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# SZELETIAN FELSITIC PORPHYRY: NON-DESTRUCTIVE ANALYSIS OF A CLASSICAL PALAEOLITHIC RAW MATERIAL

Szeletian felsitic porphyry is one of the most famous raw materials used in the Hungarian Palaeolithic.[1] It was identified, under various names, by students of the Palaeolithic material of the Bükk region in the earliest petroarchaeological descriptions. Due to its high silica content and homogeneity it was erroneously identified as hornstone,[2] later as ash-grey chalcedony,[3] even in petrographical descriptions based on thin sections.[4] Interestingly, the geological source was placed on the plateau of the Avas, where solid 'flint' and 'chert' were reported.[5] With the advance of new analytical methods and their application to archaeology, Lajos Tóth, at that time general engineer of the Diósgyőr Steel Works, and László Vértes, curator of the Hungarian National Museum, performed a classical study to fingerprint this material.

Following the geological descriptions of Gábor Pantó,[6] they sampled sources of "quartzporphyry," high silica content epi-metamorphic volcanic rock outcrops from Károly Kaán spring in the vicinity of Miskolc. They compared these samples to archaeological material from nineteen sites of various ages and industries with the help of X-ray diffraction analysis (XRD) *(Fig. 1).* Because, in addition to silica, "quartz porphyry" is composed of feldspars, mica, and kaolinite, all of them with typical XRD signals,[7] they were able to separate their raw material samples from silex (mainly postvolcanic silices, chalcedony, and hornstone). They published their results in a classic study in Acta Archaeologica Hungarica: *Der Gebrauch des glasigen Quartzporphyrs im Paläolithikum des Bükk-Gebirges.*[8] This study can be considered the first Hungarian effort to apply high-tech analytical methods to the study of lithic materials and is an early application of an archaeometrical approach in archaeology altogether.

The drawback of the method is partly its destructive character (at least, on a routine way),[9] partly rooted in the applicability of the method. XRD is typically used in combination with other methods, mainly chemical analysis of the main components and thermal analyses for more precise identification of the mineral phases.

In the mid-1970s, during a general study of Hungarian lithic raw materials by V. T. Dobosi and L. Ravasz-Baranyai, some "quartz porphyry" finds were also examined. After thin sectioning, this kind of rock was identified as felsitic banded rhyolite (*felzites-sávos riolit*),[10] which raised the problem of differentiating between palaeovolcanic rocks from the Ladinian stage and the remains of Neogene volcanism.[11] However, unless they were heavily silicified, young rhyolites were seemingly not used for the production of Palaeolithic chipped stone implements.

In course of the raw material historical research program led by J. Fülöp at the Hungarian Geological Survey,[12] a systematic study of the most important Hungarian chipped stone raw materials was performed, including – among others – Szeletian felsitic porphyry. Petrographic thin sections, chemical analy-

[1] http://www.ace.hu/litot/186-024c.html; cf. BALOGH 1964, 422–425.

[2] HERMAN 1893, 9, 17–18; HERMAN 1906, 10, 8; KADIĆ 1907, 343.

[3] KADIĆ 1909, 527, 536; KADIĆ 1915, 212; KADIĆ–KORMOS 1911, 112.

[4] VENDL 1930, 468; VENDL 1935, 229–230.

[5] PAPP 1907, 117–118. The raw material outcrop at Miskolc-Avas is, in fact, limnic quartzite: see SIMÁN 1995.

[6] PANTÓ 1951, 139–143.

[7] SZTRÓKAY et al. 1971.

[8] VÉRTES–TÓTH 1963.

[9] Modern methods of XRD allow the analysis of intact objects: p.c. by T. WEISZBURG.

[10] DOBOSI 1978, 16.

[11] DOBOSI 1978, 18.

[12] FÜLÖP 1984.

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ses of the main components, OES and IR spectra as well as X-ray diffractograms were made of all the sample raw materials.[13] The analytical series comprised only geological samples and was destructive in all cases.

### *Distribution of Szeletian felsitic porphyry on archaeological sites in the light of previous research*

Several studies have been devoted to the distribution of Szeletian felsitic porphyry, directly or as part of larger catalogues. We have tried to summarise the available evidence and arrange them in chronological order.

According to present knowledge, the earliest occurrence of this raw material is known from the fifth layer of Kálmán Lambrecht Cave. Based on palaeontological and anthracological data, the small *"Premousterian"* assemblage was dated to the Riss/Würm Interglacial.[14]

Szeletian felsitic porphyry was also found in both layers of Subalyuk Cave and in other Middle Palaeolithic cave sites in the Bükk Mountains (Lökvölgy Cave, Mexikóvölgy Cave). It should be stressed that it comprised more than 80% of the Middle Palaeolithic assemblages of Büdöspest Cave, lying in the proximity of the geological source, and other classic sites are also rich in Szeletian felsitic porphyry (Szeleta, Ottó Herman Cave, Puskaporos Rockshelter).[15] From the s.l. Mousterian limnic quartzite workshop site at Avas-Alsószentgyörgy only two tools were reported as made of felsitic porphyry.[16] The exact geological source of the "*kremenné porfýr*" found on the Late Mousterian site of Prievidza[17] (Upper Nitra valley, Slovakia), which could theoretically be identical with this material, is unknown.

Felsitic porphyry was quite popular in the Middle and Early Upper Palaeolithic bifacial industries (Bábonyian,[18] Eger-Kőporos and related industries,[19] Szeletian[20]). Cave sites with Middle Palaeolithic assemblages (Balla Cave, Háromkúti Cave, and Diósgyőr-Tapolca Cave[21]) may also be linked to this group. Tools made of Szeletian felsitic porphyry are also known from surface sites with bifacial industries of uncertain age both in Hungary (Korlát-Ravaszlyuk-tető, Kisgyőr-Bub-tető, Kistokaj-Kültelek,[22] Parád,[23] Szob, and Aszód[24]) and in Slovakia (Domica Cave,[25] Velký Gýreš,[26] and Velký Šariš[27]). It also appears in assemblages of other bifacial industries lying farther from the Bükk Mountains, e.g. on the eponym site of the Middle Palaeolithic *Jankovichian* industry,[28] and in the Slovakian (Moravány-Dlhá[29]), and Moravian Szeletian industries (Ondratice, Ořechov II[30]).

The real role of the raw material in the Middle Palaeolithic bifacial industries can not be estimated for the time being. M. Gábori mentioned in 1981, that "after working for long years 40 new collecting points have been recognised" from the hill tops in the vicinity of the Bükk Mountains.[31] In 1983, 70 tools from six sites were published in the first and, until the present, only study consecrated to the detailed examination of the Bábonyian artefacts themselves.[32] According to the laconic references made to the Sajóbábony-Méhész hill site, three paleosoils of different ages and with different archaeological cultures (*Bábonyian* and *Szeletian*) were found on the surface of the plateau.[33] These data suggest that a much more colourful picture can be drawn than was supposed earlier.

[13] BIRÓ–PÁLOSI 1986.
[14] VÉRTES 1953, 18.
[15] MESTER 1995.
[16] SIMÁN 1986, 273.
[17] BÁRTA 1979, 6, obr. 2:1
[18] ROZSNYÓI 1963; RINGER 1983; SIMÁN 1985, 14; DOBOSI 1990, 177–178.
[19] DOBOSI 1995, 51, Tab. 2.
[20] SIMÁN 1990, 192.
[21] For details see: VÉRTES–TÓTH 1963; VÉRTES 1965; HELLEBRANDT et al. 1976, 10–11. – for the recent interpretation of the find assemblages from the Balla Cave and Diósgyőr-Tapolca Cave see: RINGER 2001, 78–81.
[22] DOBOSI 1978; SIMÁN 1986, 272–273.
[23] BIRÓ 1984.
[24] *Cf. infra.*
[25] BÁRTA 1979, obr. 2:2.
[26] VÉRTES 1965, 227, Pl. XL.
[27] SIMÁN 1993, 249. – According to the Slovakian literature only leaf shaped points made of radiolarite are known from this site: KAMINSKÁ 1991, 10.
[28] BÁCSKAY–KORDOS 1984, 357, Fig. 6; GÁBORI-CSÁNK 1994, 105.
[29] BÁRTA 1979, 6–8.
[30] VALOCH 2000, 292.
[31] GÁBORI 1981, 100.
[32] RINGER 1983.
[33] RINGER et al. 2001, 75. – in respect of Miskolc-Kánás see: 78.

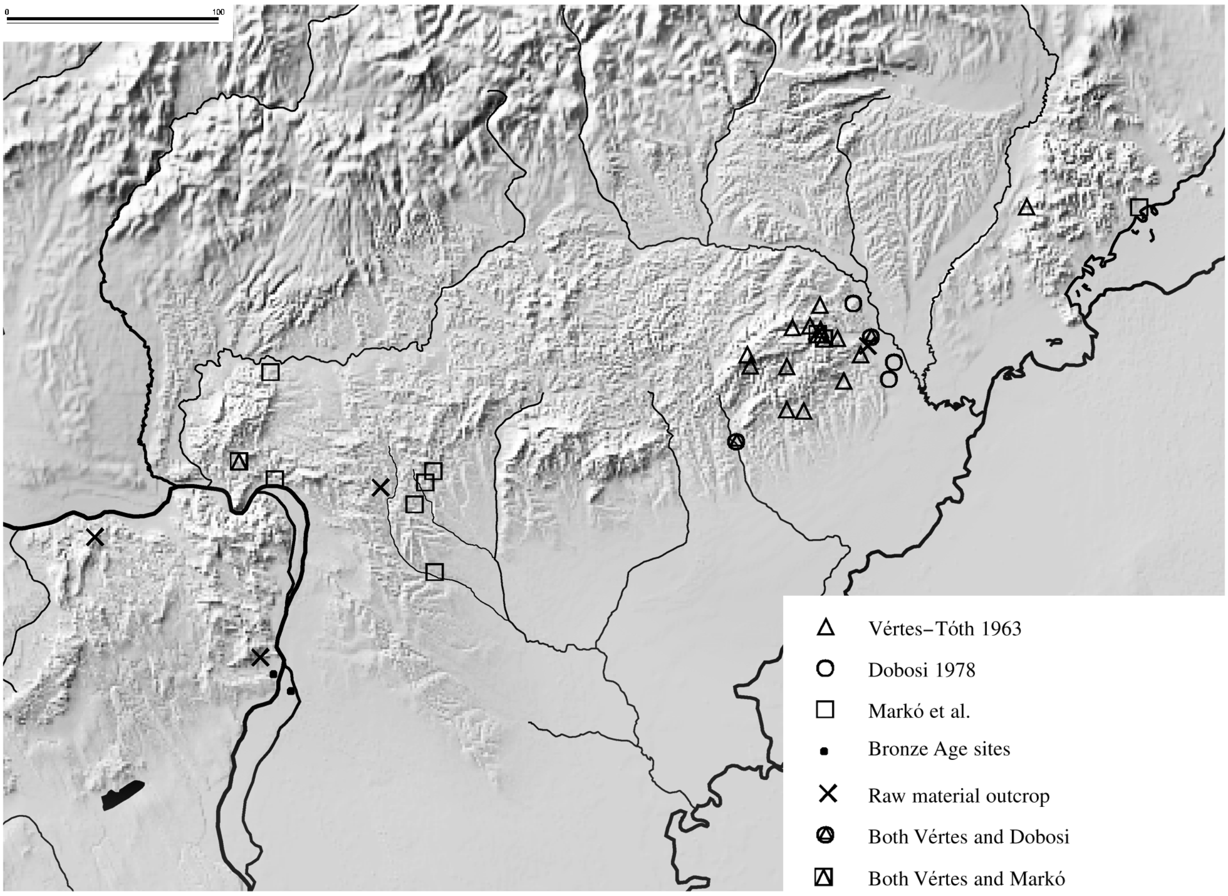


Fig. 1. Distribution of the archaeological finds made of Szeletian felsitic porphyry analysed by Vértes–Tóth, Dobosi–Ravasz, and the present measurements

In *Aurignacian*-type industries this raw material was only used in lower proportions (Istállóskő, Peskő, Ottó Herman cave,[34] Barca I.,[35] and Čečejovce-Zvonárka[36]), but its use is believed to be quite widespread in space, for example in the Ondava valley (Eastern Slovakia). An Aurignacoid high scraper made of this raw material was reported among the surface finds from the multi-period site of Nižny Hrabovec I–II.[37] At Čečejovce-Vinohrady, a leaf-shaped point[38] and at Kehnec I. a bifacial side-scraper[39] made of felsitic porphyry came to light in connection with an Aurignacian-type industry.

