TERMINOLOGICAL PRACTICE FOR SILICEOUS ROCKS IN HUNGARY FROM PETROARCHAEOLOGICAL POINT OF VIEW

KOVAKŐZETEK TERMINOLÓGIÁJA: A MAGYARORSZÁGI GYAKORLAT PETROARCHEOLÓGIAI SZEMPONTBÓL

KATALIN T. BIRÓ

Magyar Nemzeti Múzeum

E-mail: tbk@ace.hu

Abstract

The terminology of siliceous rocks is an important issue for archaeometry, in the first place, petroarchaeology. It is imperative that scientific communications should use sound nomenclature with stable disciplinary background that are recognised and acknowledged by scholars of other disciplines and other countries as well. This paper aims at summarising the Hungarian practice on the basis of mapping geology, lithostratigraphic units and petroarchaeological practice.

Kivonat

A kovakőzetek nevezéktana fontos kérdés az archeometriai (elsősorban, petroarcheológiai) megközelítés szempontjából is. Alapvető, hogy az e tárgyban írt tudományos közlemények diszciplinárisan megalapozott, egyértelmű neveket használjanak, amelyek felismerhetők és elismertek, a társtudományok és a nemzetközi kutatási gyakorlat számára. A jelen közlemény a Magyarországon használt és elfogadott terminológiát gyűjti össze, a földtani térképezési gyakorlat, a litosztratigráfiai egységek és a petroarcheológiai gyakorlat alapján.

KEYWORDS: TERMINOLOGY, SILICEOUS ROCKS, HUNGARY

KULCSSZAVAK: TERMINOLÓGIA, KOVAKŐZETEK, MAGYARORSZÁG

Introduction

Siliceous rock terminology is a very topical problem. These rocks are composed basically of SiO_2 minerals, quartz, chalcedony and opal. The SiO_2 content of these rocks is typically over 90%. We can find them in various context: sedimentary, igneous/volcanic (postvolcanic) context and metamorphic environment. They may be important constituents of regional lithologies. Fine grained, micro- and cryptocrystalline varieties with homogeneous texture and conchoidal fracture were preferentially used for the production of chipped stone artefacts; hence the distinguished interest of archaeologists for these rocks, their possible sources and possibilities for source identification (provenancing, characterisation). Correct nomenclature may help us to delimit potential source regions; a chaos in terminology, at the same, time, will blur the identity or differences. Therefore we are absolutely interested in clearing concepts and are grateful for the IMA'2010 Congress held in Budapest for the possibility.

Apart from their importance in natural sciences, siliceous rocks have a special importance in human history, especially in the most ancient times, the Palaeolithic Age and the older phase of prehistory (Neolithic and Aeneolithic periods). Chipped stone artefacts, i.e. tools made by knapping suitable rocks (hard, fine grained rocks with homogeneous texture and chonchoidal fracture), were mainly made of siliceous rocks of various type and origin, from different geological sources, different genetical record and geological age. The localisation of these sources may essentially help in reconstructing prehistoric technology and trade routes.

Identification, characterisation and research of the provenance of siliceous rocks as basic raw materials for stone artefacts dates back to more than hundred years in Hungary (Biró 2008, 2009 with further references). The first students of these problems were pioneering figures of Hungarian archaeology and geology. The systematical investigation of the chipped stone artefact raw materials sources took place in the 1980-ies, resulting in one of the first large comparative collections for lithic raw materials, the Lithotheca of the Hungarian National Museum (Biró & Dobosi 1991, Biró et al. 2000).

In discribing the specimens of the collection we were always trying to conform to the nomenclature used by mapping geology. It was often observed, however, that the different names used by different experts varied according to the background information of the researchers, leaving us with synonymes and conflicting nomenclature, in some cases, directly mistaken terminology. Moreover, the

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effort of allocating raw material type groups separated in the material of archaeological lithic assemblages to distinct source regions created a special petroarchaeological terminology implying in the name, possibilities of geographical provenance (Biró 1988, 1998).

As an archaeologist, it is not my duty to give and even less, to correct mineralogical and petrographical names. At the same time, petroarchaeological characterisation studies require to call „a spade a spade", i.e., separate the separable under different names. In this paper I am trying to collect existing practice in Hungary. In the followings, I will systematically „neglect" sandstone (which, in a sense, can be a siliceous rock itself) where I do not see terminological problems and that plays a different role in petroarchaeology.

