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V. O. MANKO, S. A. TELIZHENKO

FLINT ARTEFACTS OF LAYER 4 AT THE FATMA KOBA SITE, CRIMEA, UKRAINE

The Early Holocene complex of Layer 4 at the Fatma Koba is associated with a change from the Shpan Koba to the Murzak Koba culture. The change is marked by the appearance of pressure lamellar technology. The beginning of the transformation relates to the migration of Darkveti population from the South Caucasus. It is significant that the change in the technology of knapping did not lead to a change in the typology of the complex of modified pieces.

Key words: Crimea, Early Holocene, Trialeti industry, pressure lamellar technology, asymmetric triangles, bipolar retouch, migrations, networks.

It has always been challenging to explain new cultural phenomena in prehistory. Archaeological cultures often appear to arise spontaneously.

The origin of the Murzak Koba culture has also been discussed in different ways, with some researchers arguing for an autochthonous development, while others emphasise migration processes. In this regard, the materials from Layer 4 of the Fatma Koba site offer an opportunity to observe the transformation of one archaeological phenomenon into another in detail. This article, therefore, will present the flaked flint items found in this layer and will systematically discuss technological and typological characteristics. The assemblage can be interpreted as a transitional industry, a phenomenon that is exceptional in archaeological research. Usually, only the initial and final phases of development can be described, while the transition from one phase to another occurs so quickly that it remains elusive for archaeologists. This circumstance makes the flint complex from Layer 4 of the Fatma Koba site even more valuable.

The main objective of this article is to investigate the origins of the Murzakobian industry and to demonstrate a potential connection with flaked stone industries of Asia Minor and the Caucasus.

History of Research

The Fatma-Koba site was discovered in 1927 by S. O. Trusova and S. M. Bibikov in the Mountain Crimea, under a rock shelter on the bank of the Kubular-Dere stream (fig. 1). The first excavations were carried out in the same year by H. A. Bonch-Osmolovskyi, who attributed the industries of Layers 4, 3, and 2 at Fatma-Koba to the Tardenoisian (Бонч-Осмоловский 1934). This attribution had nothing to do with the cultural specificity of flint complexes, but rather reflected the author’s adherence to the stadial theory of Stone Age development.

Based on stratigraphic data (Бибиков, Станко, Коен 1994, tabl. XXIV–XXVI), H. A. Bonch-Osmolovskyi subdivided Layer 4 into three conditional horizons (4.3, 4.2, and 4.1). Unfortunately, the assemblages obtained were not sufficiently representative. Nevertheless, it should be noted that the asymmetrical triangles were only found in Layer 4.2, which is considered diagnostic of the Murzak Koba culture. Further excavations were carried out in 1956–1958 by S. M. Bibikov (Бибиков 1966). Unfortunately, during the excavation, Layer 4 of Fatma Koba could not be divided into horizons as those defined earlier by Bonch-Osmolovskyi.

D. Ya. Telehin was a supporter of the so-called Mountain Crimean culture (Shan Koba and Murzak Koba cultures as manifestations of a single cultural phenomenon) (Телегін 1982). Within this framework, the complexes of Layer 4 of Fatma-Koba were inter-

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© MANKO Valerii Oleksandrovych, 2026 — PhD, Senior Researc Fellow, the Institute of Archaeology of the National Academy of Sciences of Ukraine, the Department of Archaeology of the Crimea and North-Western Black Sea, ORCID: 0000-0002-2990-7234, *Valery_Manko@ yahoo.com*
© TELIZHENKO Serhii Anatoliyovych, 2026 — PhD, Senior Researcher, the Institute of Archaeology of the National Academy of Sciences of Ukraine, the Department of Archaeology of the Crimea and North-Western Black Sea, ORCID: 0000-0003-1677-4900, *telizharh@hotmail.com*

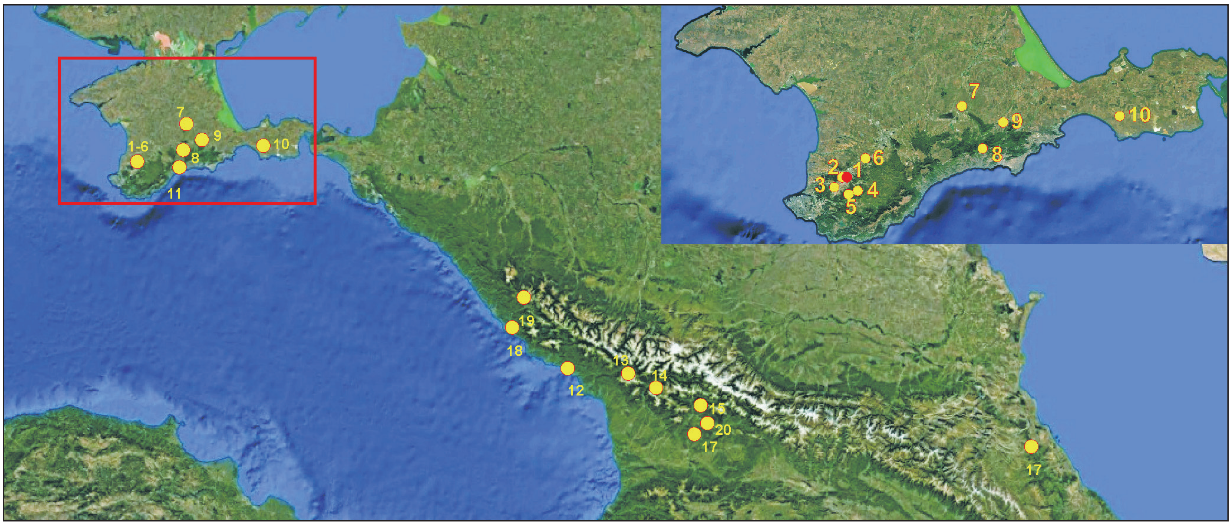

Fig. 1. Final Pleistocene and Early Holocene sites. *1* — Fatma Koba; *2* — Shpan Koba; *3* — Murzak Koba; *4* — Alimovskyi Navis, Zamil Koba; *5* — *V*odopadnyi Grotto; *6* — Skeliastyi Grotto*;* *7* — Shpan Koba, Vishenne 1; *8* — Kukrek; *9* — Buran Kaya Navis, Buran Kaya III, IV; *10* — Frontove; *11*— Laspi 7; *12* — Edzani; *13* — Zurtaketi; *14* — Kotias Klde, *15* — Darkveti; *16* — Bavra; *17* — Chokh; *18* — Melouri*;* *19* — Zemo Lemsa*;* *20* — Dghvartskhma

preted as representing only a "Murzakkobian phase" of the Mountain Crimean culture.

Following the publication of the monograph *The Final Palaeolithic and Mesolithic of the Mountain Crimea* (Бибиков, Станко, Коен 1994), the term "Murzak Koba culture" became generally accepted among Eastern European archaeologists. The authors further subdivided this culture into two facies — Points Tardenoisian and Ordinary Tardenoisian — and assigned the assemblage of Layer 4 from Fatma-Koba to the former. This interpretation is problematic because geometric microliths are, in fact, the main type of arrowhead.

More recently, O. O. Yanevych characterised Layer 4 of Fatma-Koba as a mixed layer containing artefacts associated with both the Shan Koba and Murzak Koba cultures (Яневич 2019). The layer was dated to the Boreal period, an interpretation with which we agree.

