THE OLDEST COPPER METALLURGY IN THE BALKANS

A Study of the Diffusion of Copper from Asia Minor to Southeastern Europe

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The flourishing of copper metallurgy during the Eneolithic or Chalcolithic period in the Balkans and Carpathian Basin has led to the problem of the sources of the raw material necessary for such rapid development. The question is all the more interesting as the geographic position of these parts of southeast Europe has played an important role in the interpretation of the origin of copper metallurgy in central and east Europe. Finally, the rapid development of the earliest copper and gold industry has required a more precise explanation for the origin of the new production, whose importance was equal to the stimulus provided by the first agriculture on sedentary life.

But until now there has been no reliable data concerning the earliest copper and gold mining. It has been rightly proposed that the oldest mines were destroyed by later, more intensive exploitation. The earliest miners exploited the richest ores, since at the time of their use no deposit had been touched, and there was no need to exploit greater depths. Such relatively simple works, one assumed, had little chance of preservation during later exploitation of the same locality. However, ore veins are an exception, as is confirmed by the excavations of the two oldest mines in southeast Europe, Rudna Glava in east Yugoslavia/northeast Servia, and Ai Bunar in south Bulgaria.

But these results which put an end to the traditional lack of data concerning primary mining, are not restricted to southeast Europe alone. Similar results are known from Anatolia and Iran, although they are less reliable chronologically and are restricted in the possible reconstruction of working techniques. For example, one can cite the old mining works in the region of Veshnoves, west-central Iran, and those near Kozlu, in the province of Tokat, north Anatolia.

Thus some prerequisites are known for the comparison of primary mining in the Near East and southeast Europe albeit with limitations and restrictions. This relation seems even more important as it coincides in the geographical sense with the proposed direction of the diffusion of the first metallurgical knowledge from Asia Minor to southeast Europe. When one takes into consideration the chronological priority of the knowledge of metal in the Near East in relation to Europe, this explanation of the diffusion of early metallurgy implies a certain chronological distance.

The oldest metal objects discovered so far in southwest Iran, Anatolia and Syria have been dated from the 9th millennium B.C. onwards into the first half of the 6th millennium at, for example, Zawi Chemi Shanidar, Tell Ramad, Ali Kosh and Catal Huyuk.

In the opposite direction, in southeast Europe, the first metal objects occur as single finds in the cultural groups of the Early Neolithic with absolute dates falling in the 6th millennium B.C. In both cases the phenomenon suggests the first knowledge of metal rather than the organization of a massive production of such objects. If, nevertheless, one thinks of the utilization of native copper as the first step in the evolution of copper metallurgy then one can, at the same time, propose that copper mining did not exist in this phase. Considerable quantities of native copper probably existed in the earliest exploited deposits, implying that the primary raw material for the beginning of copper metallurgy was
very easily obtained. If such a view-point is accepted, the initial phase of copper mining could be identified as a period of gathering and exploratory operations without any large-scale mining of the ores. These and similar questions were often discussed in the former explanations or theories on the origin and development of the primary copper metallurgy of the Old World; may now be generally compared with the data provided by investigations of the earliest mining sites. In this connection one may emphasize that the chronology of those Anatolian mines known so far is not clear. In the same way it is uncertain whether the mining works preserved to date in these sites belonged only to the oldest period of exploitation. As those sites have not been systematically excavated, one may expect new data after more far-reaching investigations.

With regard to southeast Europe knowledge of primary mining is somewhat more advanced. Widespread activity has been dated to the Early Eneolithic at Rudna Glava and to the Late Eneolithic at Al Bunur.

### EARLY MINING IN THE NEAR EAST

The oldest copper mines are in the Near East known so far have been discovered in the course of geological reconnaissances. As no major investigations have been carried out on these sites, but only small trial excavations, only preliminary reports exist.

One such copper mine is that in the Veshnikov area in the Qum plain in western and central Iran. During economic-geological investigation of the copper deposits, old workings have been discovered with the first exploitation dating to the Early Bronze Age, about 3300 B.C. The works consisted of underground galleries or drifts, nearly 30-40 m in length. It is important that in those drifts no traces of working with metal implements have been discovered, implying the application of techniques of strong heating and smashing of ores with simple tools. Here again, the raw materials of this volcanic stone have been found, placed at the entrance of pits or in the drifts. The mauls were rounded, up to 0.5 kg in weight and in fact were pebbles with a central groove. On the basis of the available data, it has been assumed that the exploitation of the mine corresponds generally to the Early Bronze Age.