In *Early Gravettian* sites contemporary with the *Pavlovian* of Moravia and Lower Austria, felsitic quartz porphyry was used in the vicinity of Miskolc (Sajószentpéter-Nagykorcsolás[40] and Margit-kapu[41]) as well as on other sites lying at a greater distance (Bodrogkeresztúr-Henye-hegy,[42] the environs of Hont,[43] Megyaszó-Szeles-tető,[44] and Hidasnémeti-Borházdűlő[45]). From the Epigravettian period we know of no sites from the eastern Bükk Mountains, but the raw material was used in Arka and Cejkov[46] as well as in

[34] VÉRTES 1965.
[35] BÁRTA 1979, 10; KAMINSKÁ 1991, Tab. 2.
[36] KAMINSKÁ 1991, 9.
[37] KAMINSKÁ et al. 2000, 66, 71, Pl. III. 4.
[38] KAMINSKÁ 1991, 9.
[39] SIMÁN 1986, 273. – The Slovakian technical literature does not mention the use of the Szeletian porphyry at this site: KAMINSKÁ 1991, 8–9.
[40] SIMÁN 1985.
[41] RINGER–HOLLÓ 2001, Table 1.
[42] DOBOSI 2000, 64–67.
[43] DOBOSI–SIMÁN 2000, Table II.
[44] DOBOSI–SIMÁN 1996, 17.
[45] SIMÁN 1989, 11–12.
[46] SIMÁN 1986, 273; The Slovakian technical literature does not mentioned the use of the Szeletian felsitic porphyry at this site: KAMINSKÁ 1991, 11.

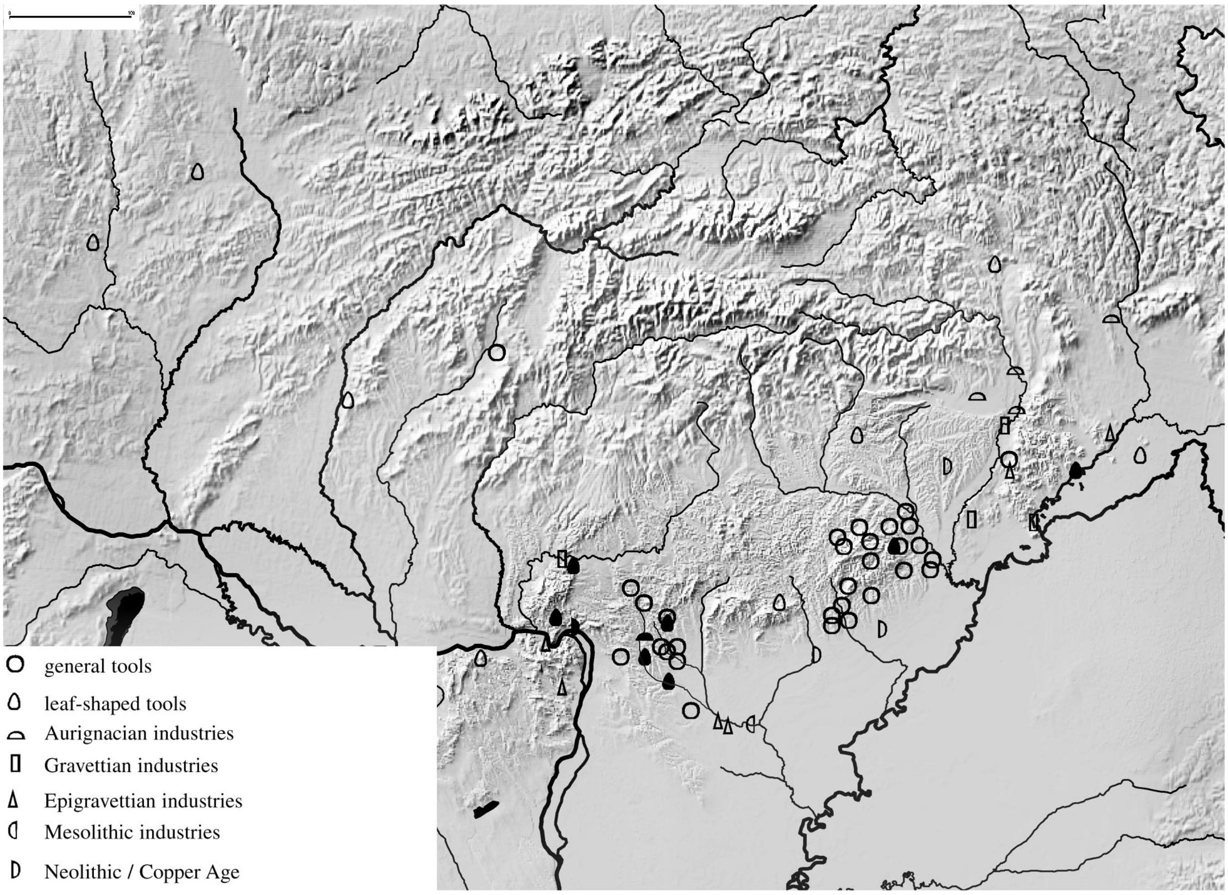


Fig. 2. Distribution of the raw material on archaeological sites (Full symbols mark sites analysed by PGAA)

the Great Hungarian Plain (Jászfelsőszentgyörgy-Szúnyogos, Székes-dűlő, Szentlőrinckáta[47]), in the Danube Bend (Pilismarót-Diós[48]) and in the Pilis Mountains (Kiskevélyi Cave[49]).

Finally, a few pieces were reported from later sites. Felsitic porphyry has been found from the Mesolithic (Rejtek Rockshelter,[50] Jászság[51]), the Neolithic (Felsővadász-Vár-domb[52] and Mezőkövesd[53]) and the Copper Age (Kompolt[54]) (*Fig. 2*).

### *New localities with Szeletian felsitic porphyry*

Some leaf-shaped points made of Szeletian felsitic porphyry beyond the local supply area have been known for a long time from the Danube Bend (Szob) and in the northern Mid-Mountains range farther from the Bükk Mountains (Aszód, Parád). In the 1960s during the field surveys and the excavations of Vera and Miklós Gábori some items came to light near Hont, both from Middle Palaeolithic (Hont-Csitár) and *Gravettian* (Ipolyság/Šahy, Parassa-Téglagyár)[55] sites. In the 1980s Gábor Gyombola collected a felsitic porphyry end-scraper of Upper Palaeolithic character near Debercsény.[56]

[47] DOBOSI et al. 1993, 58–60; DOBOSI 2001, 185.
[48] DOBOSI et al. 1981, 9, 14.
[49] DOBOSI–VÖRÖS 1994, 16.
[50] VÉRTES–TÓTH 1963, Anm. 8.
[51] KERTÉSZ 1996, 16.
[52] BIRÓ 1998, 44.
[53] BIRÓ 2002, 149–151.
[54] BÁNFFY et al. 1997, 39.
[55] DOBOSI–SIMÁN 2000, Table II.
[56] SIMÁN 1993, 248.

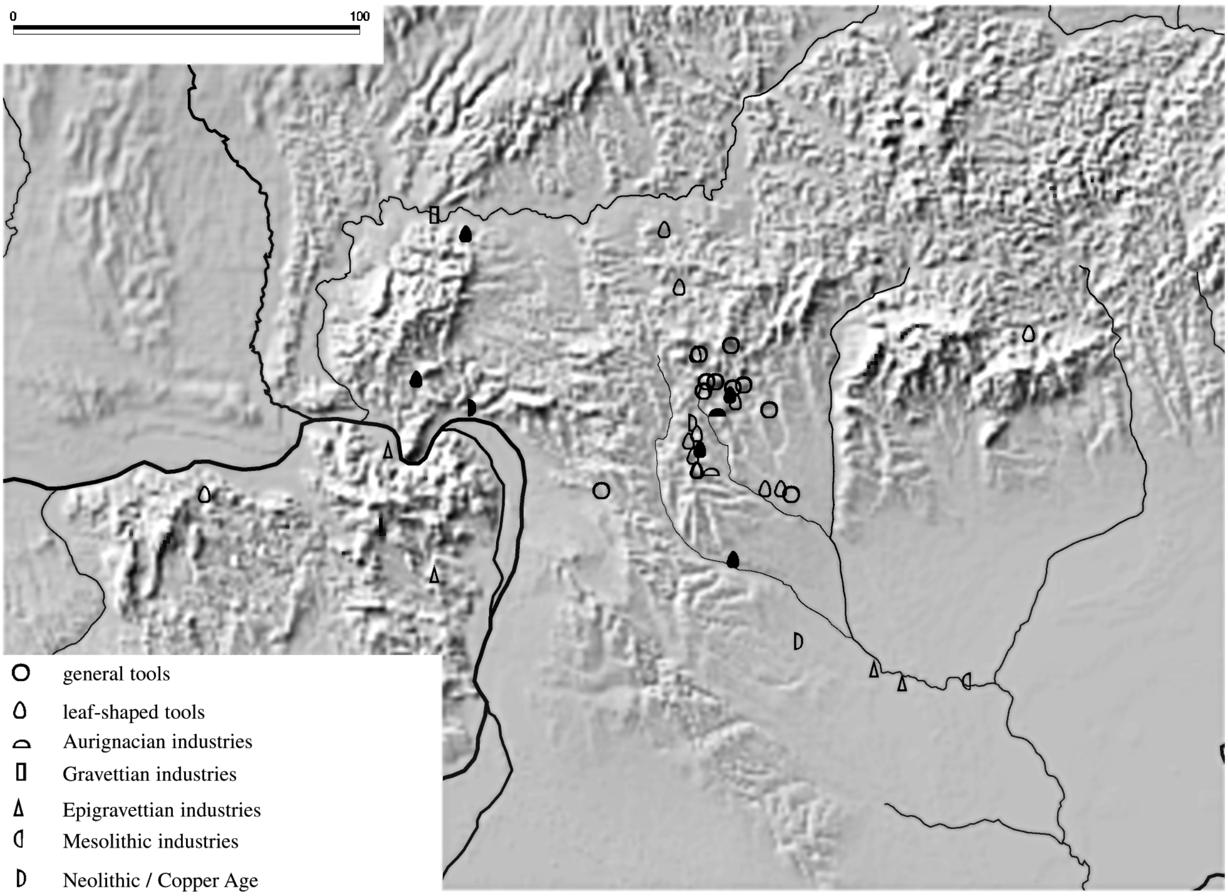


Fig. 3. Archaeological sites with Szeletian felsitic porphyry in the territory of the Cserhát mountains and the Danube Bend (Full symbols mark sites analysed by PGAA)

Recently, while reviewing chipped stone finds from the Danube Bend,[57] two other felsitic porphyry items were found in the assemblages from the environs of Verőce (a retouched blade from Fenyves-dűlő[58] and a blade segment from Magyar mál[59]), also collected by G. Gyombola. They are clearly not Palaeolithic, because they came to light together with a Neolithic-type chipped stone industry and the blade segment wears traces of sickle polish.