Methods and Terminology

In this publication, we use the terms *Shpan Koba* and *Murzak Koba* cultures. At the same time, the term *Trialetian* is used to refer to both cultural entities (Manko, Chkhatarashvili 2022).

Our research is based on a combined typological and technological analysis. Particular emphasis is placed on the technological methodology related to the production of blades, bladelets, and microblades, which are especially informative for the analysis of the flint complex from Layer 4. The inhabitants of the site employed both direct percussion and pressure lamellar core reduction strategy. Accordingly, the question of the cultural homogeneity of the complex is of great importance. The complexity of modified pieces was analysed separately for each technological group. Comparison of the results allowed us to assess the lithic assemblage of the complex as relatively homogeneous. The criteria for pressure flaking cannot be determined through measurement or statistical analysis. The only objective technological criterion is the angle at which force is applied to obtain laminar pieces. Pressure flaking methods enable laminar pieces to be obtained from surfaces positioned at obtuse angles to the force application axis. However, this criterion has very limited application. Typically, pressure laminar pieces were obtained using methods that did not require such sophisticated techniques. The angle between the force application vector and the platform was usually 60°. Therefore, various measurements are meaningless when it comes to determining the criteria of pressure flaking. Visual determination is the only possible method. Thin, slightly curved laminar pieces have parallel edges and ridges. This circumstance enables artefacts associated with pressure flaking to be identified with virtually no margin of error.

The attribution of the Layer 4 complex to the Trialetian industry made it necessary to consider the synchronous development of this industry in Asia Minor, the southern, eastern, and western shores of the Caspian Sea, as well as in the southern Caucasus and the Crimea. Such observations enable conclusions to be drawn regarding the origin of the Shpan Koba and Murzak Koba industries and suggest the existence of an extensive network at the transition from the Boreal to the Atlantic period. Thus, we can synchronise similar developments in lithic industries across different regions. The explanation of this phenomenon is supported by absolute chronological data.

Absolute chronological data were compared with relative chronological frameworks, including stratigraphic evidence from multilayer assemblages both on the territory of the Crimea and in remote regions associated with the Trialetian network.

Comparative analysis of typology, blade production techniques, and chronological data was used to assess the contribution of the Trialetian network population to the development of the European Neolithic.

Flint Complex of Layer 4

Raw material

All of the artefacts found in Layer 4 of Fatma Koba are associated with local flint sources. Several sources of flint were likely used. Most of the artefacts are made from brown and grey flint extract-ed from nodules, probably originating from nearby deposits. In particular, flint sources in the vicinity of the village of Skelia in the Baydar Valley were most likely utilised.

Flint knapping

Flint knapping aimed at obtaining blades, bladelets, and microblades through the utilisation of both direct percussion and pressure methodologies. The structure of the flint complex is shown in Table 1.

Only four cores were found in Layer 4. One of the cores is associated with direct percussion, as evidenced by the blade negatives. It is the bidirectional flat back blade core (fig. 2: 3). Its dimensions are 4.2 × 3.8 × 1.2 cm, indicating that it represents a core in the last phase of flint knapping.

Two cores are associated with a pressure blade methodology. One is the sub-cylindrical bidirectional crested back blade/bladelet core. This core exhibits two striking platforms: main and supplementary (fig. 2: 1). The latter was used to remove the hinge fractures on the flaking surface. Attempts to remove the blade from the second platform were also unsuccessful. The dimensions of this core are 7.2 × 3.0 × 2.7 cm.

The second pressure core is the bidirectional adjacent wedge-shaped blade/bladelet core. This core exhibits two striking platforms: main and supplementary. The latter was used to create the adjacent flaking surface and wedge shape of the core (fig. 2.2). Its dimensions are 4.2 × 2.5 × 1.3 cm. The core illustrated in fig. 2: 3 may represent an earlier stage of knapping, discarded due to the unsuccessful blade removal.

One of the cores shows traces of flake removals (fig. 2: 4). This specimen is a single-platform, monofrontal (single-faced), flat core with an unmodified back. It is likely associated with repeated unsuccessful attempts to resume flake removal. Its dimensions are 4.2 × 3.8 × 1.2 cm.

In addition, 23 flint fragments may be associated with failed attempts to formalise further core knapping.

There are six crested blades in the complex. These artefacts are associated with the removal of ridges from cores to create a straight, raised ridge for the initiation of blade extraction.

A total of 391 flakes were recorded. Of these, 28 are primary flakes exebit ≥75 % of the cortex (width 5–8 cm: 2; 3–5 cm: 9; 1–3 cm: 17), 41 are corticated flakes exebit <75 % of the cortex (5–8 cm: 4; 3–5 cm: 14; 1–3 cm: 23), 391 are noncorticated flakes (5–8 cm: 17; 3–5 cm: 87; 1–3 cm: 287). There are 343 lamellar pieces, and only 475 flakes in the complex. Such a ratio is highly unlikely if flint knapping took place in the area of the site. The impression is that most of the flakes were brought to the site. The number of chunks (186) corresponds to a pattern associated with the knapping of a single core.

A total of 57 blades, bladelets, and their parts, linked to a direct percussion method, were identified. The number of complete blades is greater than the number of deliberately fractured blades (Table 1). In addition, 21 blades and 9 bladelets were recorded. It should also be noted that the medial parts of the bladelets are missing.

Eighty-seven blades, bladelets, microblades, and their parts were produced using the pressure method. Complete blades are absent from this group. There are 28 proximal, 20 medial, and 14 distal parts of blanks.

In general, the structure of the complex is characterised by a large number of modified pieces (214 forming 20.38 %, Tables 1–2), which suggests that Layer 4 of the Fatma Koba site represents a logistical camp of hunters.

Modified Pieces

A total of 214 modified pieces were recovered from Layer 4 at Fatma-Koba. Taking into account the heterogeneity of the flake complex, these artefacts are grouped as follows: modified pieces on flakes – 15 items, on blades and bladelets – 99 items, on pressure blades, bladelets and microblades – 100 items.

Modified pieces on flakes

One scraper on a flake was identified (3.5 × 1.9 × 0.6 cm; fig. 2: 4). Five burins were recorded: three dihedral asymmetrical burins (2.4 × 3.1 × 0.6 cm, 3.9 × 1.8 × 0.7, 2.6 × 1.7 × 0.8 cm; fig. 2: 5); two transversal burins on laterally truncat-