Mineralogical and petrographical works on siliceous rock terminology in Hungary

There are relatively few works specifically concentrating on the terminology of siliceous rocks. One of them is by E. Károly, on the Buda **hornstone** (= **szarukő**, Károly 1936). In the same year, E. Lengyel published a paper on another type of siliceous rock with basically different conditions of formation, i.e. **jasper** (=**jáspis**, Lengyel 1936). There is, to my knowledge no other paper specifically dedicated to siliceous rock terminology on the Hungarian side. Closely related to the subject, there are a number of mineralogical treatises on SiO_2 minerals in textbooks (Koch 1985, Szakáll 2005 etc.) and specialist's studies (Takács 1983) and also useful bits of information in classical petroarchaeological studies.

Textbooks of mineralogy/petrology on siliceous rocks

In the applied geological manual by Mrs. Végh (1968) on the geology of non-metallic/ore mineral raw materials (*Nemércek földtana*), she systematised siliceous rocks the following way:

Minerals of magmatic origin / hydrothermal phase (pp. 58-62)

Minerals of sedimentary origin / siliceous sediments (pp. 73-101)

The following terms were used:

Quartz, rock crystal, opal, chalcedony (for minerals)

„Sandstone quartzite", quartz arenite / hu: homokkőkvarcit (kvarchomokkő) (=young)

metamorphic quartzite / hu: metamorf kvarcit (=old)

vein quartzite / hu: telérkvarcit

limnic quartzite / hu: limnokvarcit

limnic opalite / hu: limnoopalit

limnic chalcedonite / hu: limnokalcedonit

siliceous earth, diatomaceous earth / hu: kovaföld, diatomaföld

flint (=chert), hornstone / hu: tűzkő, szarukő

In a three-volume textbook on sedimentology (Balogh ed. 1991), Kálmán Balogh consecrated a chapter to the problematics of siliceous rocks (Balogh 1991).

He used the following main terms:

siliceous sediment / hu: kovaüledék

opal / hu: opál

geyserite / hu: gejzirit

limnic opalite / hu: limnoopalit

limnic chalcedonite / hu: limnokalcedonit

flint / hu: tűzkő

radiolarite / hu: radiolarit

spiculite / hu: spiculit

porcelanite / hu: porcelanit

The scheme on the division of siliceous rocks suggested by Balogh is reproduced here in the **Appendix** in English

Siliceous rocks in geological (mapping) practice

The most important "guideline" for a petroarchaeological terminology is the result of standard regional geology, which is best reflected in mapping. For the current summary, I am presenting the nomenclatural practice reflected in nearly 200 years of geological mapping. The electronical publications of MÁFI are of special help in this (esp. Gyalog et al. 2005).

In the geological mapping of the Tokaj Mts., especially rich in varied siliceous rocks (Gyarmati 1977), the following lithological units were used for siliceous rocks:

limnic quartzite / hu: limnokvarcit

geyserite / hu: gejzirit

hydroquartzite / hu: hidrokvarcit

On the detailed geological map of the Cserhát Mts. (Compiled by J. Noszky, 1940), no siliceous rock formations are mapped, though the area is rich in siliceous rocks from the Triassic/Jurassic as well as the Miocene period as surveyed recently by A. Markó (2005)

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On the 1: 300,000 geological map of Hungary (Balogh et al. 1958), the following lithological units were separated and mapped:

Quartzite / hu: kvarcit (Pe1[1])

Hornstone (limestone with hornstone) / hu: szaruköves mészkő (T2, T3)

Siliceous schist / hu: kovapala (T2)

Siliceous marl and limestone / hu: kovás márga / mészkő (J3)

Hydroquartzite / hu: hidrokvarcit (M2)

On the 1:200,000 the geological map of Hungary, presented on 23 sheets, the following siliceous rock lithological units were separated and mapped[2]:

L-33-V. Sopron (1981) – **quartzite / hu: kvarcit** (Paleozoic)

L-33-XII. Veszprém (1972) – **flint, cherty (=siliceous) limestone, dolomite with flint nodules /hu: tűzköves, kovás mészkő, dolomit tűzkőgumókkal** (Triassic), **cherty (=siliceous) limestone, nodular limestone, platy radiolarite, limestone with flint (=siliceous) veins, radiolarite / hu: tűzköves, gumós mészkő, lemezes radiolarit, mészkő tűzkőerekkel, radiolarit** (Jurassic)