In the last two years, new field surveys in the Cserhát Mountains yielded 28 surface sites with more than 360 implements macroscopically identified as felsitic porphyry[60] (*Fig. 3*). Until now only ready-made tools have been known at a great distance from the Bükk Mountains, but it is interesting to note that a large quantity of waste, flakes, and raw material fragments were also found. In some cases, especially at some collecting points in the territory of Vanyarc, 25 to 30 per cent of the several hundred flakes and tools collected were made of this raw material.

The majority of the tools were worked bifacially, for instance as a hand-axe, leaf-shaped point or scraper. In the environs of Galgagyörk, four open-air sites of Middle and Upper Palaeolithic industries with leaf shaped tools were situated on the same hill ridge, 4–500 m from each other. All of them yielded tools made of Szeletian felsitic porphyry.[61] A most interesting concentration of Palaeolithic sites lies in the valley

[57] MARKÓ 2002.
[58] BÁCSKAY 1992, 628; MRT 9, Site 20/30; MARKÓ 2002, 114–115.
[59] MRT 9, Sites 20/9, 20/10; MARKÓ 2002, 117–118.
[60] We must express our thanks to Sándor Béres and Attila Péntek for taking our attention to the sites of Cserhát, among others Acsa, Galgagyörk and Vanyarc.
[61] For details about some sites in the environs of Galgagyörk see: MARKÓ et al. in press.

of the Vanyarc streamlet, which runs eastward from the Galga valley. From the ridge between the Szlovácká-dolina and the Cesz-dolina ("Slovak valley" and "Transversal valley"), six surface concentrations were identified where flakes and mostly leaf-shaped tools made of Szeletian felsitic porphyry were found.

Some sites, like Galgagyörk-Szál-hegy, Galgagyörk-Májóka 1 and one of the surface concentrations on the plateau of Tatár-hill near Verseg[62] yielded tools of Early Upper Palaeolithic character made of Szeletian felsitic porphyry. It must be noted, however, that leaf-shaped points of limnic quartzite were also found at Galgagyörk-Májóka 1 and Debercsény-Mogyorós.

From the Neolithic, besides the blade segment and retouched blade from Verőce, a blunted blade was recovered from Galgagyörk-Májóka 3 and a trapezoid and a blade fragment near Zsámbok from the multi-period site called "Lovacskás" ("Nag," named after one of the surface finds from this area, a small bronze horse statue from the Celtic period). All of the latter pieces show wear traces of sickle shine. Finally, some collecting points yielded only flakes, chips, and raw material fragments *(Table 1)*.

Because of the relatively large distance from the geological source and the limitations of macroscopic inspection alone, it was necessary to consider some other similar siliceous raw materials (hornstone, radiolarite, limnic quartzite) which may be mistaken for felsitic porphyry. Some of them can be regarded as local raw materials, like the hornstone from the dolomite of Triassic Age near Csővár. We had to be aware of possible interaction of other grey siliceous materials because during the studies of the 1960s some items from Büdöspest Cave and Eger macroscopically identified as quartz porphyry proved to be a kind of hornstone after the XRD examination.[63] Therefore we tried to test our judgement with analytic instrument methods. The principles were the same as in the 1960s: fingerprinting differences between the siliceous raw materials (in this study, hornstone and radiolarite) and the volcanic rock (felsitic quartz porphyry). However, new aspects were added to the analysis, i.e. the non-destructive character of the analytical method because some of the study pieces were irreplaceable gems of the collection. The method selected for the analysis was Prompt Gamma Activation Analysis, which seemed to be suitable for the task.

## *Description of the method*

Prompt Gamma Activation Analysis (PGAA) is a powerful, multi-element method, suitable for non-destructive archaeometrical studies. Since 1997, several types of archaeological materials such as metal, stone and pottery have been investigated at the thermal and later at the cold neutron beam of the PGAA facility at the Budapest Research Reactor.

Recently, the chemical analysis of archaeological artefacts (metals, stone tools, sculptures, pottery, and so on) has attracted more attention because of the availability of new techniques. Knowledge of the elemental composition, including major and trace elements, may provide clues concerning the provenance, manufacturing process, raw materials, and authenticity of archaeological objects.[64] The most common methods, such as polarising microscope investigations and the more widespread analytical methods are destructive, which is generally a serious obstacle in the case of valuable artefacts. PGAA is one of the new candidates for coping with this problem. Its basis is a physical process: radiative capture of neutrons. Because of the low intensity of external neutron beams ($10^6$–$10^8$ $cm^{-2} \cdot s^{-1}$), PGAA can be considered non-destructive and applicable to samples that must be preserved intact. After some days of cooling (i.e. decay of short-lived radioactive products), the sample objects can be returned to the owner (museums or collectors) in their original form.

Another great advantage of PGAA is that it is a multi-element method, i.e. in theory all of the chemical elements can be detected, albeit with different sensitivities. With the help of PGAA both the major components and many trace elements in different kind of objects can be identified from the same measurement.

[62] The site lies near the highest point of the hill and is not identical with the location of V. T. Dobosi's excavation – CSONGRÁDI BALOGH–DOBOSI 1991.

[63] VÉRTES–TÓTH 1963, 4, 6.

[64] http://srs.dl.ac.uk/arch/cost-g8/index.htm

Table 1

| | Bifacial tool | Middle Palaeolithic tool | Upper Palaeolithic tool | Neolithic tool | Flake, chip | Raw material piece |
|---|---|---|---|---|---|---|
| **Acsa-Rovnya**[65] | + | | | | + | |
| Acsa-Provosznya | | | | | + | |
| Becske-Júlia-major | | | | | + | |
| Bér-Öreg-hegy | | | + | | + | |
| Bér/Vanyarc-Egresi erdő | | | | | + | |
| DebercsényMogyorós | | | + | | + | |
| Erdőkürt-Cigány-part | + | | | | + | |
| Galgagyörk-Májóka 1 | | | + | | + | |
| Galgagyörk-Májóka 3 | | | | + | | |
| Galgagyörk-Öreg-hegy | + | | | | | |
| **Galgagyörk-Komárka** | + | + | | | + | |
| Galgagyörk-Szál-hegy | | | + | | + | |
| GalgagyörkCsonkás-hegy | + | + | | | + | |
| Kálló-Alsó-hegy | | | | | + | |
| Kálló/Erdőtarcsa-Daróci-hegy | | | | | + | |
| Váchartyán-Deres | | | | | | + |
| Vanyarc 1 | | + | | | + | |
| Vanyarc 3 | | + | | | | |
| Vanyarc 4 | | | | | + | |
| Vanyarc 5 | + | + | + | | + | + |
| **Vanyarc-Tovi** | + | + | | | + | |
| Vanyarc 12 | | | | | + | |
| Vanyarc 15 | | | + | | + | |
| Vanyarc-Rókavár | | | | | + | |
| Verseg-Tatárdomb 1 | | | + | | + | |
| Verseg-Tatárdomb 2 | | | | | + | |
| Verseg-Tatárdomb 3 | | | | | + | |
| Zsámbok-Lovacskás | | | | + | | |

The chemical elements are identified in a PGAA spectrum according to the energies of their characteristic gamma-ray peaks; the quantitative analysis is based on the exact determination of gamma peak intensities. The sensitivities, or equivalently the detection limits in the first approach, are independent of the physical and chemical form of the investigated material. They depend on the nuclear property (the neutron absorption cross-section) of a given element (or isotope). Consequently, they vary within a wide range for the different elements. The most easily detectable elements are B, Cd, Sm and Gd with detection limits below 0.01 μg/g. The most difficult cases are C, N, O, F, Sn, Pb and Bi, with detection limits above 1000 μg/g. The sensitivities for all chemical elements were determined using internal standardisation measurements at the Budapest Research Reactor.

PGAA measurements do not require sample preparation; the artefacts can be positioned directly in the neutron beam. Thus the method can be regarded as rapid compared to other analytical methods. Due to the high penetrability of the neutrons, PGAA will give the average composition of the bulk material, i.e. of the object as a whole.

We have to emphasise, however, that PGAA can not distinguish between "bulk" and "surface" compositions of the same sample. Whenever it is important to follow the effect of weathering on an archaeological object, buried for hundreds or thousands of years, complementary analytical investigations are recommended.[66]

[65] Localities sampled for the present series of analysis are marked in bold in the table.

[66] For the detailed description of the method see: KASZTOVSZKY et al. in press.

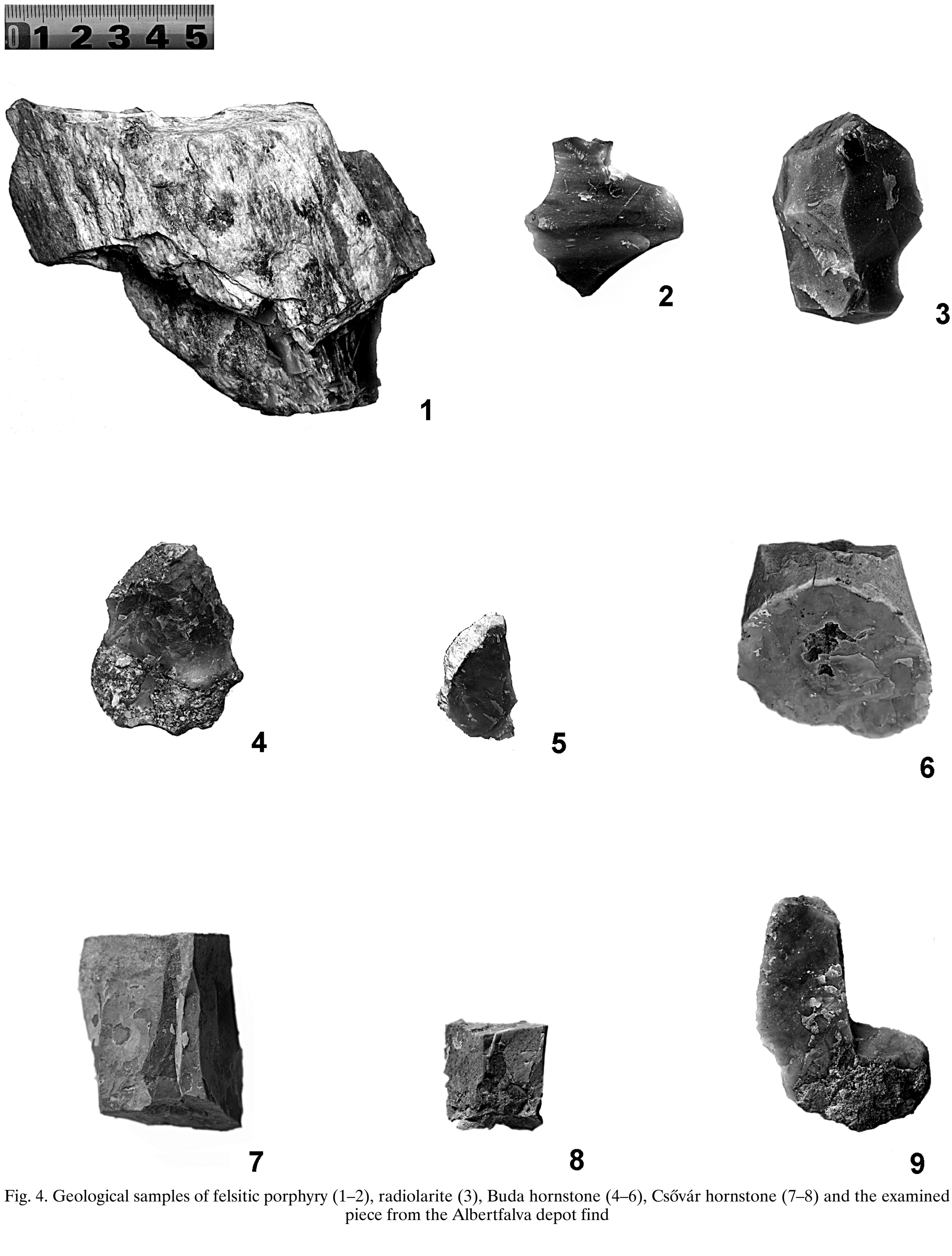


Fig. 4. Geological samples of felsitic porphyry (1–2), radiolarite (3), Buda hornstone (4–6), Csővár hornstone (7–8) and the examined piece from the Albertfalva depot find

*Experimental*

In the present experiments 19 samples were investigated, 13 of which were archaeological objects, and 6 were reference material from the Lithotheca collection of the Hungarian National Museum. Most of the samples were measured with a cold beam of $5 \times 10^7$ $cm^{-2}$ $s^{-1}$ for differing measurement times, which varied between 1500s and 52000s, depending on the sample size. Two of the samples were measured with a thermal beam of $2.5 \times 10^6$ $cm^{-2}$ $s^{-1}$ for 14000s and 50000s. The cross section of the beam was $2 \times 2$ $cm^2$ in every case. With such parameters we were able to detect all major and some trace components with acceptable precision. The elements detected are discussed below in the "Results" section.

