacijama)

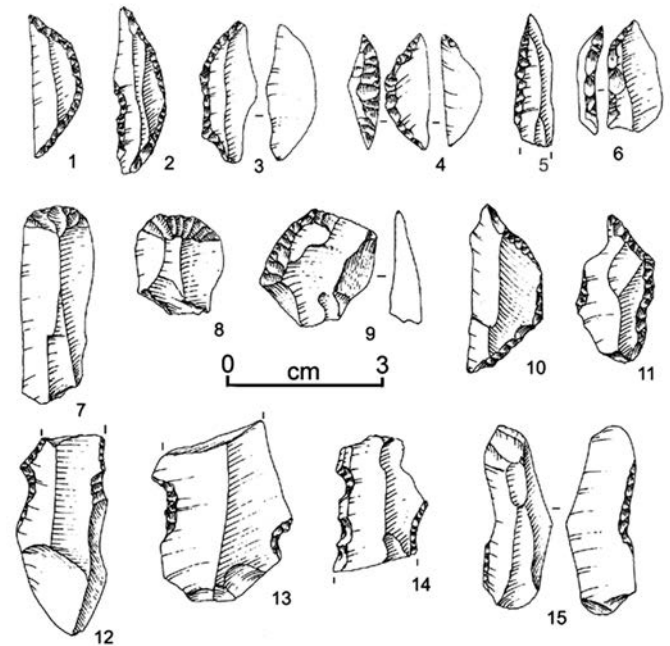
inking / tuširao: G. Almerigogna

trapezoidal arrowheads differ from both those of the west European Mesolithic complexes and those from the north-western Pontic region.¹⁸ The bone industry is represented by points and perforators polished from mammal bone flakes.¹⁹

The finds from layer 4 (228 chipped stone artefacts) come from a sub-rectangular surface of some 34 sqm between squares 13-14/b-e and 20-21/b-e, from which no structure was recovered. Most cores are prismatic with one single platform, though subconical types, and cores with detachments along the entire perimeter are also present. This assemblage is more microlithic than those from the lower-lying layers. Microbladelets and bladelets are common. The retouched blades (39) are obtained mainly by simple, marginal retouch. The end-scrapers (34) are often on short blade, although there are a few double specimens. The burins (42) are more common than end-scrapers. Simple burins and types from the angle of a broken bladelet predominate. Burins on truncation are less common, and dihedral types are even less represented. The non-geometric microliths consist of narrow bladelet points with oblique truncation (7), a few abrupt retouched points (3) and other forms. There are also two fragments of willow-leaf points recalling Swiderian types. The geometric microliths are obtained with the microburin technique. The lunates predominate (14), one trapeze, and seven scalene triangles are also present (Fig. 6).²⁰

Layer 5 did not yield any feature. The lithic assemblage consists of only 102 artefacts evenly distributed all over the excavated area. There are a few subconical bladelet cores. The end-scrapers are represented only by short types. Burins on truncation and dihedral are equally represented, while there are few simple burins. Most points are curved on blade or bladelet. The geometric microliths consist mainly of lunates, sometimes obtained by backed, bipolar retouch, though trapezes and triangles also occur.²¹

Layer 6 was easy to recognize because of its dark colour, and the great quantity of finds. It was subdivided into 6 levels. Two fireplaces were excavated in levels 2



Nalazi iz sloja 4 (228 cijepanih kamenih artefakata) dolaze iz približno pravokutne površine od 34 kvadratna metra između kvadranta 13-14/b-e i 20-21/b-e, u kojima nije pronađena nijedna struktura. Većina jezgri je prizmatična sa samo jednom udarnom plohom iako su prisutne i približno konične vrste i jezgre s odlomljenim komadima duž cijelog vanjskog ruba. Ovaj skup nalaza je više mikrolitski od onih iz nižih slojeva. Mikropločice i pločice su česte. Sječiva s dodatnom obradom (39) se dobivaju uglavnom jednostavnom, sitnom rubnom obradom. Grebala (34) su često na kratkom sječivu, iako postoji nekoliko dužih primjeraka. Dubila (42) su češća od grebala. Prevladavaju jednostavna dubila i vrste od slomljenih pločica. Dubila na zarupku su rjeđa, a diedrične vrste su još manje zastupljene. Negeometrijski mikroliti sastoje se od uskih zašiljenih pločica s kosim zarupkom (7), nekoliko šiljaka sa strmom obradom (3) i drugih oblika. Tu su i još dva ulomka vrbolikih šiljaka koji podsjećaju na sviderijenske vrste. Geometrijski mikroliti dobiveni su tehnikom mikro-dubila. Prevladavaju polumjesečasti mikroliti (14), a prisutni su i jedan trapez, te sedam raznostraničnih trokutova (Sl. 6).²⁰

Sloj 5 nije dao nikakvih značajki. Skup litičkih nalaza sastoji se od samo 102 artefakta ravnomjerno raspoređena diljem iskopanog područja. Postoji i nekoliko približno koničnih jezgara za pločice. Grebala su zastupljena samo kratkim vrstama. Dubila na zarupku i diedrična dubila jednako su zastupljena, a postoji nekoliko jednostavnih dubila. Većina šiljaka je zakrivljena na sječivu ili pločici. Geometrijski mikroliti sastoje se uglavnom od polumjeseca,

18 Биби́ков et al., 1994:65.

