

**ISKM
2019**

**12th
International
Symposium
on Knappable
Materials**

**18-22 11 2019
Hungarian
National
Museum
Budapest
Hungary**



12th International Symposium on Knappable Materials

Program
Abstracts
Field Guide

Edited by
András MARKÓ & KatalinT. BIRÓ

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Program

Day 0 (17 November)

16:00-19:30: Conference Registration at Budapest University (ELTE), Department of Mineralogy (1/C Pázmány Péter sétány, Budapest - coordinates: N47.472437° E19.063209°)

18:00: Exhibition guided tour in Mineralogy Collection

18:00-20:30 Ice-breaking party at the Department of Mineralogy

Day 1 (18 November)

Venue: Hungarian National Museum, 14-16 Múzeum körút, Budapest

8:00-12:00 Conference Registration

9:30-10:00 opening

10:00-11:00: lectures

Bedrock and Alluvial: primary and secondary raw material sources

Mester, Zs. & Faragó, N.: From Bedrock to Alluvium: Considerations on raw material sources

Prieto, A. – García-Rojas, M. – Arrizabalaga, Á. – Baena, J.: Quartzite catchment, not only on fluvial deposits: raw material characterisation of the lithic assemblage of the layer XXII-R from el Esquilleu, Cantabrian Region, Spain

Markó, A.: Use of quartzite pebbles during the LGM: a case study from Mogyorósbánya (Hungary)

11:00-11:10: discussion

11:10-11:40: Coffee break

11:40-12:40: lectures

Polished / ground stone tool production: knapping before polishing / grinding

Shao, M.: A Preliminary Study of a Knapped Basalt Stone Axe Head from Jibei Island, Penghu Archipelago, Taiwan

Lithic technology of recent periods: Modern and Mediaeval

Brandl, M. & Niebylski, J.M.: Analysis of gunflints from Modlin Fortress in Nowy Dwór Mazowiecki, central Poland

Brandl, M. – Budziszewski, J. – Niebylski, J. – Szubski, M. – Trnka, G.: Gunflints flint mine „Lysinka” in Nyzhniv, Iwano-Frankiivsk oblast (Ukraine)

12:40-12:50: discussion

12:50-14:00: lunch break

14:00-15:20: lectures

Raw material exploitation strategies: mining and surface collecting I

Barrientos, G. & Catella, L.: The study of competitive relationships between raw material sources in a regional context: an approach based on the joint analysis of paired fall-off curves

Tóth, H. Z. & Kristály, F.: Archaeometric tracing of thermal alterations produced on silicites quarried by fire setting

Doronicheva, E.: Variants of raw materials exploitation in the Middle Paleolithic in the Northern Caucasus

Marković, J. – Matović, V. – Mihailović, B.: Procurement of raw material in the Middle Palaeolithic at Šalitrena pećina (Serbia)

15:20-15:30: discussion

15:30-16:00: Coffee break

16:00-17:00: lectures

Raw material exploitation strategies: mining and surface collecting II

Kerneder-Gubała, K.: Final Palaeolithic exploitation strategies in Orońsko region, Central-Southern Poland

Budziszewski, J. – Niebyski, J. – Szubski, M.: Prehistoric flint exploitation at catchment-area of upper Dniester and Zolota Lypa rivers

Biagi, P.: Mining knappable stone resources during the Bronze Age: Examples from the Caucasus and Sindh (Pakistan)

17:00-17:10: discussion

Day 2 (19 November)

Venue: Hungarian National Museum, 14-16 Múzeum körút, Budapest

9:30-10:50: lectures

Ancient lithic trade and economics I

Djindjian, F.: Towards an Integrated lithic analysis (ILAN) : ontology, typology, manufacturing process, artifact refitting, raw material sources, intra-site spatial analysis, use-wear traces, experimental knapping

Cieśla, M. & Valde-Nowak, P.: Raw materials circulation as an indicator of cultural change in early MIS 3 in Central Europe

Hirsch, K.: Speckled Senonian Flint Artefacts in Southern Jutland. An example for flint provenancing in Denmark and Northern Germany

Franco, N. – Gilio, B. L. – Vetrivano, L.: An insight into human mobility in South Patagonia through information from lithic raw materials availability areas, artifacts distribution and characteristics, Linkage Pathways and Least Cost Paths analysis

10:50-11:00: discussion

11:00-11:30: Coffee break

11:30-12:50: lectures

Ancient lithic trade and economics II

Mançlossi, F.: Protohistoric flint exchange system: The case of the Canaanite blades

Solanas, S.: Lithic economy in South Western France during Neolithic, a case study from a coastal site: La Lède du Gurg

Vornicu, D.-M. & Sztáncsuj, S.-J.: The chipped stone industry of the Copper Age settlement at Malnaş Băi (Covasna County, Romania). The reduction and use of local stones vs. long-distance raw materials

Affolter, J. – Wehren, H – Heitz, C – Stapfer, R – Hinz, M – Thierrin-Michael, G – Emmenegger, L – Hafner, A.: Flint procurement in Switzerland during the 4th Millennium B.-C.