Geological samples were selected from the comparative raw material collection of the Hungarian National Museum.[67] Besides the source-collected reference sample of Szeletian felsitic porphyry from Tatár-árok near Bükkszentlászló (Inv. no.: L 86/024 – BUKK024 *[Fig. 4.1–2]*), a number of comparative samples were studied. Some hornstone varieties from the region of Budapest (Ördög-orom: Inv. no.: L 86/019 – ORD019 *[Fig. 4.5],* Irhás-árok: Inv. no.: L 86/021 *[Fig. 4.4]* and Denevér-utca: Inv. no.: L 87/101 – DEN101 *[Fig. 4.6]*) were selected, as well as a special greenish-grey radiolarite from the Gerecse Mountains (Lábatlan: L. 86/103 – LAB103 *[Fig. 4.3]*); a hornstone variety that may be considered local raw material in the Cserhát Mountains, from the southeastern slopes of the Vár-hegy near Csővár (Inv. no.: L 86/025 – CSOV025 *[Fig. 4.7–8]*), was also included. All the samples were selected to be macroscopically very similar to the Szeletian felsitic porphyry reference samples and the archaeological finds made of this material.

For the study we selected some items from the classical archaeological sites of Szeletian raw material lying in the proximity of the geological source near Bükkszentlászló. The first excavations in the Szeleta Cave were carried out by Ottokár Kadić and Jenő Hillebrand between 1906 and 1913.[68] The examined implements (a flake and a burin made on a partially retouched blade – Inv. no.: Pb. 661 and Pb. 665. – SZEL661, SZEL665 *[Fig. 5.1–2]*) were found during these excavations. The absolute chronology and the interpretation of the find assemblage or parts of it remain questionable despite numerous studies over the years.[69]

The Puskaporos Rockshelter, where O. Kadić carried out excavations,[70] also lies in the Szinva pass near Hámor, but at a lower level than Szeleta Cave. The special leaf-shaped industry here is considered to be the final phase of Szeletian development. During this examination a retouched flake was used (Pb. 789. – PUSK789 *[Fig. 5.3]*).

Sites lying close to the source can be considered part of the reference material. It was the most important aspect of our work to study archaeological material, attributed on macroscopical grounds as Szeletian felsitic porphyry, lying at a greater distance from the raw material source.

One of the most interesting leaf shaped points from Hungary came to light as a surface find in Sárospatak-Sötét oldal in 1905[71] (Inv. no.: Pb. 71/2. – SAROS7 *[Fig. 5.4]*). It was found 70 km east of the Bükk Mountains. It is reminiscent of the leaf shaped points of Moravány-Dlha type, with a small difference in the shaping the base.

Five samples were studied from the territory of the Cserhát Mountains. One of the most beautiful leaf-shaped points (Inv. no.: Pb. 76/1 – ASZOD76 *[Fig. 5.8]*) in Hungary was found at Aszód-Tarackás in the southern part of the Cserhát Mountains. The original location of the artefact can no longer be identified precisely, but the distance from the source was about 120 km. Viola T. Dobosi related this piece to the Kostienki 4 (Aleksandrovskaja) group[72] because of its unique shape with parallel edges.

The important site near Hont with a Middle Palaeolithic-type bifacial industry was first reported under the name of Hont-Babat after the field surveys of Miklós and Vera Gábori.[73] It is possible that M. Gábori also excavated at this site at the end of the 1960s (in his short report he mentions Hont-Csitár[74]). Following his description, analogies to a transitional industry, unique in the Carpathian Basin, can be found

[67] BIRÓ–DOBOSI 1991.
[68] KADIĆ 1915.
[69] *Cf.* RINGER–MESTER 2001.
[70] KADIĆ–KORMOS 1911.
[71] DOBOSI 1975; DOBOSI 1990, 183, Fig. 2. 7.
[72] DOBOSI 1990, 183, Fig. 2. 10.
[73] CSÁNK 1959, 19; GÁBORI 1964, 13.
[74] GÁBORI 1981, 100, footnote 13.

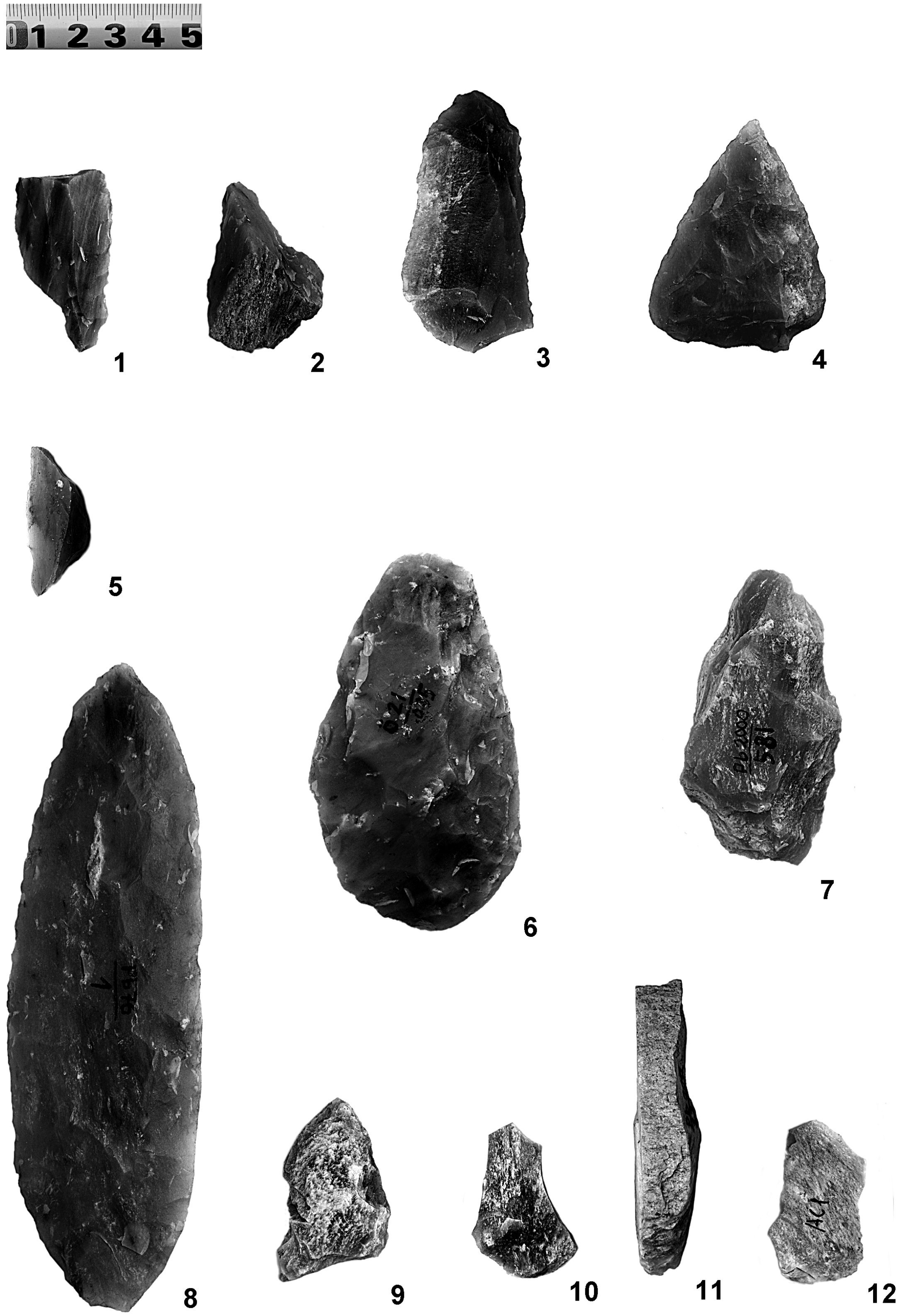


Fig. 5. Archaeological finds made of felsitic porphyry from the Bükk Mountains (1–3), Sárospatak (4), Danube Bend (5–6) and the Cserhát Mountains (7–12)

in the assemblage of Razdrojovice (Moravia).[75] V. Csánk mentioned these two sites (Hont-Babat and -Csitár) in connection with the Transdanubian *Jankovichian* industry.[76] Among the raw materials used on this site, hydroquartzite dominates (more than 50%) over hornstone, northern flint, and different kinds of radiolarite, obsidian, and quartzite. The proportion of felsitic porphyry is 3.7%. The site lies at about 125 km from the source of the raw material. For the current analysis a flake (Inv. no.: Pb. 99/301. – HONT301 *[Fig. 5.11–12]*) was selected from the 1969 excavation material.

Acsa-Rovnya is a rich Aurignacian open-air site in the southwestern part of the Cserhát Mountains, in the valley of the Galga streamlet. During surface collection several felsitic porphyry flakes were found; one of them was examined (Inv. no.: Pb. 2001/22. – ACS22) in this study. During the excavation of V. T. Dobosi in August, 2002, several more pieces came to light both as a surface finds and from the culture-bearing layer.[77]

From Galgagyörk-Komárka, a special knife with S-shaped, undulating edges was studied (Inv. no.: Pb. 2001/581. – GALG581 *[Fig. 5.7]*). This tool was found on the top of the row of hills above the Galga valley. Besides the general limnic quartzite flakes from the same site, a side scraper and a flake of Szeletian felsitic porphyry were also recovered. The sites of Acsa and Galgagyörk are situated 105 km from the Bükk Mountains.

The fragment of a leaf shaped point from Vanyarc-Tovi (Pb. 2003/71. – VANY11 *[Fig. 5.9]*) was found in the southernmost concentration of the series of sites near Vanyarc, about 100 km from the geological outcrop. Another leaf shaped point from the same area is very similar to that from Sárospatak; a bifacial fragment, a side scraper, 18 flakes and 14 chips made of this raw material were also found (of 157 items, 36, or 23% were of felsitic porphyry).

The third area of interest is the Danube Bend. At the upper entrance of the pass in December, 1934, a famous, finely elaborated leaf-shaped point (Inv. no.: Pb. 21/1935 – SZOB21 *[Fig. 5.6]*) was found at Szob-Öregfalu-dűlő.[78] It was one of the first tools examined by petrographical methods in the 1960s.[79] The excavation yielded no positive results; below the ploughed surface soil only the weathered andesite bedrock was found, without any traces of Palaeolithic settlement. An examination of the small plateau by the geographer Andor Kéz found that there were no terrestrial sediments of Pleistocene Age.[80] Besides the point, a truncated blade, a decortication flake of hydroquartzite, two pebble fragments, and a raw material piece of Transdanubian radiolarite are known from the site. These latter items are certainly much younger than the leaf-shaped point, which has the best parallels in the Moravian *Szeletian*. The site lies more than 135 km distance from the source of the raw material.

