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The Middle Paleolithic of Arabia*

The study focuses on the origin and evolution of the Middle Paleolithic in the Arabian Peninsula, a major crossroads of human and animal migrations connecting Africa with Eurasia in the Late Middle and Early Late Pleistocene. Middle Paleolithic human dispersal in Arabia was caused by intermittent environmental changes and related fluctuations of the Bab-el-Mandeb level. A key role in the African Middle Paleolithic was played by Afro-Arabian Nubian lithic industries showing characteristic Levallois features and associated with anatomically modern humans who had migrated from Africa. Arabian finds are discussed with reference to the Out-of-Africa and Multiregional models of human evolution. Based on the totality of cranial, archaeological, and paleogenetic data, it is proposed that modern humankind emerged from an admixture of at least four related taxa, which had evolved in Africa and Eurasia. A hypothesis about the migration of Homo sapiens from Africa across Arabia to Southeast Asia and Sahul 70–50 ka BP is discussed.

Keywords: *Aridization, pluvials, Pleistocene, Levallois reduction method, bifaces, Afro-Arabian Nubian industry.*

The main Middle Paleolithic sites of Arabia

Owing to its geographical position, the Arabian Peninsula, just as the Levantine corridor, was an extremely important transition region for animals and humans, migrating between Africa and Eurasia. The possibility for migration through Arabia was determined by climatic conditions. Over 3 million square kilometers of the Peninsula are covered with deserts. During periods of cooling, an arid climate would emerge in Arabia, when the sea level would decrease and the Bab-el-Mandeb would dry out, or large areas of ground with small channels, passable for human and animal migrations, would emerge between the African and Arabian shores. During aridization of the climate on the Peninsula, desertification would intensify, particularly in the interior areas. Areas of comfortable living environment would shrink, and human communities would concentrate around paleolakes, in refugia where there were available water sources. The prolonged habitation of human groups in isolation triggered the appearance of new techniques of primary and secondary lithic reduction. During the pluvials, the areas of human and animal habitation would expand, and migrations within the Arabian Peninsula would become more intense. Moving between Africa and Eurasia would become hampered owing to the rise of the sea level, when the Bab-el-Mandeb would become a serious obstacle.

According to its natural environment, Arabia belongs to the Saharo-Arabian phytogeographic region. From

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this point of view, the most favorable periods for the settlement of humans in the Peninsula in the Middle Paleolithic were MIS 5e and 5a*, and the first half of MIS 3 (Sanlaville, 1992; Rose, 2004; Rosenberg et al., 2012; Drake, Breeze, Parker, 2013; and others). After 115 ka BP, when Arabia and the Levant had the most favorable environmental conditions for vegetation, the Sahara and all of North Africa experienced a period of strong aridization (Drake, Breeze, Parker, 2013). In MIS 5.2 (100–90 ka BP), Arabia also underwent considerable aridization (Preusser, 2009). In the first half of MIS 3 (55–50 ka BP), conditions for human habitation in Arabia slightly improved, as is evidenced by the sites in the area of Wadi Surdud in the western part (Delagnes et al., 2012) and Jebel Faya 1 (the upper cultural layers) in the eastern part of the Peninsula (Armitage et al., 2011). Both sites were located in a kind of refugium with reliable sources of water.

The periods when pluvial and arid conditions did not coincide in various parts of the region, were most favorable for migration processes. The specific environmental situation in the Arabian Peninsula determined the character of human settlement in the region and the techno-typological features of the industry in the Middle Paleolithic. We should mention the possibility of multiple human migrations from Africa into Arabia at the end of the Middle/Late Pleistocene, and a wide variety of industries, which resulted from the prolonged isolated habitation of human populations around paleolakes in extremely arid periods. When the climate would become warmer and more humid, arid steppes and deserts would turn into semi-arid savannah, the territories of comfortable human habitation would greatly expand, and the humans could have migrated not only all over the Peninsula, but also from Africa to Arabia and back (Rosenberg et al., 2011, 2012), as well as to the neighboring regions.

Thus, there were several periods of warming accompanied by increased humidity in the Late Pleistocene. Humans inhabited not only oases but also desert areas of Arabia. Particularly favorable was the initial period of the last interglacial stage, when a warm and humid climate was established in the Peninsula, and an arid climate was established over a significant part of Northeast Africa. The population in Arabia decreased during cooling and aridization. The prolonged habitation of hunter-gatherer groups in isolated natural and climatic niches led to technological divergence and the emergence of local Middle Paleolithic industries. At the time when climate conditions in the Levant and Arabia significantly differed, hunter-gatherer groups would move to the areas with a more favorable climate, and migrations from north to south and back would become more active.

The dynamics of migration flows between Africa and Arabia largely depended on sea level changes. When the sea level was lower, significant areas of coastal plains would emerge in Arabia and become inhabited by humans. A reverse process would occur when the sea level would rise: the sea would swallow the coastal areas, including those where Paleolithic sites used to be located. Therefore, the sites that emerged during the regression of the sea are presently not available for archaeological study. As it was mentioned above, the periods of warming and increased humidity were favorable for the movement of people from Africa to Arabia and within Arabia, but at the same time, the strait separating the south of Arabia from Africa also expanded. This mismatch of various parts of the region in their climatic conditions determined the specific nature of human settlement in Arabia in the Pleistocene.

In Arabia, no paleoanthropological finds of the Early and Middle Pleistocene have been discovered. The most numerous Lower Paleolithic sites in this region belong to the Acheulean tradition (Petraglia, 2003). A number of Lower Paleolithic localities with pebble-and-flake and Acheulean industries were discovered in Arabia by the Soviet-Yemen expedition, which worked for 20 years starting in 1992. The expedition results have been summarized by K.A. Amirkhanov (1991, 2006) in numerous articles and two monographs. The earliest Paleolithic localities with the pebble-and-flake industry, found by the expedition members, date between 1.65–1.35 Ma BP (Amirkhanov, 2006). During the field work, 21 sites with the Acheulean industry were found in addition to the sites with the pebble-and-flake industry. Four sites with the Acheulean industry, Mashhad I, III, IV, and V, have been identified as stratified sites.

Sites in various geomorphological positions containing the Acheulean industry were studied by Amirkhanov in several provinces of South Yemen. They form several groups oriented in a west-east direction. The easternmost group comprised localities of Wadi Dawan, the western group—localities in the Jebel Tala area. They are separated by approximately 700 km.

A total of 342 artifacts were discovered at the sites, including 52 artifacts identified as bifaces or partially prepared biface-like tools. The majority of the finds represented waste products or the results of raw material testing. The tool set was dominated by a variety of side-scrapers.

Products of primary reduction at the Acheulean localities of South Arabia were mostly represented by single-platform cores. Double-platform cores were very scarce. A small number of cores did not have specially-

*The designation of intervals according to oxygen isotope stages (numeric and alphabetic) in this article corresponds to that of the studies listed in the references.

prepared striking platforms, and hammerstone strikes were applied against the natural surface. The majority of cores showed striking platforms shaped by one or two transverse spalls. Quite often, striking surfaces constituted a sharp angle with the flaking surface. Additional rejuvenation of the striking platform was not performed. Cores were reduced by removing parallel and sub-parallel massive blades and blade-flakes. As Amirkhanov observed, "Firstly, we cannot speak about the borrowing of this technique, since it emerged very early and was conditioned by the peculiarities of the local raw materials. Secondly, the introduction of the sub-parallel reduction technique did not lead to a qualitative change in the industry or to substantial acceleration of the Paleolithic culture development. Broadly defined, the Levallois reduction technique is combined here with the widespread use of bifacially worked tools" (2006: 142).

The Acheulean tradition of South Arabia, from our point of view, represents special and very clear evidence of the fact that the Acheulean is not a culture but an industry. In this regard, it is very important to consider the chronology of emergence of the bifacial technique in Arabia. Amirkhanov divides the Acheulean localities of South Arabia into early Acheulean and late Acheulean, according to techno-typological criteria. In his opinion, Early Acheulean sites might have belonged to one of the stages in the first half of the Acheulean, while Late Acheulean sites might have belonged to one of the stages of the second half of that period. The materials from the stratified sites of the Mashhad group, dated to 450–410 ka BP, can be attributed to the first half of the Acheulean (Ibid.: 288). The Jol-Urum I locality was also considered by Amirkhanov to be early Acheulean.

All Acheulean sites discovered by the expedition of Amirkhanov, in our opinion, constitute a single unit. They didn't contain any typical African or Near Eastern cleavers. All bifaces were of the same type and were manufactured from pebbles or large partings, but not from flakes. The tool set consisted mainly of various side-scrapers and choppers. The Acheulean of South Arabia represented a very specific homogenous technocomplex. The only TL-date was obtained for the site of Mashhad III using a sample from the layer underlying the cultural horizon; therefore, the age of the latter should not exceed 450 ka. Another Acheulean site was discovered at the foot of Jebel Tala; on the basis of the typology of the lithic assemblage it was dated to 250–100 ka BP (Report…, 1965). Later, the expedition of Amirkhanov found three more Acheulean localities in this area. According to their techno-typological features, the assemblages from these localities did not differ from those previously found at other Acheulean sites of South Arabia. Therefore, the South Arabian Acheulean sites can be dated to 450–130 ka BP.

The Soviet-Yemen Expedition of K.A. Amirkhanov discovered Middle Paleolithic sites mainly in Western Hadhramaut (Wadi Dawan and Wadi Al-Gabr). In total, 11 sites with shallow cultural layers were found. Amirkhanov (2006) united them into a single cultural and chronological group on the basis of the unity of the sites according to their geomorphological position, techno-typological features, similarity of raw materials, and the degree of patina formation and weathering of the objects' surfaces.

The technique of primary core reduction at all sites was based mainly on the principle of subparallel flaking. According to Amirkhanov, the Levallois index at all sites did not exceed the numbers typical for the classic Levallois industries (Ibid.: 296). The cores were mostly single-platform and subprismatic, intended for production of blade-blanks (Fig. 1, *10–12*). Amirkhanov identified an important feature: the rejuvenation of striking platforms, which was found in a small number of cores. He considered the lack of traces from additional treatment of striking platforms as one of the foundations for classifying the Middle Paleolithic Hadhramaut industry as Levallois non-faceted facies. Discoid shapes were also observed among the cores.

Some scholars identify three variants of the Middle Paleolithic industry in Central and North Arabia: the Mousterian of the Acheulean tradition, the pebble Mousterian, and the Aterian (Petraglia, Alsharekh, 2015). As far as the term "Mousterian" is concerned, archaeologists express some doubts as to the validity of its application to the materials from Arabia, "Despite the overall similarity in the reduction technology of cores and flakes, the Arabian 'Mousterian' assemblages are not the direct equivalents of the Levantine and Zagros Mousterian" (Ibid.: 679). From our point of view, Arabia, as well as the Levant, had no Mousterian industry (Derevianko, 2016a, b, c).

Three Middle Paleolithic localities were discovered in the Nefud Desert in the north of Saudi Arabia, in the area of the Jubbah paleolake (Petraglia et al., 2011, 2012). The settlements were located along the shores of the lake, which was overgrown with grass and sparse trees. The time of the hominin settlement corresponds to the humid and warm periods MIS 7 and 5. The stratigraphic sequence included aeolian and calcrete deposits, paleosols, and buried soils. Multidisciplinary research has established that during the peak of rainfall in MIS 5e, the area of the lake reached 76 km^2.

