Flint mining and early copper mining in the South-East Europe

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Recently, more precise knowledge of primary copper mining has emerged from investigations of two well-preserved mines from the Eneolithic (Chalcolithic) period in the Balkans, viz. Rudna Glava in North-East Yugoslavia (JOVANOVIĆ, OTTAWAY, 1976) and Ai Bunar in South Bulgaria (CHERNIH, 1975). Despite of the lack of C-14 dates from both mines, one could say that Rudna Glava dates to the middle or second half of the fourth millenium B.C. in comparison with the end of the fourth millenium at Ai Bunar (JOVANOVIĆ, OTTAWAY, 1976).

The oldest copper mining ought to be understood as a specialized activity, whose aim was to supply raw material for the earliest copper industry. Mining was generally based on permanent increase in geological-mineralogical knowledge of the prehistoric populations of Europe. It was only the initial stage of such experience, but quite enough to provide raw materials for flint and stone industries during the non-metallic periods of prehistory.

This is confirmed by the sequence of mine workings at some richer flint sources. In the Swiss Alps, for example, the usage of the same source during the Middle and Late Paleolithic, as well as Neolithic, has been established (Löwenburg near Basel; SCHMID, 1975). Large scale of exploitation of flint during the Late Paleolithic are also known in South Poland (Swiderian culture). There the deposits of flint in chalk were extracted by means of shallow open casts. The export of this kind of chocolate flint was also estabilished almost as far as 200 km. From its source (KOZLOWSKI, KOZLOWSKA, 1975). Similar examples would be probably more numerous, as recent investigations of flint deposits have shown, as a rule, a long lasting exploitation, not always limited to single periods alone (GURINA, 1976).

In this sense, the beginning of mining indicated the theorethical conclusion that the requisite material, found on the surface, existed further, below surface. Surface finds were then observed as the sign of deeper deposits, covered by other material, i.e. barren soil. It is not possible to determine the time when such an idea of the underground deposits appeared, but that process is clearly illustrated by the sequence of extraction at some of the rich flint deposits. The example of the Rijckholt-St. Geertruid flint mine is very instructive in this sense, as it clearly illustrated the advance of primary mining technology beginning with gathering, and ending with rather sophisticated underground workings (CLASON, 1971; FELDER, RADEMAKERS, 1973).

Numerous excavated flint mines indicate the existence of advanced flint mining technology from extreme Western Europe to the plains of East Europe, south of the Austrian Alps and the Pannonian plain. Lack of flint mines in the Balcan is a consequence, in the first place, of the unsatisfactory investigations of this territory, but the natural habitat played also an important role.

One should bear in mind that the most important mines with the developed flint extraction technology were located in the plains of West and East-Europe. In regions of chalk, rich in flint deposits, evolved an advanced mining, with an effective technology (GURINA, 1976).

From the former facts, one could thus conclude that the developed mining in Prehistoric Europe existed before the first appearance of copper mining. The first use of copper dates to the Early Eneolithic, just at the time when flint mining achieved a remarkable advance. The parallel existence of those two branches of primary mining enables a direct comparison of their techniques.

Discovery of copper ore deposits could be connected with the common mineralogical knowledge of the Early Eneolithic populations, acquired during permanent explorations of sources of flint and stone. Besides, the oxide minerals of copper (malachite and azurite), were already used for green and blue pigments. Therefore they could be collected before the start of metallurgical processing. Native copper, closely connected with the zone of the oxidation of primary ore deposits, could also be very easily recognized. In this sense copper ore deposits, distinguished from the surroundings by their strong colours, could be well known in Prehistoric Europa, first in the South-East and Central regions, before the processing of copper started. Single finds of copper implements in the early neolithic groups of South East Europe point to such knowledge of copper deposits, rich in native copper (JOVANOVIĆ, OTTAWAY, 1976).