Verőce is another site also lying near the Danube Bend, in the valley of the Lósi streamlet on a southern hillside called Magyar mál. Some years ago G. Gyombola collected stone artefacts from the surface. One of them is a typical blade segment made of felsitic porphyry (Inv. no.: Pb. 86/382. – VER383 *[Fig. 5.5]*) with one curved, blunted side and the opposite edge with sickle shine. Two burins, a blunted-truncated blade, a retouched blade fragment, a notched blade and some chips made on several varieties of hydroquartzite and obsidian were also found. Based on the blade segment, their age can be placed in the Middle Neolithic *(Linienbandkeramik)*.[81] The distance from the source is 125 km.

For comparative material we chose two flakes inferred to be made of local Buda hornstone from Bronze Age sites in the vicinity of Budapest. The sites of Albertfalva and Csepel were selected (uninventorised items in the Budapest Historical Museum – ALB19, CSEP22 *[Fig. 4.9]*).[82]

[75] GÁBORI 1976, 80–81.

[76] GÁBORI-CSÁNK 1984; *cf.* DOBOSI–SIMÁN 2000, 321.

[77] Personal communication by V. Dobosi.

[78] GALLUS 1937, 138–139, Pl. 77.1, Pl. 80; GÁBORI–GÁBORI 1957, 52, XIV. 14; DOBOSI 1990, 184, Fig. 2.9; MRT 9, Site 26/10; DOBOSI–VÁRI 1997, 70–72, Fig. 56; MARKÓ 2002, 82–83.

[79] VÉRTES 1965, 162.

[80] Mentioned: GALLUS 1937.

[81] MRT 9, Sites 20/9, 20/10; MARKÓ 2002, 117–118.

[82] For the depot finds and the petrological-mineralogical references about the Buda hornstone see: BIRÓ 2002.

## *Results*

The concentrations of the components detected were expressed in weight percentage of oxides for major elements and in ppm for accessory and trace elements (*Table 2*).

Although the $SiO_2$ concentrations in the investigated samples were rather high (70 to 98%), we were able to identify other major components such as $Na_2O$, MgO, $Al_2O_3$, $K_2O$, CaO, $TiO_2$, MnO and $Fe_2O_3$ with great accuracy. In addition, some of the trace elements such as B, S, Cl, Sm, Eu and Gd were measured with acceptable precision, which may help to classify the objects.

According to the major components of $SiO_2$, $Al_2O_3$ and $K_2O$ themselves, the investigated objects seemed to form two clear groups (See *Fig. 6–8*). In order to clarify the similarities of the composition, the different element concentrations were normalised by the concentrations of $SiO_2$ and $Al_2O_3$ for each sample. The different ratios were investigated in detail, and almost all of them i.e. $Na_2O/SiO_2$, $(Na_2O + K_2O)/SiO_2$, $TiO_2/SiO_2$, $K_2O/SiO_2$, $Fe_2O_3/SiO_2$, $Al_2O_3/SiO_2$, $K_2O/Al_2O_3$, $TiO_2/Al_2O_3$, $(Na_2O + K_2O)/Al_2O_3$ were found to show the same characteristic groupings of the objects. One of the significant element ratios is plotted on a chart (See *Fig. 9*). Note the logarithmic scale on this chart.

According to our data we can state the following: two well-marked clusters can be seen on most of the plots. One comprises the typical siliceous raw materials (radiolarite and hornstone), while the other contains the archaeological pieces assumed to be Szeletian felsitic porphyry and the geological samples. From the Lithotheca collection the most similar example to the Palaeolithic objects is the sample collected in Bükkszentlászló.

Table 2

| | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | MnO | CaO | MgO | $Na_2O$ | $K_2O$ | $H_2O$ | B | S | Cl | Sm | Eu | Gd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ACS22** | 76.6 | 0.034 | 11.5 | 0.118 | 0.029 | 0.44 | 0.60 | 1.58 | 8.36 | 0.158 | 23.4 | 2008 | 6 | 0.94 | 0.51 | 1.53 |
| **SZOB21** | 80.6 | 0.024 | 9.5 | 0.061 | 0.009 | 0.47 | 0.21 | 0.45 | 8.03 | 0.115 | 39.5 | 1987 | 9 | 1.17 | 2.00 | 1.86 |
| **HONT301** | 75.7 | 0.036 | 11.8 | 0.201 | 0.010 | 0.08 | 0.71 | 1.10 | 9.57 | 0.163 | 14.1 | 2516 | 19 | 0.61 | 1.10 | 1.04 |
| **VER383** | 78.0 | 0.035 | 10.9 | 0.425 | 0.004 | 0.32 | | 1.60 | 7.95 | 0.122 | 32.3 | 2898 | 2 | 0.20 | 0.19 | 0.31 |
| **GALG581** | 75.3 | 0.035 | 12.5 | 0.221 | 0.007 | 0.08 | 0.49 | 0.94 | 10.05 | 0.223 | 28.5 | 452 | 10 | 0.43 | 0.52 | 0.64 |
| **SZEL661** | 77.7 | 0.034 | 11.1 | 0.103 | 0.015 | 0.20 | 0.29 | 1.30 | 8.58 | 0.163 | 47.1 | 2101 | 36 | 1.04 | 1.50 | 1.71 |
| **SZEL665** | 77.6 | 0.031 | 11.1 | 0.154 | 0.005 | 0.30 | 0.18 | 0.43 | 9.95 | 0.073 | 31.8 | 800 | 440 | 0.55 | 0.98 | 0.80 |
| **SAROS71** | 75.7 | 0.031 | 12.5 | 0.104 | 0.003 | 0.34 | | 0.98 | 10.18 | 0.126 | 35.4 | 278 | 4 | 0.08 | | 0.14 |
| **ASZOD76** | 75.7 | 0.030 | 12.3 | 0.086 | 0.008 | 0.46 | 0.77 | 1.79 | 8.72 | 0.128 | 26.4 | | | 1.19 | 0.06 | 2.00 |
| **PUSK789** | 77.1 | 0.023 | 11.0 | 0.156 | 0.005 | 0.27 | 1.29 | 1.57 | 7.87 | 0.136 | 17.6 | 2088 | 10 | 1.66 | | 2.82 |
| **VANY11** | 76.7 | 0.029 | 11.7 | 0.233 | 0.018 | 0.29 | | 1.06 | 9.28 | 0.192 | 20.8 | 2180 | | 0.40 | 0.05 | 0.75 |
| **ALB19** | 96.6 | 0.008 | 0.3 | 0.010 | 0.001 | 1.46 | 0.89 | 0.05 | 0.05 | 0.559 | 24.7 | 61 | 9 | 0.12 | 0.37 | 0.17 |
| **CSEP22** | 97.6 | 0.008 | 0.3 | 0.018 | 0.007 | 1.47 | 0.09 | 0.04 | 0.04 | 0.397 | 14.5 | 41 | 0 | 0.07 | 0.34 | 0.07 |
| **ORD019** | 98.1 | 0.109 | 0.1 | 0.031 | 0.001 | 0.81 | 0.53 | 0.04 | 0.03 | 0.290 | 16.7 | 95 | 4 | 0.04 | 0.28 | 0.10 |
| **IRH021** | 97.7 | 0.011 | 0.4 | 0.019 | 0.001 | 0.58 | 0.40 | 0.03 | 0.05 | 0.714 | 61.1 | 84 | 10 | 0.06 | 0.37 | 0.08 |
| **BUKK024** | 77.4 | 0.059 | 11.7 | 0.180 | 0.007 | 0.37 | 0.60 | 2.22 | 7.29 | 0.192 | 18.2 | 86 | 9 | 0.46 | 4.70 | 0.75 |
| **CSOV025** | 69.4 | 0.029 | 0.9 | 0.151 | 0.014 | 28.06 | 0.49 | 0.03 | 0.10 | 0.815 | 5.2 | 402 | 22 | 0.54 | 0.24 | 0.74 |
| **DEN101** | 97.6 | 0.025 | 0.6 | 0.177 | 0.003 | 0.44 | 0.41 | 0.03 | 0.07 | 0.584 | 3.0 | 154 | 8 | 0.28 | 0.06 | 0.36 |
| **LAB103** | 96.9 | 0.017 | 0.7 | 0.056 | 0.004 | 0.86 | 0.10 | 0.14 | 0.13 | 1.109 | 23.3 | 141 | 78 | 0.90 | 0.25 | 1.16 |

## *Conclusions*

PGAA proved to be an easy and non-destructive method for making fine and clear distinctions between the felsitic porphyry and other siliceous raw materials, although at the current state of development the method was not suitable for distinguishing among the different hornstone and radiolarite sources. The new results from PGAA confirmed our opinion made on the basis of macroscopic observation of field survey material and strengthened the observation made on the Szob leaf shaped point. A possible path for