Two cultural layers were identified at the earliest site of Jebel Qattar 1 (JQ-1). Twenty eight artifacts mostly made of quartz and quartzite (68 %), were extracted from the lower layer in the upper part of the buried soil, which was attributed to MIS 7. All finds were flakes including Levallois varieties with faceted striking platforms (Fig. 2, *10*). The flakes were usually small, around 3 cm

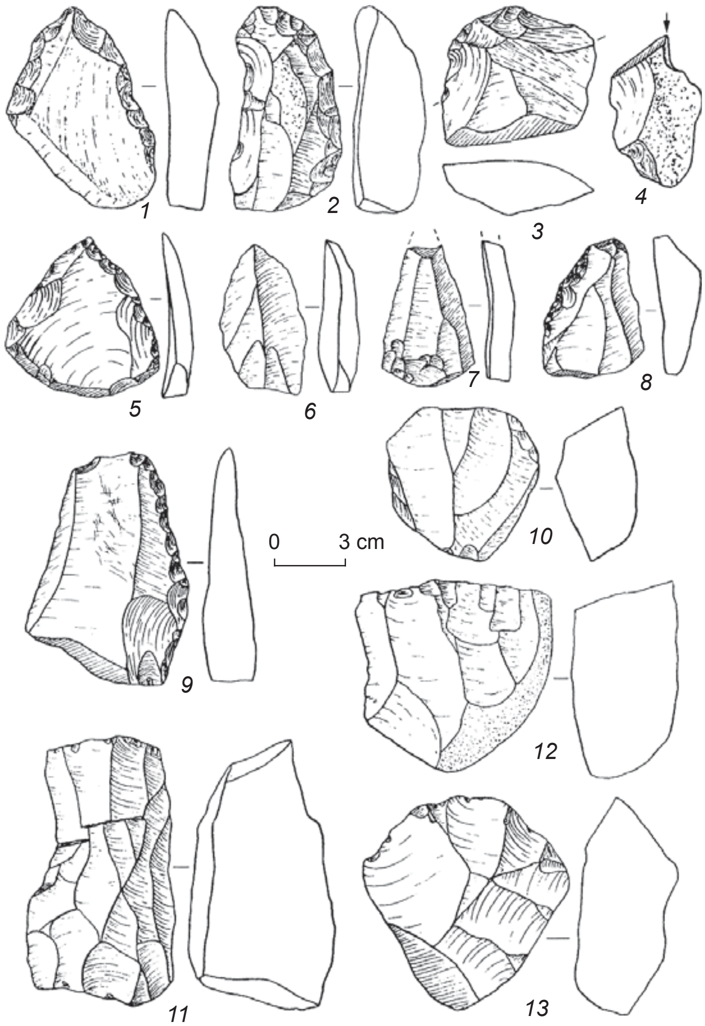

Fig. 1. Middle Paleolithic artifacts discovered in Yemen (after: (Amirkhanov, 2006)).
1–3, *8*, *9* – side-scrapers; *4* – burin; *5–7* – Levallois points; *10*, *12* – single-platform cores; *11* – double-platform subprismatic core; *13* – fan-shaped core.

in size. This can be explained by the properties of quartz and quartzite mostly used at this site, which occurred as individual inclusions of small sizes. The OSL-date of 211 ± 16 ka BP was obtained for this layer.

There were 518 artifacts discovered at the site of Jebel Qattar 1 in an unclear stratigraphic position. The second cultural horizon, where the finds occurred *in situ*, was found in the lower part of the deposits classified as paleosol of the MIS 5a period. Landscapes with mixed grassy vegetation of the S3 type and small inclusions of woody vegetation were typical of the period when this horizon was formed. These landscapes testify to the climate change towards aridization.

There were 114 artifacts of small size found in the upper cultural layer at the site of Jebel Qattar 1. They included 95 pieces of debitage, 9 cores, and 10 retouched tools mostly made of quartz and quartzite (89 %). The cores were small-sized, of the Levallois type; they were discoid, radial, and unilateral for production of atypical Levallois points. Traces of faceting were observed in 19 % of blanks. In ten objects, retouching was applied along one edge from the dorsal and ventral sides. One pseudo-Levallois point had bilateral retouch. According to scholars, the technique of primary reduction included the removal of short flakes from discoid cores, and detachment of flakes and pseudo-Levallois points from unilateral radial cores with faceted striking platforms (Fig. 2, *1–6*) (Petraglia et al., 2012: 7). This cultural horizon was dated to 95 ± 7 ka BP.

The site of Jebel Katefeh 1 (JKF-1) is located 800 m east of Jebel hill. The artifacts occurred at the surface on the top and on the slopes of the hill. In total, 923 objects were collected. Subsequently, archaeologists made an excavation trench 2 m wide and 12 m long, revealing nine layers consisting of interbedded sand and silt, which indicates instable climatic conditions, namely, the alternation of dryness and humidity.

The cultural layer occurred almost at the bottom of the stratigraphic sequence, in horizon H, which consisted of pale-yellow sand cemented with silt and veined with orange intercalations. Three hundred stone objects of small size were discovered in this layer. In total, 1222 artifacts were found in the layer and on the surface, including 1113 pieces of debitage (91 %), 99 cores (8 %), and only 10 partially retouched tools. Blanks without additional retouch must have been used for various works.

Ninety seven percent of the artifacts were made of quartz and quartzite. According to scholars, surface materials and finds from the stratified layer are technologically homogeneous and constitute a single group (Ibid.: 8). Cores of quartz (61 spec.) and quartzite (37 spec.) differ typologically. Archaeologists do not exclude the possibility that this resulted from the use of various raw materials and size of the original stone pieces.

According to techno-typological features, 39 cores were identified as Levallois cores, including centripetal cores with several negative scars, with a single and two opposed striking platforms, as well as unidirectional convergent and radial cores. Levallois points and flakes of triangular shape were produced from unidirectional convergent Levallois cores (Fig. 3). Radial cores were mainly used for production of flakes. Cores were made not only of quartzite blocks, which were readily available in this area, but also of large flakes. It was possible to carry out the refitting of individual artifacts. One flake of rhyolite (the source of the raw material is unknown) from

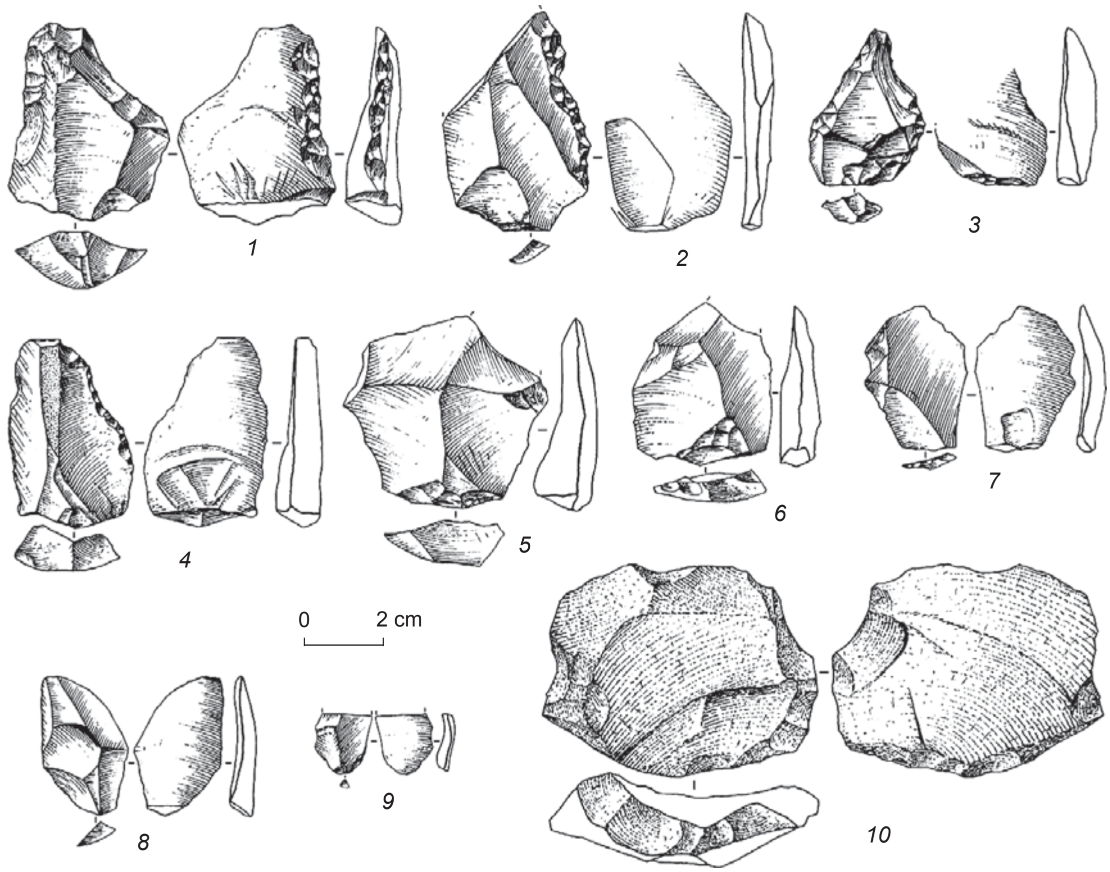

Fig. 2. Lithic artifacts from the site of Jebel Qattar 1 (JQ-1) (after: (Petraglia et al., 2012)).
1–4 – pseudo-Levallois points; *5*, *6* – Levallois flakes; *7–9* – flakes; *10* – Levallois flake with faceted platform.

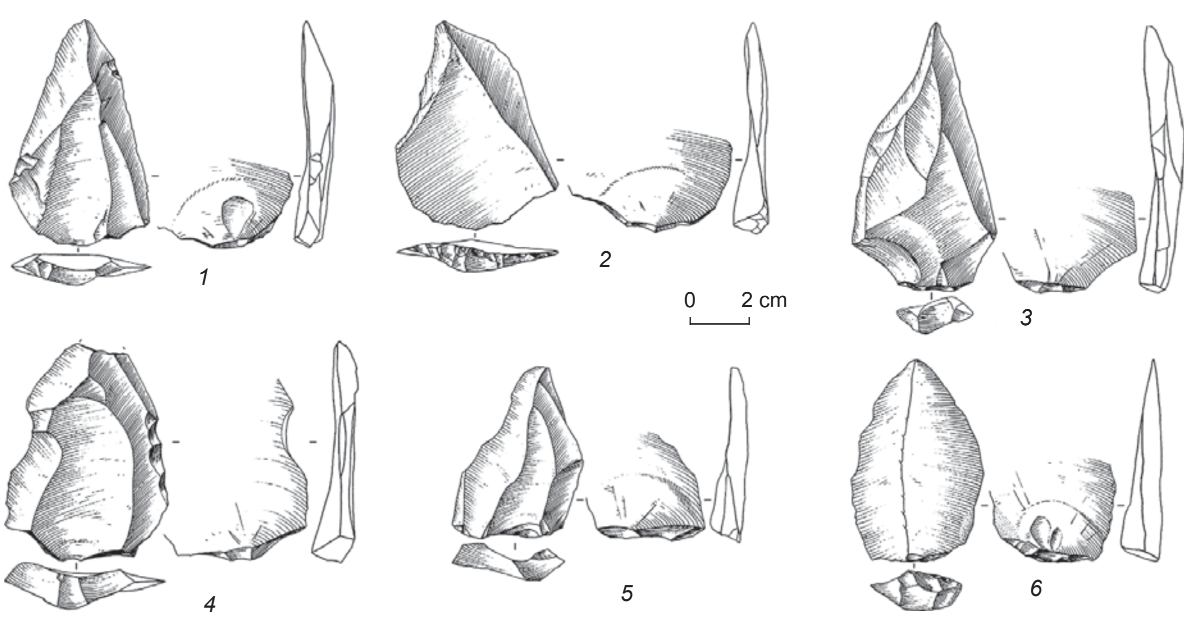

Fig. 3. Lithic artifacts from the site of Jebel Katefeh 1 (JKF-1) (after: (Petraglia et al., 2012)).
1–3 – Levallois triangular flakes (pseudo-Levallois points with faceted platforms); *4* – pseudo-Levallois point with one retouched side;
5 – Levallois triangular flake with a dihedral platform and negative scars of unidirectional flaking; *6* – flake with a faceted platform.

the culture-bearing layer had a counterpart in another flake found on the surface, which confirms the contemporaneity of the materials deposited in the layer and on the present-day surface.

Flakes (744 spec.) constituted the main part of the debitage. Twenty four percent of the flakes had faceted striking platforms. Only 11 blanks were retouched. Apparently, blanks in the form of flakes and points were used for work without additional retouch. This was confirmed by the analysis, using a high-power microscope, of seven blanks, including two Levallois points, three Levallois flakes, a blade, and a flake (six of quartzite and one of quartz), with relatively well-preserved edges. Five finds showed residues of vegetable or animal origin; thus, these objects must have been used for working with meat or plants. Such traces were absent only on the flake and on the blade. It was suggested that two Levallois points, which preserved the residues of animal origin, were attached to the shaft (Ibid.: 11). Scholars also believed that Jebel Katefeh 1 was a short-term site located on a dune near a water body.