L-34-I. Tatabánya (1968) - **cherty (=siliceous) dolomite, limestone, limestone with flint nodules / hu: tűzköves dolomit, tűzköves mészkő** (Triassic), **tűzkőgumós mészkő** (Jurassic)

L-34-II. Budapest (1966) - **cherty (=siliceous) limestone hu: tűzköves mészkő** (Triassic), **hydroquartzite / hu: hidrokvarcit** (Miocene)

L-34-VII. Székesfehérvár (1972) - **cherty (=siliceous) limestone / hu: tűzköves mészkő** (Triassic), **nodular limestone with flint (i.e., chert) / hu: tűzköves gumós mészkő** (Jurassic), **postvolcanic hydrothermal silicification / hu: utóvulkáni hidrotermális kovásodás** (Eocene)

M-34-XXXII. Salgótarján (1966) – **quartzite / hu: kvarcit** (Triassic)

M-34-XXXIII. Miskolc (1975) - **cherty (=siliceous) limestone / hu: tűzköves mészkő** (Perm), **cherty (=siliceous) limestone, siliceous schist, flint / hu: tűzköves mészkő, kovapala, tűzkő** (Triassic)

M-34-XXXIV. Sátoraljaújhely (1966) – **siliceous sediments (hydroquartzite, geyserite, limnic quartzite, diatomaceous earth) / hu: kovaüledékek (hidrokvarcit, gejzirit, limnokvarcit, kovaföld** (Miocene)

This summary is obviously incomplete, however, it demonstrates clearly that terminology as well as mapping practice was not consequent even in the more recent times.

Siliceous rocks in the Lithostratigraphical Formations

Closely related to mapping, the list of lithostratigraphical formations also contain a highly standardised and unified nomenclature, including, among others, siliceous rocks. As it is well known, the constructors of the lithostratigraphical units aimed at putting the most characteristic rock types into the name of the formation or its subordinate members. For the survey of siliceous rocks among accepted lithostratigraphical units, two basic publications were used in which lithographical units were systemathised and, later, completed (Császár ed. 1997; Gyalog & Budai eds. 2004).

Name of the siliceous rock included in formation name:

Lókút Radiolarite Formation (lJ2-3)

Csipkéstető Radiolarite Formation (cJ3)

Bányahegy Radiolarite Formation (bJ2)

Darnó Radiolarite Formation (dT2-3)

Szárhegy Radiolarite Formation (sT2-3)

Siliceous rock names occurring in the lithological descriptions (not in the formation name):

radiolarite (hu: radiolarit, 16) + Bódvavölgy Ophiolite Formation (bvT2-3); Buchenstein Formation (bT2) as "calcareous or siliceous tuffite (radiolarite)";

flint (~chert) (hu: tűzkő, 8) Lábatlan Sandstone Formation (lK1-2); Lókút Radiolarite Formation (lJ2-3) "Póckő Flint Member and Margithegy Flint Member"; Isztimér Limestone Formation (iJ1) "spongiolite cherty limestone and spongiolite limestone"; Kishát Limestone Formation (kJ1) (with manganese-containing cherty beds); Csővár Limestone Formation (cT3-J1) (with flint lenses)

"flinty" (~cherty) (hu: tűzköves, 23) Szentiványhegy Limestone Formation (sJ3-K1) (cherty limestone); Márévár Limestone Formation (mvJ3-K); Pálihálás Limestone Formation (pJ3) cherty limestone); Lókút Radiolarite Formation (lJ2-3); Várkony Limestone Formation (vJ3); Eplény Limestone Formation (eJ1-2); Telekesvölgy Komplex (TT3-J); Isztimér Limestone Formation (iJ1); Rezi Dolomite Formation (rT3) (cherty dolomite); Veszprém Marl Formation (vT3) (cherty limestone); Rónabükk Limestone Formation (rbT3); Felsőtárkány Limestone Formation (ftT3); Hollóstető Limestone Formation (htT3); Szinva Metabasalt Formation (snT3); Pötschen Limestone Formation (pT3); Szőlősardó Marl Formation (saT3); Buchenstein Formation (bT2); Felsőörs