A similar investigation of sources of raw materials has been carried out in central Anatolia at Kozlu. Tokat province. Limited exploratory work pointed to the existence of underground prehistoric works, more

### In both areas the exploitation began and ended within the framework of a single period of shape, for example, that in the Near East in the Veshnikov area. It seems that exploitation was directly related to the wealth of the social classes, present at the time of primary exploitation of copper ores, a number of such deposits existed, Selected sites, according to the recent data, contained a low quantity of ore by modern criteria yet with a high percentage of copper. Proportional to the needs of early copper metallurgy, such ore deposits yielded rather large amounts of copper. Therefore the choice of copper ore beds—especially oxide but also sulfide ores with secondary enrichment of the carbonate minerals—was based on knowledge acquired through former mining experience. Besides, those mining sites, though few in number, confirm the use of malachite, azurite and cuprite as the earliest raw material for mining copper. Such a conclusion was already known on the basis of analyses of the contents of the earliest copper objects; similarly, finely-ground carbonate minerals prepared for further processing have been discovered in some Eneolithic sites in southeast Europe, namely the settlements of the final Eneolithic in south Bulgaria. At Fafos, a Vinca site on the Kosovo plain in south Serbia, a similar mixture consisted of malachite, azurite and cuprite.

Similarities between old copper mines in southeast Europe and Asia Minor are also noticeable in the application of techniques of ore extraction. As none of those mining sites were metal implements used. It seems that the lack of metal tools in those mines is related to their higher value, but also to the technology of primary mining and the local conditions of such deposits. It is probable that copper implements were not sufficiently hard and durable for effective and continuous use in mining works. The quality of smelted copper, in particular its hardness and resistance to heavy action, did not allow for the manufacture of tools in contemporary mining. One of the reasons was the oldest mining production the need for hard copper alloy was ever present. On the other hand, this common phenomenon in the mines discussed previously may have a chronological significance: there are just two copper axes noted at Al Bunur, but they are chance finds. We would be quite justified in supposing that all the old mining works not only a mass of ore from metal tools were established during the Eneolithic and Early Bronze Age.

Of course this conclusion lacks precision
represented at Rudna Glava by rectangular, spherical, oval and wedge-shaped forms. The most likely conclusion to be drawn from these facts—on no traces of working by metal tools and a plethora of stone tools, especially massive mauls—is that the mine could be dated to the Eneolithic or Bronze Age. Following are some other characteristics, mostly confirmed by the investigation of Rudna Glava.

The presence of the remains of hearths or bright areas in the shafts points to use of the technique of alternate heating and cooling of the ores to break up compact blocks. Further, the use of water tools, mainly wedges and scrapers, is typical of mines of this age. Finally, current data do not favor the smelting of ores during this period at the mine itself, or in the immediate vicinity. An exception is the mining works from the Bronze Age of the Austrian Alps, where ore smelting was carried out in the vicinity of the shafts, so that the whole process of obtaining the metal was organized at the same place.

The distribution of massive stone tools connected with old mining works is so vast that one could hardly suppose their diffusion from a single center or region. For example, their appearance could be followed in various chronological phases from the Far East to the west coast of Europe and the central regions of Asia Minor. In addition to the examples from Rudna Glava, mauls of this type are known from old mining works in central Europe at Spiania Dolina, in central Italy at Cornacchione, province de Crosseto, and on the southwest shores of Ireland at Mount Gabriel.

At all of these sites, as probably at many others still undiscovered, such implements are nearly identical in form as well as in purpose and treatment. Therefore it seems reasonable to regard their origin and appearance as a consequence of the same or a similar technological level of primary metallurgy and mining of copper in the Old World. The utilization of the copper ore deposits was carried out therefore by a community with technology oriented to the use of the same tool types.