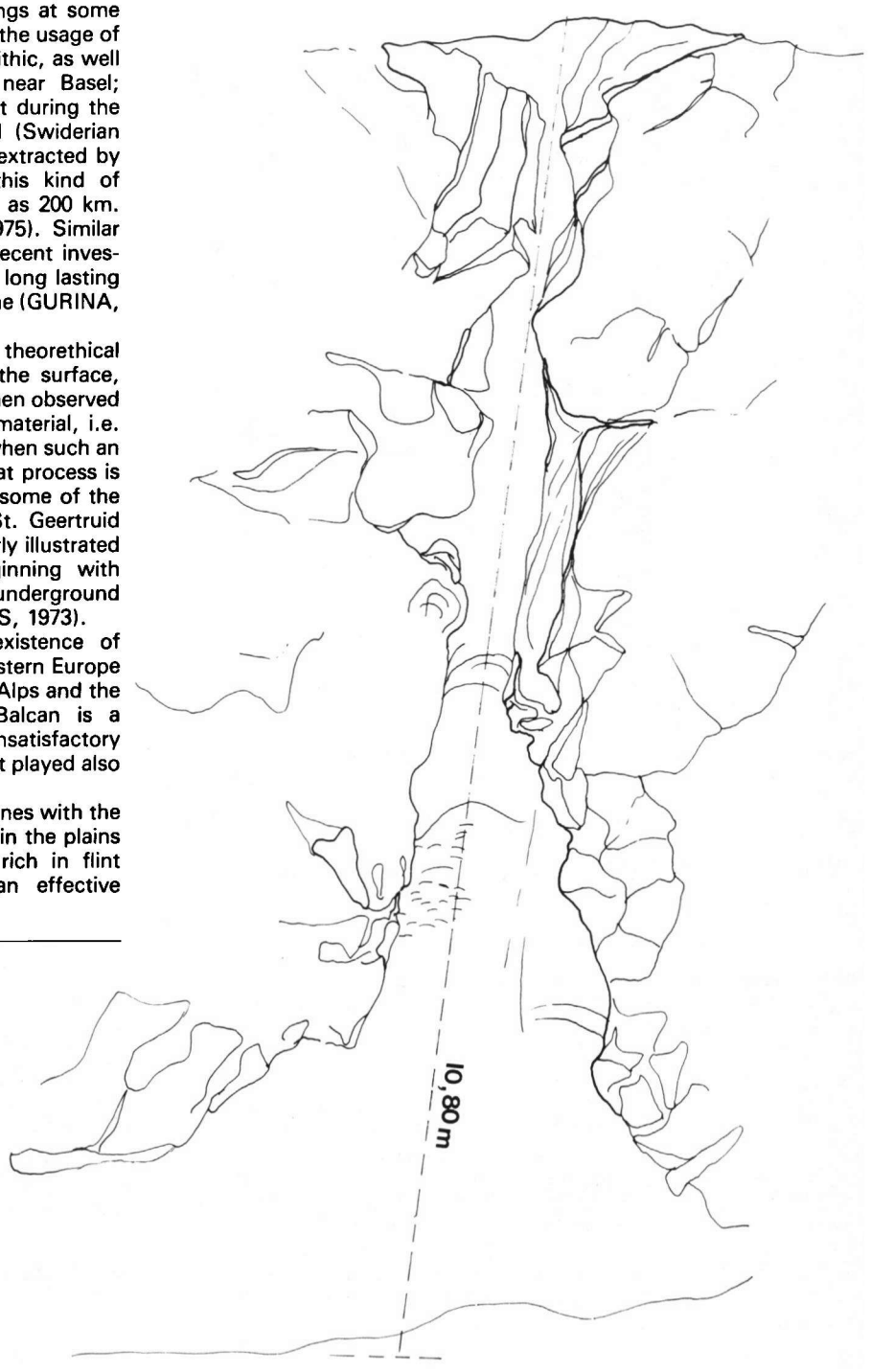

Fig. 1. Rudna Glava. Longitudinal section of shaft no. .8

The technology of the oldest copper mining, judging by the facts provided from Ai Bunar and Rudna Glava, is less developed in comparison with contemporary flint mining. Both mining techniques were divided according to their main aim; extraction of flint implies finding seperate layers or concretions of this material, while copper mining was directed to winning the greatest possible quantity of ores. In the first case, the shafts were merely the access to the desired material, in the second one, they represent empty ores channels (Fig. 1).