[1] In brackets, the standard abbreviations for geological age

[2] only the siliceous rock lithological units listed here

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Limestone Formation (fT2); Bódvarákó Formation (brT2) (cherty dolo-marl, siliceous aleurolite);

silex (hu: kova, 1) Hárshegy Sandstone Formation (hOl1) "binding matter";

siliceous (hu: kovás, 17) Kálla Gravel Formation (klPa2) (siliceous sandstone quartzite); Tard Agyag Formation (tOl1) (siliceous schistose marl); Lókút Radiolarite Formation (lJ2-3); Telekesoldal Komplex (TJ) (siliceous marl-claystone); Várkony Limestone Formation (vJ3) (siliceous limestone); Fonyászó Limestone Formation (fJ3) (siliceous limestone and radiolarite); Dorogó Calcareous Marl Formation (dJ2) ("siliceous marl"); Csővár Limestone Formation (cT3-J1); Vasas Marl Formation (vJ1) (siliceous sandstone); Buchenstein Formation (bT2); Csernelyvölgy Sandstone Formation (cO3); Rágyincsvölgy Sandstone Formation (rO3);

limnoopalite (hu: limnoopalit, 1) Sajóvölgy Formation (sMb-Pa1)

quartzite (hu: kvarcit 8) Zámor Gravel Formation (zPa1); Nadap Andesite Formation (nE2-3); Recsk Andesite Formation (rE3); Mályinka Formation (mC2); Balatonfőkajár Quartzphyllite Crystalline Schist Komplex (FPz)

Further data in Gyalog & Budai eds. 2004:

quartzite (hu: kvarcit): Murakeresztúri Tuffaceous Sandstone Formation (muT); Darnó Conglomerate Formation (dMe); Magasbörzsöny Andesite Formation (mbMb); Ligetmajor Diatomaceous Earth Member (eb lMs2–Pa1); Rátka Quartzite Member (eb rMs2–Pa1); Megyaszó Conglomerate Formation (maPa1)

The Geological Map of Hungary (Gyalog et al. ed. 2005)

On the most recent and widely available digital geological map, the following siliceous rocks are treated as individual lithological units:

Eponym units:

Radiolarite (hu: radiolarit)

Szárhegy Radiolarite Formation

Dallapuszta Radiolarite Formation / Darnóhegy Radiolarite Formation

Lókút Radiolarite Formation

Bányahegy Radiolarite Formation

Csipkéstető Radiolarite Formation

Flint (hu: tűzkő)

Póckő Flint Member

Margithegy Flint Member

Limnic quartzite (hu: limnokvarcit)

Gyöngyöspata Limnic Quartzite Member

Rátka Quartzite Member (sic!)

Quartzite

Seprőkötőhegy Quartzite Member

Nagyfüzes Quartzite Member

Other lithological units with siliceous rocks specifically mentioned:

Radiolarite (hu: radiolarit (33)[3]): Várhegy Formation, Buchenstein Formation, Bódvavölgy Ophiolite Formation, Hídvégardó Olistostrome, Szárhegy Formation, Telekesvölgy Komplex (radiolarite-spiculite), Eplény Limestone Formation, Darnó Conglomerate Formation,

Flint[4] (hu: tűzkő (8)): Pötschen Limestone Formation, Isztimér Limestone Formation, Lókút Radiolarite Formation, Iharkút Formation

Siliceous... (hu: tűzköves... (29)): Bódvarákó Formation (siliceous dolomarl, siliceous aleurolite), Felsőörs Limestone Formation, Buchenstein Formation, Reifling Limestone Formation, Bódvalenke Limestone Formation, Szinva Metabasalt Formation, Szőlősardó Marl Formation, Pötschen Limestone Formation, Felsőtárkány Limestone Formation, Veszprém Marl Formation, Sándorhegy Formation, Rezi Dolomite Formation, Telekesvölgy Complex, Csővár Limestone Formation, Isztimér Limestone Formation (spongiolite), Eplény Limestone Formation, Lókút Radiolarite Formation, Oldalvölgy Formation, Pálihálás Limestone Formation, Szentiványhegy Limestone Formation, Várkony Limestone Formation, Márévár Limestone Formation

Silex (hu: kova (3)) Hárshegy Sandstone Formation - binding material of the sandstone matrix; Keszthely Mts.: young hot water sediments

Quartzite (hu: kvarcit (23)) Füzesárok White Schist Formation, Balatonfőkajár Quartzphyillite Formation, Mónosbél Formation, Nadap Andesite Formation, Recsk Andesite Formation, Darnó Conglomerate Formation, Erdőbénye Formation, Rátka Quartzite Member,[5] Megyaszó Conglomerate Formation, Zámor Gravel Formation, Kálló Gravel Formation,