19 Биби́ков et al., 1994: Table XXII.

20 Биби́ков et al., 1994: Table LXI and Plate 8.

21 Биби́ков et al., 1994: Table XIV and Plate 7.

20 Биби́ков i sur., 1994: Tabela LXI i Tabla 8.

and 3, close to a wide, elongated heap of bones. The flint-knapping area was excavated close to it. A *Helix* midden, charcoals, bone fragments and flints were found below a "cover" of large stones in level 4.

The chipped stones (76,116 artefacts, and 1693 tools) were obtained from grey or whitish flint; their characteristics are described in the paragraph below.²² The bone industry consists mainly of straight points obtained from long bone flake.²³ The faunal assemblages that are represented almost exclusively by wild animals throughout the entire sequence, have been discussed by N. Benecke (2006) and A. Schen *et al.* (2012).

Two contrasting radiocarbon dates have been obtained from bone from level 1 of this layer: Ki-11805 (9910±180 uncal BP) and Ki-11806 (11260±190 uncal BP).²⁴ Apart from the very high standard deviation, the two dates do not match given that, while the first is to be attributed to the early Preboreal, the second fits into the expected range for the Allerød interstadial.

4. The interpretations of Shan-Koba's sequence in Soviet times

For many years Shan-Koba has been considered the reference site for the end of the Palaeolithic and Mesolithic periods of the Ukraine.

As reported above, G.A. Bonch-Osmolovsky attributed the three lowermost layers 6, 5 and 4 to the Azilian, and the upper layer 3 to the Tardenoisian.²⁵ M.V. Voevodsky referred to Shan-Koba to show that the Mesolithic complexes of the USSR are not as homogeneous as previously suggested. He defined two local cultures, corresponding to the two main phases already proposed by G.A. Bonch-Osmolovsky, which he called Shan-Koba (the lower assemblages with lunates) and Murzak-Koba (the upper ones with trapezes),²⁶ a view partly supported by another author.²⁷

During most of the Soviet period Shan-Koba was considered a typical case of "single culture interpretation"²⁸, where the end of the Palaeolithic and Mesolithic were thought to develop uninterruptedly, and locally produced by the same community. He also defined two different aspects of the Crimean Mesolithic respectively called 1) steppe, and 2) mountain. This author later called Gornokrimskaya (culture of the Crimean mountains) the Crimean Mesolithic, a term later adopted by other authors,²⁹ which he subdivided into two stages: Shan-Koba

ponekad dobivenih strmom bipolarnom obradom, iako se trapezi i trokuti također javljaju.²¹

Sloj 6 je vrlo prepoznatljiv zbog svoje tamne boje i velike količine nalaza. Podijeljen je na 6 razina. Dva ognjišta su iskopana na razinama 2 i 3, u blizini prostrane i izdužene hrpe kostiju. Blizu nje pronađeno je mjesto za okresivanje kremenja. Otpaci puževa, komadi ugljena, komadići kosti i kremenja pronađeni su ispod „pokrova“ od velikog kamenja na razini 4.

Cijepano kamenje (76.116 artefakata i 1.693 alata) dobiveno je iz sivog ili bjelkastog kremenja: njihova svojstva su opisana u odlomku ispod.²² Koštana industrija uglavnom se sastoji od ravnih šiljaka dobivenih od dugih koštanih odbojaka.²³ O faunističkom materijalu, koji je kroz cijeli stratigrafski slijed gotovo isključivo predstavljen divljim životinjama, raspravljali su N. Benecke (2006.) i A. Schen i sur. (2012.).

Dva usporedna radiokarbonska datuma su dobivena iz kosti razine 1 ovoga sloja: Ki-11805 (9910±180 uncal BP) i Ki-11806 (11260 ± 190 uncal BP).²⁴ Osim vrlo visoke standardne devijacije, ova dva datuma se ne podudaraju s obzirom da se prvotni pripisuje ranom preborealu, a drugi se uklapa u očekivani raspon za interstadijal Allerød.

4. Tumačenja stratigrafskog slijeda Šan-Kobe u sovjetskim vremenima

Već dugi niz godina Šan-Koba se smatra referentnim nalazištem za kraj paleolitičkog i mezolitičko razdoblje Ukrajine.

