Hammerstone from multilayer Early Paleolithic Ainikab I site (Inner Dagestan)

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1. INTRODUCTION

The earliest indisputable traces of human presence in the Caucasus during the Oldowan period were found more than twenty years ago (Dzaparidze V., Bosinski G et al., 1989: 67-116). During the last seven years archaeological evidence about people of this period in the Caucasian region and adjacent territories considerably extended both geographically and chronologically. In 2002 the Lower Paleolithic complex ‘Bogatyr’ - Rodniky ‘was found in the Tamanský peninsula during the Kuban Paleolithic expedition organized by the Institute for the Material Culture History of the Russian Academy of Sciences (Bosinski G., Scełiński V. E., Kulakov S. A., 2003; Kulakov S. A., Želenskiý V. E., 2004). Since 2003, systematic expeditions of Institute of Archeology and Ethnography of the Siberian Branch of Russian Academy of Science, and by North Caucasian Paleolithic expedition of the Institute of Archeology of the Russian Academy of Sciences under the direction of academician A. P. Derevyanko and correspondent member of RAS H. A. Amirkhanov. During only three years of researches (2003 to 2005) tens of Oldowan and early Acheulean sites have been found in Dagestan (Амирханов Х.А., 2007 - a; 2007- b; 2009: 329; Таймазов А. И., 2009: 175-187; Деревянко А. П., 2009: 13). Even if the “primitiveness” of the most ancient tools does not any more mean a lack of "well expressed" types (Амирханов Х.А., 2006: 329; Таймазов А. И., 2009: 175-187; Желенский В. Е., Кулаков С. А., 2009: 204), many questions about the genesis of the most ancient cultures are quite successfully investigated «in the frames of comparative-historical typology» (Амирханов Х.А., 2007- а; 2007- b: 25; 2009: 29-35; Любин В.П., Беляева Е.В., 2006: 31).

SUMMARY - Hammerstone from multilayer Early Paleolithic Ainikab I site (Inner Dagestan) - The earliest evidence of the Oldowan period people in the Caucasus were found more than twenty years ago. Regardless this short period, general ideas of chronology and geography for the most ancient Paleolithic of Caucasian region had changed. Local types of industries have been recognized even if differences in technology as well as in morphology may be detected. An hammerstone from quartz pebble was found in 2008 during the excavation of Ainikab I site in Inner Dagestan. Other tools made from flint have been also found: choppers, peaks...etc. The only explanation useful to explain the presence of the quartz pebble in the archaeological layer is related to the human activity and not to natural factors. In fact, use traces have been observed and their characteristics allow the interpretation of an hammerstone with specific working zone. Traces shows multiple multidirectional impact among which prevailed the straight ones. Part of the pebble opposed to the main working zone is the handling part of tool. Its surface has natural micro relief without any traces of use. This hammerstone turns to be the oldest evidence of this kind in the territory of Eurasia.

RIASSUNTO - Percussore dal sito multistrato Paleolitico Ainikab I (interno Dagestan) - Le più antiche evidenze della presenza dell’Oldowiano nel Caucaso furono rinvenute più di 20 anni fa. Nel corso di questo breve periodo le teorie sulla cronologia e geografia del Paleolitico antico del Caucaso sono cambiate. Oggi si riconoscono peculiari associazioni litiche caratterizzabili sia tecnologicamente sia tipologicamente. Un percussore in quarzo venne rinvenuto nel 2008 nel sito di Ainikab I, nella regione interna del Dagestan, in associazione ad altri strumenti in se学费: choppers, peaks,. . . La sola spiegazione per la presenza del ciottolo di quarzo all'interno del livello archeologico prevede l'intervento umano, in quanto la possibilità che le tracce di uso osservate su tale percussore siano di origine naturale è da escludere. Le tracce si caratterizzano per la presenza di impatti multipli e multidirezionali tra i quali prevalgono quelli perpendicolari alla superficie. Una area del ciottolo opposta a quella attiva viene interpretata come la zona di contatto con la mano dell’utilizzatore. A tutt’oggi il percussore può essere considerato come la più antica evidenza archeologica di questo tipo in Eurasia.

