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# Ś L ą S K I E SPRAWOZDANIA ARCHEOLOGICZNE



I N S T Y T U T   A R C H E O L O G I I  
U N I W E R S Y T E T U   W R O C Ł A W S K I E G O

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## NEW RESULTS OF INVESTIGATIONS ABOUT THE PROVENIENCE OF THE RAW MATERIAL FOR HEAVY STONE TOOLS IN THE LINEAR POTTERY CULTURE OF LOWER AUSTRIA

**Abstract:** Mineralogical investigations for the heavy tools of two LBK settlements (Rosenburg, Mold) and one graveyard (Kleinhadersdorf) in Lower Austria showed a distinct choice of the raw materials for the tools, which seemed to be determined by their future function. The quality criteria for the adzes were especially high, amphibolite/foliated amphibolite was nearly exclusively used. With high probability this raw material came from the region of the Jizera Mountains (Jizerské hory) in northern Bohemia, where the exploitation of stones as well as the production of tools has been proven recently for the Linear Pottery culture (LBK). It was most astonishing to see that even high-quality quernstones were transported over long distances. Most of the grinding stones of the Mold settlement and some of the Kleinhadersdorf graveyard are made of a special quartz sandstone, whose nearest possible area of origin lies in Central Bohemia.

**Keywords:** choice of raw materials, origin of raw materials, adzes, grinding stones

Until some years ago very few mineralogical analyses of heavy stone tools existed in Austria and nearly no investigations concerning the sources of the raw materials. Therefore, I always admired the most important and interesting results that sort of research by Włodzimierz Wojciechowski since the 80th of the 20th century, I even was a little jealous (Wojciechowski 1984; 1990; 1996). Prof. Wojciechowski and I met personally several times and he always emphasized the importance to seek the mining places of the different raw materials. I am very glad to be able to present in his honourable memory the first successful investigations for Linear Pottery culture (further: LBK) stone tools from Austria. It is important to note that all results presented shortly in the following text would not exist without the most dedicated cooperation of Dr. Michael Götzinger, Institute of Mineralogy and Crystallography of the Vienna University.

Since the beginning of my studies in archaeology I was interested to know from where people got their raw materials. Therefore a petrological expertise by Prof. Dr. H. Wieseneder for two fragments of adzes is to be found in my PhD-thesis upon



a late LBK settlement site in Poigen near Horn, Lower Austria. Both adzes are made of amphibolite. The petrographic thin section showed under the microscope that the rock included hornblende, plagioclase and quartz. All these components indicate a source outside the Alpine region, probably in the zone of the Moravikum (Lenneis 1977, 53). This disappointing result was the reason, why mineralogical analyses are missing in the publications of LBK inventories published in the following years. The situation changed only a little more than 10 years ago. Within this time we got some interesting results of mineralogical analyses of adzes as well as of grinding stones which I would like to present shortly in the following text.

### AMPHIBOLITE – THE FAVOURED RAW MATERIAL FOR LBK ADZES

While people produced the stone axes of different sizes and forms from various raw materials, they nearly exclusively used amphibolite of extreme high quality for the adzes. This phenomenon is to be seen in Austria in the inventories of two settlement sites, Rosenberg and Mold, and in the grave furniture's of the Kleinhadersdorf cemetery.

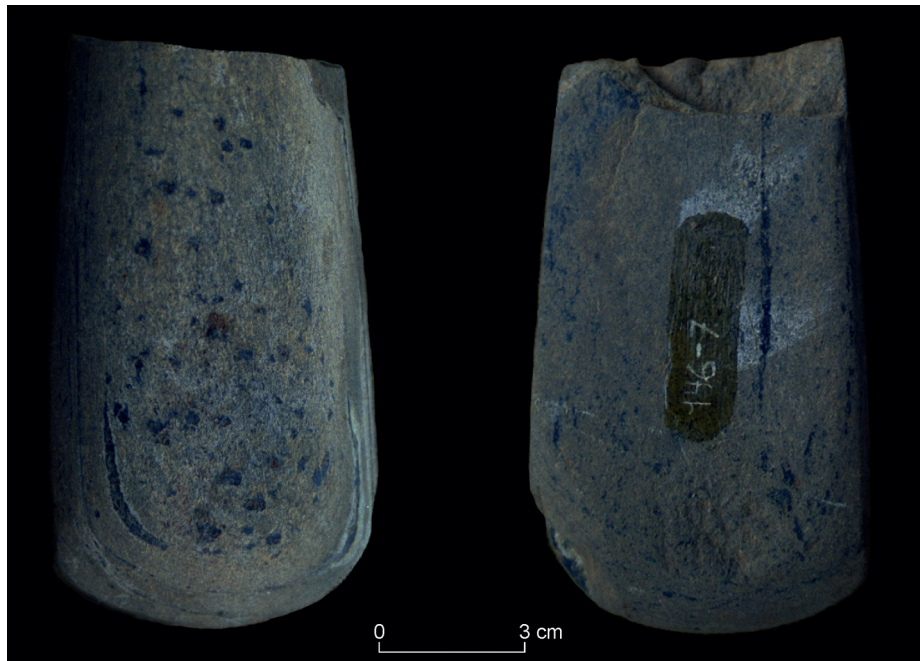
Rosenburg is a small settlement with only seven houses, which mainly were poorly preserved. The situation of the site in the rather deep valley of the Kamp together with a lot of specialities indicate, that it was a "Sonderplatz" (special site) of the elder LBK (Lenneis 2009). There are only two fragments of adzes. From each of them nearly the half is preserved. They are produced from foliated amphibolite (Fig. 1; Fig. 2). This raw material may originate from the near surroundings of the site as well as from the gravels of the Kamp River (Götzinger, Lenneis 2009, 108). Common amphibolite is the dominant rock in the terrain of the excavation and in the immediate surroundings too (Götzinger 2009, 107 and Abb. 58 – geological map).