Kako je navedeno gore, G. A. Bonč-Osmolovski pripisao je tri najniža sloja 6, 5 i 4 azilijenu, a gornji sloj 3 tardenoazijenu.²⁵ M. V. Voevodski referirao se na Šan-Kobu kako bi pokazao da mezolitički kompleksi SSSR-a nisu homogeni kao što je ranije sugerirano. On definira dvije lokalne kulture koje odgovaraju dvjema glavnim fazama koje je G. A. Bonč-Osmolovski već predložio i nazvao Šan-Koba (donji skupovi nalaza s polumjesečastim oblicima) i Murzak-Koba (gornji skupovi nalaza s trapezima),²⁶ a čije mišljenje djelomično podržava i drugi autor.²⁷

Tijekom najvećeg dijela sovjetskog razdoblja, smatralo se da je Šan-Koba tipičan primjer „tumačenja jedne kulture“²⁸ pri čemu se vjerovalo da se kraj paleolitika i mezolitik razvijaju bez prekida i da su ih lokalno stvarale iste zajednice. Telegin je također definirao dva različita aspekta krimskog mezolitika, odnosno nazvao ih je 1) stepom, i 2) planinom. Ovaj autor je kasnije nazvao krimski mezolitik Gornokrimskaja (kultura krimskih planina), a termin su

22 Биби́ков *et al.*, 1994: Tables I-XIII and Plate 5 and 6.

23 Биби́ков *et al.*, 1994: fig. XX.

24 Ма́нько, 2010: Table 2.

25 Бо́нч-Осмо́ловский, 1934.

26 Во́еводский, 1950.

27 Фо́рмозов, 1954.

28 Теле́гин, 1966.

29 Биби́ков *et al.*, 1994: 182.

21 Биби́ков i sur., 1994: Tabela XIV i Tabla 7.

22 Биби́ков i sur., 1994: Tabela I-XIII i Table 5 i 6.

23 Биби́ков i sur., 1994., sl. XX.

24 Ма́нько 2010: Tabela 2.

25 Бо́нч-Осмо́ловский, 1934.

26 Во́еводский, 1950.

27 Фо́рмозов, 1954.

28 Теле́гин, 1966.

(with lunates) and Murzak-Koba (with trapezes).³⁰ According to D.Ya. Telegin the Late Mesolithic assemblages developed locally from the Late Palaeolithic and Early Mesolithic complexes.

Many scholars did not accept this view. For instance, according to L.L. Zaliznyak, Shan-Koba and Murzak-Koba are two different cultures.³¹ Furthermore the typological and functional study the microliths from the above two sites, demonstrated that the so-called transition industries of the long sequences of the Crimean caves and shelters do not show any interruption; in contrast they are due to an admixture of different assemblages.³² According to this latter author the industries from the upper Shan-Koba layers differ from those of the lower-lying ones, suggesting that Shan-Koba and Murzak-Koba represent two distinct entities. In the early 1990s V. Cohen, re-analysed the Late Palaeolithic and Mesolithic chipped stone assemblages of the Crimea, following the typological lists proposed by G.E.E.M. (1969; 1972), and described a few new cultural aspects, some of which are represented at Shan-Koba.³³

The cultural attribution of the above sequences was interpreted in two main ways. Some authors attributed both Shan-Koba and Murzak-Koba to the Mesolithic;³⁴ others suggested that the Shan-Koba culture developed since the end of the Palaeolithic, and Murzak-Koba during the Holocene.³⁵

5. The definition of the Shan Koba Culture

The Shan-Koba culture was first defined as typical of a restricted region of the Crimean mountains,³⁶ displaying lithic inventories varying according to its three main periods of development. In their elaborated analysis of the cultural sequence, the above authors differentiated the earlier aspect in three different assemblages that they respectively called 1) Shan-Koba, 2) Fat'ma-Koba, and 3) Syuren II.

According to the finds from layers 6 and 5 of Shan-Koba rock-shelter, they attributed the above oldest horizons to the Allerød/Younger Dryas periods, mainly according to the faunal associations,³⁷ and compared the chipped stone assemblages to those of the Azilian and Romanellian complexes of the west European literature.³⁸

They also defined a later stage of this culture from Shan-Koba layer 4, characterised by industries of Late Epigravettian type that they attributed to the end of the

kasnije usvojili ostali autori²⁹ i podijelio ga u dvije faze: Šan-Koba (s polumjesečastim oblicima) i Murzak-Koba (s trapezima).³⁰ Prema D. Ja. Teleginu, skupovi nalaza iz kasnoga mezolitika razvijeni su lokalno iz kompleksa kasnog paleolitika i ranoga mezolitika.

Mnogi znanstvenici nisu prihvatili to mišljenje. Na primjer, prema L. L. Zaliznjaku, Šan-Koba i Murzak-Koba su dvije različite kulture.³¹ Nadalje, tipološka i funkcionalna studija mikrolita iz dva gore navedena mjesta pokazala su da tzv. prijelazne industrije dugačkih stratigrafskih slijedova krimskih špilja i pripećaka ne pokazuju nikakav prekid. Suprotno tome, posljedice su kombinacije različitih skupova nalaza.³² Prema potonjem autoru, industrije iz gornjih slojeva Šan-Kobe razlikuju se od onih nižih, što sugerira da Šan-Koba i Murzak-Koba predstavljaju dva različita entiteta. U ranim 1990-im godinama, V. Cohen ponovno je analizirao cijepani litički materijal iz kasnog paleolitika i mezolitika na Krimu, prateći tipološke liste koje je predložio G.E.E.M. (1969., 1972.) i opisao nekoliko novih kulturnih aspekata, od kojih su neki zastupljeni u Šan-Kobi.³³