Key words: Oldowan, Caucasus, Dagestan, traceology, usewear, hammerstone

Parole chiave: Oldowiano, Caucaso, Dagestan, tracciologia, analisi funzionale, percussore

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2. HAMMERSTONE FROM THE 11TH LAYER OF AYNIKAB I SITE

An hammerstone made from a quartz pebble (Fig. 01 above) was found in the 2008 excavation of the 11th layer of Aynikab I site (Fig. 1 below) in Inner Dagestan (Амирханов X.A., 2007a). The pebble (length : 10 cm, width: 8 cm, thickness: 4 cm, weight:325 gr.) has a triangular morphology in the plan view and it shows high degree of edges rounding. Even if most of the surface of the pebble was covered by dense calcite cortex, it was defined as a hammerstone since its discovery; in the same layer of the site were found flint tools: choppers, peaks, side scrapers and other morphologies characteristic for the Oldowan industries. It is worth to mention that the presence of a quartz pebble in proluvial deposits of this mountain valley is a kind of “geological nonsense” by itself. In fact, quartz is not a local raw material in a radius of at least 20 -40 km from the site. Up to now, the provenance of this quartz pebble still remains unclear due to the fact that locations with quartz deposits that could be eroded and transported as detritic material by the local streams of Akusha or Usisha are currently unknown. It is also necessary to remind here that Aynikab site is situated in a mountain valley with elevations of about 1200-1500 m above the sea level. Therefore, the only possible explanation of the pebble presence in the archaeological layer is linked to the human activity.

Usually, use-wear traces on hammerstones made from fragile isotropic materials consist of conic cracks localized on their working surface/s. When a direct (face-to-face) impact occurs on a surface of a hammerstone, a full conic, “peephole” ringed crack is formed (Fig. 3a); such type of cracks are often visible on a surface of even not transparent types of stones. The diameter of these “peephole” conic cracks depends on the size of the contact surface between a hammerstone and a processed material. The morphology of a contact zone also influences the form of a conic crack. When the blows are not straight but have an angulated direction, the blows generate a so-called “opened” conic or semi-conic crack (Fig. 3b). This crack arises behind a contact zone and its is possible to evaluate the direction of the blow by looking at its orientation: the opened part is always facing the movement of the hammerstone at the moment of percussion. When the two types of conic and semi-conic cracks are concentrated and/or superimposed one to each other because of the intensive use of the same working surface, direct inter-cone cracks are vis-

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Fig. 1 - (Above) Hammerstone found in the 11-th layer of Aynikab I site. Big oval specified a place of the main working surface, by a small oval outlines the place of the second working surface. The dotted line led round a zone without wear traces - the handle part of a tool. (Below) Cross section of the Aynikab I site cultural deposits. The star specified level the 11th layer in which the quartz hammerstone was found. Akushinsky district, Dagestan.

Fig. 1 - (In alto) Percussore (Ainikab I, strato 11). Macrotracce di diversa intensità individuano due zone di contatto. La linea trattegiata indica l’area senza tracce di uso e quindi la parte presa in mano dello strumento. (In basso) Sezione trasversale della stratigrafia del sito di Ainikab I (distretto di Akushinsky, Dagestan). La stella individua lo strato 11 in cui è stato trovato il percussore in quarzo.
ile (Fig. 3c). As a result, the surface of a working surface of a hammerstone starts to be damaged.