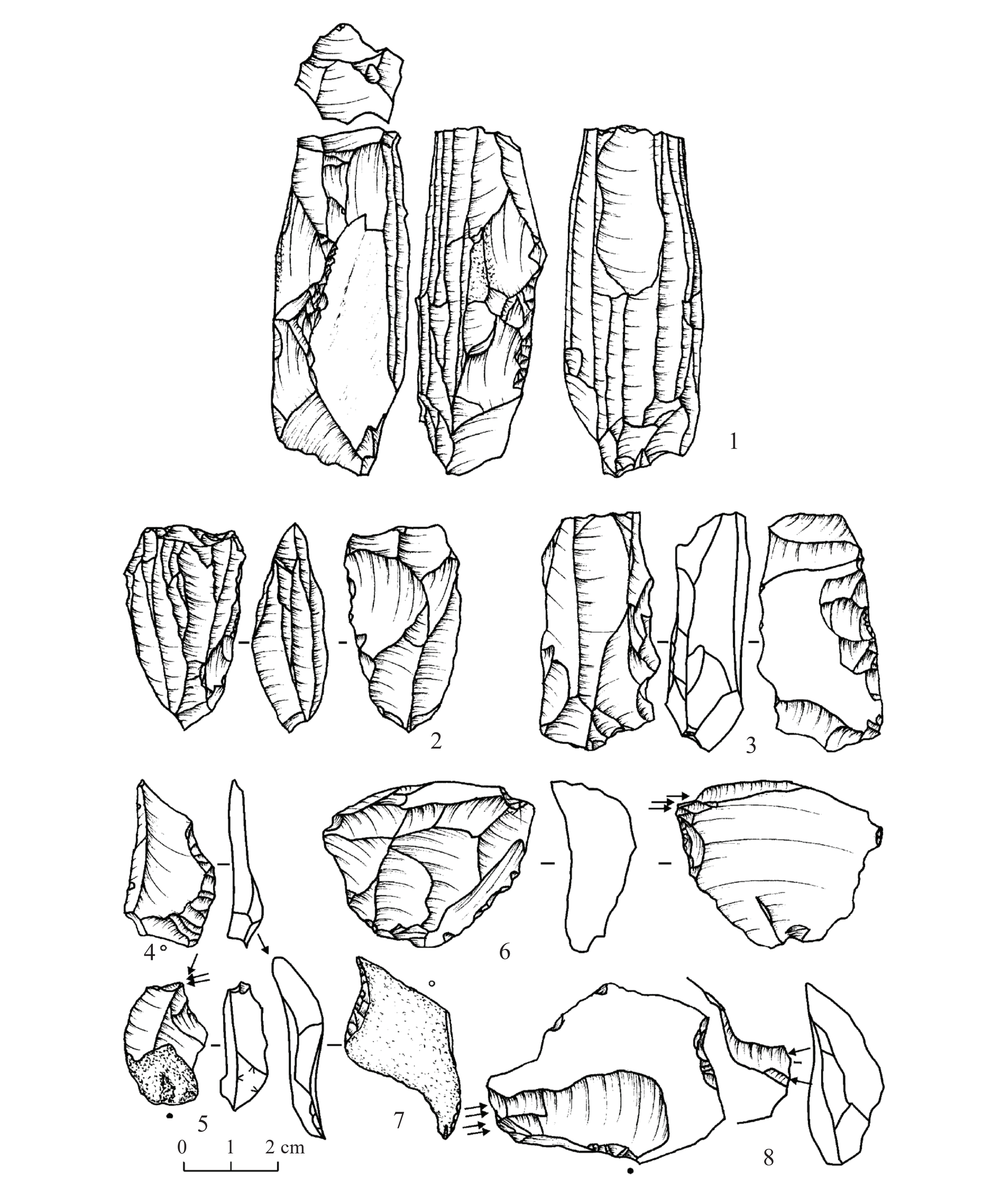

Fig. 2. Fatma Koba, Layer 4. *1–3* — cores; *4* — scraper on flake; 5–8 — burins on flakes

ed flakes (4.3 × 3.7 × 1.2 cm and 4.3 × 2.3 × 0.6 cm; fig. 2: 6–7). One transversal burin on modified splintered piece on the flake was found (5.0 × 4.0 × 1.5 cm, fig. 2: 8).

Two retouched flakes were documented (4.3 × 2.7 × 1.0 cm and 4.6 × 3.7 × 0.9 cm; fig. 2: 11 3: 11), along with six notched flakes. These notched flakes range in length from 2.4 to 4.7 cm, width 1.8–2.8 cm, and thickness 0.5–1.3 cm.

Modified pieces on pressure lamellar pieces

A total of 109 modified pieces created on direct percussion blades were found.

Four scrapers were identified: one end-scrape on a blade (fig. 3: 1); two end-scrapers on blades with broken distal parts (fig. 3: 2–3); one double end-scraper (fig. 3: 4). Dimensions range from 2.0–3.4 cm in length, 1.6–1.9 cm in width, and 0.4–0.6 cm in thickness. All scrapers have convex working edges, formed with sub-parallel retouching.

Twenty-five burins were recorded: fourteen angle burins on broken proximal (fig. 3: 5–11), medial (fig. 3: 12–14), and distal (fig. 3: 15) parts of blades, including one bilateral (fig. 3: 5); five angled burins on unmodified proximal (fig. 3: 16, 18) and distal (fig. 3: 17) portions of blades; three burins on oblique truncated proximal (fig. 3: 22) and medial (fig. 3: 19) portions of blades, including one bilateral (fig. 3: 22); one angled dihedral burin; and two combined burins, including one angled bilaterally on an unmodified proximal portion of the blade (fig. 3: 23) and one angled dihedrally — dihedral symmetric (fig. 3: 21). Dimensions: 2.3–5.0 cm in length, 1.3–2.6 cm in width, and 0.3–1.2 cm in thickness.

One combined tool was recorded, an end-scraper and angled burin created on a broken blade (1.9 × 1.5 × 0.7 cm; fig. 3: 20).

Thirty-one retouched blades with marginal edge retouch were found: 15 proximal (fig. 3: 10), nine medial, and two distal portions; three medial portions of crested and retouched blades (length 1.4–4.0 cm, width 0.7–2.2 cm, and thickness 0.2–0.6 cm).

There are 35 notched blades and bladelets in the assemblage, of which 11 display semi-steep retouched notches. There is one crested blade (fig. 4: 1), nine proximal (fig. 4: 2–7), and one medial portion of blades and bladelets. The remainder (24 artefacts) have notches formed with single presses of a retoucher: five blades (fig. 4: 9), eleven proximal (fig. 4: 9, 10, 11), seven medial (fig. 4: 12), and one distal portion (dimensions: 1.3–6.7 cm length, 0.8–2.9 cm width, and 0.3–0.7 cm thickness).

The most informative part of the complex is associated with hunting weapons. Geometric microliths were represented by three mid-height asymmetrical triangles, one of which has an abrupt retouched notch on the short margin, and an abrupt bipolar retouched notch on the longest margin (fig. 4: 13). The dimension is 2.8 × 0.9 × 0.3 cm. Two mid-height asymmetrical triangles have abrupt retouched sides (2.0 × 1.0 × 0.5 and 2.1 × 0.8 × 0.2 cm; fig. 4: 14–15).

There are four backed pieces on bledelets with bipolar retouch, three of which were made from the medial sections (dimensions: 4.2 × 1.0 × 0.5, and 1.5 × 0.7 × 0.3; 1.7 × 0.7 x 0.4 cm; fig. 4: 16–17, 19); and one from distal portion (1.0 × 0.7 × 0.2 cm; fig. 4: 18).

One abrupt retouched bladelet on a distal fragment (2.1 × 1.0 × 0.3 cm; fig. 4: 20) and one oblique truncated blade (3.4 × 1.4 × 0.3 cm; fig. 4: 21) were identified.

Two unexpected artefacts in this assemblage of hunting-related material were tanged projectile points, which display diagnostic macrofractures directly associated with their usage as projectiles. There are Amuk-type leaf-shaped points (fig. 4: 25) in addition to a Byblos point with a thin tang (dimensions: 4.1 × 1.0 × 0.3 cm; fig. 4: 24). Both points have tangs formed by abrupt retouch and flat retouch on the proximal portion of their ventral surfaces.