Kulturalna atribucija gore navedenih stratigrafskih slijedova interpretira se na dva glavna načina. Neki autori pripisuju i Šan-Kobi i Murzak-Kobi mezolitiku,³⁴ dok drugi tvrde da se kultura Šan-Koba razvijala od kraja paleolitika, a kultura Murzak-Koba tijekom holocena.³⁵

5. Definicija kulture Šan Koba

Kultura Šan-Koba je prvo definirana kao tipična za ograničeno područje krimskih planina,³⁶ prikazujući litički inventar koji se razlikuje prema trima glavnim razdobljima razvoja. U svojoj razrađenoj analizi kulturnog slijeda, gore navedeni autori razdvojili su raniji aspekt na tri različita skupa nalaza koje redom nazivaju 1) Šan-Koba, 2) Fat'ma-Koba, i 3) Sjuren II.

Prema nalazima iz slojeva 6 i 5 pripećka Šan-Koba, oni su pripisali gore navedene najstarije horizonte razdoblju Allerød/mlađeg drijasa, uglavnom prema životinjskim zajednicama³⁷ i usporedili cijepani litički materijal s onim azilijenskih i romanelijenskih kompleksa u zapadnoeuropskoj literaturi.³⁸

Također su definirali kasniju fazu ove kulture iz sloja 4 Šan-Kobe, koja je karakterizirana industrijama kasnoepigravetijenskog tipa a koju su pripisivali kraju prebo-reala.³⁹ Zadnja faza je poznata iz sloja 3 i odnosi se na

30 Телегин, 1976; 1982; 1985; 1989.

31 Зализняк, 1995; 1998.

32 Нужный, 1992.

33 Коен, 1991.

34 Мацкевой, 1977, Телегин, 1982; 1985.

35 Коен, 1991; Нужный, 1992; Зализняк, 1998; 2005; Cohen, 1999.

36 Бибилов, *et al.*, 1994: 144.

37 Громова and Громов, 1937; Бибилов, *et al.*, 1994: 174.

38 Бибилов *et al.*, 1994: 146.

29 Бибилов *i sur.*, 1994, 182.

30 Телегин, 1976, 1982, 1985, 1989.

31 Зализняк, 1995, 1998.

32 Нужный, 1992.

33 Коен, 1991.

34 Мацкевой, 1977, Телегин, 1982, 1985.

35 Коен 1991; Нужный, 1992; Зализняк, 1998, 2005; Cohen, 1999.

36 Бибилов, *i sur.*, 1994, 144.

37 Громова *i* Громов, 1937; Бибилов, *i sur.*, 1994, 174.

38 Бибилов *sur*, 1994, 146.

39 Бибилов, *i sur.*, 1994, 181-182.

Site name	Provenance	Depth in cm	Lab Number	Material	Delta 13C	Date uncal BP	Date cal BC 1 sigma	Date cal BC 2 sigmas
SK1	Layer 3/3-2, square 18v	80-90	GrA-50241	Bone fr	20.07	7775+/-45	6650-6530	6685-6485
SK2	Layer 3/3-3, square 19b	90-100	GrA-50242	Bone fr	20.19	7075+/-45	6591-6485	6633-6463
SK3	Layer 4/4-2, square 19e	100-110	GrA-50244	Bone tool	20.42	9575+/-45	9130-8828	9176-8784
SK4	Layer 6, square 18e	170-180	GrA-50246	Bone tool	20.12	11170+/-45	11193-11013	11291-10917

Preboreal.³⁹ The last stage is known from layer 3, referred to the “Gornokrimskaya” culture, characterized by trapezoidal, Tardenois-like geometric microliths, attributed to the Boreal period, because of the finds from Laspi 7 layer D, radiocarbon-dated to the first half of the ninth millennium BP (Bln-17951/1: 8570±75 uncal BP and Bln-17951/2: 8760±70 uncal BP and other Kiev dates),⁴⁰ which the authors link with the Grebeniki culture of the north-western Pontic region.⁴¹

Reverting to the first aspect of the Shan-Koba culture, the two Shan-Koba layers 6 and 5 are probably related with chronologically different occupation periods (layer 6, Allerød interstadial: GrA-55046 and Ki-11086; and layer 5, probably Early Preboreal, as suggested by Ki-11085?). Although the above two assemblages show different typological and technological characteristics, they were considered together by the above authors, representing the first stage of the so-called Shan Koba culture. The main characteristics of the industries from both layers 6 and 5 have been summarized as follows:⁴²

1) One, two or more platforms prismatic cores, 2) predominance of retouched blades, 3) large end scrapers on blades, short end scrapers on flakes, and thumbnail end scrapers, 4) predominance of burins on truncation, 5) recurrence of “little tranchet” technique as specific feature of the Shan-Koba culture, 6) some twenty three types of abrupt-retouched points, 7) presence of geometric microliths among which are segments (lunates) and triangles predominating over trapezes, represented by isolated specimens, 8) there are a few microburins (Fig. 7).⁴³

6. The new AMS dates

Given the complexity of the problems reported above, the somewhat contrasting interpretation of the Shan-Koba sequence given by different authors, and the uncertain absolute chronology of the so-called Shan-Koba culture, four small bone samples, two of which from tools (SK3 and SK4) retrieved during the excavations carried out in 1935-1936 by S.N. Bibikov, were submitted to Groningen radiocarbon laboratory for AMS dating, in order to contribute to the definition of the chronology of the different layers of the shelter.