The use-wears formation process occurs on a working surface according to the scheme shown in Fig. 4. The best morphology for the working surface of a hammerstone is the convex, “egg like” one; this morphology provides stability during the percussion activity. At the beginning of its use, a grid of cracks of various types forms on the hammerstone working surface (Fig. 4a); later, the intensification of the percussion activity has as a consequence the increasing damage of the convex working surface and, then, its flattening (Fig. 4b). While working surface is getting more and more flat, the peripheral areas of a working surface becomes susceptible of fractures; these fractures may provide the formation of flakes or the complete splitting of the hammerstone in two parts (Fig. 4c). It is important to note that this model of use wear formation process in a hammerstone is universal and it could be used also for hammerstones made from soft and/or loose lithic materials such as limestones or sandstones. The experimental sequence of this process is observed on a flint nodule used as a hammerstone (Fig. 5). A convex part of a hammerstone with a nodule cortex (Fig. 5-1), is gradually getting flat as a result of damage. The limits of the flat surface show small negatives of chips removals; in the center of the working surface, traces of the crack, which existed in a nodule prior to the beginning of its use as a hammerstone, appear (Fig. 5-2). Further use of this hammerstone led to even bigger damage and higher level of surface flattening, removals of larger flakes from the edge zones, and to a bigger exposure of a crack in the middle (Fig. 5-3). At the final stage, after having lost a quarter of its weight with a damage and fractures of various size (including the large ones located on the edges), the hammerstone splitted up in two parts due to a crack found inside the nodule at early stages of use (Fig. 5-4).

Let’s return to the artifact from Ainikab I. After cleaning it by means of a weak solution of acid, it was possible to find wear traces suggesting a hammerstone use. More than 500 impact traces are located in a well defined area of the pebble, as shown in Fig. 1 above. Impact traces are completely rounded with opened conic and semi conic cracks; often, some isolated small pits appeared between the cracks (Fig. 6a). Traces are also partially present on a concave surface of the pebble (Fig. 1 above-a): this could be explained as the result of the use of this part of the pebble surface since the beginning of inter-cones cracks formation and primary damage (Fig. 3a). In close proximity to the main group of traces specified above, a distinct functional area can be found (Fig. 1 above, small circle); it shows a concentrated number of blow traces (up to 20, Fig. 5b) mainly characterized by unidirectional opened semiconic cracks that could be representing a series of hits. The two functional areas are linked one to each other by the presence of cone cracks even if their concentration is not relevant.

The distribution of use wears, as defined by circles in Fig. 1 above, is well visible. Only sporadic conic cracks are present outside the main functional area at a maximum distance of about 15 mm. All other surfaces of the tool are traceologically “pure” (Fig. 1 above, dotted line) and the natural microrelief of the pebble is visible (Fig. 5c). Most likely, this pebble was found in rather slow water flow; in fact pebbles made of brittle isotropic rocks, occurring in fast water streams, have numerous traces of multiple irregular blows on all surfaces and particularly on their perimeter (i.e. all faces around the edge). On such pebbles the traces of blows localized in depressions or in zones with the lowered relief are almost absent; on the contrary, these traces are especially developed on all convex zones of the pebble surfaces. It is important to note that naturally ham-}

The boulders processed during glacial or fluvio-glacial depositions, or ice impact on the coast, also have an oval form and rounded edges, but they are characterized by distinct scratches on lateral surfaces (Fig. 6).

The probability of the natural origin of the traces
on pebble from Ainikab I described above is almost equal to zero for the following reasons: a) traces of blows are located on a limited zone of the pebble, all other surface is traceologically "pure"; b) part of the traces are situated inside of a concave zone of the pebble surface, which is surrounded by unaffected convex zones without wears (Fig. 1 above-a). Such situation can not be expected as a result of the pebble alteration by natural processes; c) conic cracks of full type with ring "eyes" prevail in the zone of the concentration of traces; d) traces of two distinct groups of wear have various orientation: this is the result of two differently acting impact agents.

We do not know any natural process that could be the cause of a such complex of traces. In conclusion, the interpretation of this tool showing so clear and organic complex of traces is unequivocal: it is a pebble used as hammerstone by the accurate identification of specific functional areas. The zone with intensive damage traces is the working surface of the hammerstone; this part of the tool has traces of multiple multidirectional blows among which prevailed straight. The part of the pebble opposed to the main working zone is the handling part of the tool; its surface has natural microlief without any traces of use. The smallest area showing unidirectional "opened", semiconic cracks located nearby the main functional area testifies that at some instant the handling of the tool changed and it was reoriented in order to carry on a different action: the hammerstone was systematically used for making oblique blows directed on a tangent to the processed material surface.