Two artefacts are interpreted as possible awls resulting from the reuse and modification of end-of-life tanged points (fig. 4: 22–23).

Modified pressure laminar pieces

A total of 90 modified pieces created on pressure blades, bladelets, and microblades were found in the complex of Layer 4 at Fatma Koba.

Five end-scrapers, three on intact blades (fig. 5: 1–3) and two on blades with removed proximal sections (fig. 5: 4–5). Length 1.4–2.7 cm, width 1.2–1.8 cm, thickness 0.3–0.6 cm. All scrapers have convex working edges, formed with semi-steep scraper retouching. One of the scrapers was formed from another end-scraper after its edge was broken (fig. 5: 4).

Twelve burins, including five angled on broken (fig. 5: 6–8) and partial (fig. 5: 9–11) bladelets. Two double-angled burins with diagonally positioned negatives of spalls (fig. 5: 9–10); one angled dihedral burin on a pressure blade, and one double burin on an unmodified proximal portion were found. Dimensions: length 1.3–4.2 cm, width 0.7–1.1 cm, thickness 0.1–0.7 cm.

A total of 40 retouched blades and bladelets includes only one bladelet with semi-steep retouch (fig. 5: 13). Thirteen artefacts have marginally retouched edges: one with a retouched blade and 12 medial (fig. 5: 12, 14) portions (length 1.2–5.7 cm, width 0.8–1.4 cm, thickness 0.1–0.6 cm). Notched blades and bladelets are represented by 24 examples.

A very interesting find includes the so-called "ancoche", a medial blade with diagonally placed abrupt retouched notches (fig. 5: 16; 4.6 × 1.3 × 0.4 cm). Four proximal portions of blades and bladelets (fig. 5: 15, 17) have semi-steep retouched notches (2.1–7.5 × 0.6–1.2 × 0.2–0.5 cm). Other notched blades, bladelets, and their parts formed by a single retoucher press (19 artefacts, including two proximal (fig. 5: 18), 15 medial (fig. 5: 19–23), and two distal (fig. 5: 24) portions; length 1.4–2.6 cm, width 0.7–1.2 cm, thickness 0.2–0.5 cm).

One piercing, awl-like tool with semi-steep convergent retouch (2.0 × 1.4 × 0.3 cm) was found.

Twenty-six geometric microliths on pressure bladelets include 12 low asymmetric triangles and

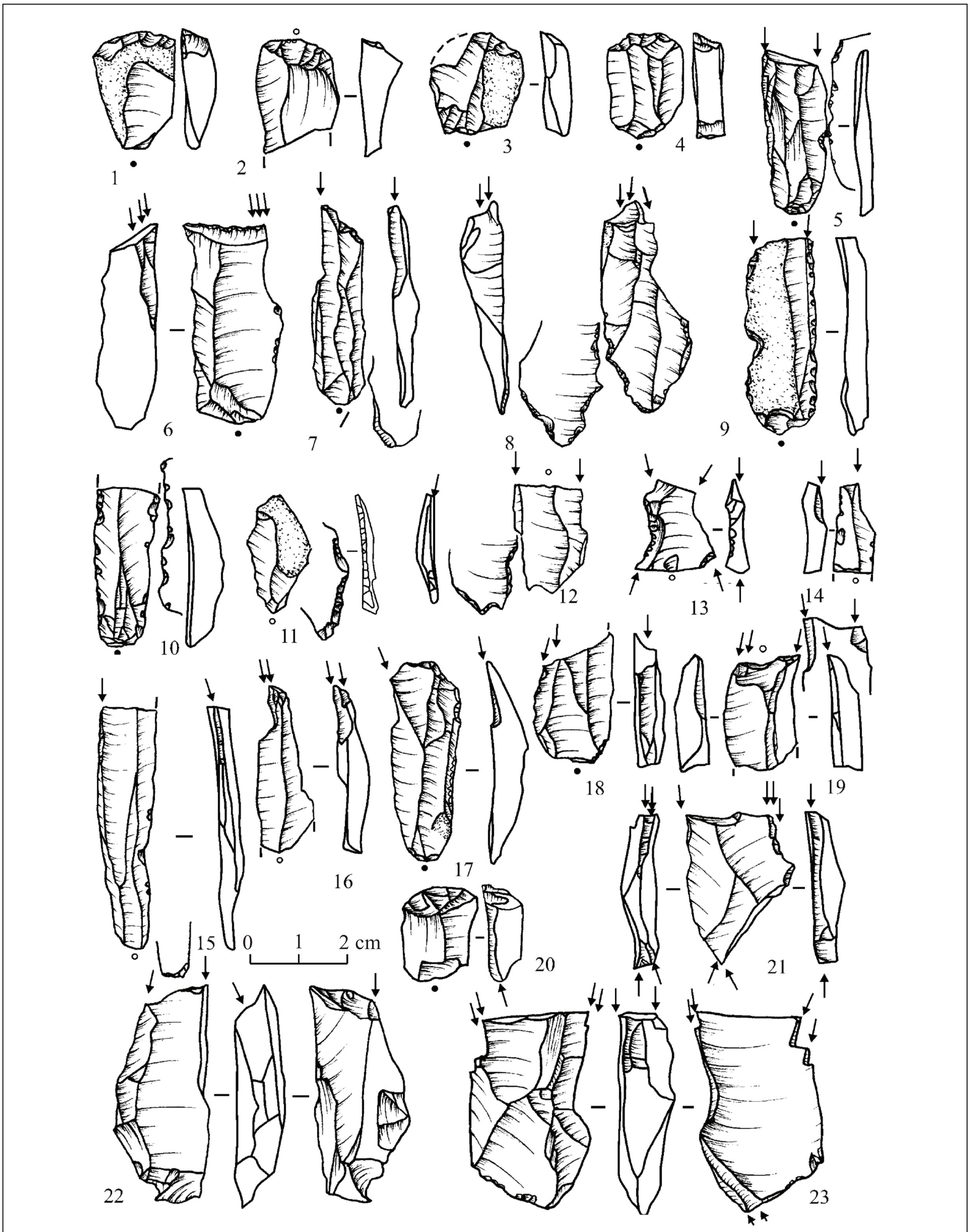

Fig. 3. Fatma Koba, Layer 4. Tools on blades linked with direct percussion. *1–4* — scrapers; *5–23* — burins

14 trapezes. Among asymmetric triangles, one is with an abrupt retouched notch on the short side, and abrupt bipolar retouch on the long side (fig. 5: 25; 3.9 × 0.9 × 0.3 cm), and five with abrupt retouched sides (fig. 5: 26–29, 40; 1.5–2.2 × 0.7–0.8 × 0.1 cm). Fragments of six asymmetric triangles were also found (fig. 5: 30–34, 39). Of 14 trapezes, one is low, long, and symmetric with abrupt retouched sides and two notches near a small base (fig. 5: 35; 3.0 × 1.0 × 0.2 cm); two low symmetric with