Several OSL-dates were obtained for the cultural layer of that site: the early dates are 87 ± 6 and 86 ± 11 ka BP, and the later dates are 49 ± 5 and 53 ± 6 ka BP. Scholars supposed that the samples which gave the later dates, might have originally been deposited in the overlying layer.

The third site, Jebel Umm Sanman 1 (JSM-1), is located on the largest hill in the area; the hill's base reaches 7 km from north to south and 3 km from east to west. The site is located at the southeastern part of the hill, at a height of about 820 m. A small number of artifacts was discovered on the surface. The cross-section of a small excavation showed deposits up to 50–60 cm thick lying on the native limestone and overlain by a 5–10 cm layer of aeolian sand. The deposits had two layers: pink-gray (layer B) and light-grayish-yellow (layer C); both layers contained artifacts. Samples for OSL-dating were taken from layers B and C. Layer B revealed the dates of 96 ± 9 and 42 ± 9 ka BP, and layer C revealed the dates of 140 ± 14 and 61 ± 8 ka BP. Scholars believe that the most probable chronological range for this site is 100–60 ka BP. The humans settled in this place during the wet pluvial MIS 5, while in the arid period of MIS 4 the site was buried under the sand (Ibid.: 13–14).

In total, 88 artifacts were recovered from the site: 11 objects were gathered from the surface, and 77 were extracted from the layer. The collection contained 74 pieces of debitage, 4 retouched implements, and 10 cores. The raw materials were quartzite (92 %) and quartz (5 %). Three blanks, two fragments, and five Levallois cores with traces of centripetal reduction from the edge to the center (Fig. 4, *2–4*) were identified among the cores. Fourteen flakes had faceted platforms. Among the retouched objects, scholars found two bifaces. Judging by the drawing of one of them (Fig. 4, *5*), the object was bifacially treated with medium and small retouching only at the edges, and may be attributed to the side-scraper type.

M.D. Petraglia and his colleagues pointed out that the human groups could have penetrated into Arabia not only across the Bab-el-Mandeb Strait, but also from the Levant, Sinai, the plains of Mesopotamia, the Euphrates basin, and the Persian Gulf (Ibid.). Migration within the

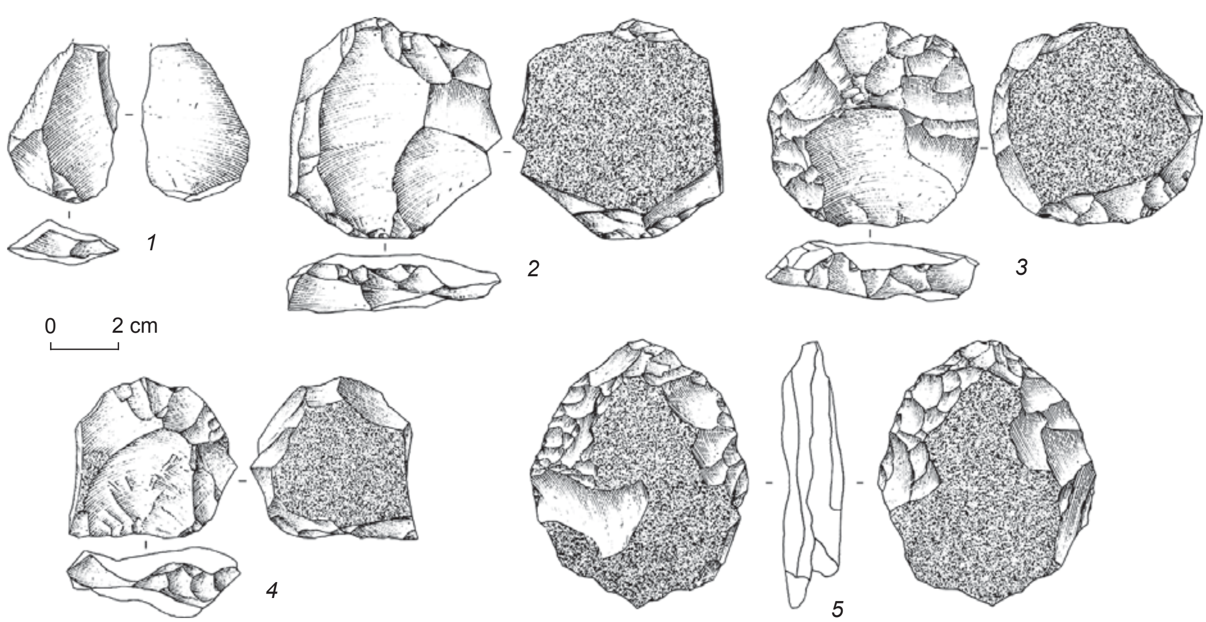

Fig. 4. Lithic artifacts from the site of Jebel Umm Sanman 1 (JSM-1) (after: (Petraglia et al., 2012)).
1 – Levallois flake; *2–4* – cores; *5* – biface.

Peninsula was possible during the pluvials, when there emerged an extensive network of rivers, and lakes were filled with water. According to scholars, multidirectional migrations and dispersals of groups of anatomically modern humans in the central regions of Arabia resulted in their hybridization with the Neanderthals in the northern territories (Petraglia et al., 2011).

When mapping the Jubbah paleolake, it became clear that it was not isolated, but was a part of an extensive system of other paleolakes. Judging by the formation of paleosols and calcrete deposits, which were formed in an arid climate, the natural environment in the vicinity of Jebel Qattar 1 and Jebel Katefeh 1 was favorable for human habitation. The date of 211 ± 16 ka BP for the lower cultural horizon at Jebel Qattar 1 allows considering it one of the earliest sites in the north of the Arabian Peninsula. This makes it possible to attribute it to the terminal Acheulo-Yabrudian period of the Levant, and to assume that the Neanderthals lived there at an early stage (Petraglia et al., 2012: 16).

Two other sites, Jebel Katefeh 1 and Jebel Umm Sanman 1, belonged to the later periods of MIS 5 and 4. According to their techno-typological features, their industry was close to the Middle Paleolithic industries of the Levant. The use of unidirectional, centripetal, and convergent unidirectional systems of primary reduction in the industry of sites at the Jubbah paleolake was similar to the Middle Paleolithic complex of the Tabun C type in the Levant. Upon comparing 55 cores from Jebel Qattar 1, Jebel Katefeh 1, layer C of Tabun, El-Wad, Skhul, the Horn of Africa, Haua Fteah (Libya), the Aterian industry, the Middle Stone Age technocomplexes in Africa, the Middle Paleolithic assemblages from the Indian sites of the time before and after the eruption of the Toba supervolcano, Petraglia and his colleagues found the closest similarities between the cores from the sites near Jubbah paleolake and from the C layer of Tabun. In their opinion, the cores from India differed from those found at the Middle Paleolithic sites to the south of the Sahara and the sites at Jubbah paleolake (Ibid.: 19–20).

Discussing the fate of the hunter-gatherer groups, who settled in the Nefud Desert in arid and hyper-arid periods, Petraglia and co-authors noted that small populations of Middle Paleolithic hominins in the Arabian Peninsula probably diminished to the point of local extinction or survived in natural niches-refugia, which was accompanied by gene flow (Ibid.: 20).

Middle Paleolithic artifacts, including Levallois cores with traces of centripetal blank reduction, were collected from the surface in the south-west of Saudi Arabia, near Lake Mundafan (Crassard et al., 2013). The materials from this locality shared some common features with the objects from Jubbah and from the Nubian industrial complex.

J. Rose and E. Marks analyzed the finds from the northwest of Arabia and proposed an original scenario for the development of industries in the area between Northwestern Arabia and the Southern Levant. Short broad-based Levallois points were found at the sites of Jubbah and Mundafan, and the industry manifests the features of radial core-reduction according to the Tabun C type, as well as features of Nubian Levallois reduction. Therefore, Rose and Marks (2014) argue that in MIS 5, areas of dispersal of the Levantine and African-Arabian hunter-gatherers might well have coincided.

According to S.J. Armitage and his colleagues, the lithic inventory from the Paleolithic site in Jebel Faya in the United Arab Emirates may indicate that anatomically modern humans might have settled in Arabia at an early time (Armitage et al., 2011). Jebel Faya is a 10 km long karstic massif rising 350 meters above the sea level. It is located to the south of the Strait of Hormuz, 55 km from both the Gulf of Oman and the Persian Gulf. The site of Jebel Faya (FAY-NE-1) was discovered in the northeastern part of the massif under a rock shelter located at an altitude of 180 m a.s.l. Three Paleolithic assemblages were identified during excavations at the site. The earliest assemblage C was deposited at the bottom. Three OSL-dates are available for that assemblage: 127 ± 16, 123 ± 10, and 95 ± 13 ka BP. It was overlain without a clear boundary by assemblage B with no available dates. The deposits containing these assemblages were covered by a sterile horizon, overlain by the deposits containing assemblage A.

In terms of primary reduction, assemblage C is characterized by several strategies of Levallois flaking. One of the strategies was associated with trimming of the working platform for the subsequent radial removal of flakes (Ibid.: Fig. 5, *2*). The blanks included volumetric blades, flakes, and foliate blanks, while the tools were represented by small bifaces, side-scrapers, end-scrapers, denticulate tools, burins, perforators, and retouched flakes (Fig. 5).

Assemblage B indicates the absence of the Levallois system of reduction. The tool set included side-scrapers, end-scrapers, notched-denticulate tools, burins, and perforators. Laminar removals were rare. The blanks for production of tools were flakes, including laminar flakes.

According to the archaeologists, assemblage C is neither technologically nor typologically associated with the Levantine Middle Paleolithic, but is very similar to the materials from the sites of East and Southeast Africa. On this basis, scholars suggest that the human groups who created assemblage C were associated with the anatomically modern humans who migrated from Africa in the early period of MIS 5 (Ibid.: 454). It is, however, difficult to agree with this suggestion. An industry from about 120 ka BP that would belong to the populations who preserved the tradition of manufacturing bifaces, is unknown both in East and North Africa. The Afro-

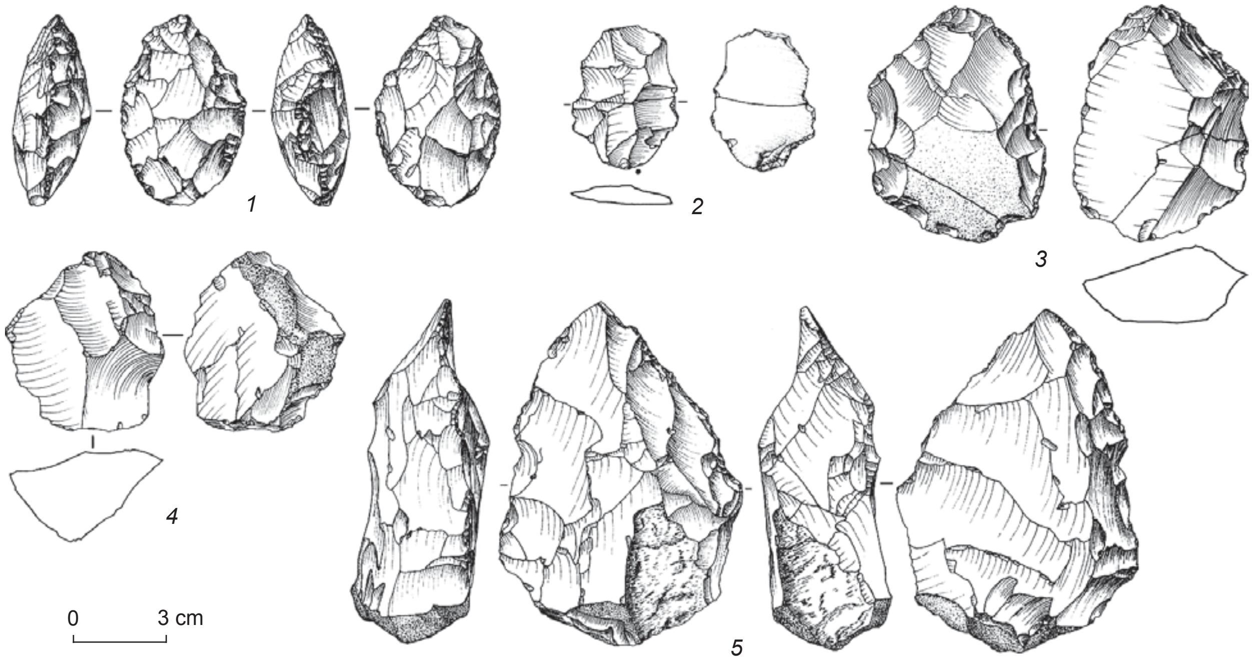

Fig. 5. Lithic industry from the site of Jebel Faya, assemblage C (after: (Armitage et al., 2011)).
1 – foliate biface; *2* – Levallois flake; *3* – bifacial blank; *4* – radial core; *5* – large biface.