39 Биби́ков, *et al.*, 1994: 181-182.

40 Телегин, 1989: 109; Biagi and Kiosak, 2010: Table 1.

41 Биби́ков, *et al.*, 1994: 161.

42 Биби́ков, *et al.*, 1994: 145-147; 213.

43 Биби́ков *et al.*, 1994: Tables LIX and LX.

Figure 7. Shan-Koba: list of the new AMS dates and characteristics of the samples

Slika 7. Šan-Koba: Popis novih datuma dobivenih tehnikom AMS i karakteristike uzoraka

„Gornokrimska” kulturu, koju karakteriziraju trapezoidni geometrijski mikroliti poput tardenoazijenskih, a pripisuje se borealnom razdoblju zbog nalaza iz Laspi 7 sloja D, čija je starost određena metodom radioaktivnih izotopa ugljika u prvu polovicu devetog tisućljeća prije sadašnjosti (Bln-17951/1: 8570±75 uncal BP i Bln-17951/2: 8760±70 uncal BP te ostali kijevski datumi),⁴⁰ što autori povezuju s kulturom Grebeniki sa sjeverozapadnog pontskog prostora.⁴¹

Osvrćući se na prvi aspekt kulture Šan-Koba, slojevi 6 i 5 Šan-Kobe su vjerojatno vezani s kronološki različitim razdobljima zaposjedanja pripečka (sloj 6, interstadijal Allerød: Gra-55046 i Ki-11086, a sloj 5, vjerojatno rani preboreal, kako je predložio Ki-11085?). Iako dva gore navedena skupa nalaza pokazuju različite tipološke i tehnološke karakteristike, navedeni autori razmatrali su ih zajedno kao prvu fazu tzv. kulture Šan Koba. Glavne karakteristike industrije iz slojeva 5 i 6 su sažete kako slijedi:⁴²

1) jedna, dvije ili više ploha prizmatičnih jezgri 2) prevladavanje sječiva s dodatnom obradom 3) velika grebala na sječivima, kratka grebala na odbojcima i noktolika grebala, 4) prevladavanje dubila na zarupku 5) učestala tehnika „malog rezala”, kao specifična značajka kulture Šan-Koba, 6) neke dvadeset i tri vrste šiljaka izrađenih strmom obradom 7) prisutnost geometrijskih mikrolita među kojima polumjesečasti oblici i trokuti prevladavaju nad trapezima, a koje predstavljaju izolirani primjerci, 8) postoji nekoliko mikrodubila (Sl. 7).⁴³

6. Novi datumi AMS tehnikom

Zbog složenosti ranije navedenih problema, ponešto suprotne interpretacije stratografskog slijeda Šan-Kobe koju su donijeli različiti autori, te neizvjesne precizne kronologije tzv. kulture Šan-Koba, četiri mala uzorka kostiju, od kojih dva u obliku alata, (SK3 i SK4) pronađena tijekom iskapanja koje je proveo S. N. Bibikov 1935.-1936. predana su Radiokarbonskom laboratoriju u Grönningenu na

40 Телегин, 1989, 109; Biagi i Kiosak 2010, Tabela 1.

41 Биби́ков, *i sur.*, 1994, 161.

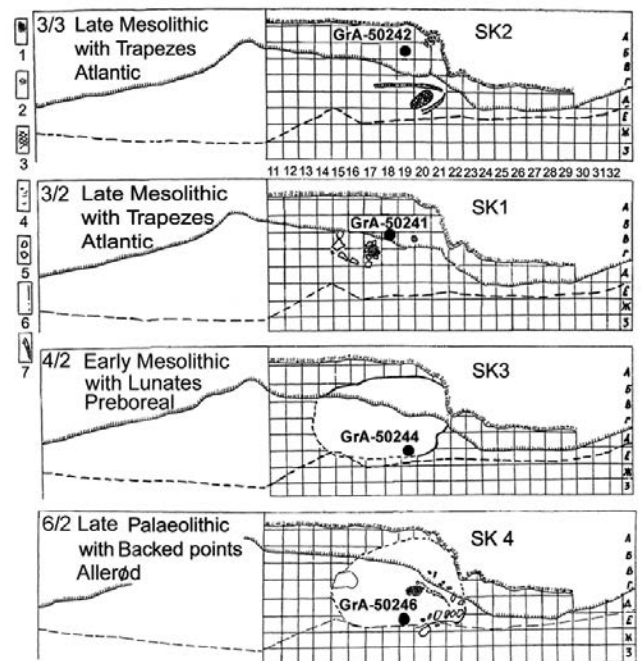
42 Биби́ков, *i sur.*, 1994, 145-147, 213.