The LBK settlement of Mold is a site of medium extent with an estimated total surface of 30,500 m<sup>2</sup>. 14,400 m<sup>2</sup> are excavated and gave the rests of 20 houses, some with excellent preservation (Lenneis 2010; Lenneis, Schwarzäugl 2019). Beside a very big amount of findings there only are three small fragments of adzes. They are produced from amphibolite/greenschist (see for ex. Fig. 3) and from an amphibolite/greenschist or greenschist with very fine grain. Another fragment (inventory n°521–144) was that heavy damaged that it was not possible to determine it as an adze or an axe. The raw material is a strongly foliated amphibolite with very fine grain. For the first time the mineralogists supposed that this raw material might come from a mine in Moravia or Bohemia (Götzinger et al. 2010, 196, 197 table 1).

In the LBK graveyard of Kleinhadersdorf near Poysdorf 57 graves with skeletons, four cremation graves and 26 empty graves are documented. There are 20 adzes which were found in 16 graves belonging to men or children as far as the anthropological identification was possible. Four adzes came from situations supposed to be disturbed graves (Neugebauer-Maresch, Lenneis 2015). The mineralogical analysis of the adzes



**Fig. 1.** Rosenberg, Lower Austria. Fragment of an adze (1 – 10/2) (photo E.Lenneis)



**Fig. 2.** Rosenberg, Lower Austria. Fragment of an adze (146 – 7) (photo E. Lenneis)



**Fig. 3.** Mold, Lower Austria. Fragment of an adze (1143 - 1) (photo E. Lenneis)

showed that they all were produced from the same raw material – amphibolite/foliated amphibolite – while the axes are made of different raw materials with much lower quality. The very high-quality amphibolite/foliated amphibolite of the adzes of Kleinhadersdorf seems to be the same as was used for most of the adzes of the Vedrovice graveyard in Moravia (Neugebauer-Maresch, Lenneis 2015, 123, table 24; Götzinger 2015). For the last A. Přichystal found out that the source of the raw material lies in the Jizera Mountains (Jizerské hory) in northern Bohemia close to the Polish border and the Giant Mountains (Přichystal 2002, 215). The very developed standardisation of the tools enables the possible production in near vicinity of the raw material sources and the dissemination of the finished products.

In the southern part of the Jizera Mountains systematical investigations uncovered some working places of the amphibolite or metabasite. At Jistebsko 1 an explicit working place of the LBK was identified. Extensive petrological and geochemical analyses of the rock proved, that it is the same rock as the raw material mostly used for the adzes from many LBK settlement regions in Germany (Ramminger 2009; Ramminger, Šída 2012). Similar analyses for the Austrian adzes are still missing, but are planned for the next future. Further questions to solve will be to find out, if beside of Jistebsko1 there are other LBK working sites too and if there are also similar traces of workshops and mining waste dip indicating the production of adzes close to the raw material source.



**Fig. 5.** Kleinhadersdorf, Lower Austria, grave Verf.22, adze (find n° 5) (photo E. Lenneis)

For quite a long-time most scholars thought that the raw material for the grinding stones – due to their considerable weight – only came from sources in the near surroundings of the settlements. With this assumption, we also started the investigation of 85 rests of grinding stones from the LBK settlement of Mold, which I presented shortly above. The extent mineralogical analysis of all these grinding stones showed an unexpected diversity of raw materials. Only a third of these rocks (29%) can be found in the nearer vicinity of the settlement, the part of the different rock types vary between 4 to 6%. Quartzite with Amphibole was used more often (23%). This rock type is known from different quarries in the zone of the “Moravo-Silesikum” in a distance of 20 to 150 km northeast of the settlement. The far dominant raw material (48%) is a high-quality quartz sandstone (see for ex. Fig. 6 a + b; fig. 7). Unexpectedly this rock is a foreign raw material. It contains glauconite, which indicates an origin in the region of the Bohemian “Oberkreide” (upper chalk zone in central Bohemia).