It is difficult to judge how the tool was kept in a hand. However, quite confidently, it is possible to assume...
that the way of handling the pebble was not peculiar to the manner that is currently practiced by modern flint-knappers. In fact, the hammerstone was oriented with flat edge facing the knapped material. Blows were produced by this relatively straight, not too much convex edge of triangular pebble. This means that one of the triangle flat sides was chosen as the working surface of hammerstone (Fig. 7a). Contrary to this, any modern flint knapper most likely would choose as a working surface one of the triangular pebble corners.

This hammerstone is the most ancient tool of this kind among all known in the territory of Eurasia. Unfortunately, we have nothing to compare, as we do not have any data on hammerstones found in cultural layers of other Oldowan sites of Eurasia. Therefore, it seems essentially important to note that on hammerstones, which were found at the sites of Olduvai Gorge in Tanzania, we have nearly the same position of working edge (Fig. 7a). Contrary to this, any modern flint knapper most likely would choose as a working surface one of the triangular pebble corners.

Sizes of conic cracks are the same on both functional surfaces. This allows us to suggest that the hammerstone was used for processing in the same way the same material and this material is known: it is flint.

The closest modern flint sources lying in parent breed in situ and are found 4 km from Ainikab 1 site, in the valley of Tsulikana river, on the top of Turu Balu mountain (Fig. 8a). This crop today allow to identify 16 flint layers lying obliquely in the rock exposure. Flint nodules of various shapes lie in very dense limestone (Fig. 8b). The proluvial deposits and/or fluvial glacial deposits producing the erosion of these crops represent the main sediment units of all occupation layers at Ainikab I site (Амир...
That is, flint nodules were a very easy to collect raw material for the ancient people of this territory. Flint nodules were already extracted from dense limestone by natural processes and transferred afterwards on a small distance without considerable damage. Even today there are a lot of flint nodules and products of their distruction (chunks of flint) easily collectable in the natural expositions of proluvial deposits (Fig. 8c). It is very probable that the availability of good raw material was the main reason for the presence of the human groups in this area. Archeological finds testify that such redeposited flint was the unique source of raw material for the people of any time of Stone Age.

The hammerstone was probably used to produce stone tools, cores, flakes and chips. In the stone assemblage of Ainikab I site (the 11th layer) all of the listed categories of knapping products are present. Their technical features as well as their own realization are clear signs of the hard hammerstone use (Fig. 9a,b,c). There are a lot traces of conic cracks (“eyes”) of the full and opened types found on the surface of many artifacts (Fig. 9d). It is important to emphasize that the form and the size of these traces are almost identical to those found on the hammerstone. This observation definitely testifies the identity of contact zones arising on the hammerstone and on the artifacts while flint-knapping (compare: Fig. 5b and Fig. 9d). It means that we have the right to ascertain a relationship between tool manufacturing processes and hammerstone application. On the one hand, tools, flakes and chips of Ainikab I site (11-th layer) were made by the same hard hammerstone; on the other hand, a hammerstone occurring from the layer was used to knap hard material.

In order to verify these assumptions about the Ainikab site flint knapping, a series of experiments was carried out. The raw material was collected in different localities such as in the surrounding territory of the Ainikab I site, flint raw material resources at Mukhkay and Gegalashur sites located at about 2 km from Ainikab 1 site, and on the mountain Turu Balu in the Tsulikaninka river valley. Despite some distinctions in color - from dark gray, almost black translucent, to light-gray spotty opaque - all types of flints appeared to be very similar. Regardless the color variability, it was decided to call these types of flint occurring from this area as the “Inner Dagestan flint”.

Fig. 6 - The boulder, processed during glacial and/or fluvio-glacial transferring, or the coast ice impact. Zhokhova isl., Novosibirsk islands.