43 Биби́ков *i sur.*, 1994, Tabela LIX i LX.

Figure 8. Shan-Koba: location of the bone samples collected for AMS dating (circle) from three different layers. 1) and 2) fireplaces, 3) hearth pit, 4) land snails, 5) stones, 6) limit of the cultural layer, 7) heap of land snails (after Бибииков et al., 1994: Figs. 23 and 24, with variations)

Slika 8. Šan-Koba: Položaj uzoraka kosti prikupljenih za datiranje tehnikom AMS (krug) iz tri različita sloja. 1) i 2) ognjišta, 3) ognjišna jama, 4) kopneni puževi, 5) kamenje, 6) granica kulturnog sloja, 7) hrpa kopnenih puževa (prema Бибииков i sur., 1994., Slike 23 i 24, s varijacijama)

redrawn by / precrtao: P. Biagi



The characteristics of the samples, their provenance, radiocarbon, and calibrated dates are shown in Fig. 7. They were selected from well-defined layers, depths and, whenever possible, structures. Although only four samples from three different layers (6, 4 and 3), two of which from the same layer 3, (levels 3 and 2 respectively) were taken (Fig. 8), the results clearly show that the Shan-Koba sequence is not at all "continuous", as already shown by the radiocarbon dating of animal teeth from the same sequence.⁴⁴

In effect layer 6 belongs to the end of the Allerød interstadial (GrA-50246: 11170±50 uncal BP),⁴⁵ layer 4 to the middle of the Preboreal (GrA-50244: 9575±45 uncal BP), and layer 3 to the Atlantic (GrA-50241: 7775±45, and GrA-50242: 7075±45 uncal BP respectively). A gap of some two thousand years, most probably partly to be filled by the undated layer 5, is shown by GrA-50246 and GrA-50244, while another hiatus of some two thousand years occurs also between the two overimposed layers 4 and 3 (GrA-50244 and GrA-50241) (see also Figs. 2). The new results can be compared with those previously obtained from teeth samples.⁴⁶ It is important to remark that the date published by the above author from layer 3/3 (8357±52 uncal BP: KIA-9571) is remarkably older than that from the same layer from Groningen laboratory (GrA-50242), which does not fit into the chronological sequences from both laboratories.

Apart from its cultural attribution, and the acceptability of the term Shan-Koba culture, the rock-shelter started to be inhabited around the end of the Palaeolithic, as previously suggested by other authors;⁴⁷ it was later settled in the Preboreal period by bands of Mesolithic hunter-gatherers, and finally resettled during the Atlantic by other communities of hunter-gatherers, with a totally different cultural background. Although a former date (Ki-11085) might eventually show that the site was inhabited also around the beginning of the Preboreal, Early Mesolithic period (Ki-11085), the question

datiranje tehnikom AMS kako bi se doprinijelo definiranju kronologije različitih slojeva pripečka.

Karakteristike uzoraka, njihovo podrijetlo, radiokarbonski i kalibrirani datumi su prikazani na Sl. 7. Izabrani su iz dobro definiranih slojeva, dubina i, kad god je to moguće, struktura. Iako su uzeta samo četiri uzorka iz tri različita sloja (6, 4, i 3), od čega su dva iz istog sloja 3, (odnosno razine 3 i 2) (Sl. 8), rezultati jasno pokazuju da stratigrafski slijed Šan-Kobe uopće nije „neprekinut“, kao što je već pokazano radiokarbonskim datiranjem životinjskih zubi iz istog slijeda.⁴⁴

Zapravo, sloj 6 pripada završetku interstadijala Allerød (GrA-50246: 11170 ± 50 uncal BP),⁴⁵ sloj 4 sredini preboreala (GrA-50244: 9575 ± 45 uncal BP), a sloj 3 atlantiku (GrA-50241: 7775 ± 45, odnosno GrA-50242: 7075 ± 45 BP uncal). Razmak od oko dvije tisuće godina, kojeg vjerojatno dijelom pokriva nedatirani sloj 5, pokazuje GrA-50246 i GrA-50.244, dok druga praznina od oko dvije tisuće godina nastaje također između dva superponirana sloja 4 i 3 (GrA-50244 i GrA-50241) (vidi također Sl. 2). Novi rezultati se mogu usporediti s onima koji su prethodno dobiveni iz uzoraka zuba.⁴⁶ Važno je napomenuti da je datum koji je objavio gore navedeni autor iz gornjeg sloja 3/3 (8357 ± 52 BP uncal: KIA-9571) značajno stariji od onog iz istog sloja iz laboratorija u Gröningenu (GrA-50242), a koji se ne uklapa u kronološke sljedove iz oba laboratorija.