Arabian industrial complex is apparently close in time to the assemblage C of Jebel Faya. It is impossible that two flows of anatomically modern people with very different industries (Jebel Faya and the Afro-Arabian Nubian industry) would leave Africa almost at the same time. Petraglia (2011) does not rule out the possibility that assemblage C was left by unknown hominins.

The assemblages A and B were quite different both from assemblage C and from the industries of the neighboring territories. This can be probably explained by the prolonged isolation of the creators of these assemblages during the arid period. Armitage and his co-authors do not exclude that assemblage A at the site of Jebel Faya might have been created by populations who left Africa during the second migration wave in the second half of the MIS 3, during the humidification of the climate, when many streams emerged, stretching from the Al Hajar Mountains to the basin of the Persian Gulf (Armitage et al., 2011). In our view, there are no sufficient grounds for such a conclusion.

Assemblage B does not have absolute dates, but judging from the stratigraphic position of the tools, Petraglia thought that it was possible to attribute it to the period of 95–40 ka BP (Petraglia et al., 2011). Several dates were obtained for assemblage A using the OSL-method: 38.6 ± 3.1 and 40.2 ± 3 ka BP; three finds from the overlying sterile sand gave the dates of 38.6 ± ± 3.2; 34.1 ± 3.2, and 34.1 ± 2.8 ka BP.

Assemblage C from the site of Jebel Faya contained bifacial foliates. In this regard, the Late Pleistocene assemblage with bifaces of this type is of interest, which was discovered in Oman along dry riverbeds associated with the basins of relic lakes on the Najd Plateau and in the Huqf depression (Rose, 2004). The rivers supplied by seasonal rains, which intensified in the pluvial periods, became permanent perennial streams flowing down from the highlands into a vast inner basin, currently covered by sands of the Rub' al Khali Desert.

All sites found in the area typically show the surface occurrence of the cultural layer, and small numbers of artifacts. The most numerous finds were collected at the site of Wadi Arah 5 km south of Bir Khafsa. The finds were concentrated in the deposits of fine-grained matt-brown chert on the edge of the crescent-shaped outcrop, which bordered the ancient playa lake. The archaeological materials without traces of rolling or minimum weathering were in undisturbed condition. In total, 42 artifacts were gathered over an area of 28 m^2.

The most numerous group comprised side-scrapers (11 spec.) and bifaces (9 spec.). Six side-scrapers were made on bilateral flattened flakes with faceted striking platforms. Bifaces had foliate or rounded shapes. They were made of thin discoid blades, and were shaped by intensive scalar retouching on both sides with soft-hammer percussion. The bifaces were of small size ranging from 4 to 8 cm.

The collection contains an exhausted core with centripetal negative scars. Considering this and other blanks, Rose concluded that the specific properties of raw materials forced the inhabitants of the site to combine the centripetal core reduction technique and the *façonnage* technique (Ibid.: 553). The same technique, in his opinion, was widespread in the Middle Stone Age in East Africa.

The sites with bifacial foliates on the Najd Plateau have no dates. Based on the fact that a similar industry was not found in the Levant and the Zagros, Rose argued that "If, indeed, the Oman foliates/ovates date to the Upper Pleistocene, it provides concrete evidence for one or more human dispersal events out of sub-Saharan Africa" (Ibid.: 554). Assemblage C from the site of Jebel Faya, which contains bifaces, and the finds from the site on the Najd Plateau may possibly belong to the same industry. Since Upper Paleolithic parallels to the Arabian industries with bifaces are not known in East Africa, and similar industries are absent from the transit area, technological convergence cannot be excluded. This assumption is supported by the materials of the Afro-Arabian Nubian industry that was discovered in the Dhofar Governorate in Oman, which could have been chronologically close to assemblage C. It is noteworthy that the so-called bifaces from the site near the Jubbah paleolake are completely different from the bifaces of Southeast Arabia, and in fact they cannot be called "bifaces" in the literal sense because they are typologically closer to bifacial foliate points.

The solution of a number of important issues relating to the Middle Paleolithic in Arabia is associated with the study of the Afro-Arabian Nubian technocomplex, which incorporated the African and Arabian tradition of lithic reduction, defined by the presence of traits typical of the Nubian variant of the Levallois system of core reduction (Usik et al., 2013: 244). The Nubian Levallois technology was first identified in the 1960s on the territory of Sudan and subsequently in the eastern oases of the Sahara, in the hills near the Red Sea. Short-term sites with the Nubian Levallois technology have been discovered in the Horn of Africa (Beyin, 2013).

Two different industries are identified in the Nubian technocomplex: the Early Nubian industry which chronologically belongs to the stage of MIS 5e (about 130–115 ka BP) and the Late Nubian industry dated to MIS 5a (82–71 ka BP), that is the chronological gap between the industries was about 50 ka. The Early Nubian technocomplex predominantly contains cores of the Nubian Levallois type with traces of bifacial reduction (type 2), and Lupemban foliate bifaces. The Nubian cores of type 1 were much more frequently used for primary reduction in the Late Nubian industry (Usik et al., 2013; Rose, Marks, 2014; and others).

The discovery of sites with the Early Nubian Levallois system of primary reduction in the south of Arabia was of great importance for solving the problems of the earliest human migrations from Africa into Eurasia. The first evidence for the spread of the Nubian Levallois technology in Arabia was discovered in the 1980s in Western Hadhramaut in Yemen.

New extensive material on the Middle Paleolithic of South Arabia was obtained during the studies of Paleolithic sites in the Dhofar Governorate in Oman from 2010–2012 (Rose, Marks, 2014; Rose et al., 2011; Usik et al., 2013; and others). Archaeologists managed to find there about 260 sites with superficial deposition of the cultural layer that contained artifacts associated with the Afro-Arabian Nubian technocomplex and the local version of the industry, which was formed at a later time on the basis of the classic Nubian complex. From several dozens to two thousand artifacts were found at individual sites in Dhofar.

Sites with the industries of the Nubian Levallois type mostly occurred on arid gravel plains and along dry riverbeds. The highest concentration of sites was in the vicinity of the village of Mudayy, which can probably be explained by the abundance of high-quality chert in the area. Scholars observe that Dhofar is characterized by a distinctive natural environment caused by its unique microclimate. The Jebel Qara-Jebel Samhan mountain chain inhibited the passage of humid monsoon winds coming from the Indian Ocean, which resulted in relatively high precipitation (200–300 mm per year) in the mountains and a decrease in temperatures from June to September (Usik et al., 2013: 245). The availability of a sufficient amount of lithic raw materials for producing tools, and permanent water sources attracting animals were bound to bring humans to the area. Localities with the classic Nubian complex are located in the area from the slopes of Dhofar to the Rub' al Khali Desert (Rose, Marks, 2014).

Scholars conducted a thorough analysis of the technical methods of processing stone tools from the five most informative sites in Dhofar (Usik et al., 2013). Within the framework of the Nubian Levallois method, two systems can be distinguished for forming the central distal ridge. For type 1 Nubian cores, two divergent distal removals were made from the main working surface for creating a steep distal ridge, and then a pointed blank was detached from the proximal end (Fig. 6). Type 2 cores show the traces of bilateral treatment of the main working surface (Fig. 7). In the process of subsequent splitting, the creators of the Nubian complex could have given the object of one type the appearance of another type. Archaeologists also distinguished a type 1/2 that in different proportions combines elements from the system of preparation of the two basic types. A small amount of centripetal Levallois and non-Levallois cores, including unidirectional, bidirectional, and transverse cores, have also been found at the Afro-Arabian sites (Ibid.).

There are only a few retouched tools present at the sites of the Nubian Levallois. We can give the following explanation for this fact: most sites were used as workshops, and people would take the best tools away with them. The tool set includes Levallois points, side-

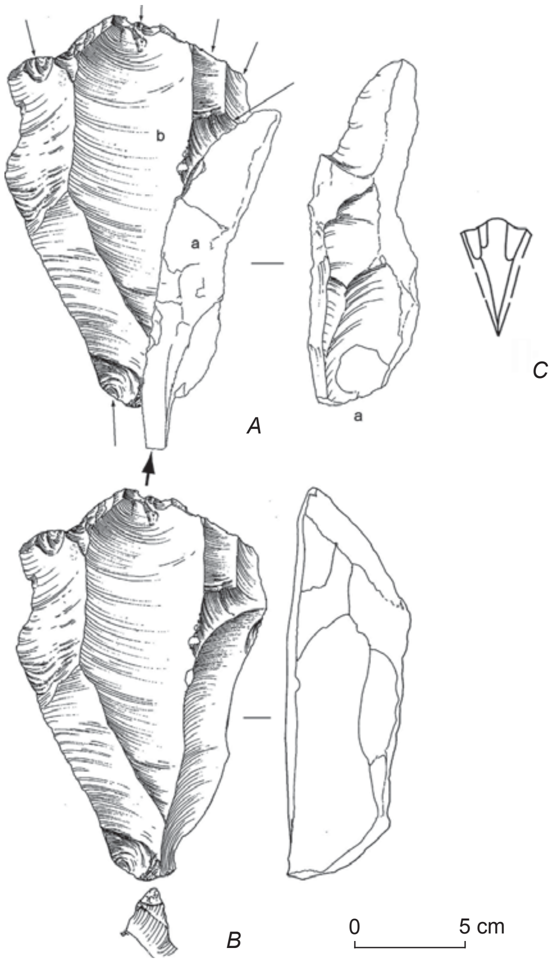

Fig. 6. Refit of a type 1 core (sample No. 564) from the locality TH 383 c (*A*, *B*) (after: (Usik et al., 2013)), and the reduction diagram of a type 1 core (*C*) (after: (Rose, Marks, 2014)).

scrapers, notched-denticulate tools, and end-scrapers. Bilaterally processed objects such as bifaces, typical of the Early Nubian Levallois industry in Northeast Africa, were not found in Dhofar.

The initial dispersal of the human groups possessing the Nubian technocomplex from Africa to Arabia happened at the beginning of MIS 5 (Rose et al., 2011). At that time, a severe drought struck North Africa (Drake, Breeze, Parker, 2013), while a warm climate formed in Arabia, and the populations crossed over on the shelf of the Bab-el-Mandeb to more favorable territories of Arabia. The site of Aybut Al Auwal, one of the earliest localities in Dhofar, is dated to 106 ± 9 ka BP (Usik et al., 2013).

The sites in Dhofar with materials belonging to the Afro-Arabian Nubian technocomplex are characterized by large elongated points removed from cores following the Nubian Levallois reduction system. Thus, at the site of Aybut Ath Thani, Nubian Levallois cores amounted to 155 out of 172 cores, or 90 %. The site of Jebel Markhashik 1 had the lowest share of such cores reaching 57 % (65 of 115 cores) (Rose, Marks, 2014).