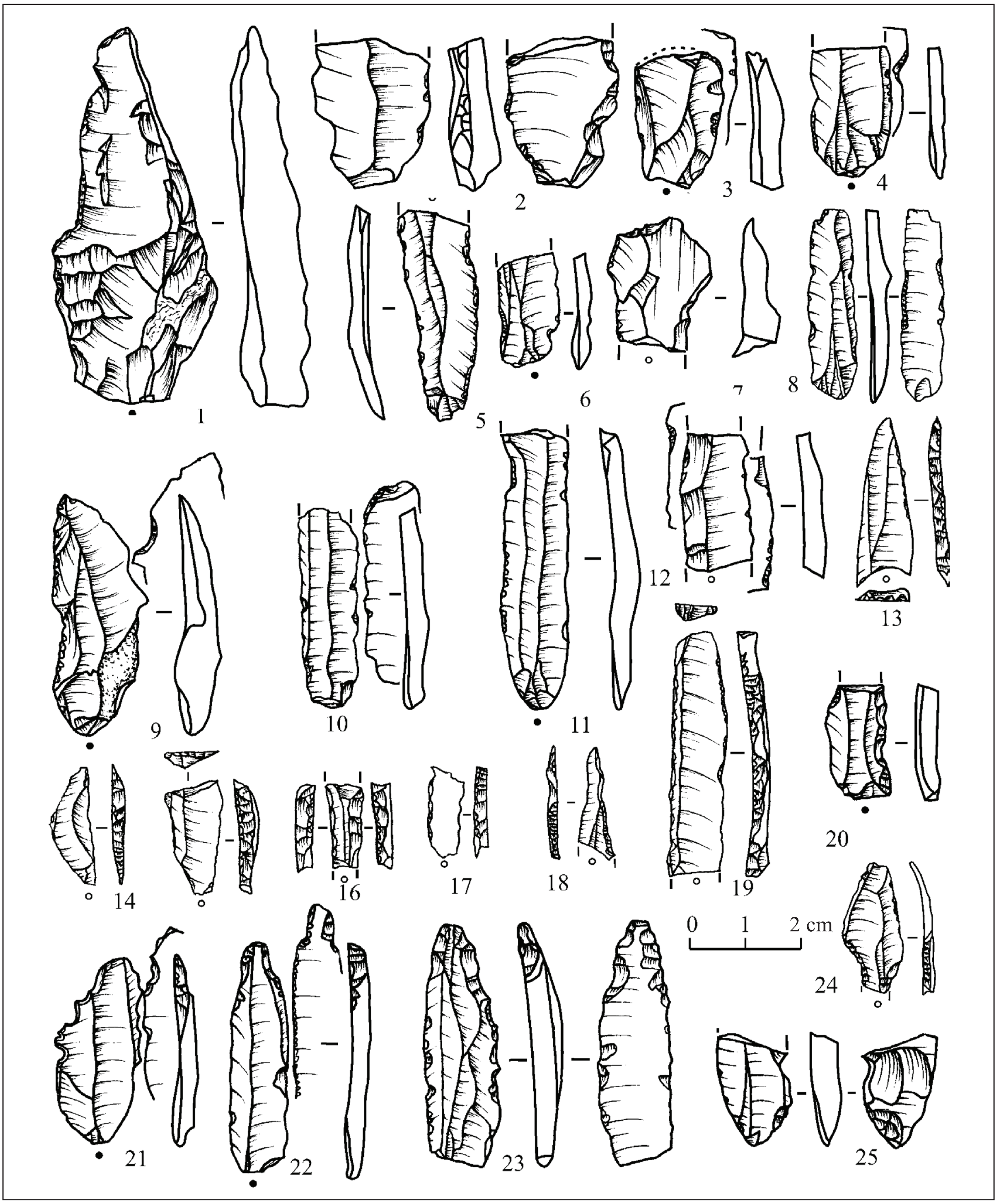

Fig. 4. Fatma Koba, Layer 4. Tools on blades linked with direct percussion. *1–12* — retouched and notched blades and bladelets; *13–21* — microliths; *22–23* — perforators (drills); *24–25* — tanged points

abrupt retouched sides and denticulated small bases (fig. 5: 36–37; 2.1 × 0.8 × 0. cm and 1.7 × 0.8 × 0.1 cm); one low symmetric with abrupt retouched sides and a small base (fig. 5: 38; 1.6 × 0.9 × 0.1 cm); seven low symmetric (fig. 5: 44–49) trapezes, and two asymmetric (fig. 5: 41–43) with abrupt retouched sides (1.0–2.5 × 0.7–1.0 × 0.1 cm). All trapezes and triangles display traces of use-related damage consistent with projectiles.

Six artefacts belong to the non-geometric microliths complex: one distal portion of an abruptly bipolarly retouched microblade (fig. 5: 51; 2.4 × 0.4 × 0.3 cm); one medial part with an abruptly retouched ventral edge (fig. 5: 52; 1.9 × 0.7 × 0.2 cm); one truncated