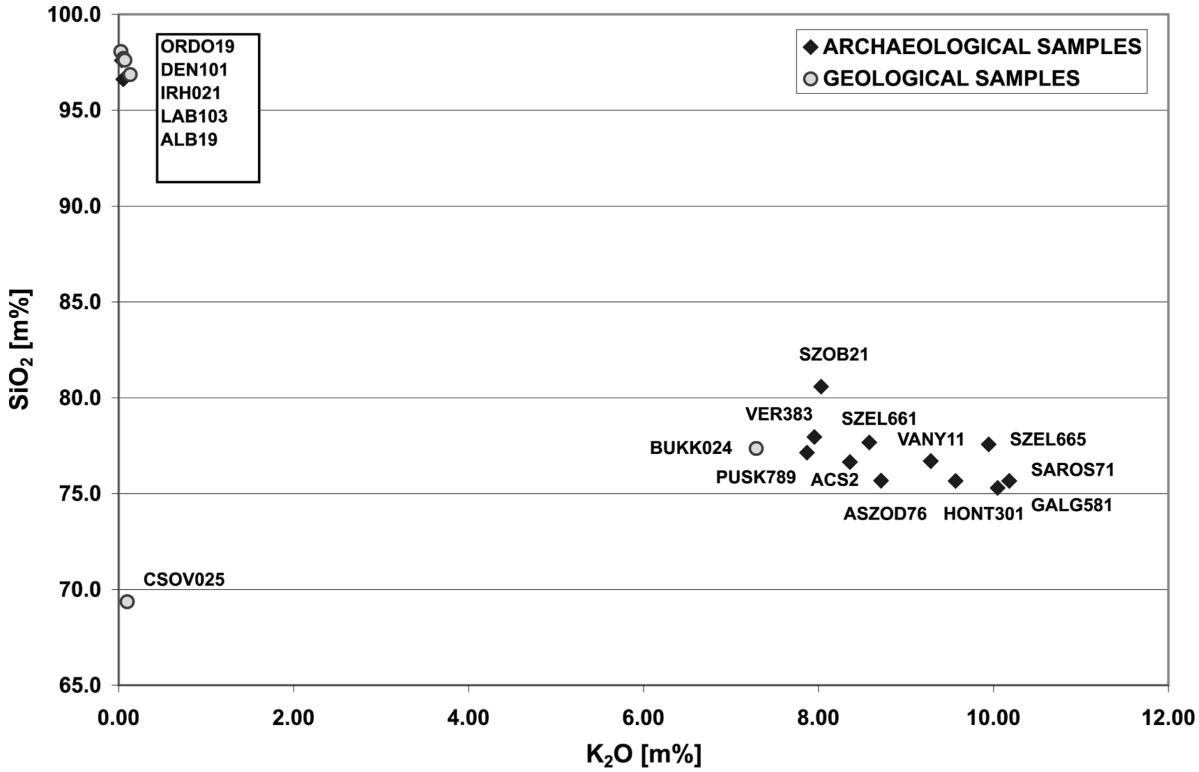


Fig. 6. Major components

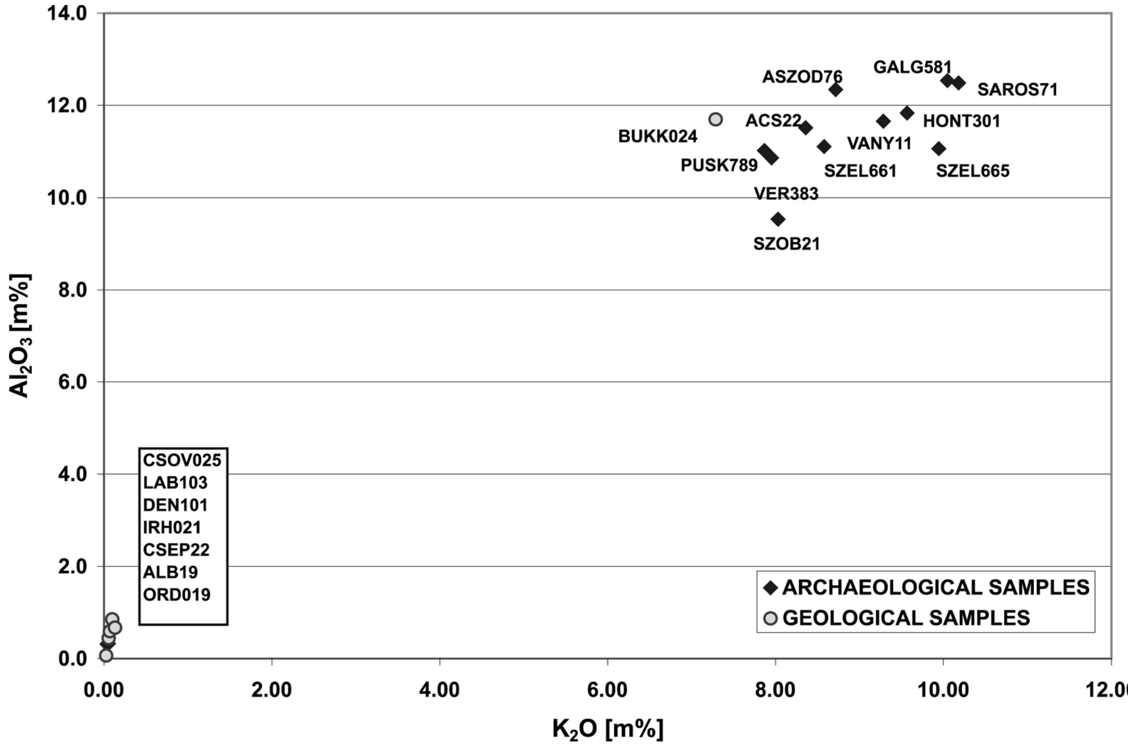


Fig. 7. Major components

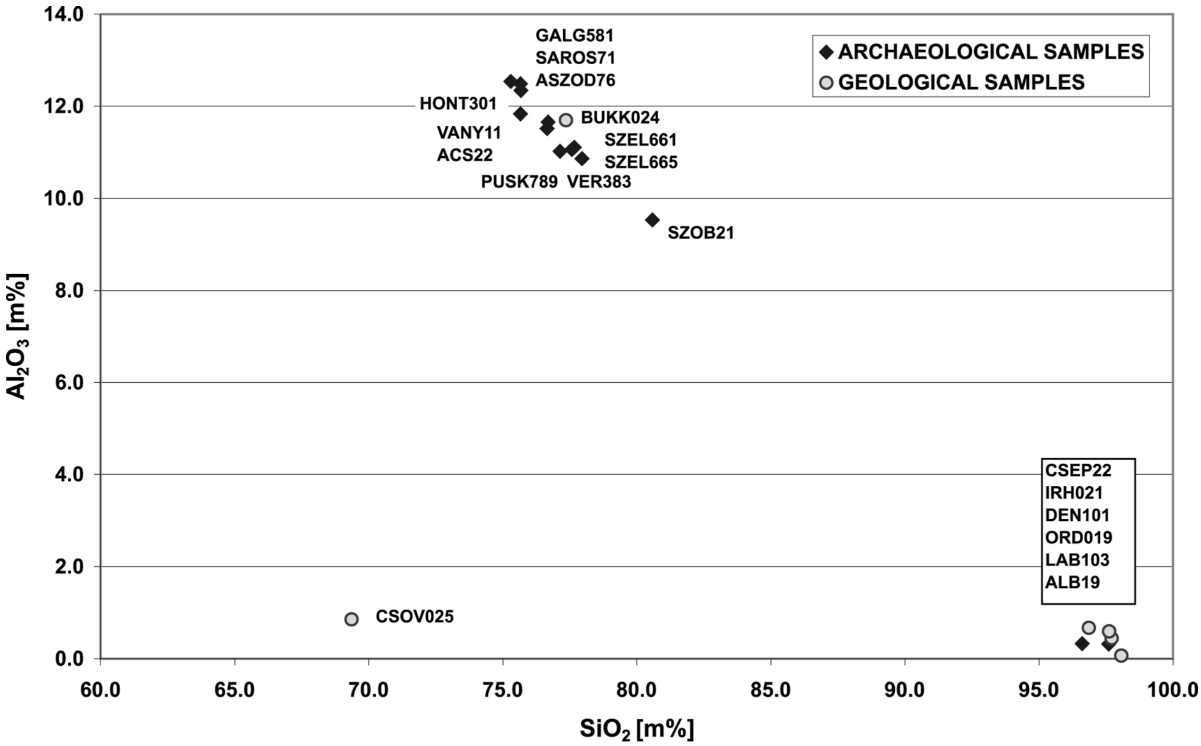


Fig. 8. Major components

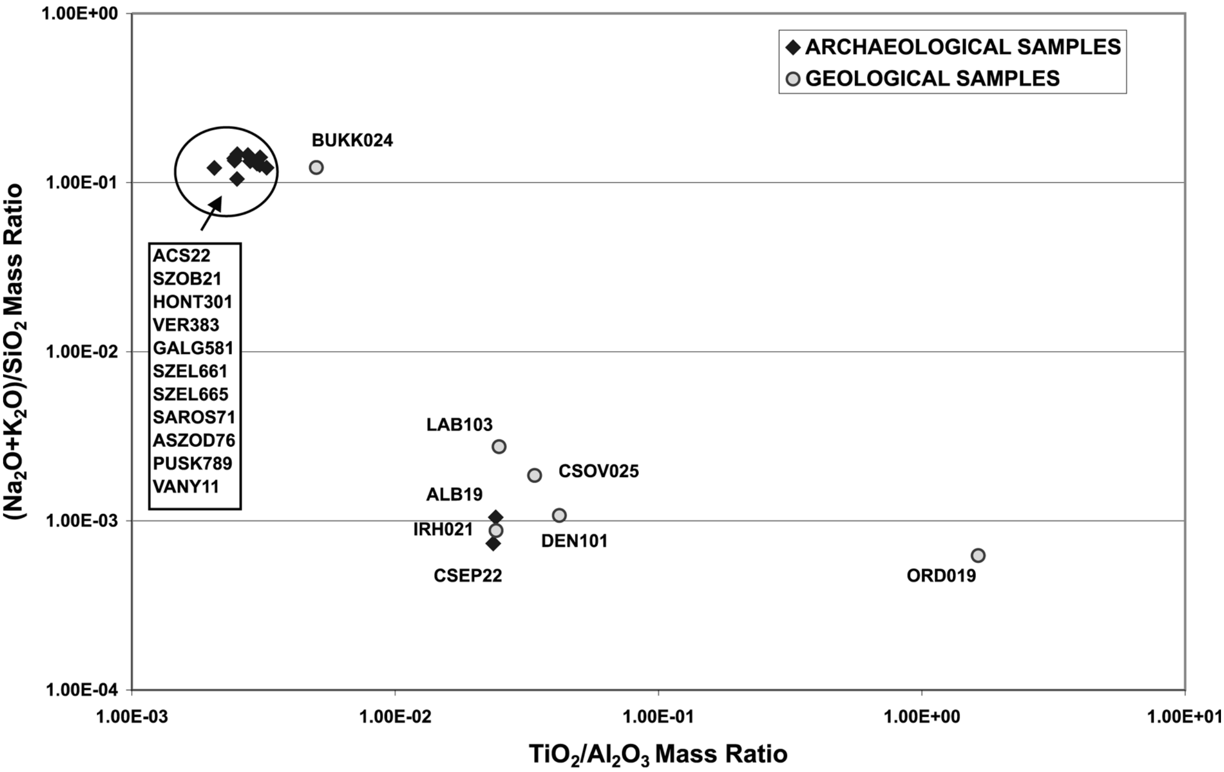


Fig. 9. Major components

further studies may be the examination of archaeological finds from the Palaeolithic period which were identified macroscopically as hornstone (Érd[83]) and material claimed to be felsitic porphyry on macroscopic grounds relatively far from the source area (farther than 50 kms), especially Slovakian/Moravian finds.

From an archaeological point of view, our studies confirmed clear relations between the territories of the Cserhát and Bükk Mountains. This observation is supported by the results of the archaeological investigations as well, because the typological composition of the small assemblages show connections with the Middle and Early Upper Palaeolithic of the Bükk Mountains and only rarely with Transdanubian territories.[84] Among the thousands of finds there are hardly a dozen that show any affinity with the Levallois technique – just as in the case of the *Bábonyian* of the eastern part of the Bükk. In the light of the new data, the Cserhát Mountains might have served as an interference area between the classical territories of the leaf shaped industries, between the Bükk and the Transdanubian groups,[85] but with the dominance of Eastern ties.

Our knowledge of the distribution area of Szeletian felsitic porphyry has changed considerably. In the 1960s it seemed that this raw material was used only in a limited territory with a 35 km radius and the maximum distance was thought to be around 50 km, with some exceptions such as Arka.[86] This view changed in 1965, when the point from Szob proved to be made from "quartz porphyry",[87] but in the 1970s the intensive use of the raw material was inferred to be only in a circle of 50 km radius.[88] According to the new measurements of the new finds from the Cserhát region, it seems certain that this area was also the part of the "quartz porphyry territory" in respect of the industries with leaf shaped implements. Besides the retouched tools there is a great quantity of working flakes and chips in the assemblages, meaning that the tools were made on the spot.

It can be inferred that in the foothill region of the Mátra Mountains some similar leaf-shaped industries using Szeletian felsitic porphyry may come to light in the future. The absence of data can be possibly explained by lack of specific field surveys.

In Aurignacian assemblages the ratio of the Szeletian felsitic porphyry is quite low, but it is present also at a greater distance. The distances from the geological source of the site near Acsa (105 km) and Nižny Hrabovec (115 km) are comparable. The role of leaf-shaped points in the Aurignacian industries remains a question,[89] but sometimes, as in the case of Acsa or Čečejovce-Vinohrady, they are made of exotic raw material, notably of Szeletian felsitic porphyry.