Fig. 6. Mold, Lower Austria, fragment of grinding stone (127-14/1) (photo E. Lenneis)

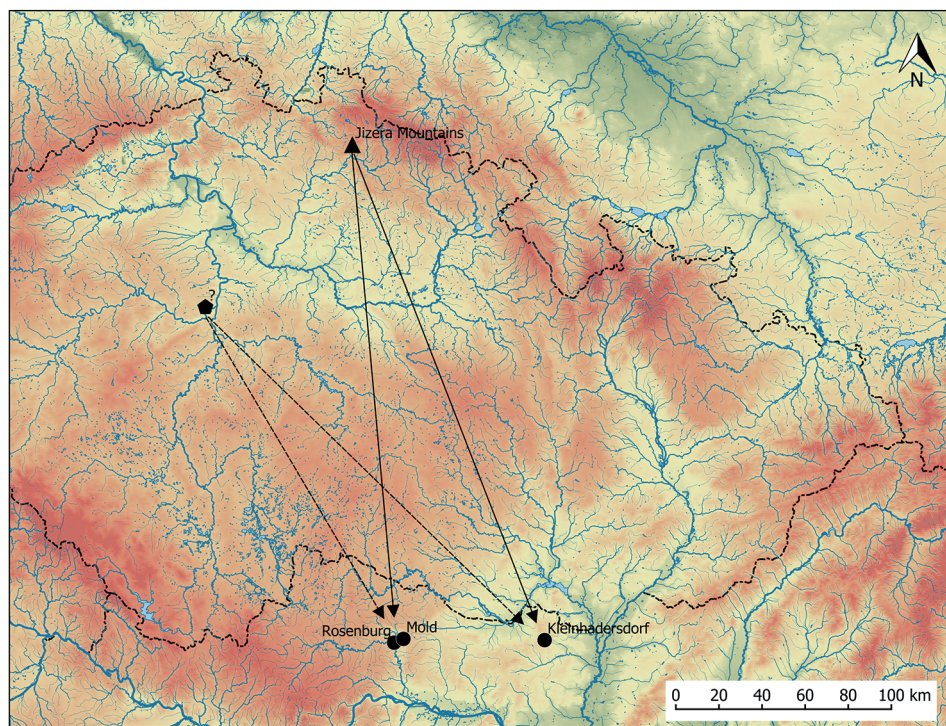




Fig. 7. Mold, Lower Austria, fragment of grinding stone (692-5) (photo E. Lenneis)



Fig. 8. Kleinhadersdorf, Lower Austria, grave Verf.67/1, fragment of grinding stone (find n°1) (photo E. Lenneis)



**Fig. 9.** LBK sites in Lower Austria and the probable regions of origin of the raw material in Bohemia: for the adzes (black lines), for most of the grinding stones (dotted line) (graph E. Lenneis)

Therefore, the raw material for the grinding stones or the tools themselves must have been transported over a distance of about 150 km (Götzinger et al. 2010, 195, 203–207).

Within the grave goods of the LBK cemetery of Kleinhadersdorf there is an unusual high amount of six rubbing plate fragments and 16 fragments of grinding stones. On several of these fragments traces of ochre were detected. The pulverisation of colour minerals might have been the primary use of the rubbing plates, which often are nearly complete and of considerable size. Surprisingly, they only were 2.0 to 2.5 cm thick. For these rubbing plates people used a very fine-grained sandstone, which can be found in the near surroundings and which is most suitable for the pulverisation of minerals. It certainly would not be possible to use these plates for the grinding of cereals. The 16 fragments of grinding stones were produced from quartz sandstone of medium-sized grains, which is most appropriate for the production of flour. Three fragments also contained inclusions of a glauconite (see for ex. Fig. 8) indicating that this most estimated raw material for grinding stones even was transported to the region of Kleinhadersdorf near Poysdorf (Neugebauer-Maresch, Lenneis 2015, 128–133 and table 27; Götzinger 2015, 170).

Recent research concerning the raw material for the grinding stones of an LBK settlement in Kosoř in the south of Prague gave indications for a big zone, where the quartzite and the high-quality quartz sandstone for these tools comes from. The authors even suggested that it might be the same material as used on the Austrian sites (Lička et al. 2014, 69, Obr. 16+17, 86–87).

### Preliminary results

The most interesting preliminary results of the recent investigations concerning the adzes, axes and grinding stone within the LBK of Lower Austria is the fact, that people seem to have chosen the raw materials for the tools very carefully and with good knowledge of their qualities. One gets the impression that people selected the raw material with the further function of the tools in mind. They established an impressive network to get the best material – or even the best tools – for their most important adzes, but also for part of their grinding stones (Fig. 9). The amphibolite/foliated amphibolite was nearly exclusively used for the adzes. This raw material might have come from a rather limited area in the south of the Jizera Mountains (Jizerské hory), where working places as well as traces for tool production are proved by recent research for the time of the LBK.

The region of origin of the high-quality quartz sandstone with glauconite, which was most suitable and favoured for the grinding stones, can't be determined so exactly. It is supposed to be in central Bohemia, the zone south-south-west of Prague in the surroundings of the LBK site Kosoř might be one of the possible sources.

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