At five sites selected for more detailed study, archaeologists recorded a large number of typical Nubian cores, which were common throughout Dhofar. The fifth site (TH 268) differed from other sites by the presence of Nubian cores of small size; there were also flat miniature bifacial cores with opposed faceted striking-platforms, and unilateral cores for parallel removal of laminar blanks (Fig. 8). The technology of producing these cores somewhat differed from the classic Nubian Dhofar technology. The localities where it was used are not isolated

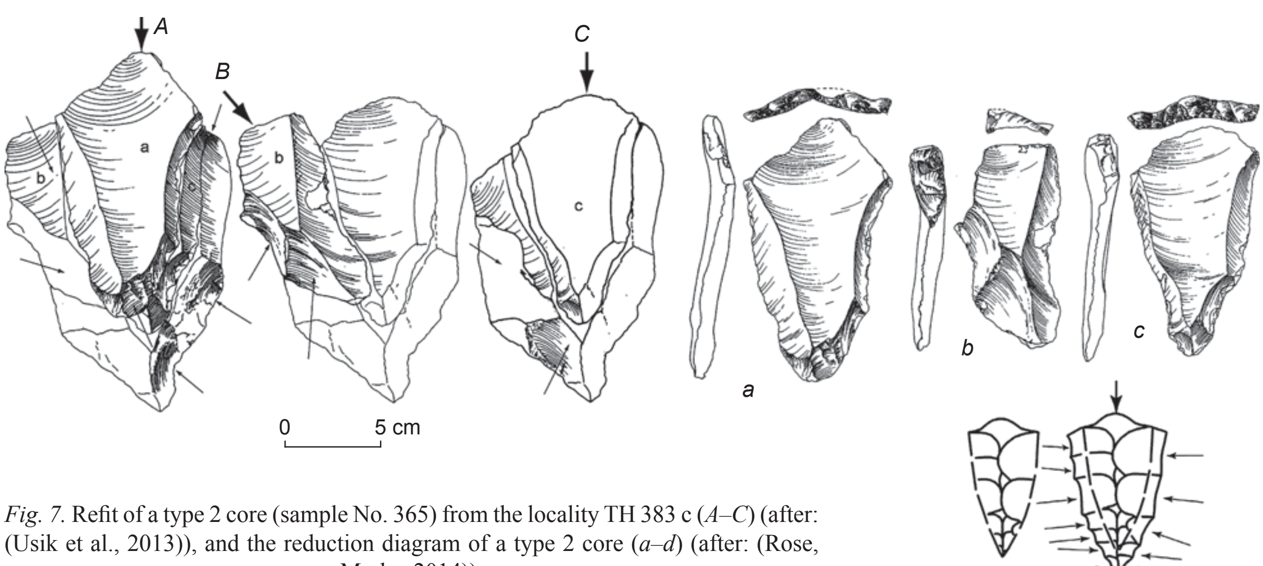

Fig. 7. Refit of a type 2 core (sample No. 365) from the locality TH 383 c (*A–C*) (after: (Usik et al., 2013)), and the reduction diagram of a type 2 core (*a–d*) (after: (Rose, Marks, 2014)).

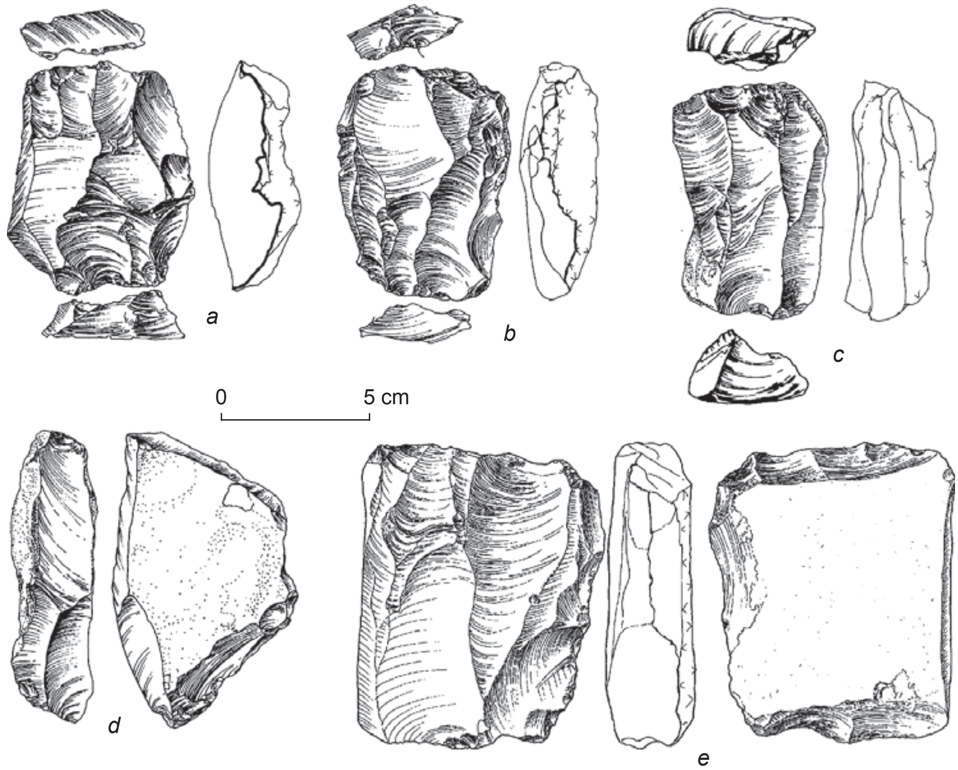

Fig. 8. Flat, opposed-platform bidirectional cores (after: (Usik et al., 2013)).

cases. Archaeologists classified their technocomplexes as a separate industry, calling it the Mudayyan industry (Usik et al., 2013: 261). The objects associated with the Mudayyan industry differed from the classic Dhofar artifacts. The Dhofar objects are often covered with a dense black patina containing spots of manganese oxide. They acquired a slightly rounded shape as a result of aeolian weathering, and were subjected to chemical impact that led to the emergence of a chipped surface. The Mudayyan artifacts are covered with light-colored, light-pink or glossy deep-red patina; they are not rounded, and show no traces of chemical exposure. Collections of tools from the sites with the classic Dhofar and Mudayyan industries, which were located close to each other, are substantially different. The sites with the Mudayyan assemblages are located mainly on the tops of residual hills, while the sites with the classic Nubian technology are located at the foot of hills (Ibid.: 262). The above characteristics of these two industries show their techno-typological and chronological differences.

In Dhofar, during the aridization of Arabia and concentration of the population in the refugia, the autochthonous Mudayyan industry emerged on the basis of the Afro-Arabian Nubian technocomplex. The approximate time of its existence probably coincides with the weakening of monsoons from the Indian Ocean after 75 ka BP (Rose, Marks, 2014).

As opposed to the sites with the classic Afro-Arabian Nubian industry with only a small amount of retouched tools, the Mudayyan localities contain a larger number of tools, and their typological set is much more diverse.

The primary reduction in this industry was based on the micro-Nubian Levallois technology. The industry also has double-platform cores for removal of blades in opposite directions. The micro-Nubian Levallois cores constitute 19–37 % of all cores at the Mudayyan localities (Fig. 9). Levallois points are the most numerous at these localities (18–58 %), but they are much smaller than the Nubian ones. A specific feature of the Mudayyan industry is the predominance of tools of the Upper Paleolithic type (42–77 %), including end-scrapers with straight and convex edges, burins, and drills.

The Mudayyan industry reflects many features of the Afro-Arabian industrial complex. During its existence, Levallois reduction was focused on production of miniature Levallois points. In addition, in some cases, the Nubian Levallois system was modified into the system of recurrent bidirectional flaking. Blades and points were removed in opposite directions both from the broad working-surface, and at the butts (Ibid.).

Paleoanthropological evidence suggests that the creators of the African Nubian Levallois complex were anatomically modern humans (Rose et al., 2011; Rose, Marks, 2014; and others). At Taramsa Hill at the site

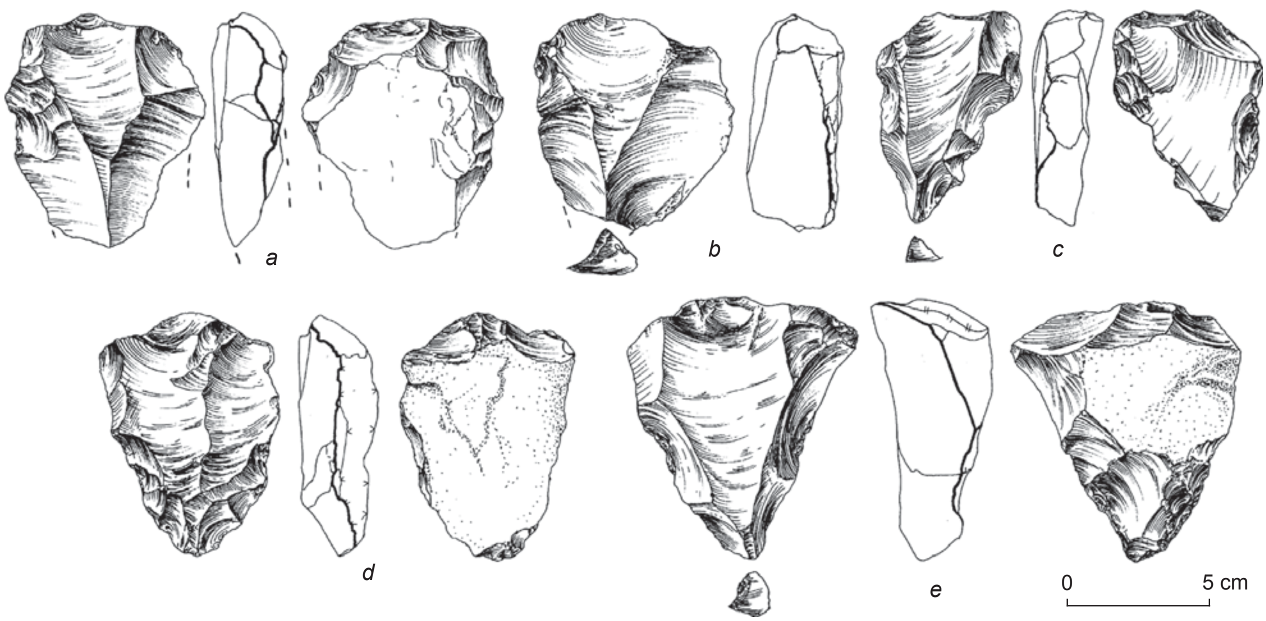

Fig. 9. Micro-Nubian cores from the Mudayyan localitites (after: (Usik et al., 2013)).

of Taramsa 1, the burial of a child of the anatomically modern type was found (Vermeersch et al., 1998); it belonged to the period when the human group with the Nubian industry returned to Africa from Arabia. It was established that the child was buried in a sitting position in a pit about 1 m deep, that is, the burial was intentional (Ibid.: 478). The burial was first dated to 80.4–49.8 ka BP, and the average age was defined as 55.5 ± 3.7 ka BP. Later, the age was corrected to 68.6 ± ± 8 ka BP (Usik et al., 2013).

Thus, the Nubian Levallois complex of South Arabia is evidence for the migration of anatomically modern people from Africa to Eurasia. Human groups moved from Africa to the Arabian Peninsula along the southern route through the Bab-el-Mandeb. Distinctive localities with the Nubian Levallois industry, as was the case with Dhofar, have not been found in the Levant and North Arabia, although there were probably some temporary contacts between the migrants from Africa and the Levantine populations. The site of Asfet that was discovered at the coast of the Red Sea in Eritrea confirms that anatomically modern humans migrated from Africa to Arabia along the southern route (Beyin, 2013). This suggestion is also supported by the map of the sites with the Nubian Levallois complex, which A. Beyin presented in his article (Ibid.: Fig. 10).

Arabia was the least populated in MIS 4 and 3, when there was aridization of climate, and most of the Peninsula became hardly suitable for human settlement. Paleolithic sites in Arabia of that time were found only in refugia with reliable water resources. One such shelter was located near a small residual reservoir at the foot of the western highlands of Yemen, in the basin of Wadi Surdud. Human groups lived there approximately 55–50 ka BP in relatively complete isolation.

The sites of Shi'bat Dihya-1 (SD 1) and Shi'bat Dihya-2 (SD 2) in the area of Wadi Surdud, in the transition period from a semi-arid to arid climate, were a kind of refugia (Delagnes et al., 2012, 2013; Sitzia et al., 2012). The natural and climatic environment of Wadi Surdud provided favorable living conditions for animals and humans even in an arid climate. Medium-altitude foothills were characterized by the availability of long-term and predictable sources of water, which contributed to the emergence of ecological niches suitable for humans and animals. Two such ecological niches are known during MIS 3 on the Arabian Peninsula: one in Wadi Surdud, and the other on the border with the southern part of the Rub' al Khali Desert, on foothills with the Tihama coastal plain to the west and the foothills of the Al Hajar Mountains to the east. The sites of SD 1 and 2 have been studied in the former area, and the sites of Jebel Faya and the assemblages A and B (Delagnes et al., 2012: 469), that were discussed above, have been studied in the latter area.

In Wadi Surdud, two complexes containing cultural horizons in the interstratified 6 m thickness of river sediments were investigated. Over 5000 artifacts were recovered from both archaeological horizons. Highly-fragmented animal bones were found during the excavation at the site of SD 1. Bovids, equids, suids, and porcupines were identified by the teeth in the faunal remains. Equids represented the taxon typical of the arid steppe environment.

