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Utilization of siliceous weathering products during the Neolithic and Aeneolithic of the Czech Republic

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Siliceous weathering products originated during the geological history on different rock types of the Bohemian Massif. Two main groups of siliceous weathering products have been divided. To the first group belong opal and plasma (green coloured), which are formed as a part of the lateritic profiles mostly on ultrabasic rocks. Trnka (1981) studied opal from weathering cover of another metamorphic rocks (e.g. gneisses). According to Plusnina and, Szpila (1990), in special cases, they may generate recently under low temperature conditions as well. Together with described siliceous masses there are many varieties of silicificated lateritic residues and "siliciophites". The second group consists of clastic siliceous sediments including silcretes, i.e. products of surface and subsurface silicification. On the Bohemian Massif two major types of silcrete have been recognized: chert breccia and silica-cemented sandstones - quartzites (isolated blocks of quartzites called "sarsens, sluňáky "), which could represent different silicification mechanisms. Both silcrete types are preserved mainly as denudation relicts. Siliceous weathering products could be used as indicators of paleogeographical and paleoclimatical changes in geological past, but in the event of silcretes, only if their mode of origin is known.

Siliceous weathering products represented significant raw material for chipped industry during the Paleolithic and also the Neolithic/Aeneolithic of the Czech Republic.

Opal and plasma

From southern Bohemia, Žebera (1952) published the findings of artefacts made from brown variety of opal in the Epipaleolithic site near Křemže. Besides, there are many sources of opal and plasma also in southwest Moravia in area of Jevišovice and Náměšť nad Oslavou, which utilization were first mentioned by Přichystal (1979) and Kovárník (1980). Přichystal (1980, 1984) described plasma as a raw material on several Neolithic settlements (e.g. site at Těšetice - Kyjovice (the Znojmo district) with the Moravian Painted Ware culture). According to Kovárník (1992), in Czech- Moravian Highlands, there are a lot of localities where these kinds of raw material can be found, but only a few of them were used in the primeval period. This author informes of mining and primary processing of plasma in vicinity of Jevišovice, its distribution on the Neolithic / Aeneolithic sites, in which could represent the prevalent raw material. Similar data were given by Přichystal (1999). Kovárník (1992) also described several sources of opal (Mešovice, Čížov- the Znojmo district; opals from area of Nová Ves near Oslavany, Třebíč etc.) and findings of opal artefacts from the Upper Paleolithic site Lhánice II (the Třebíč district), the Late Neolithic site Příštpo (the Třebíč district) with the Moravian Painted Ware culture and the Middle Neolithic site near Čížov with the Linear Pottery culture - Šárka stage. Mrázek and Holá (1978) studied plasma (localities around Oslavany: Biskoupky, Hrubšice and Nová Ves near Oslavany) from gemological point of view.

Relicts of silcrete: quarzites and chert breccia

Both silcrete varieties represented significant raw material for production of chipped implements during the Paleolithic and younger ages as well.

Quartzites are distributed in regions of the Czech Republic largely as scattered solitary blocks ("sluňáky"), except ones from the Late Cretaceous and the Early Tertiary of north-west Bohemia (the Kadaň and Most areas).

Quartzites are potencially analogous to silcretes occuring elsewhere in the world (e.g. in the Tertiary Paris Basin in France (Thiry, Simon-Coinçon 1996); siliceous boulders ("sarsens, puddingstones") laying on various Cenozoic formations in southern England, where were used for parts of megalithic monuments such as the Avebury Stone Circle (Hepworth 1998, Ullyot et al. 1998) etc.).

Knowledge about quartzites from north- west Bohemia were summarized by Malkovský and Vencl (1995). They discussed genesis, division with characteristic features and exploitation during prehistory. Neústupný (1966) described mining of Tušimice type during the Neolithic/Aeneolithic. According to Friedrich (1972), Bečov type was mined in surface pits and in open shafts till the Middle Bronze age. In addition, several types of described quartzites (Skršín, Bečov, Tušimice) are known from the Paleolithic to the Neolithic / Aeneolithic in Moravia as well.

Chipped artefacts made from quartzites "sluňáky" were described from the Late Paleolithic settlements situated on southern slopes of Drahanská vrchovina Highland (central Moravia) by Absolon (1935), Štelcl and

Malina (1973) and others. Quartzite blocks are possible to find also at Nízký Jeseník Highland and Maleník block, which were used on the Aurignacien sites around Přerov (Přichystal 1999).

Sources of chert breccia are known from the Krumlovský les Highland, Brno agglomeration and central part of the Moravian Karst. Chert breccia from the Krumlovský les Highland were studied by Jaroš (1965) and Přichystal (1998). There is evidence for its utilization on several Paleolithic and Neolithic/Aeneolithic sites in the vicinity of Moravský Krumlov (Vedrovice). Artefacts made from chert breccia are known also from the Early Bronze age site Kubšice.

The author studied the collection of siliceous weathering products, which utilization (exploitation) is expected or proved. Studying siliceous weathering products of serpentinites is based on thin sections observation, determination of SiO_2 modifications by X-ray diffraction and analyses of trace elements by ICP (Inductively Coupled Plasma). In conformity with X-ray powder diffraction, several SiO_2 modifications were indicated. Opals (milk-white opals from localities Bohouškovice near Křemže and Smrček near Nedvědice) included disordered crystalline low temperature a - cristobalite (lussatite) and a - tridymite, so it is possible to used the term opal-CT. Some kinds of opal reveal the transformation to chalcedony (including minor content of quartz). Almost all studied plasma and silicified lateritic residues consist of microcrystalline quartz (chalcedony). In siliceous matrix of last described material could be observed relict structures (often emphasized by mixture of ferrous compounds) and remnants of minerals (e.g. amphiboles, chlorites, magnetite etc.). Among investigated siliceous masses there are considerable differences at trace elements contents, especially Ni and Co, which could be caused by position within weathering profiles or by origin during different stages of weathering.

As regards of silcretes, the most important is determination of their origin. On the Bohemian Massif, two genetic categories have been recognized: pedogenic ("complex" or "weathering") and groundwater ("simple") silcrete. Their division is based on detailed description of micromorphological features under polarizing microscopy and analyses of individual features (titanium and iron contents) by electron microprobe. Thin sections (chert breccia, Moravian quartzites) were made only from scattered blocks, because there are no profiles preserved. Pedogenic silicification (which results in origin of almost all quartzites) took place on former land surface, so it is the most useful paleoenvironmental indicator. Groundwater silcretes (Bečov type of quartzite) could form in different depths and they are related to former groundwater phenomenon. It is possible to observe also multiphase silicification in some chert breccia. Recognition of silcrete genetic types, their mineralogy and chemistry may be useful for identification of source area as well.

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