**FLINT AND COPPER MINING COMPARED**

It is understandable also that the broad distribution of the technology of copper mining must be based on previous experience in the mining of other minerals. Copper mining was not the first mining; before the appearance of the oldest copper mines in Europe, flint mines were already in existence. There is evidence that the quarrying of flint was as old as the Late Paleolithic in central Europe. There is also no reason for the origin of the mining of flint to be connected with any priority center. It is obvious that all developed cultures of the Mesolithic and Neolithic had to use local sources of material for the construction industry of chipped and polished stone tools, including here some local differences in the working techniques. In this connection it is clear that over the whole of the Old World the mining of flint and other minerals preceded copper mining, because the first had been developed as a response to the permanent demand for such raw material inherent in the Neolithic economy.

A number of flint mines have been discovered in west, east and central Europe. Some of them were investigated by systematic excavations giving reliable evidence on methods of exploitation. At the site of Krasnoe Soloe in White Russia, zones with vertical shafts, which were dug for the utilization of flint veins, occupied a large area, with more than a thousand shafts. The shafts had a diameter of 1.5-2 m. and reach a depth of 6 m. cutting through layers of chalk to find the rich deposits of flint. Abandoned shafts were filled by the matter from other, active shafts, or transformed into some sort of workshop for the rough fashioning of flint. Developed patterns of mining technology are seen at the flint mine at Latchfell – Ingham, near Brabant, in Belgium. Horizontal galleries branched out from the base of vertical shafts, similar to examples from the well-known flint mines of Grimes Graves in England. Vertical shafts which were dug to obtain flint were also known from Muemer, near Vienna, dated to the Late Neolithic or the beginning of the Early Eneolithic in Grenoble. Interlinking shafts, supporting posts that protected the galleries from subsidence or landslip are some of the characteristics represented at those flint mines. All of them confirm the use of developed mining techniques for obtaining flint in the time preceding, but also contemporaneously with, the early phase of earliest copper metallurgy. The vast scale of flint exploitation during the non-metallic periods of the iron industry is so clear that, until now, little discussion has referred to separate centers where flint mining may have originated. There is a commonly accepted idea that the mining of flint or other minerals has had independent origins and has met the local needs of every Neolithic population in the Old World. It is understandable that regions exceptionally rich in other raw materials—for example, obsidian—may have become exporters of finished or semi-finished articles over varying distances. But the export of the technology of the mining has not, as a rule, been taken into consideration in discussions of basic mining activity in prehistoric Europe.

On the basis of the simple relation between the mining of flint and the chipped stone industry, it is clear that detailed knowledge of copper preceded the developed phase of its primary mining. In this sense, the proposed stage of the use of native copper may have served as an introduction to more intensive utilization of the oxide ores. Since the appearance of native copper was as a rule connected with rich deposits of carbonate minerals of that metal, whose veins come directly to the surface, the utilization of native copper led, as is already known, to the exploitation of oxide ores of copper.

If such a view is correct, and it has been mostly accepted in the present explanation of the origin of copper metallurgy, one would expect the appearance of the larger mining works later, in the Late Eneolithic period or Early Bronze Age. The mines from the Near East mentioned above confirm such a dating in the Early Bronze Age. The examples from southeast Europe introduce some new elements in the investigations of the origin of copper mining or initial copper metallurgy.

The data from Rudna Glava point to large-scale exploitation of copper carbonate minerals. In the course of former excavations, nearly 25 vertical shafts were discovered as emptied channels of ore veins of various dimensions. The depth of some of them reached 20 m.; sometimes the veins ran into each other, or branched into sloping channels. The most important shafts, within the zone which has been explored so far, were concentrated along large fissures or broad cracks, e.g. shafts 3b, 4 and 5. Excavations in the area outside the
9 Entrance of shaft 5b

10 Altar with door's head terminal from hoard No. 3

11 Access platforms and upper part of shafts 3 and 4

12 Hoard No. 3 in situ

13 Profile of the material accumulated during the exploitation of the Early Eneolithic shafts
modern open-cast iron mine were carried out by Euxinus and Metalmurgia at Bor and the Institute of Archaeology in Belgrad. These discovered new, important stratigraphic data consisting of massive levels of material data from the shafts and accumulated during their exploitation.

On the research side of the masses of Rudna Glava, this reliable stratigraphy shows a relatively long duration of ancient mining activity. These three levels have accumulated in the course of the same cultural period— the Early Eneolithic—indicate individual

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**Bibliography**


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**Expedition**