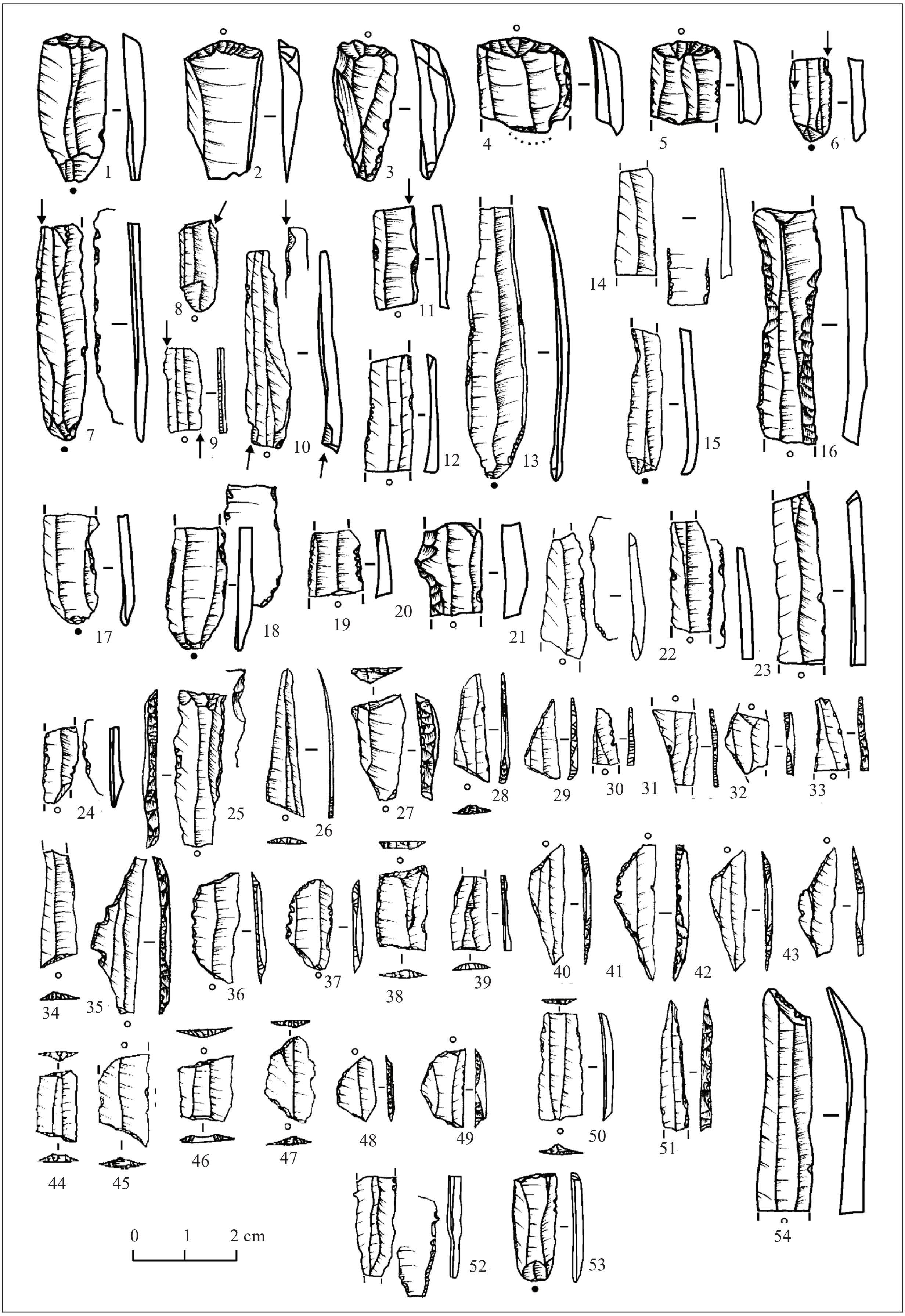

Fig. 5. Fatma Koba, Layer 4. Tools on blades linked with pressure blade technology

facetted proximal (fig. 5: 53), and two medial (fig. 5: 54) portions of bladelets (dimensions: 2.0–4.2 × 0.7–1.0 × 0.1–0.3 cm); as well as one bi-truncated facetted bladelet (fig. 5: 50; 2.2 × 0.8 × 0.1 cm).

Overall, Layer 4 can be divided into three sub-assemblages. It is reasonable to assume that pressure blades and bladelets are associated with the Murzak Koba culture. Direct percussion blades and bladelets can be linked to the Shpan Koba culture. Tools on flakes could belong to either cultural traditions. These assumptions will be discussed in the next section of the article.

Discussion of the Homogeneity of the Layer 4 Complex at the Fatma Koba Site

The question of the homogeneity of the Layer 4 complex at the Fatma Koba site arises from the simultaneous presence of two different lithic reduction strategies and a considerable diversity in the typology of modified pieces. Blades obtained by direct percussion and pressure methods are equally represented. Modified pieces associated with pressed blades are marked by the presence of trapezes, which are absent from the assemblage of modified pieces produced on non-pressed blades.

At first glance, this might suggest that the mixed nature of the Layer 4 complex has been convincingly demonstrated. However, a more detailed comparison of the typology of modified pieces leads to a more controversial conclusion. Certain types of flint exhibit similarities in complexes associated with different types of blanks. These materials can hardly be interpreted as monocultural. At the same time, radiocarbon evidence shows that the layer was formed rapidly, suggesting intensive interaction between representatives of different industries.

Two new dates were obtained recently during the preparation of this article. These dates are associated with the end of the Preboreal and the beginning of the Boreal periods. One of the dates (FTMC-IH63-3 — 9542 ± 49 BP uncal — 9121–8736 BC cal) coincides with previously obtained dates marking the onset of the Span Koba culture (Яневич, 2019). The other date (4 FTMC-IH63-4 — 9034 ± 52 BP uncal — 8292–7973 BC cal) is slightly later and may be associated with the emergence of pressure blade technology and the transformation of the Shpan Koba culture into the Murzak Koba culture. The series of scrapers shows similarity. All scrapers are made on straight blades with parallel edges, and all retouched working edges are convex. Semi-steep flaking retouch was used to shape the working edges.

The typology of burins, associated with different types of blanks, is likewise similar across both complexes. The most numerous are angle burins on broken blades and bladelets. Dihedral burins and burins on truncated facetted blades are also present in both groups.

The presence of notched blades in the assemblage is particularly noteworthy. Both types of blades (direct and pressure) are associated with the production of notched artefacts by means of a single pressing method. Such notches occur not only on blades and bladelets, but also on trapezes. Three trapezes bear notches on a small proximal base, which allows us to consider the complexity of notched blades of both types.

Complexes of non-geometric microliths linked with different types of blanks are likewise similar. Common microlith types include abrupt bipolar retouched blades, abrupt retouched blades, and truncated facetted blades. Geometric microliths also display partial similarity: both blank types were used to produce asymmetric triangles with abrupt retouched or notched sides.

With which archaeological cultures should these microliths be associated? Geometric and non-geometric microliths produced on non-pressure blades are traditionally attributed to the Shpan Koba culture, while the same microliths produced on pressure blades are associated with the Murzak Koba culture. Overall, this general similarity indicates that the Shpan Koba and Murzak Koba cultures represent the same cultural tradition. We argue that the introduction of pressure blade technology led to the transformation of the Shpan Koba industry. Unfortunately, the material from Layer 4 does not allow for arranging it by depositional depth. Microliths that can be associated with one of the cultures are found at both the top and bottom of the layer. This may be the result of washout processes affecting the deposit. Alternatively, the transformation of the Shpankobian industry may not have involved a sudden shift in flaking techniques or microlith typology. Archaic features may have coexisted with innovative technology for some time.

The transformation of the Shpankobian industry into the Murzakkobian industry, driven by changes in blade production technology, was a widespread phenomenon in the Early Holocene. This process can be traced across regions associated with the Trialetian industry. S. K. Kozlowski (1999) described this industry in detail, associating it with Asia Minor, the eastern, southern, and western coasts of the Caspian Sea, and the South Caucasus. The main features of the Trialetian industry were as follows:

- the use of direct and indirect percussion methods in the reduction of cores;
- the presence of asymmetric triangles;
- the presence of truncated faceted blades;
- the presence of symmetric triangles;
- the use of the microburin technique.

It should be noted that not all sites display all of these characteristics, but both the Shpankobian and Murzakkobian industries can be assigned to the Trialetian group. The Shpankobian industry shows particularly close parallels with sites in the South Caucasus. The site of Kotias Klde (Meshveliani et al. 2007) is almost identical to the Shpankobian complexes in Crimea. The chronological unity of the Trialetian sites of Crimea and the Caucasus has been described in detail (Manko, Chkhatarashvili 2022). Here, we will highlight one unique parallel: the presence of bladelets with bipolar retouched edges, a feature characteristic only of Trialetian cultures in the Caucasus and Crimea, and associated with the influence of later Imeretian cultural traditions. Trialetian industries in other regions also demonstrate technological development associated with the emergence of the pressure technique. Evidence of this technique has been documented at Darkveti (Layer 5) (Nebieridze 1978) and Chokh (Layer C) (Amirkhanov 1987). Thus, we can trace the parallel development of Trialetian cultures in Crimea, the South Caucasus, and the western Caspian region.