A similar phenomenon may be observed in the *Gravettian* and *Epigravettian* period, when the ratio of Szeletian felsitic porphyry is very low, but still some pieces reached the environs of Hont and even the Pilis Mountains. Previously, the spread of "quartz porphyry" was interpreted according to a linear model.[90] By now, however, we have data on the use of the raw material in all the stream valleys of the Cserhát, and from nearly all "lithic" periods. It means that during the Middle and Early Upper Palaeolithic a much larger territory than was inferred earlier was supplied fairly evenly with Szeletian felsitic porphyry, and this continued into the Neolithic period. From recent field surveys we know of some other Neolithic tools (tools with sickle polish, micro-blades, and micro-cores), identified macroscopically as Szeletian felsitic porphyry quite distant from the Bükk Mountains. It remains an open question whether this raw material originates directly from the Bükk Mountains or whether during the Neolithic some earlier archaeological sites were used to extract it as secondary sources.

[83] DIENES 1968, 111.

[84] *Cf.* GÁBORI 1976; GÁBORI-CSÁNK 1958 – an atypical fragment of a leaf-shaped point made of Transdanubian radiolarite was recovered recently from Galgagyörk-Májóka 3 (MARKÓ et al. in press), a typical leaf-shaped point of Jankovichian type came to light from Hévizgyörk-Bikázó.

[85] *Cf.* MESTER 2000.

[86] VÉRTES–TÓTH 1963, 8.

[87] VÉRTES 1965.

[88] DOBOSI 1978.

[89] KAMINSKÁ 1991, 10, 30.

[90] SIMÁN 1986; 1993.

## REFERENCES


BÁCSKAY 1992 = E. BÁCSKAY: Pattintott kőeszközök vizsgálata a szobi és a váci járás (Pest megye) néhány őskori lelőhelyén (A study of chipped stone implements from some prehistoric sites of Szob and Vác districts of Pest County). MÁFIJ 1990 (1992) 621–636.

BÁCSKAY–KORDOS 1984 = E. BÁCSKAY–L. KORDOS: Fontosabb szórványleletek a MÁFI gerinces-gyűjteményében (9. közlemény) (Major finds scattered fossils in the Palaeovertebrate Collection of the Hungarian Geological Institute – Communication 9). MÁFIJ 1982 (1984) 355–361.

BALOGH 1964 = K. BALOGH A Bükkhegység földtani képződményei (Die geologische Bildungen des Bükk-Gebiges). MÁFIÉ 68. Budapest 1964.

BÁNFFY et al. 1997 = E. BÁNFFY–K. T. BIRÓ–A. VADAY: Újkőkori és rézkori telepnyomok Kompolt 15. sz. lelőhelyen (Neolithic and Chalcolithic finds from Kompolt, Site Nr. 15). Agria 33 (1997) 19–57.

BÁRTA 1979 = J. BÁRTA: K problematike proveniencie surovín na výrobu štiepanej kamennej industrie v paleolite Slovenska. SlA 27 (1979) 5–15.

BIRÓ 1998 = K. T. BIRÓ: Lithic implements and the circulation of the raw material in the Great Hungarian Plain. Budapest 1998.

BIRÓ 2002 = K. T. BIRÓ: New data on the utilisation of the Buda hornstone in the Early Bronze Age. BudRég 36 (2002) 131–143.

BIRÓ–DOBOSI 1991 = K. T. BIRÓ–V. T. DOBOSI: Lithotheca – Comparative raw material collection of the Hungarian National Museum. Budapest 1991.

BIRÓ–PÁLOSI 1986 = K. T. BIRÓ–M. PÁLOSI: A pattintott kőeszközök nyersanyagának forrásai Magyarországon (Sources of lithic raw materials for chipped artefacts in Hungary). MÁFIJ 1983 (1986) 407–435.

CSONGRÁDI BALOGH–DOBOSI 1991 = É. CSONGRÁDI BALOGH–V. T. DOBOSI: Paleolit és neolit kőeszközök Verseg-Tatárdombon (Paleolithic and late neolithic stone artifacts from Verseg-Tatárdomb). StComit 21 (1991) 97–111.

DIENES 1968 = I. DIENES: Examen pétrographique de l'industrie – In: V. Gábori-Csánk (ed.): La station du Paléolihique Moyen d'Érd–Hongrie. Budapest 1968, 111–114.

DOBOSI 1975 = V. T. DOBOSI: Magyarország ős- és középsőkőkori lelőhely katasztere (Register of palaeolithic and mesolitic sites in Hungary). ArchÉrt 102 (1975) 64–76.

DOBOSI 1978 = V. T. DOBOSI: A pattintott kőeszközök nyersanyagáról (Über das Rohmaterial der retuschierten Steingeräte). FolArch 29 (1978) 7–19.

DOBOSI 1990 = V. T. DOBOSI: Leaf-shaped implements from Hungarian open-air sites. In: Feuilles de pierre – Les industries a pointes foliacées du Paléolithic superieur Européen. Études et recherches archéologiques de l'Université de Liège 42. Liège 1990, 175–188.

DOBOSI 1993 = V. DOBOSI: Jászfelsőszentgyörgy-Szunyogos, felsőpaleolit telep (Jászfelsőszentgyörgy-Szunyogos, upper palaeolithic localty). Tisicum 8 (1993) 41–60.

DOBOSI 1995 = V. T. DOBOSI: Eger-Kőporostető. Révision d'un industrie à outils foliacés. Paleo 1re Supplement (1995) 45–55.

DOBOSI 2000 = V. T. DOBOSI: Archaeological investigations at Bodrogkeresztúr-Henye. In: V. T. Dobosi (ed.): Bodrogkeresztúr-Henye (NE-Hungary), Upper Palaeolithic site. Budapest 2000, 5–111.

DOBOSI 2001 = V. T. DOBOSI: Antecedents: Upper Palaeolithic in the Jászság region. In: R. Kertész–J. Makkay (eds.): From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22–27, 1996. Archaeolingua 11. Budapest 2001, 177–191.

DOBOSI et al. 1981 = V. T. DOBOSI–I. VÖRÖS–E. KROLOPP–F. SCHWEITZER: Pilismarót-Diós: új őskőkori telep (Pilismarót-Diós: eiene neue Paläolitischsiedlung). CommArchHung 1981, 9–27.

DOBOSI–SIMÁN 1996 = V. T. DOBOSI–K. SIMÁN: New Upper Palaeolithic site at Megyaszó-Szelestető. CommArchHung 1996, 5–22.

DOBOSI–SIMÁN 2000 = V. T. DOBOSI–K. SIMÁN: Upper Palaeolithic in the region of Hont village. In: Zs. Mester–Á. Ringer (eds): A la recherche de l'Homme Préhistorique. Études et recherches archéologiques de l'Université de Liège 95. Liège 2000, 321–337.

DOBOSI–VÁRI 1997 = V. T. DOBOSI–Á. VÁRI: Horváth Adolf János régészeti feljegyzései (Archaeological notes by Adolf János Horváth). FolArch 46 (1997) 47–91.

DOBOSI–VÖRÖS 1994 = V. T. DOBOSI–I. VÖRÖS: Material and chronological revision of the Kiskevély Cave. FolArch 43 (1994) 9–50.

FÜLÖP 1984 = J. FÜLÖP Az ásványi nyersanyagok története Magyarországon (The history of … raw materials in Hungary). Budapest 1984.

GÁBORI 1958 = V. GÁBORI: Neue paläolithische Funde im Eipel-Tal. AR 10 (1958) 55–61.

GÁBORI 1964 = M. GÁBORI: A késői paleolitikum Magyarországon (Late Palaeolithic in Hungary). RégTan 3. Budapest 1964.

GÁBORI 1976 = M. GÁBORI: Les civilisations du Paléolithique Moyen entre les Alpes et l'Oural. Equisse historique. Budapest 1976.

GÁBORI 1981 = M. GÁBORI: Az ősember korának kutatása Magyarországon (1969–1980). MTAK (II) 30/1 (1981) 91–109.

GÁBORI-CSÁNK 1983 = V. GÁBORI-CSÁNK: La grotte Remete "Felső" (Supérieure) et le "Szeletien de Transdanube". ActaArchHung 35 (1983) 249–285.

GÁBORI-CSÁNK 1994 = V. GÁBORI-CSÁNK: Le Jankovichien, une civilisation Paléolithique en Hongrie. Études et recherches archéologiques de l'Université de Liège 53. Liège 1994.

GÁBORI–GÁBORI 1957 = M. GÁBORI–V. GÁBORI: Études archéologiques et stratigraphiques dans les stations de loess paléolithiques de Hongrie. ActaArchHung 8 (1957) 3–117.

GALLUS S 1937 = S. GALLUS: Néhány újabb magyarországi paleolit-lelőhely (Eine neue Paläolithfundstellen Ungarns). ArchÉrt Ú. F. 50 (1937) 137–139.

HELLEBRANDT et al. 1976 = M. HELLEBRANDT–L. KORDOS–L. TÓTH: A Diósgyőr-Tapolca-barlang ásatásának eredményei (Ergebnisse der Ausgrabungen in der Diósgyőr-Tapolca-Höhle). HOMÉ 15 (1976) 7–36.

HERMAN 1893 = O. HERMAN: A miskolczi paleolith lelet [The Palaeolithic find of Miskolc]. ArchÉrt 13 (1893) 1–25.

HERMAN 1906 = O. HERMAN: Zum Solutréen von Miskolc. MAGW 36 (1906) 1–11.

KADIĆ 1907 = O. KADIĆ: Adatok a szinvavölgyi diluviális ember kérdéséhez (Beiträge zur Frage des diluvialen Menschen aus dem Szinvatale). FtK 37 (1907) 333–345.

KADIĆ 1909 = O. KADIĆ: Paleolitos kőeszközök a hámori Szeleta-barlangból (Paläolithische Steingeräten aus der Szeletahöhle bei Hámor in Ungarn). FtK 39 (1909) 524–540.

KADIĆ 1915 = O. KADIĆ: A Szeleta-barlang kutatásának eredményei [Results of the excavations of the Szeleta Crave]. A Magyar kir. Földtani Intézet Évkönyve 23 (1915) 149–278.

KADIĆ–KORMOS 1911 = O. KADIĆ–T. KORMOS: A hámori Puskaporos és faunája Borsod megyében [The Puskaporos Rock-shelter in Borsod county and its fauna]. A Magyar királyi Földtani Intézet Évkönyve 19 (1911) 109–149.

KAMINSKÁ 1991 = L. KAMINSKÁ: Význam surovinej základne pre mladopaleolitickú spoločnosť vo východokarpatskej oblasti. SlA 39 (1991) 7–58.

KAMINSKÁ et al. 2000 = L. KAMINSKÁ–J. K. KOZŁOWSKI–B. KAZIOR–M. PAWLIKOWSKI–K. SOBCZYK: Long term stability of raw material procurement systems in the Middle and Upper Palaeolithic of Eastern Slovakia: a case study of the Topla/Ondava river valleys. Praehistoria 1 (2000) 63–81.

KASZTOVSZKY et al. in press = ZS. KASZTOVSZKY–ZS. RÉVAY–G. L. MOLNÁR: Archaeometry research at the Budapest Prompt Gamma Activation Analysis laboratory. in press

KERTÉSZ 1996 = R. KERTÉSZ: The Mesolithic in the Great Hungarian Plain: A survey of the evidence. In: Tálas, László (ed.): At the Fringes of Three Worlds. – Hunter-gatherers and farmers in the Middle Tisza valley. Szolnok 1996, 5–34.

MARKÓ 2002 = A. MARKÓ: Őskőkori lelőhelyek az Ipoly-torok és Vác városa között [Palaeolithic Sites along the Danube between the Mouth of the the River Ipoly and Vác]. Unpublished thesis, Eötvös Loránd University, Budapest 2002.

MARKÓ et al. in press = A. MARKÓ–A. PÉNTEK–S. BÉRES: Chipped stone assemblages from the environs of Galgagyörk (Northern Hungary). Praehistoria 3.

MESTER 1995 = ZS. MESTER: Le matériel lithique de la Grotte Büdöspest. Faciès d'atelier ou industrie intermédiaire? Paleo 1re Supplement (1995) 31–35.