Fig. 6 - Ciotolo con alterazioni provocate da trasporto glaciale e/o fluvioglaciale o da impatto con ghiaccio (isola di Zhokhova, Novosibirsk).
The Dagestan flint represents one of the most dense and firm versions of this type of knapping raw materials in Russia. With the exception of nodule morphology and characters of the cortex, it is in many respects similar to the Crimean flint. Both versions, thanks to their hardness and plasticity, are very good for biface production (including thin bifaces). Peculiar properties of Dagestan flint have been understood during the experimental knapping. The first one is that hammerstones of medium hardness produce the same effects of soft hammers; this could be seen in the products of knapping and, first of all, in the form of fracture initiatives. In order to verify this observation, several experiments were made with the aim to produce Chopper tools by means of hammerstones with different degrees of hardness. During the experiments were used a soft hammerstone - a proluvial boulder found in the field near the farm Ainikab in local dense marl, and a firm hammerstone - a dense quartz pebble from Murmansk region, whose mechanical properties are similar to those of the hammerstone from Ainikab I site. The following data were obtained as a result of 200 experimental percussions:

<table>
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<tr>
<th></th>
<th>Pronounced bulbs</th>
<th>Middle bulbs</th>
<th>Flat bulbs</th>
<th>Bending fracture initiation</th>
<th>Split platforms and bulbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft hammerstones</td>
<td>14%</td>
<td>14%</td>
<td>43%</td>
<td>20%</td>
<td>9%</td>
</tr>
<tr>
<td>Hard hammerstones</td>
<td>20%</td>
<td>20%</td>
<td>40%</td>
<td>12%</td>
<td>8%</td>
</tr>
</tbody>
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While the prevalence of flat bulbs and bending (non conical) fractures produced by soft hammerstone is quite admissible, the percentage distribution of the results produced by the hard hammerstone is completely unexpected. Instead of an abundance of pronounced and middle bulbs (as theoretically expected characteristics of hard hammerstone), we have much more flat bulbs and not conic initiations of fracture. In other words, we have received nearly the same ratio as it was fixed in experiments with a soft hammerstone. Even together, pronounced and middle size bulbs make only 40% of all spalls made by hard hammerstones. Spalls with non conical (bending) initiation together with flat, poorly convex bulbs reached the 52%. Such experimental data allow us to note that a large number of flakes and chips with flat and not conical bulbs of force, and/or the presence of flake scars with same characteristics in a stone industry assemblage can’t be a sign or the indicator of a soft hammerstone use for this kind of Dagestan flint.

The experimental data above discussed are very indicative and will be taken into consideration in future analysis of Ainikab I site stone tools collection. Unfortunately, the quantity of artifacts found today in the various layers of this site is scanty; it doesn’t allow us to generate any comparative ideas of variability of the stone industries of various layers. We have to patiently collect our supervisions. Thus, on the basis of the analysis of the hammerstone and of its context, a behavior of ancient inhabitants of Ainikab I site is reconstructed. The hammerstone made from rare, not local stone was chosen and brought to a site rich in flint raw material, where it was repeatedly and intensively used in different types of flint knapping processing. Analogies may be found in the Oldowan stone industries of Africa.

3. CONCLUSIONS

Experimental-traceological researches of the Oldowan industries of the Caucasus and Ciscaucasia are only at their initial stage. Unfortunately, materials of Dmanisi
site aren’t available yet to a wide range of researchers.

Both Bogatyry and Ainikab I sites, as well as many other sites of Oldowan industries found in Russian territory, are excavated on very limited surfaces. But it is necessary to be surprised when so powerful results of researches may be obtained from such a small sites. Conclusive proofs of human activity in the territory of Russia during Oldowan era are received. We hope that the state of preservation of stone and bone materials on both sites will allow us to increase our knowledge about the most ancient human activities. On Bogatyry site, the presence of macro traces on bones and on stone tools is very possible. On the contrary, the absence of large bones in Ainikab I occupation layers is very distressingly. It is not excluded that it is connected with a difference in a functional purpose of the specified sites. However, quality of a flint and degree of safety of many flint tools from Ainikab I, in particular products covered with a calcium cortex, don’t exclude prospects of micro use wear traces detection on their surfaces.

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Preistoria Alpina