It is therefore necessary to identify the origin from which the Shpan Koba industry acquired pressure blade technology. The Kukrek culture initially ap-

Table 1. **Fatma-Koba. Lithic artefacts from Layer 4. Absolute number and percentages are given**

Types of artefacts	**Number**	**Percentage**
Cores linked with direct or indirect percussion	2	0.19 %
Cores linked with pressing flaking	2	0.19 %
Core fragments	23	2.19 %
Crested blades	6	0.57 %
Blades (lw dp*)	21	2.00 %
Proximal blade fragments (lw dp*)	14	1.33 %
Medial blade fragments (lw dp*)	3	0.29 %
Distal blade fragments (lw dp*)	5	0.48 %
Bladelets (lw dp*)	9	0.86 %
Proximal bladelet fragments (lw dp*)	2	0.19 %
Medial bladelet fragments (lw dp*)	0	0.00 %
Distal bladelet fragments (lw dp*)	3	0.29 %
Blades (lw pf**)	0	0.00 %
Proximal blade fragments (lw pf**)	9	0.86 %
Medial blade fragments (lw pf**)	1	0.10 %
Distal blade fragments (lw pf**)	1	0.10 %
Bladelets (lw pf**)	13	1.24 %
Proximal bladelet fragments (lw pf**)	14	1.33 %
Medial bladelet fragments (lw pf**)	27	2.57 %
Distal bladelet fragments (lw pf**)	11	1.05 %
Microblades (lw pf**)	2	0.19 %
Proximal microblade fragments (lw pf**)	5	0.48 %
Medial microblade fragments (lw pf**)	2	0.19 %
Distal microblade fragments (lw pf**)	2	0.19 %
Corticated flakes (≥75% of the cortex)	28	2.67 %
Corticated flakes (<75% of the cortex)	41	3.90 %
Non-corticated flakes	391	37.24 %
Chunks	186	17.71 %
Burin spalls	13	1.24 %
Modified pieces	**214**	20.38 %
Total	**1050**	100.00 %

(lw dip*) Linked with direct and indirect percussion.
(lw pf**) Linked with pressure flaking.

pears to be a plausible candidate, as both cultures coexisted in Crimea during the Preboreal-Boreal period. However, the Kukrek culture can be excluded for several reasons. Firstly, Kukrekian bullet-like cores are absent from Layer 4 at Fatma-Koba. Secondly, the long coexistence does not correlate with the spread of pressure blade technology in early Shpan Koba complexes. Moreover, the Kukrek pressure blade technology was associated with the production of grooved wooden tools used to hold cores that were very difficult to replicate.

Who, or what, mediated this transition? Low symmetrical trapezes with abruptly retouched sides occur in Layer 4. This type of trapeze is known from south-eastern Europe in the Hrebenyky and Matviiv Kurgan cultures, and from the southern and central Caucasus in the complexes of Darkveti culture (Manko, Chkhatarashvili 2022). It seems reasonable to assume that the westward movement of the Darkvetian population could have led to the emergence of a new centre of pressure flaking distribution in the south of Eastern Europe.

The westward movement of the Darkvetian population (Manko, Chkhatarasvili 2022) is supported by absolute chronology. Layer 4 (M1) at Sosruko dates to the first half of the Boreal and yielded trapezes on pressure blades as well as tongue-like cores (Леонова 2021). All of these artefacts have close analogues in Layer 4 at Fatma-Koba, which is also dated to the first half of the Boreal.

Low symmetrical trapezes with abruptly retouched sides have been recorded in numerous Crimean complexes, including Layer 3 at Shan Koba, Layer 3 at Murzak Koba, Layers 4 and 3 at Fatma Koba, and several sites on the Kerch peninsula. It should be noted that such trapezes are always accompanied by Murzak Koba culture materials.

Whether a synthesis of Murzak Koba and Darkveti cultural traditions took place remains unclear. It is possible that during the second half of the Boreal period, both cultural traditions were distributed across the same territory, used the same campsites, and maintained close contacts. The technological innovations of the Darkveti culture transformed the Shpankobian industry.

Supporting evidence can be found in the material from Fatma Koba and Murzak Koba excavated by H. A. Bonch-Osmolovskyi. Excavations in the 1950s were not always sufficiently precise. For example, Layer 4 at Fatma Koba was investigated as a single unit, whereas H. A. Bonch-Osmolovskyi divided the lithological layers into horizons, which allowed for more detailed observations.

Layers 4.3 and 4.1 at Fatma Cave, Layers 4, 3.4, and 3.2 at Murzak Koba (excavated by H. A. Bonch-Osmolovskyi) yielded only trapezes. At the same time, Layers 4.2 at Fatma Cave, 3.3 and 3.1 at Murzak Koba, contained the full range of hunting weapons, asymmetrical triangles, etc. It should be noted that the term “Murzak Koba

Table 2. **Fatma Koba. Modified pieces from Layer 4**

Modified pieces	On flakes	%	On blades	%	On pressure blades	%	Total	%
Scrapers	1	6.67 %	4	3.67 %	5	5.56 %	10	4.67 %
Burins	6	40.00 %	25	22.94 %	12	13.33 %	43	20.09 %
Retouched flakes	2	13.33 %	0	0.00 %	0	0.00 %	2	0.93 %
Notched flakes	6	40.00 %	0	0.00 %	0	0.00 %	6	2.80 %
Combined tool	0	0.00 %	1	0.92 %	0	0.00 %	1	0.47 %
Retouched blades	0	0.00 %	31	28.44 %	14	15.56 %	35	16.36 %
Notched blades	0	0.00 %	35	32.11 %	24	26.67 %	59	27.57 %
Piercing tool	0	0.00 %	0	0.00 %	1	1.11 %	1	0.47 %
Burinated pieces	0	0.00 %	0	0.00 %	2	2.22 %	2	0.93 %
Triangles	0	0.00 %	3	2.75 %	12	13.33 %	15	7.01 %
Trapezes	0	0.00 %	0	0.00 %	14	15.56 %	14	6.54 %
Backed bipolar blades	0	0.00 %	4	3.67 %	1	1.11 %	5	2.34 %
Backed blades	0	0.00 %	1	0.92 %	1	1.11 %	2	0.93 %
Oblique truncated facetted blades	0	0.00 %	1	0.92 %	4	4.44 %	5	2.34 %
Tanged point	0	0.00 %	2	1.84 %	0	0.00 %	2	0.94 %
Awls	0	0.00 %	2	1.83 %	0	0.00 %	2	0.93 %
Total	**15**	**100.00 %**	**109**	**100.00 %**	**90**	**100.00 %**	**214**	**100.00 %**

culture" may encompass at least two interstratified phenomena. It is also likely that Layer 3 at Shan Koba consists of several layers. The excavations did not allow us to identify clean layers. Nevertheless, the presence of seven trapezes of the Darkvetian type in Layer 3.4 of Shan Koba should be noted.

The presence of low trapezes in some complexes of the Murzak Koba culture likely reflects the coexistence of two technological traditions. Darkvetian groups or Darkvetian technological traditions may have spread widely into the steppe zone, where the Hrebenyky and Matviiv Kurgan cultures developed.

In conclusion, the Layer 4 complex at Fatma Koba reflects the interaction between the Shpankobian/Murzakkobian and Darkvetian groups. The influence of the Darkvetian culture led to a significant transformation of the Shpan Koba lithic industry, which resulted in the emergence of the Murzak Koba culture. This transformation was driven by the adoption of Darkvetian pressure blade technology methods. However, the introduction of new methods for producing blades did not result in any changes to the overall typology.

It is possible that during the late Preboreal and early Boreal periods, the site was used either simultaneously or alternately by people of different cultural traditions. Alternatively, cultural ties may have been established between different population groups during the joint use of the site, leading to the transformation of the Shpankobian industry.