MESTER 2000 = ZS. MESTER: Apparition du Jankovichien au Sud de la montagne de Bükk (Hongrie) – In: Zs Mester–Á. Ringer (eds): A la recherche de l'Homme Préhistorique. Études et recherches archéologiques de l'Université de Liège 95. Liège 2000, 247–255.

MRT 9 = I. DINNYÉS–K. KŐVÁRI–J. KVASSAY–ZS. MIKLÓS–S. TETTAMANTI–I. TORMA: Pest megye régészeti topográfiája XIII/2: A szobi és váci járás. Magyarország régészeti topográfiája 9. Budapest 1993.

PANTÓ 1951 = G. PANTÓ: Az eruptívumok földtani helyzete Diósgyőr és Bükkszentkereszt között [Geology of the southern ingenous belt in the Eastern part of the Bükk Mountains]. FtK 81 (1951) 137–143.

PAPP 1907 = PAPP K.: Miskolcz környékének geologiai viszonyai [The geological settings of the environs of Miskolc]. A Magyar Királyi Földtani Intézet Évkönyve 16 (1907) 91–135.

RINGER 1983 = Á. RINGER: Bábonyien – Eine mittelpaläolithische Blattwerkzeugindustrie in Nordostungarn. DissArch II:11. Budapest 1983.

RINGER 2001 = Á. RINGER: Középső-paleolitikum (Middle Palaeolithikum). In: Á. Ringer (ed.) Emberelődök nyomában. Az őskőkor emlékei északkelet-Magyarországon. Miskolc 2001, 70–82.

RINGER–HOLLÓ 2001 = Á. RINGER –ZS. HOLLÓ: Sajószentpéter Margit-kapu-dűlő. Egy felső-paleolit lelőhely a Sajó völgyében (Sajószentpéter Margit-kapu-dűlő, un site Paléolithiqu Supérieur dans la vallé de Sajó). HOMÉ 40 (2001) 63–71.

RINGER–MESTER 2001 = Á. RINGER–ZS. MESTER: A Szeleta-barlang 1999–2000. évi régészeti revíziójának eredményei (Die Ergebnisse der Revision der Szeleta-Höhle in den Jahren 1999–2000). HOMÉ 40 (2001) 5–19.

ROZSNYÓI 1963 = M. ROZSNYÓI: Mezolit-gyanús szórványleletek a Bükk hegység északnyugati részén (Colonies sporadiques apparement mésolithiques dans la partie Nord-Ouest de la montagne de Bükk). EMÉ 1 (1963) 69–80.

SIMÁN 1985 = SIMÁN K.: Paleolit leletek Sajószentpéteren (Palaeolithic finds on Nagykorcsolás hill at Sajószentpéter, NE Hungary). HOMÉ 22–23 (1985) 9–20.

SIMÁN 1986 = K. SIMÁN: Felsitic quartz porphyry. In: K. T. Biró (ed.): Őskori kovabányászat és kőeszközazonosítás a Kárpát-medencében. Budapest–Sümeg 1986. (International Conference on Prehistoric Flint Mining and Lithic Raw Material Identification in the Carpathian Basin). Budapest 1986, 271–275.

SIMÁN 1989 = K. SIMÁN: Hidasnémeti – Upper Palaeolithic site in the Hernád valley (Northeast Hungary). AAC 28 (1989) 5–24.

SIMÁN 1990 = K. SIMÁN: Considerations on the “Szeletian Unity”. In: Feuilles de pierre – Les industries a pointes foliacées du Paléolithic superieur Européen. Études et Recherches archéologiques de l’Université de Liège 42. Liège 1990, 189–198.

SIMÁN 1993 = K. SIMÁN: Őskőkori leletek Nógrád megyében (Funde aus der Vorzeit im Komitat Nógrád). NMMÉ 18 (1993) 247–254.

SIMÁN 1995 = K. SIMÁN: Prehistoric mine on the Avas Hill at Miskolc. APolona 33 (1995) 371–382.

SZTRÓKAY et al. 1970 = K. I. SZTRÓKAY–GY. GRASELLY–E. NEMECZ–J. KISS: Ásványtani praktikum II (Handbook of mineralogical practice). Budapest 1970.

VALOCH 2000 = K. VALOCH: Das Szeletien Mährens – seine Wurzeln und Beziehungen. In: Zs. Mester–Á. Ringer (eds): A la recherche de l’Homme Préhistorique. Études et recherches archéologiques de l’Université de Liège 95. Liège 2000, 287–294.

VENDL 1930 = A. VENDL: A büdöspesti paleolitos szilánkok kőzettani vizsgálata. Matematikai és Természettudományi Értesítő 47 (1930) 468–484.

VENDL 1935 = A. VENDL: Adatok a cserépfalui paleolitok kőzettani ismeretéhez. Matematikai és Természettudományi Értesítő 53 (1935) 203–231.

VÉRTES 1953 = L. VÉRTES: Az alsópaleolitikum emberének első biztos eszközlelete (La première trouvailles d’outil de l’homme du paléolithique ancien en Hongrie). ArchÉrt 80 (1953) 17–26.

VÉRTES 1965 = L. VÉRTES L.: Az őskőkor és az átmeneti kőkor emlékei Magyarországon [Remains of the Palaeolithic and Mesolithic Period in Hungary]. A magyar régészet kézikönyve [Handbook of Hungrian Archaeology] 1. Budapest 1965.

VÉRTES–TÓTH 1963 = L. VÉRTES–L. TÓTH: Der Gebrauch des glasigen Quarzporphyres im Paläolithikum des Bükk-Gebirges. ActaArchHung 15 (1963) 3–10.

1 **Hiba! A könyvjelzõ nem létezik.** cf. Balogh 1964, 422-425.
2 Herman 1893, 9, 17-18; Herman 1906, 10, 8; Kadić 1907, 343.
3 Kadić 1909, 527, 536; 1915, 212; Kadić – Kormos 1911, 112.
4 Vendl 1930, 468; 1935, 229-230.
5 Papp 1907, 117-118. The raw material outcrop at Miskolc-Avas is, in fact, limnic quartzite; see Simán 1995.
6 Pantó 1951, 139-143.
7 Sztrókay et al. 1970.
8 Vértes – Tóth 1963.
9 Modern methods of XRD allow the analysis of intact objects: p.c. by T. Weiszburg
10 Dobosi 1978, 16.
11 Dobosi 1978, 18.
12 Fülöp 1984.
13 Biró – Pálosi 1986.
14 Vértes 1953, 18.
15 Mester 1995.
16 Simán 1986, 273
17 Bárta 1979, 6, obr. 2:1
18 Rozsnyói 1963; Ringer 1983; Simán 1985, 14; Dobosi 1990, 177-178.
19 Dobosi 1995, 51, Tab. 2.
20 Simán 1990, 192.
21 For details see: Vértes – Tóth 1963; Vértes 1965; Hellebrandt et al 1976, 10-11. – for the recent interpretation of the assemblages from Balla Cave and Diósgyôr-Tapolca Cave see Ringer 2001, 78-81.
22 Dobosi 1978; Simán 1986, 272-273.
23 Biró 1984.
24 Cf. infra
25 Bárta 1979, obr. 2:2.
26 Vértes 1965, 227, Pl. XL.
27 Simán 1993, 249. – According to the Slovakian literature only leaf shaped points made of radiolarite are known from this site: Kaminská 1991, 10.
28 Bácskay – Kordos 1984, 357, Fig. 6; Gábori-Csánk 1994, 105.
29 Bárta 1979, 6-8.
30 Valoch 2000, 292.
31 Gábori 1981, 100.
32 Ringer 1983
33 Ringer – Mester 2001, 75. – in respect of Miskolc-Kánás see: 78.
34 Vértes 1965.
35 Bárta 1979, 10; Kaminská 1991,Tab. 2
36 Kaminská 1991, 9.
37 Kaminská et al. 2000, 66, 71, Pl. III. 4.
38 Kaminská 1991, 9.
39 Simán 1986, 273. – The Slovakian technical literature does not mention the use of the Szeletian porphyry at this site: Kaminská 1991, 8-9.
40 Simán 1985.
41 Ringer – Holló 2001, Table 1.
42 Dobosi 2000, 64-67.
43 Dobosi–Simán 2000, Table II.
44 Dobosi – Simán 1996, 17.
45 Simán 1989, 11-12.
46 Simán 1986, 273. The Slovakian technical literature does not mention the use of the Szeletian felsitic porphyry at this site: Kaminská 1991, 11.
47 Dobosi 1993, 58-60; Dobosi 2001, 185.
48 Dobosi et al. 1981, 9, 14.
49 Dobosi–Vörös 1994, 16.
50 Vértes –Tóth 1963, Anm. 8.
51 Kertész 1996, 16.
52 Biró 1998, 44.
53 Biró 2002, 149-151.
54 Bánffy et al. 1997, 39
55 Dobosi–Simán 2000, Table II.
56 Simán 1993, 248.
57 Markó 2002.
58 Bácskay 1992, 628; MRT 9, Site 20/30; Markó 2002, 114-115.

59 MRT 9, Sites 20/9, 20/10; MARKÓ 2002, 117-118.

60 We must express our thanks to Sándor Béres and Attila Péntek for turning our attention to the sites of the Cserhát, among others Acsa, Galgagyörk, and Vanyarc.

61 For details about some sites in the environs of Galgagyörk see: MARKÓ et al. in press.

62 This site lies near the highest point of the hill and is not identical with the location of V. T. Dobosi's excavation – CSONGRÁDINÉ BALOGH – DOBOSI 1991.

63 VÉRTES – TÓTH 1963, 4, 6.

64 http://srs.dl.ac.uk/arch/cost-g8/index.htm

65 Localities sampled for the present series of analysis are marked bold in the Table.

66 For a detailed description of the method see: KASZTOVSZKY et al. in press.

67 BIRÓ – DOBOSI 1991.

68 KADIĆ 1915.

69 *cf.* RINGER – MESTER 2001.

70 KADIĆ – KORMOS 1911.

71 DOBOSI 1975; 1990, 183, Fig. 2. 7.

72 DOBOSI 1990, 183, Fig. 2. 10.

73 GÁBORI 1958, 61, obr. 16.

74 GÁBORI 1981, 100, footnote 13.

75 GÁBORI 1976, 80-81.

76 GÁBORI-CSÁNK 1983; cf. DOBOSI –SIMÁN 2000, 321.

77 personal communication, V. Dobosi

78 GALLUS 1937, 138-139, Pl. 77.1, Pl. 80; GÁBORI – GÁBORI 1957, 52, XIV. 14; DOBOSI 1990, 184, Fig. 2.9; MRT 9, Site 26/10; DOBOSI – VÁRI 1997, 70-72, Fig. 56; MARKÓ 2002, 82-83.

79 VÉRTES 1965, 162.

80 Mentioned: GALLUS 1937.

81 MRT 9, Sites 20/9, 20/10; MARKÓ 2002, 117-118.

82 For the uninventorised finds and the petrological-mineralogical references for the Buda hornstone see: BIRÓ 2002.

83 DIENES 1968, 111.

84 cf. GÁBORI 1976; CSÁNK 1958 – an atypical fragment of a leaf-shaped point made of Transdanubian radiolarite was recovered recently from Galgagyörk-Májóka 3 (MARKÓ et al. in press), a typical leaf-shaped point of Jankovichian type came to light from Hévizgyörk- Bikázó.

85 cf. MESTER 2000.

86 VÉRTES – TÓTH 1963, 8.

87 VÉRTES 1965.

88 DOBOSI 1978.

89 KAMINSKÁ 1991, 10, 30.

90 SIMÁN 1986; 1993.