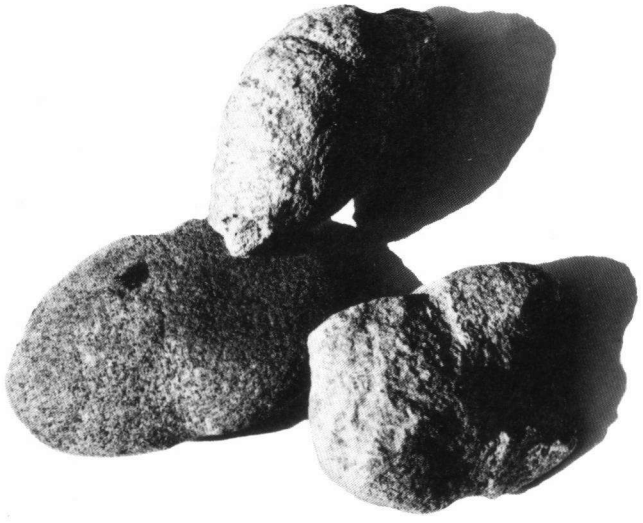

Fig. 2. Rudna Glava. Stone mauls from the base shaft no. 4a.

It is quite obvious at Rudna Glava, where a large number of early eneolithic shafts were preserved in older paleozoic limestone. Here the old miners followed the magnetite and chalkopyrite veins directly. The result of disintegration of the latter led to considerable concentrations of the oxide minerals of copper mainly of malachite and azurite. Here access platforms were dug - oval or funnel - shaped pits (JOVANOVIĆ, OTTAWAY, 1976), that cut through the humus layer and erosion products to the entrance of the ore chappel. After that the old miners just followed the channels, if its variable profile enabled deep excavation.

The ore were lifted out from the depth mostly 16-20m, after application of the old technique of alternate heating and cooling. The crumbling of ores was done by massive pebble-mauls, made of volcanic stone (Fig. 2) This working method is also known from some flint mines, especially where the layers of this mineral were bedded in hard limestone (SCHMID, 1976).

The use of antler tools is also documented (Fig. 3). Similar usage, but it seems, on a larger scale, has also been observed at all the flint mines. There is another analogy with the treatment of the raw material lifted out from the shafts. With flint mines, the first phase of the rough chipping of the concretions leads to the semifinished products. With the copper ores of Rudna Glava, mechanical treatment separates the oxide minerals from magnetite, including, probably, flotation at the end. In this case finally crushed oxide minerals of copper were obtained, similar to a powder.

A comparison between the technology of primary copper mining and the already developed exploitation of flint shows without doubt a higher technological proficiency in the latter. It could be explained first by the linger acquisition of experience in the use of flint, but also by the fact that mining of metal has meant a transition to a different kind of raw material. That is why coper mining originated through the application of local technological knowledge, as in independant development in its techniques.

The transition to the use of copper oxides was caused, naturally, by the initial introduction of copper. One should therefore underline the importance of the appearance of copper mining, as

Fig. 3. Rudna Glava. Antler tool from the base shaft no. 4a in situ.

it provided the raw materials for the rapid development of metallurgy in South-East and Central Europe. In that way the most important question of the evolution of the copper metallurgy by early Eneolithic population of South-Easst and Central Europe, has been solved by their own development, based on local knowledge of the requisite minerals. The origin of the knowledge of the processing of copper in that case is not of essential importance, as all the initial problems of the development of the first metal industry in these regions of Europe, were solved by the own technology.

In this respect the Early Eneolithic is the period when two essential mining technologies of prehistoric Europe coincided. On the one hand flint mining reached its peak, providing all the needs of sedentary agricultural communities for different tools, while on the other side the mining of copper began its development. The gradual introduction of metal in the commom usage would remove the mass use of flint tools, and mining of that material fall in consequence. Thus it is not accidentally that the largest flint mining workings were as a rule linked with the Late Neolithic and Eneolithic, reaching the beginning of the Early Bronze Age.

Some differences between the mining techniques of the both raw materials, flint and copper, are also noticeable. So the more simple copper mining technology reached a developed form just in the Bronze Age (PITTIONI, 1951). This advance phase of regression of technological achievement is a good example that this mining had its own, independent development. It seems that it did not receive any important and direct influence from the technologically more superior civilizations of the Mediterranean.

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