For raw materials, inhabitants of the site mostly used rhyolite (93.8 %), widely occurring in the alluvial sediments of the Wadi Surdud riverbed and two of its tributaries, Shi'bat Dihya and Shi'bat al-Sharj. For producing tools, slightly rounded angular blocks were selected from the alluvium. Rhyolite, which is characterized by a fine-grain structure and homogeneity, was used to manufacture flakes and blades. Two chopper-like cores were made of basalt. From these cores, flakes were removed without preparation of a striking platform. One core showed traces of bipolar percussion; another one was turned into a hammerstone.

During the excavation, archaeologists were able to discover production waste, and to conduct six core-refits, each comprising 6 to 18 spalls. Treatment of these cores involved a minimal number of technical spalls, especially while preparing the surfaces for flake removal. Striking platforms also underwent minor treatment, which also included partial faceting. Sub-triangular flakes and Levallois-type flakes differ from laminar flakes only in their somewhat larger size of dihedral and faceted butts (Ibid.: 460).

Blades and laminar flakes which served as blanks constitute a large share of finds at the site of SD 1; they were produced using two strategies (Delagnes et al., 2012). The first strategy was aimed at obtaining blades, while the second strategy was used for production of flakes and sub-triangular laminar flakes. Levallois flaking was also present at this site. Levallois blanks were removed from cores formed with minimal preparation of the working and striking platforms. Knappers carefully selected raw materials and mainly used those stone pieces that had sharp corners, to produce blanks with minimal effort. Scholars observed that simple strategies of core reduction, which involved minimal preparation, were combined with high technical skills: materials indicate a precision of blows (Ibid.: 464).

A specific feature of the core preparation strategy was the versatility of the treatment system that made it possible to obtain various artifacts within a single reduction sequence. This can be clearly seen from pointed blades and sub-triangular flakes, which were removed from semi-circular cores. Refitting of the cores has shown that different types of blanks were obtained from a single core.

Levallois reduction is represented by a small number of cores that typologically can be divided into three groups: single- and double-platform cores for detachment of blades with broad working surfaces, cores that were unidirectional and triangular in plan, and centripetal cores. Their striking platform was formed by several major spalls. At the site of Shi'bat Dihya 1, only a small amount of Levallois cores were found, but their typological diversity manifested great variability of the primary lithic reduction methods. Notably, Levallois cores did not always meet all criteria used in defining this method; the striking platforms showed almost no traces of faceting.

Among the debitage, a large number of pointed blades, sub-triangular flakes, and blades produced using different methods was observed, revealing a developed laminar reduction strategy (Fig. 10, *11*). Most of the debitage showed no retouching; apparently, unretouched spalls were used for carrying out various jobs at the site. Twenty five of the retouched objects can be classified as notched tools, denticulate tools, and end-scrapers.

At the site of SD 2, no large-scale investigation has been carried out. In total, 1336 artifacts were found, mostly consisting of unifacial non-Levallois implements. Four radial cores made of green basalt were found. Their striking platforms were not specially prepared; the blows were made using a hard hammerstone against the natural stone surface. There were also sub-triangular flakes and pointed blades (Fig. 11, *14–17*), similar to the SD 1 items. Despite the fact that the sites of SD 1 and SD 2 differ from each other in the number of artifacts, their relationship in terms of key techno-typological characteristics is undeniable. At the site of SD 2, there were fewer sub-triangular flakes and pointed blades as compared to SD 1, but since that site was only partially investigated, this feature cannot be considered a key indicator for attributing its industry to a different type.

According to its techno-typological features, SD 1 is most connected with the layer B industry at Jebel Faya (Delagnes et al., 2012). Yet, the significant distance between these sites apparently made an impact on the specific nature of their lithic inventories. Lithic tools from Shi'bat Dihya differ from the Tabun B-type assemblages that were from the Terminal Middle Paleolithic sites of the Levant. Triangular flakes and laminar blanks with broad bases at the sites of SD 1 and SD 2 are reminiscent of similar objects from the site of Amud (layers B^4 and B^2), yet they differ in the method of forming the striking platform. While short points from Amud show well-expressed striking platforms ("chapeau de gendarme"), blades and sub-triangular flakes with broad bases from Shi'bat Dihya have no faceted striking platforms. The industry of Shi'bat Dihya, like that of Jebel Faya, represents a converged technology that evolved among human groups who became isolated in the niches-refugia owing to the arid climate. Scholars admit the possibility of short-term contacts between the inhabitants of the site of Shi'bat Dihya and the creators of the Terminal Middle Paleolithic industry of the Levant (Ibid.: 471). Parallels between the industries at the sites of Shi'bat Dihya and the contemporaneous sites of East Africa cannot be found.

The issue of taxonomic affiliation of the human groups who settled in Wadi Surdud from 55–50 ka BP remains open. However, scholars are convinced that

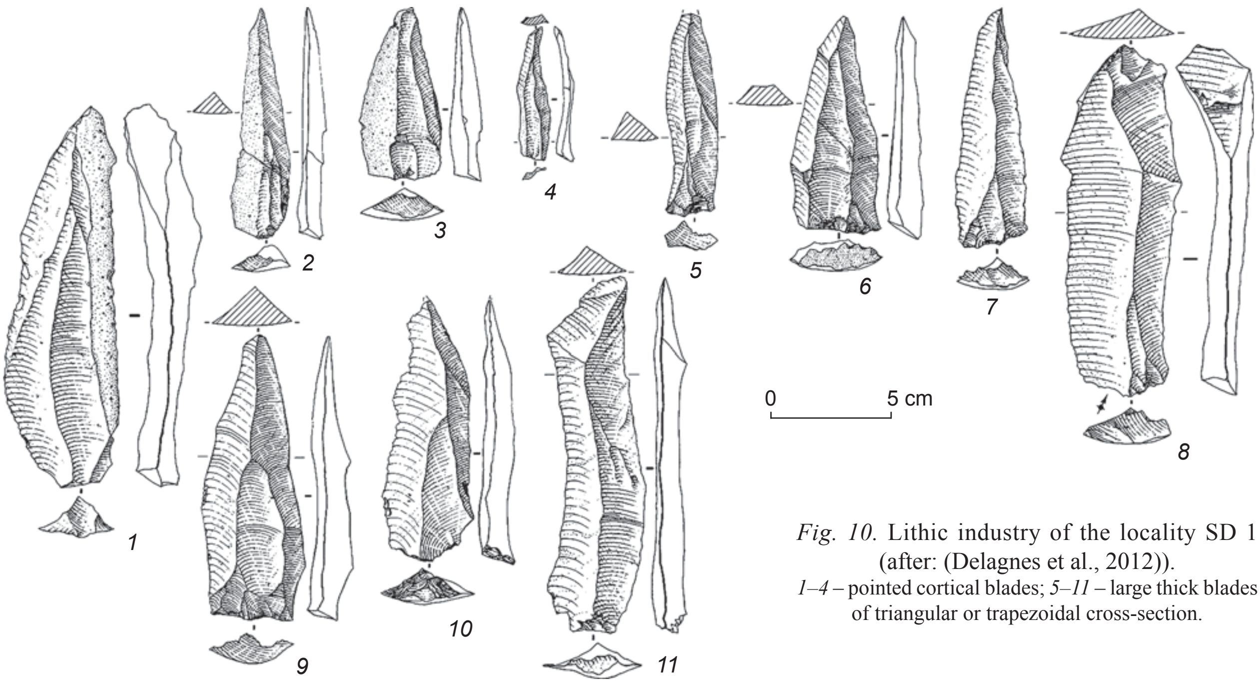

Fig. 10. Lithic industry of the locality SD 1 (after: (Delagnes et al., 2012)).
1–4 – pointed cortical blades; *5–11* – large thick blades of triangular or trapezoidal cross-section.

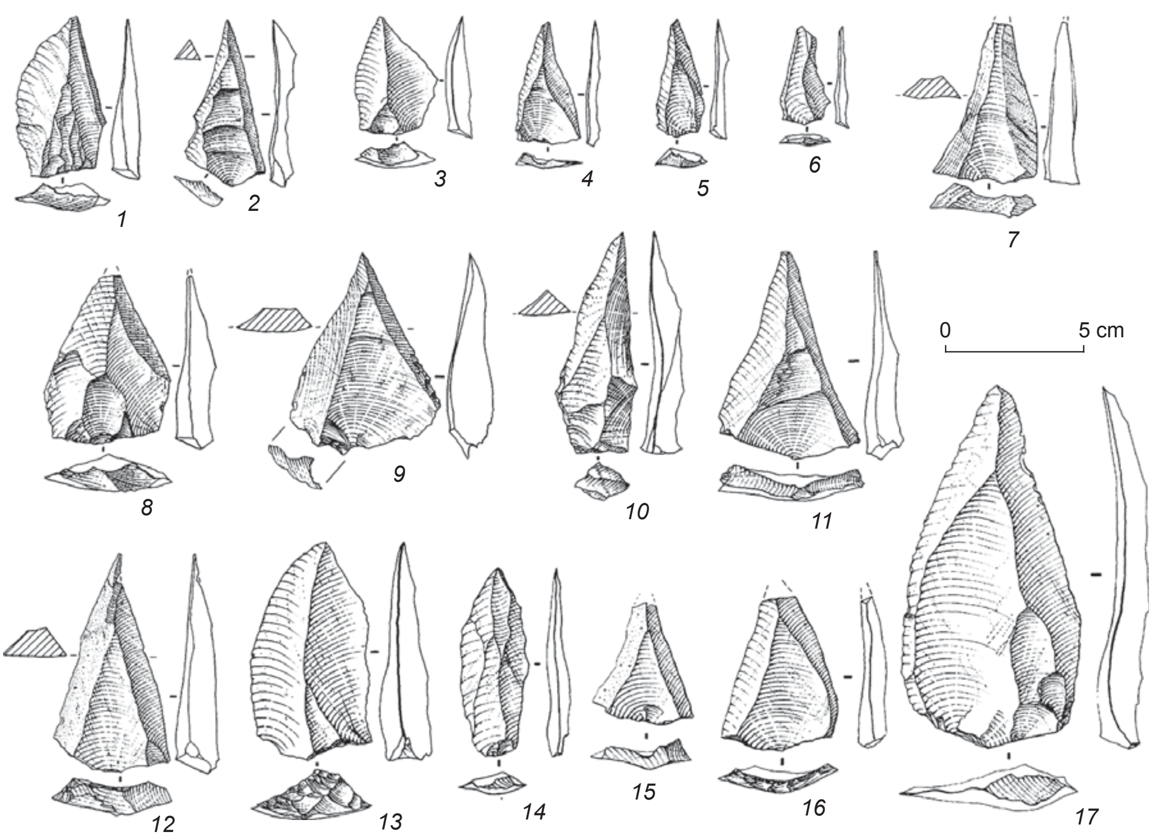

Fig. 11. Lithic industry of the localities SD 1 (*1–13*) and SD 2 (*14–17*) (after: (Delagnes et al., 2012)).
1 – crested blade; *2–6* – small pointed blades; *7* – lateral blank; *8–13* – pointed blades; *14–17* – pointed blades and flakes.

these populations were in no way associated with anatomically modern people migrating from Africa, who could have continued moving further to the east of Asia reaching Australia, since the Middle Paleolithic industry found at the sites of SD 1 and SD 2 in Wadi Surdud was absolutely different from the African one. A. Delagnes and her colleagues put forward two suggestions (Delagnes et al., 2012). First, if the inhabitants of Shi'bat Dihya were anatomically modern humans, they should be the descendants of modern humans who settled in Arabia in 120–80 ka BP (Ibid.: 471). Second, the inhabitants of the sites might have been the southern Neanderthals, who lived at that time in the north of the Arabian Peninsula, in the Middle East, the Levant, and the Zagros (Ibid.).

Several locations with stone tools were found in the area of the Saiwan paleolake in Oman. The most intense amelioration of the inner regions of Arabia, and the formation of lakes in the pluvial periods occurred approximately 6–11, 78–82, 100, and 120–130 ka BP (Rosenberg et al., 2011, 2012), which is confirmed by the speleodata for the southern part of Arabia (Fleitmann et al., 2007). According to the geomorphological data, at certain periods, Lake Saiwan covered an area of up to 1400 km^2 and had a maximum depth of 25 m (Rosenberg et al., 2012: 14). Artifacts, including bifacially worked tools, were located in superficial deposits, approximately 30 km from the border of the maximum expansion of the lake. Good preservation of the finds in the absence of established dates raises some doubts concerning their old age, although typologically the bifaces from the localities by Lake Saiwan can be compared to similar implements from Jebel Faya C and the Najd Plateau.