Table 3. **Radiocarbon dates**

№	Date uncal BP	Lab. No.	Material	Date cal BC	Site	Context	Culture	Publication
1.	9542 ± 49	FTMC-IH63-3	Bone	9121–8736	Fatma Koba	Layer 4	Shpan Koba	In first
2.	9034 ± 52	FTMC-IH63-4	Bone	8292–7973	Fatma Koba	Layer 4	Shpan Koba / Murzak Koba transition	In first
3.	9363±73	KIA-9570	Bone	9043-8348	Shan Koba	Layer 4	Shpan Koba	Biagi at al. 2014
4.	9575±45	GrA-50244	Bone	9193-8767	Shan Koba	Layer 4	Shpan Koba	Benecke 2006
5.	9560± 50	KIA-3589	Bone	9191-8753	Shpan Koba	Layer 2-1	Shpan Koba	Яневич 2019
6.	9150± 150	ГИН-5276	Bone	8798-7868	Shpan Koba	Layer 2-3	Shpan Koba	Яневич 2019
7.	9790± 50	KIA-3688	Bone	9362-9161	Shpan Koba	Layer 2-4	Shpan Koba	Яневич 2019
8.	9730± 50	KIA-3687	Bone	9299-8878	Shpan Koba	Layer 2-5	Shpan Koba	Яневич 2019
9.	9760± 60	KIA-3686	Bone	9327-8867	Shpan Koba	Layer 3-2	Shpan Koba	Яневич 2019
10.	9890± 80	Ki-5824	Bone	9741-9237	Shpan Koba	Layer 3-2	Shpan Koba	Яневич 2019
11.	9930± 60	KIA-3685	Bone	9739-9271	Shpan Koba	Layer 3-4	Shpan Koba	Яневич 2019
12.	9840± 50	KIA-3684	Bone	9444-9236	Shpan Koba	Layer 3-5	Shpan Koba	Яневич 2019
13.	9940± 50	KIA-3683	Bone	9734-9289	Shpan Koba	Layer 3-6	Shpan Koba	Яневич 2019
14.	8357± 52	KIA-9571	Bone	7573-7194	Shan Koba	Layer 3.3	Murzak Koba, early phase	Benecke 2006
15.	8625± 40	GrA-35704	Bone	7734-7584	Laspi 7		Murzak Koba, early phase	Яневич 2019
16.	8620± 40	GrA-35703	Bone	7735-7582	Laspi 7		Murzak Koba, early phase	Яневич 2019
17.	10400±60	RTT-4703	Bone	10648-10047	Kotias Klde		Trialetian	Meshveliani et al. 2007
18.	9270± 60	RTT-4698	Bone	8693-8304	Kotias Klde		Trialetian	Meshveliani et al. 2007
19.	10120±30	IGANAMS-8441	Bone	9927-9458	Chokh	Layer D	Trialetian	Амирханов 2022
20.	10410±30	IGANAMS-8112	Bone	10635-10149	Chokh	Layer D	Trialetian	Амирханов 2022
21.	10470±30	IGANAMS-8443	Bone	10670-10244	Chokh	Layer E	Trialetian	Амирханов 2022
22.	8170± 25	IGANAMS-9876	Bone	7316-7066	Sosruko	Layer M1(4)	Darkveti culture	Леонова 2021
23.	8940± 30	IGANAMS-7987	Bone	8254-7962	Sosruko	Layer M1(4)	Darkveti culture	Леонова 2021
24.	8780± 170	LU-9167	Bone	8288-7543	Sosruko	Layer M1(4)	Darkveti culture	Golovamova et al. 2020

* INTCAL20 terrestrial (Northern Hemisphere) calibration curve (Reimer et al. 2020). OxCal 4.4.4 (© Christopher Bronk Ramsey 2025).

Conclusions

The transformation of the Shpan Koba culture occurred over a very short period at the end of the Preboreal and during the first half of the Boreal. During this period, the spread of pressure blade technology methods is recorded in all regions, without exception, associated with the development of this culture. This circumstance allows us to assert that the global information network continued to exist during this time.

The cultural influence of the Darkvetian (Hrebenyky) culture was associated with the spread of pressure blade technology methods in the Crimea.

The development of Murzak Koba culture in the Crimea probably continued until the beginning of the Atlantic period, as evidenced by the presence of asymmetrical triangles in Layer 3 at Fatma-Koba. Murzakkobian materials occur here within the same lithological layer as those of the Tash Air culture.

The Shpan Koba and Murzak Koba cultures were part of the Trialetian culture, which existed from the 10th to the 8th millennium BC across Asia Minor, the Eastern, Southern, and Western Caspian regions, the Southern Caucasus, the Crimea, and the Dnipro rapids region.

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Валерій О. Манько[1]*, Сергій А. Теліженко*[2]

[1]*Кандидат історичних наук, старший науковий співробітник, Інститут археології НАН України, відділ археології Криму та Північно-Західного Причорномор'я, ORCID: 0000-0002-2990-7234, Valery_Manko@ yahoo.com*

[2]*Кандидат історичних наук, старший науковий співробітник, Інститут археології НАН України, відділ археології Криму та Північно-Західного Причорномор'я, ORCID: 0000-0003-1677-4900, telizharh@hotmail.com*

КРЕМ'ЯНИЙ КОМПЛЕКС ШАРУ 4 СТОЯНКИ ФАТЬМА КОБА, КРИМ УКРАЇНА

Розкопки стоянки Фатьма Коба відбувалися у 1927 р. під керівництвом Г. А. Бонч-Осмоловського та у 1956–1958 рр. під керівництвом С. М. Бібікова. Колекція 1927 р. зберігається у Петербурзі й наразі недоступна для вивчення. Статтю присвячено аналізу колекції 1956–1958 рр., що зберігається у наукових фондах археологічного музею Інституту археології НАН України.

Культурний шар 4 формувався протягом бореального періоду голоцену як результат відвідування стоянки носіями різних культурних традицій, які проживали на території Криму одночасно. Є сліди тимчасового перебування на місці стоянки носіїв кримської свідерської, кукрецької та гребениківської культур. Основу ж комплексу складають матеріали, які належать до шпанкобинської та мурзаккобинської культур. Відкладення культурного шару відбувалося протягом досить тривалого часу, тому основним завданням аналізу було відокремлення шпанкобинських та мурзаккобинських артефактів. З цією метою здійснено аналіз крем'яних артефактів, виготовлених із різних типів заготовок та відходів виробництва: відщепів та пластинчастих заготовок, отриманих методом ручного відтиску.

Враховуючи той факт, що ранні шпанкобинські комплекси не були пов'язані з використанням відтискної техніки, вдалося відносно коректно розділити знаряддя двох археологічних культур. Порівняння знарядь на звичайних та відтискних пластинах показало, що типологія комплексів є абсолютно подібною. Особливо показовим було порівняння мікролітичних комплексів, які продемонстрували морфологічну й типологічну подібності.

Отримані дані типологічного аналізу дозволили зробити висновок, що мурзаккобинська культура пов'язана походженням із шпанкобинською. Трансформація шпанкобинської культури відбулася під впливом міграційної активності дарквецького населення Північного Кавказу, які з'явилися на території Криму в середині Бореалу.

Ключові слова: Крим, ранній голоцен, еріалетська індустрія, відтискна техніка, асиметричні трикутники, біполярна ретуш, міграції, мережа взаємодії.

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