Limnic quartzite (hu: limnokvarcit (7)): Gyöngyöspata Limnic Quartzite Member; Szurdokpüspök Formation, Erdőbénye Formation

Limnoopalite (hu: limnoopalit (1)): Sajóvölgy Formation

The following terms, used in other mapping practice were also tested:

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[3] the numbers in brackets are sum of instances of mentioning in the explanation text, an index of the "popularity" of the term

[4] "tűzkő" is often used in a wider sense for silex in general or chert. Therefore "siliceous" will mean partly *tűzköves* and *kovás,* inconsequently.

[5] meaning, hydro- and/or limnic quartzite

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Hydroquartzite (hu: hidrokvarcit 0)

Hornstone (hu: szarukő 0)

Jasper (hu: jáspis 0)

3. Classical petroarchaeological literature

Starting from the first works on chipped stone artefacts in Hungary, the raw material of the tools was of primary concern. The first descriptions separated "**obsidian**" and "**silex**" (**hu: kova**). (e.g. Rómer 1878 with distribution map: re-published by Biró 2005 *Fig.1*.). Later on, the term "**tűzkő**" (i.e., **flint**) was introduced meaning silex in general (Papp 1907). In the description of the first large Palaeolithic sites, the following terms were introduced[6]:

Tata (Kormos 1912):

flint (hu: tűzkő)

quartzite (hu: kvarcit)

hornstone (hu: szarukő)

lydite (hu: lidit)

stomolite (hornfels)

jasper (hu: jáspis)[7]

limestone

silex (hu: kova)

Szeleta-cave (Vendl in Kadić 1915) using thin section petrography:

ash-grey chalcedony (Szeletian felsitic porphyry / metarhyolite, Dobosi 1978)

chalcedony (various colours) **(hu: kalcedon)**[8]

chalcedony-opal (various colours) **(hu: kalcedon-opál)**[9]

opal (hu: opál)

quartzite (hu: kvarcit)

limnic quartzite (hu: limnokvarcit)

Subalyuk-cave (Vendl 1933, 1935, Vendl in Kadic 1915) using thin section petrography:

hornstone (hu: szarukő)

sandstone

silicified marl

chalcedony (hu: kalcedon) [10]

jasper (hu: jáspis)

milky quartz (hu: tejkvarc)

radiolarite (hu: radiolarit)

obsidian

The next important step in lithic artefact petroarchaeology is the time of the great monographs in the 1960-ies. For Tata, Érd and later on Vértesszőlős professional petrographic studies were made, finding the local resources mainly for the Middle and Lower Palaeolithic industries. László Vértes collected the available natural scientific data on Hungarian sites including petrographical identification (Vértes 1965, Biró 2008a) and came up with the following terms:

obsidian (hu: obszidián)

Szeletian felsitic porphyry/metarhyolite (hu: Szeletai kvarcporfír/metariolit)

hydroquartzite (hu: hidrokvarcit)

porphyryte (hu: porfirit)

block silex (hu: tömbös kova)

pebble silex (hu: kovakavics)

silex (hu: kova)

Pebble (hu: kavics)

quartzite (hu: kvarcit)

wood opal (hu: faopál)

bone (hu: csont)

others (hu: egyéb)

Additional terms Vértes was using in his other works:

stone marrow (hu: kővelő)

limnic quartzite (hu: limnokvarcit)

Swieciechów silex (hu: Swieciechówi kova)

sandstone (hu: homokkő)

radiolarite / jasper (hu: radiolarit/jáspis)

Following the period of the "great monographs" Viola Dobosi in an important article (Dobosi 1978) asked for the help of professional geologists, working at that time on petroarchaeological problems, to help in clarifying siliceous rock nomenclature. The study was concentrated on, mainly, lithic raw materials from North-East Hungary. The specimens were divided into two classes, i.e. „**Tűzkövek**" (=**flint**) and „Kőzetek" (=rocks). Among the former, types with radiolaria (=**radiolarite**), types with large amount of **opal** and types with large amount of plant fossils (=**hydroquartzite**[11]) were separated by the geologist, Ms. Ravasz-Baranyai. Among the „rocks" she also mentioned opal and opalised rhyolite tuff as well as hyalitic rhyolite.