Paleolithic sites in Shi'bat Dihya belong to the late phase of the Middle Paleolithic. It is difficult to say anything certain about the further development of Paleolithic industries and the transition from the Middle to the Upper Paleolithic in Arabia, since owing to the arid climate, which occurred in the second half of MIS 3 and a part of MIS 2, "no Upper Paleolithic has ever been clearly identified in the entire Arabian Peninsula" (Delagnes et al., 2013: 242).

The appearance of anatomically modern humans in Arabia can be associated with the localities that contain the Aterian industry. So far, we know of one well-studied site with the Aterian industry in the Arabian Peninsula. It is located on the south-western rim of the Rub' al Khali Desert (McClure, 1994). Three hundred artifacts were found in an area of about 100 m^2. Large Aterian unilaterally worked tanged points stand out among the objects that also include small bilaterally worked foliate implements, end-scrapers, borers, knives, denticulate tools, some of which have tangs. The majority of the objects were made on flakes and have retouch on their dorsal surfaces. In the future, more sites with the Aterian industry left by anatomically modern humans may be found.

Arabia and the issue of anatomically modern humans dispersal in Eurasia

It is obvious for all those who deal with the origins of the *Homo* genus that humans originated in Africa no later than 2.5 Ma BP. Human migration from Africa to Eurasia started around 1.8–1.7 Ma BP. The problem of the origin of anatomically and genetically modern humans, as well as their dispersal around the planet, still remains the subject of discussion. Among the many hypotheses proposed, two have been the most actively discussed in the last 20–30 years. We agree with some points of the monocentric (out-of-Africa) and the polycentric (multiregional evolution) approaches, but strongly disagree with other aspects of each of them.

It is clear for scholars that the earliest anthropological materials associated with early anatomically modern humans originate from Africa. The anthropological remains of the early *Homo sapiens* from the sites of Florisbad, Laetoli, Omo, Herto, Jebel Irhoud, etc. go back to the Middle–Early Late Pleistocene. Genetic diversity of human populations in Africa suggests that anatomically and genetically modern humans emerged in this region. Genetic, anthropological, and archaeological studies conducted over the last 15 years have shown that not only Africa was the ancestral home of humans. In Eurasia, there were at least three centers where modern humans evolved: Europe, East and Southeast Asia, Central Asia and southern Siberia (Derevianko, 2011). In our opinion, if we view the model of the origin of *Homo sapiens* in the form of a tree, Africa would be the tree trunk in this evolutionary process.

A breakthrough in the study of the origin of modern humans was made by the paleogeneticists, who have established that modern humans in Eurasia inherited from 1 to 4 % of their DNA from Neanderthals. From 4.8 to 11.3 % of the Neanderthal DNA was discovered in the genome of a *H. sapiens* representative who lived 35–37 ka BP in Oase Cave in Romania (Fu et al., 2015). No less sensational were the results of DNA sequencing of a girl whose bone remains were found in Denisova Cave in the Altai (Krause et al., 2010). It turned out that the inhabitants of the cave, who had an Upper Paleolithic industry of approximately 50 ka BP, belonged neither to *H. sapiens* nor to the Neanderthals; they represented a completely different, previously unknown, taxon. Given that some of the modern populations of Southeast Asia inherited up to 5 % of DNA of the Denisova hominins, and also took part in the formation of the gene pool of modern humans, this taxon was named *H. sapiens altaiensis* ("Denisovan") (Derevianko, 2011). These and other discoveries did not reconcile the supporters of the Out-of-Africa and Multiregional approaches in solving the problem of the origin of *H. sapiens*. One of the supporters of monocentrism and a prominent anthropologist K. Stringer (2014: 251) claims that the best model is the recent African origin of humans. The followers of the polycentric hypothesis believe that the results of the new paleogenetic and archaeological studies have fully confirmed their theory. We are of the opinion that one should refrain from unnecessary discussions and from searching the weaknesses in the arguments of the "opponents", but we should jointly seek answers to any unsolved questions. There are several of them:

1) When and via which routes did anatomically modern humans migrate from Africa to Eurasia?

2) When and where did the hybridization between anatomically modern humans and Neanderthals take place?

3) When and where did *Homo sapiens altaiensis* (Denisovan) evolve?

4) Can the earliest anatomically modern humans of Africa be considered the only taxon—the ancestors of all people living on Earth, or has modern mankind originated from several related taxa (subspecies?) evolving in several large regions? Let us briefly consider some of these questions.

Our hypothesis on the origin of anatomically modern humans is based on the theory that approximately 1.8 Ma BP, *Homo erectus* left Africa, and since that time the slow process of human dispersal throughout Eurasia began. According to archaeological and anthropological studies, the first wave of *Homo erectus* penetrated into the Caucasus (Dmanisi), and into East and Southeast Asia. About 1.3–1.2 Ma BP, *Homo erectus* appeared in Europe (Atapuerca).

The turning point in the development of modern humans goes back to 800–400 ka BP. Many scholars link this period with the appearance of a new species of *Homo heidelbergensis*/*rhodesiensis* in Africa (Rightmire, 1996, 1998; Bräuer, 2008, 2010, 2012; Hublin, 2001, 2009; and others). The paleoanthropologists do not share a common view as to whom the remains from Mauer 1, Steinheim, Swanscombe, Fontéchevade, Arago 21, or the anthropological materials of the Middle Pleistocene of Atapuerca belonged. These and other anthropological finds manifest a patchwork of advanced and archaic (erectoid, Neanderthaloid, and sapient) traits. The European anthropological remains of the early and middle stages of the Middle Pleistocene are in many ways similar to the African remains from Bodo, Kabwe, Ndutu, Eyasi, and Tighenif. The erectoid and sapient traits are also combined in a mosaic way in these and other cranial and postcranial African finds.

Homo heidelbergensis/*rhodesiensis* was a single species. A part of this population (*H. heidelbergensis* with the Acheulean industry) migrated to the Levant, and then about 600 ka BP to Europe, while another part (*H. rhodesiensis*) settled in Africa and subsequently gave rise to modern humans 200–150 ka BP. *H. heidelbergensis* in the Levant led to the origins of two morphologically and genetically close taxa—humans of the modern type (Skhul and Qafzeh) and Palestinian Neanderthals (Tabun, Amud, and Kebara). Late Neanderthals in Europe evolved on the basis of *H. heidelbergensis*. The results of DNA sequencing of hominins 430–530 thousand years old at the site of Sima de los Huesos (Atapuerca, Spain) have a great importance in this respect. Their mitochondrial DNA yielded the genes of the Denisovans, and their nuclear DNA the genes of the Neanderthals (Meyer et al., 2014, 2016). From our point of view, the combination of the genes of Denisovans and Neanderthals in the gene pool of *H. heidelbergensis* resulted from the evolution of erecti; the genes of these two taxa were present in African late erectoid forms that constituted the basis for the process of speciation about 300 ka BP.

The evolution of late erectoid forms towards sapienization in the East and Southeast Asia was different. The migratory wave of *H. heidelbergensis* with the Acheulean industry did not penetrate into this territory, and its techno-typological complex of pebble-and-flake industry developed in a different way as compared to Africa and Europe (Derevianko, 2015). In East and Southeast Asia, the Acheulean industry was not found, although the presence of bifacial stone reduction technique resulting from technological convergence before 800 ka BP has been observed (Derevianko, 2014; Derevianko et al., 2016). The evolutionary development of the humans and of their industry in this territory occurred on a local basis, without the critical influence of migrating human groups from the west of Eurasia, who had a different industry. This did not exclude short-term contacts between the autochthonous populations and those who came from the adjacent territories, and gene exchange between them. The population of the Levant, whose gene pool contained both Denisovan and Neanderthal genes, could have migrated to the east and reached the Altai about 300 ka BP, and some part of this population went further into East and Southeast Asia. As a result of further hybridization of these populations with the indigenous populations, the Denisovan and Neanderthal genes have been preserved in the gene pool of some modern peoples of East and Southeast Asia (Derevianko, 2016c).

In general, the process of human evolution in the east of Asia in the Middle Pleistocene was different from that of Africa and Europe. In East and Southeast Asia, relatively few anthropological materials from the second half of the Middle Pleistocene have been found, but the available remains of the late erecti from Zhoukoudian, Jinniushan, Dali, and other places, which combine erectoid and sapient traits, suggest that an intensive process of sapienization was also taking place in the east of Asia (Derevianko, 2011). The proposed model of human evolution in the east of Asia casts doubt on the hypothesis of the origin of *H. sapiens* from *H. heidelbergensis*/*rhodesiensis* alone, without the participation of the late erecti in the process of speciation.

Evolution of the late erectoid forms towards sapienization in the Early and Middle Pleistocene in Africa, Europe, and Southeast and East Asia might have happened according to the same scenario. This is confirmed by a certain morphological similarity between the African, European, and Chinese hominins. Some researchers explain the similarities between the anthropological finds from Jinniushan and Dali, and from Europe by the migration of *H. heidelbergensis* into China (Groves, 1994). This hypothesis is not supported by archaeological materials. The lithic industry of hominins on the territory of China differed substantially from that in Europe. The morphological similarities between the hominins separated by many thousands of kilometers can be explained, in our view, by a unidirectional (convergent?) development of local populations, which cannot be called speciation because eventually it led to the formation of subspecies: *H. sapiens africanensis* in Africa, *H. sapiens neanderthalensis* in Europe, *H. sapiens orienthalensis* in the east of Asia, and *Homo sapiens althaiensis* (the Denisovan) in the south of Northern Asia and in Central Asia. These four major regions were not completely isolated from each other, and short-term contacts between the populations might have occurred over a long period of time (200–400 thousand years); small numbers of humans migrated from one region to the other, which resulted in the exchange of gene material.

Thus, humanity today is not only the descendant of the early African humans, but also the species that emerged as a result of hybridization of at least four related taxa (subspecies?) that evolved in Africa and Eurasia and shared the earlier common morphological and genetic roots. This was a long process, initiated by the exit of *H. heidelbergensis* from Africa about 800 ka BP. Gene exchange and other factors over 100–200 thousand years formed four related taxa that differed morphologically but were capable of hybridization and reproduction*. These four taxa were the humans of the modern type from Africa (*H. sapiens africanensis*), *H. sapiens neanderthalensis* from Europe, *H. sapiens orienthalensis* from the East and Southeast Asia, and *H. sapiens altaiensis.* They all formed modern humanity.

Geneticists believe (and they are supported by many archaeologists and anthropologists) that haplogroup L 3, which appeared in African populations about 84 ka BP, haplogroups M and N, of approximately the same age, and haplogroup R originating in India can be found in many Asian populations (Forster et al., 2001; Forster, 2004; Palanichamy et al., 2004; Macaulay et al., 2005; Oppenheimer, 2005, 2009; and others). The presence of haplogroups M, N, and R of similar age in the gene pool of the modern-type humans is one of the testimonies for the migration of modern people from Africa to Eurasia. These haplogroups were found in the Melanesians and the Aboriginal Australians, and the anatomically modern humans who emerged in Australia 60–50 ka BP (Roberts et al., 1998; Thorne et al., 1999; O'Connor, Chappell, 2003; O'Connell, Allen, 2004; and others).

The time when the anatomically modern humans left Africa, their numbers, and migration routes into the east of Asia still remain debatable. P. Forster and S. Matsumura (2005) believe that migration from Africa occurred between 85 and 55 ka BP. Many scholars follow this view.

The number of migrations of anatomically modern humans from Africa also remains an open question. Some scholars assume that there could have been several migration waves (Lahr, Foley, 1994; Stringer, 2000; and others). This assumption is based mainly on the cranial materials discovered in the early 1990s. It was believed that one migration wave from Northeast Africa moved along the north of the Red Sea through the Isthmus of Suez into the Levant, while another migration wave was associated with East African ancestry (Underhill et al., 2001). S. Oppenheimer (2004b, 2009) tested the lineage of the "relic" indigenous populations of South, Southeast, and East Asia, the Indian Ocean and Sahul for the presence of haplogroups M and/or N, and came to the conclusion that all of these populations, as well as other non-African groups, were descended from L 3, which confirms the theory of a single human exodus out-of-Africa. These two haplogroups appear in the human populations of Eastern Eurasia, including South Asia. The gene pool of the population of Western Europe and the Levant contained only haplogroup N. These results allowed Oppenheimer to conclude that the single migration wave from Africa moved not through the Isthmus of Suez, but through the mouth of the Red Sea.