Neovisno o njegovoj kulturnoj atribuciji i prihvatljivosti pojma kultura Šan-Koba, naseljavanje pripečka započelo je krajem paleolitika, kao što su ranije sugerirali ostali

44 Benecke, 2006: Tab 2.

45 see Alley, 2000; Yu and Eicher, 2001.

46 see Benecke 2006.

47 Бибииков, et al., 1994: 146.

44 Benecke 2006, Tabela 2.

45 vidi Alley, 2000; Yu i Eicher, 2001.

46 vidi Benecke 2006.

that the results raise concerns the reliability of the term Shan-Koba culture, which was defined according to the typological characteristics of assemblages belonging to different climatic and cultural periods, spanning from the Late Palaeolithic Allerød warm oscillation to the Preboreal Mesolithic.

7. Discussion

The new results contribute to the study of the suggested "continuous" stratigraphies of the Crimean caves, and point out the importance of AMS dating for achieving a highly needed, acceptable chronological sequence of the Late Palaeolithic and Mesolithic cultures in the region, which is still badly known.⁴⁸

In this respect it is important to point out that the AMS dates recently obtained from two different identified charcoal samples from the same layer of Laspi 7⁴⁹ partly fill the sequential gap shown by the new Shan-Koba dates (Fig. 9). According to them, the very poor early industries with microlithic trapezoidal geometrics from Laspi 7, attributed to the Murzak Koba culture,⁵⁰ made their appearance in the Crimean peninsula during the second half of the Boreal period.

This fact is of major interest if we compare the Laspi 7 dates with the slightly later results from BPPP-2 pollen core obtained from the neighbouring mountains of southern Crimea (Fig. 1). The oldest date from this profile (Beta-156479, 8550±40 uncal BP)⁵¹ marks a dramatic environmental event, more precisely the beginning of development of Mediterranean woodland cover, during a period of lowering temperature and precipitation.⁵² Interestingly "Kukrek" lithic artefacts were found at the same depth during sampling, suggesting the presence of hunter-gatherers in the area when the tree cover began to change, following a period of increasing lower moisture.⁵³

Comparable AMS dates have been obtained also from the Grebeniki culture open-air site of Mirne,⁵⁴ suggesting that communities of hunter-gatherers, settled in different territories close to the north Black Sea coast of present-day Ukraine, began to produce the earliest blade and trapeze chipped stone assemblages⁵⁵ roughly in the same period.⁵⁶ They suggest the adoption of new hunting techniques, following the new environmental conditions that began to establish during the second half of the Boreal climatic period.

autori;⁴⁷ kasnije je naseljen u preborealnom razdoblju družinama mezolitičkih lovaca-sakupljača, a konačno ponovno naseljen u atlantiku drugom zajednicom lovaca-sakupljača, s potpuno drugačijom kulturnom pozadinom. Iako će prethodni datumi (Ki-11085) možda na kraju pokazati da je nalazište bio naseljeno i oko početka preboreala, tj. razdoblja ranog mezolitika (Ki-11085), rezultati ostavljaju otvorena pitanja o pouzdanosti pojma kultura Šan-Koba koja je bila definirana prema tipološkim karakteristikama skupova nalaza koji pripadaju različitim klimatskim i kulturnim razdobljima, s rasponom od tople Allerød oscilacije kasnog paleolitika do preborealnog mezolitika.

7. Rasprava

Novi rezultati predstavljaju doprinos proučavanju predloženi "neprekinutih" stratigrafija krimskih špilja i ukazuju na važnost datiranja tehnikom AMS za postizanje vrlo potrebnog, prihvatljivog kronološkog slijeda kasno paleolitičke i mezolitičke kulture u regiji, koji je još uvijek slabo poznat.⁴⁸

U tom smislu važno je istaknuti da AMS datumi nedavno dobiveni iz dva različita identificirana uzorka ugljena iz istog sloja Laspi 7⁴⁹ djelomično popunjavaju stratigrafsku prazninu na koju ukazuju novi datumi Šan-Kobe (Sl. 9). Prema njima, vrlo siromašne rane industrije s geometrijskim trapezoidalnim mikrolitima iz Laspi 7, pripisane kulturi Murzak Koba,⁵⁰ pojavile su se na krimskom poluotokom tijekom druge polovice borealnog razdoblja.

Ova činjenica je od velikog značaja ako usporedimo datume za Laspi 7 s nešto kasnijim rezultatima BPPP-2 jezgre peluda dobivene iz susjednih planina na jugu Krima (Sl. 1). Najstariji datum iz tog profila (Beta-156479, 8550 ± 40 uncal BP)⁵¹ obilježava dramatičan okolišni događaj, točnije početak razvoja mediteranskog šumskog pokrova tijekom razdoblja spuštanja temperature i oborina.⁵² Zanimljivo je da su litički artefakti "Kukrek" pronađeni na istoj dubini tijekom uzorkovanja, što ukazuje na prisutnost lovaca-sakupljača na području gdje se šumsko zemljište počelo mijenjati i to nakon razdoblja smanjenja vlage.⁵³

Usporedivi datumi dobiveni tehnikom AMS iz nalazišta na otvorenom kulture Grebeniki iz Mirne,⁵⁴ ukazuju da su zajednice lovaca-sakupljača, naseljene na različitim područjima blizu sjeverne crnomorske obale u današnjoj Ukrajini, počele proizvoditi najraniji cijepani litički materijal sa sječivima i trapezima⁵⁵ otprilike u

48 see Benecke, 2006.