Discussion

The author was first facing the problem of siliceous rock nomenclature in the early 1980-ies while mapping, registering and collecting rocks viable for

[6] siliceous rocks marked **bold**

[7] in fact, it is radiolarite (Végh-Viczián 1964, Biró 2004)

[8] in fact, hydro- and limnic quartzites

[9] basically, limnic quartzites

[10] limnic quartzite and, partly Szeletan felsitic porphyry

[11] correctly: limnoquartzite

chipped stone artefacts in Hungary (Biró 1984a,b, Biró & Pálosi 1986). The lesson I could draw from my initial efforts was to respect the opinion of geologists, in the first place, mapping geologists and record terminological practice in standard descriptions based on a database and collection approach (Biró & Dobosi 1991, Biró et al. 2000 Biró 2005). We collected hand specimens with all available information: provenance data, geology, lithology and complete it with as much as we know by analytical data (thin section, geochemistry, palaeontology and geochronology).

In a recent summary on Hungarian lithic raw materials (Biró 2009) I made the following scheme (**Fig. 1.**, after Biró 2009 fig. 2)[12]. At the same time I am aware of existing conflicting terminologies that make our regional and inter-regional work (=provenance analysis of lithic material) really difficult, sometimes contradictory.

Conclusions

Since the 1980-ies, the necessity for a standard and applicable terminology in respect of siliceous rocks used for prehistoric stone tools is absolutely clear. The systematic unification of terminology should be based on clear mineralogical, genetical and lithostratigraphical criteria. Regional, ie. "fingerprinting" aspects should be based on these standards.

The attitude of mapping geologists is seemingly different. Some simplify all siliceous rocks under „tűzkő" (flint / chert, meaning silex); some do not even think they are diagnostic in separating different lithologies. Detailed regional maps can be more specific and exact, but not necessarily so.

There are, however, tendencies observable: **hornstone (hu: szarukő)** is seemingly going „out of fashion" while **radiolarite (hu: radiolarit)**, probably due to its excellent environment marker characteristics, is getting gradually more important.

Problematic issues

- **silex/chert/flint/** "hornstone" (for shallow water sedimentary siliceous rocks)

- "**-quartzite**" in non-metamorphic context e.g. limno-, hydroquartzites (even Rátka Quartzite Formation for Neogene sedimentary series!)

- **jasper** (for radiolarite)

- **radiolarite / chert / lydite /siliceous schist and slate / chert**

[12] omitting items which do not fall into the category of "siliceous rocks")

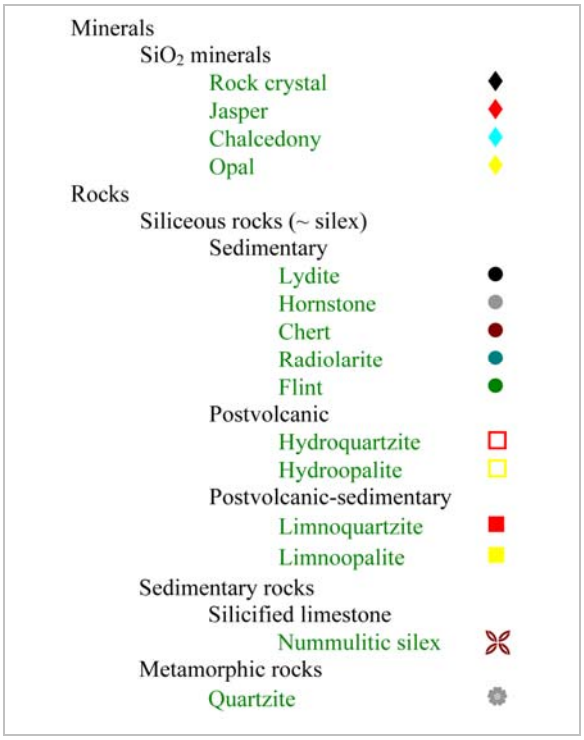

Fig. 1.: Scheme on siliceous rocks used for prehistoric stone artefacts in Hungary (after Biró 2009 fig. 2.)

1. ábra: Kovakőzetek a magyarországi őskori kőeszközök nyersanyagai között (Biró 2009 fig.2. nyomán)

It would be really important to agree on proper nomenclature, maybe on a broad/more specific basis, first clearing the mineralogical and geological background and later adding the petroarchaeological information as well.

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