Recently, the possibility of the exodus out-of-Africa of anatomically modern humans prior to the catastrophic eruption of the Toba supervolcano (Sumatra) about 74 ka BP is being discussed (Petraglia et al., 2007, 2010; Soares et al., 2011; and others). A major archaeologist and follower of the monocentric hypothesis, P. Mellars and his colleagues examined this suggestion in great detail from archaeological and genetical points of view, and came to

*We do not yet have sufficient anthropological evidence to speak of the morphological features of *H. sapiens altaiensis* (the Denisovan).

the conclusion that the movement of modern-type humans from the east of Africa to South Asia took place along the coast approximately 60–50 ka BP (Mellars et al., 2013). Many scholars have argued for the southern route from Africa to Australia (Lahr, Foley, 1994; Oppenheimer, 2004a; and others).

At the present, scholars almost unanimously support the hypothesis of the migration of anatomically modern humans from Africa into South, East, and Southeast Asia via the southern route along the ocean coast in the chronological range of 60–50 ka BP. That is, the southern part of Arabia should have been a transit area that people would inevitably pass on their way from Africa to Asia. We have already discussed this problem (Derevianko, 2011). Without rejecting the possibility of such a route of migration flow from Africa to Asia in the above chronological range, we, however, do not find sufficient archaeological and anthropological evidence for the *a priori* acceptance of this suggestion.

For addressing this problem, we should go back to the overview of the Paleolithic localities in the Arabian Peninsula. Three localities, which go back to the first half of the Late Pleistocene, have been discovered in the north of Saudi Arabia, near Jubbah paleolake: the upper cultural horizon at Jebel Qattar 1 (JQ-1) with the date of 95 ± 7 ka BP, and Jebel Katefeh 1 (JKF-1) with the earliest date of about 90 ka BP and a late date of about 50 ka BP. At the site of Jebel Qattar 1, 518 artifacts were collected in vague stratigraphic conditions, and 114 lithic artifacts were collected from the upper cultural layer. The primary reduction was associated with cores for removal of flakes. The blanks included an atypical Levallois point. Small number of blanks had faceted platforms.

A little over 2000 artifacts were found in the layer and on the surface in Jebel Katefeh 1 (JKF-1). The cores were of the Levallois type, centripetal, unidirectional convergent, and radial. Levallois points and sub-triangular flakes prevailed among the blanks. Only 11 blanks were retouched.

One more site, that of Jebel Umm Sanman 1 (JSM-1), in the north of Arabia is attributed to a wide chronological range of 100–60 ka BP. Eighty eight artifacts were found at this site, including five centripetal Levallois cores with scars of flake removal from the edge towards the center. Some flakes had faceted platforms.

Judging by the small number of finds, all three localities investigated in the area of the Jubbah paleolake should be attributed to short-term sites of small human groups. The sites were located on the shore of the lake, and over time were covered with sand. The lithic inventory shows some similarities with the Levantine Middle Paleolithic industry of the Tabun C type. The people who had settled in that area might have been the Levantine population that remained in isolation for some time with the onset of an arid climate. This is evidenced by the Middle Paleolithic tools that were found on the shores of Lake Mundafan and combine techno-typological elements of the Nubian Levallois system and the Levantine system, as well as some traits typical of the industries in the area of Jubbah paleolake.

Three Paleolithic assemblages (C, B, and A) were discovered at the site of Jebel Faya (FAY-NE-1). The earliest assemblage C, with the available dates of 127 ± ± 16, 123 ± 10, and 95 ± 13 ka BP, reflects several strategies of radial reduction, and contains bifaces, denticulate tools, burins, and retouched flakes. Assemblage B is not associated with the Levallois system of reduction. The estimated date for this assemblage is 95–40 ka BP (Petraglia et al., 2011). The uppermost cultural layer is dated to 40–30 ka BP. The industry in the upper horizons B and A differs from that of assemblage C. According to scholars, assemblage C was left by anatomically modern humans who migrated from Africa (Armitage et al., 2011). In the first part of the article we have already discussed this issue. From our point of view, in East Africa, there are no industries that would be similar to assemblage C in terms of techno-typological characteristics. Such an industry has not been found in the western part of Arabia, which could have served as a transit area for human groups migrating from Africa to Arabia. An important argument is that localities with the Afro-Arabian Nubian complex, which was created by anatomically modern humans migrating from Africa to Arabia, were found in the adjacent territory, in Oman.

The assemblage C of Jebel Faya and the Nubian Levallois industry of the early sites are almost contemporaneous; it is unlikely that two flows of anatomically modern humans with different industries could have migrated from Africa to Arabia. Therefore, we believe that the site of Jebel Faya was left by local human groups who were in contact with populations of the adjacent territories, including the Levantine populations, during the pluvials. Bifacial tools have also been found on the Najd Plateau. Assemblages A and B resulted from adaptation of the Jebel Faya population to a more arid climate, and its isolation due to desertification in the neighboring regions.

The arrival in Arabia of anatomically modern humans from Africa about 115–110 ka BP was marked by the appearance of an entirely different techno-typological complex in this territory. As we mentioned above, about 260 short-term sites with surface occurrences of artifacts, associated with the Afro-Arabian Nubian technocomplex and the local Mudayyan version of the industry, which formed at a later time on the basis of the classic Nubian complex, were found in the Dhofar Governate, Oman, in 2010–2012. From several dozens to two thousand artifacts have been discovered at the sites of hunter-gatherer groups in Dhofar, which indicates their short-term functioning.

The most arid conditions occurred in Arabia in MIS 4 and 3. Human groups could have disappeared from the driest areas and accumulated in the niches-refugia with reliable sources of water. Over the large area of the Peninsula, in addition to individual finds, assemblages from two localities of this period were found: assemblages B and A of Jebel Faya in the east and Shi'bat Dihya 1 and 2 in the west. These were short-term sites of little hunter-gatherer groups with a numerically insignificant lithic industry.

We have provided a brief overview of the discovered and investigated Middle Paleolithic sites in order to show how sparsely Arabia was populated owing to its specific natural and climatic environment. We are confident that in the future, a more careful search in this territory might make it possible to discover new Paleolithic localities. However, the number of sites is unlikely to increase so much that it would become possible to assume that their population could have covered a distance of 12,000–15,000 km from Africa to Australia.

Some scholars have linked the chronological range of 60–50 ka BP with the most intense spread of the anatomically modern humans from Africa to the eastern areas of Eurasia reaching Australia (Oppenheimer, 2009; Forster, Matsumura, 2005; Macaulay et al., 2005; Lahr, Foley, 1994, 1998; Stringer, 2000; Mellars, 2006; and others). In MIS 4 and 3 (70–40 ka BP), the most severe arid climate in the Late Pleistocene became established in most parts of Arabia, and according to some experts, dispersal of humans in this area was generally problematic; humans possibly settled only in niches-refugia (Drake, Breeze, Parker, 2013; Petraglia et al., 2011; Rosenberg et al., 2012; and others).

Delagnes and her colleagues believe that there is no clear evidence of the continuous habitation of human populations in Arabia between MIS 5 and the onset of MIS 3 (Delagnes et al., 2012). The populations who lived in the beginning of MIS 3 in the south of the Peninsula, especially in the Wadi Surdud and Jebel Faya (A and B), apparently did not enrich the material culture of the region with any new behavioral strategies. In the Arabian Peninsula, during the Middle Paleolithic, there are no signs of producing complex stone tools, such as standardized and side-bladed tools or composite hafting systems, as well as using personal adornments, pigments, or symbolic objects (Delagnes et al., 2013: 240). Thus, there are no sufficient archaeological materials to consider Arabia the starting point for the dissemination of the African anatomically modern humans to the east of Asia as far as Australia. In addition, no lithic inventory and symbolic objects of either the African or the Arabian Middle Paleolithic techno-typological complex have been found anywhere en route from Arabia to Australia.

As a proof, the followers of the Out-of-Africa hypothesis of migration of the anatomically modern humans from Africa to Eurasia use the microlithic industry found on the island of Sri Lanka and in India that includes tools on blades with backed dorsal surface and insert blades in the form of trapezoids and segments, as well as beads and engravings, which are surprisingly similar to the artifacts of the Howiesons Poort industry in South Africa (Clarkson et al., 2009; Perera et al., 2011; Mellars et al., 2013; and others). The Howiesons Poort industry in South Africa goes back to 70–50 ka BP, while the sites with the microlithic technique and non-utilitarian and symbolic objects date to 40–35 ka BP. On the basis of similarities between the Howiesons Poort microlithic complexes and the contemporaneous Indian complexes one could make a conclusion concerning the migration of anatomically modern humans from Africa to South Asia. However, the question remains, why such an industry is not known not only in Arabia, but also along the entire route to South Asia and further east to Australia?

An explanation for this phenomenon is the hypothesis about a rapid movement of the migration flow from Africa to Australia along the narrow coastal line of the ocean (Oppenheimer, 2004a, 2005, 2009; Mellars, 2006; Mellars et al., 2013; and others). The proponents of this hypothesis suppose that the members of this migratory wave from Africa were moved very fast along the coast on timber floats or boats, and subsequently, due to the rise of the ocean level, no archaeological evidence has survived. According to Mellars, a small-numbered group of migrants moved along the narrow coastal strip during the lowered ocean level, and followed the same adaptation strategies as in Africa. Movement along the coast excluded prolonged contacts with indigenous populations (Mellars, 2006).

This model of migration from Africa to the East raises many questions. In the Paleolithic, any migration had to be a slow process. Moving into adjacent territories became necessary with an increase in population, when there were no sufficient food resources in the formerly inhabited region. How many generations passed and how much time did it take the migrating groups to reach Australia? The proponents of that idea do not rule out that for their movement the populations of anatomically modern humans could have used floating structures. However, wood processing tools are not known in the Howiesons Poort industry, and without such tools it was impossible to build a timber float or a boat. There are some more arguments against the hypothesis of fast movement of human groups from Africa to Australia; yet, the genetic evidence supports the idea of migration of anatomically modern humans from Africa to Australia. Further field studies in Arabia, the South and Southeast Asia should give a definitive answer to the question of how and when it happened. At present, there remains a number of unresolved issues.

Conclusions

The Middle Paleolithic of Arabia differed from the Middle Paleolithic of the Levant. We believe that according to the materials of the investigated Paleolithic sites, only small human groups were dispersed over the Arabian Peninsula in the Middle and Late Pleistocene because of relatively arid climatic conditions. Even the population of anatomically modern humans with the Afro-Arabian Nubian techno-typological complex in Dhofar, which occurs at about 260 sites, was not very numerous. All of these sites typically show the surface occurrence of cultural horizons. The number of finds at these sites ranges from several specimens to 2000 items. The sites are usually short-term. One small group of people might have moved from one location to another several times a year. The presence of a few sites with scarce inventory testify to the small amount of population and sparse habitation in Arabia in the Middle Paleolithic.

The available inventory indicates that there were two migrations of anatomically modern humans from Africa, represented by the Nubian and the Aterian industries, which stand out distinctly from the entire Middle Paleolithic techno-typological complex of Arabia. The Middle Paleolithic of Arabia is manifested by industries of local origin. During the pluvials, the population in the region increased; the migration routes, as well as the contacts with populations of the neighboring areas including the Levant, expanded, and the exchange of innovations in lithic processing and gene flow between various groups of people took place.

In the periods of extreme aridity, the populations settled in the niches- refugia with permanent water resources; over time, the population became reduced or disappeared completely (Petraglia et al., 2011; Stewart, Stringer, 2012; and others). Adapting to the changing environment, hominins in the refugia developed new adaptation strategies resulting in the emergence of different techniques of lithic reduction.

We allow the possibility that anatomically modern humans migrated from Africa through Arabia to the east of Asia reaching Australia 70–50 ka BP, but we believe that so far there is no sufficient archaeological evidence to support this hypothesis.

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