49 Biagi and Kiosak, 2010: Table 3.

50 Бонч-Осмоловский, 1934; Телегин, 1989: 109.

51 Cordova and Lehman, 2005: Table 5.

52 Cordova and Lehman, 2005: fig. 2.

53 Cordova and Lehman, 2005; Cordova, 2007.

54 Станко, 1982.

55 Clark, 1958.

56 Biagi and Kiosak, 2010: 34.

47 Бибииков, i sur., 1994, 146.

48 vidi Benecke, 2006.

49 Biagi i Kiosak 2010, Tabela 3.

50 Бонч-Осмоловский, 1934; Телегин, 1989., 109.

51 Cordova i Lehman, 2005; Tabela 5.

52 Cordova i Lehman, 2005: sl. 2.

53 Cordova i Lehman, 2005; Cordova, 2007.

54 Станко, 1982.

55 Clark, 1958.

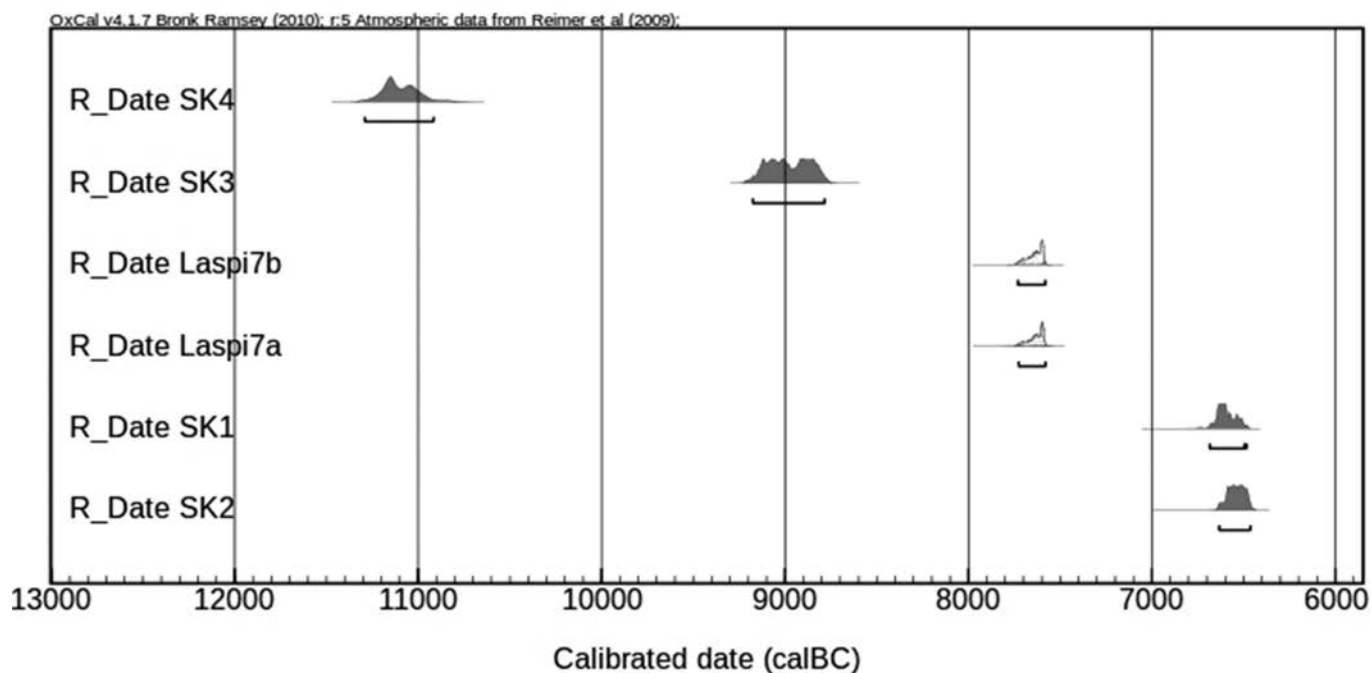


Figure 9. Shan-Koba: plot of the new AMS calibrated BC dates (SK1-SK4) compared with the results from Laspi 7

Slika 9. Šan-Koba: Ispis novih kalibriranih BC datuma dobivenih AMS tehnikom (SK1-SK4) u usporedbi s rezultatima iz Laspi 7

courtesy of / ljubaznošću: T. Fantuzzi

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istom razdoblju.⁵⁶ Takvo što upućuje na usvajanje novih tehnika lova, nakon novih okolišnih uvjeta koji su se počeli uspostavljati tijekom druge polovice borealnog klimatskog razdoblja.

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