12:50-13:00: discussion

13:00-14:00 lunch break

14:00-15:20: lectures

Characterising lithic sources I

Gómez de Soler, B. – Soto, M. – Vallverdú, J. – Bargalló A. – Chacón, M. G. – Martín-Viveros, J. I. – Romagnoli, F. – Soares Remiseiro, M. – Vaquero, M.: Sant Martí de Tous: a chert 'self-service' for the Catalan Central Depression (Northeast of the Iberian Peninsula)

Sánchez de la Torre, M. – Utrilla, P. – Domingo, R. – Jimenez, L – Le Bourdonnec, F.-X. – Gratuze, B.: Lithic raw material procurement at Chaves Cave (Huesca, Spain). A geochemical approach to define Palaeolithic human mobility

Bogosavljević-Petrović, V. – Brandl, M. – MacDonald, B. L. – Klesner, C. – Šarić, K. – Cvetković, V. – Jovanović, D. – Jovanović, D. – Starović, A.: From quarry to settlement in the central Balkans: test of the origin of stone raw materials based on LA-ICP-MS and microanalysis

Parish, R. M.: Sourcing chert artifacts in order to determine prehistoric pilgrims? At the Poverty Point site, a UNESCO World Heritage site in Louisiana, USA

15:20-15:30: discussion

15:30-16:00 Coffee break

16:00-17:10 UISPP meetings

Late Roman Seuso treasure: guided tour in the exhibition in the HNM

Day 3 (20 November)

Venue: Mining and Geological Survey of Hungary, 14 Stefánia street, Budapest

9:30-11:10: lectures

Characterising lithic sources II

Yoo, Y.: How can the raw material characterization be more satisfactory? A Comparative Mechanical Approach

Biró, K.T.: Role of 'phenotypes' in petroarchaeological characterisation

Szilágyi, V. – Kasztovszky, Zs. – Biró, K. T. – Maróti, B. – Harsányi, I.: Beyond the macroscopic phenotypes: knappable siliceous raw materials in the Carpathian Basin. Selectivity and limits of PGAA-based chemical characterization

Wehren, H. – Affolter, J. – Kiosak, D. – Hinz, M.: Sedimentary microfacies for the determination of the raw material provenance of artefacts

Brandl, M. – Hauzenberger, C. – Filzmoser, P. – Martinez, M. M.: Protocol for geochemically sourcing secondary deposits of siliceous rocks

11:10-11:20: discussion

11:20-11:50: Coffee break

11:50-13:10: lectures

Geology and mineralogy of knappable materials

Gurova, M. – Andreeva, P. – Stefanova, E.: Revisiting flint raw materials from Bulgaria (Shumen district): petrography and LA-ICP-MS analyses

Přichystal, A.: Classification of siliceous rocks in Central Europe

Schmidt, P.: Heat treatment and the mechanical properties of rocks

Lithotheques: collections of comparative raw materials

Biró, K.T.: 33 years of the Lithotheca in the Hungarian National Museum

13:10-13:20: discussion

13:20-14:20 lunch break

14:20-15:20: Poster session

Bedrock and Alluvial: Primary and Secondary Raw Material Source

Hanthy, K.: The Spirit of Stones

Geology and mineralogy of knappable materials

Moník, M. – Milde, D. – Hadraba, H. – Nerudová, Z. – Schnabl, P.: Heat-induced changes in cherts and location of Magdalenian hearths

Characterising lithic sources

Acquafredda, P. – Larocca, F. – Minelli, A – Micheletti, F. – Pallara, M.:

Petroarcheometric analysis on obsidian artefacts found within some prehistoric caves of Southern Italy

Basha, F. – Beqiraj, E – Bejko, L.: Preliminary data on the utility and provenance of the lithic tools in the Neolithic settlement of Dërsnik (Albania)

- Conati Barbaro, C. – Moscone, D. – Acquafredda, P. – Pallara, M. – Muntoni, I. – Iamoni, M. – Simi, F. – Coppini, C. – Morandi Bonacossi, D.: Sourcing obsidian using SEM-EDS and WD-XRF analyses: new data from Northern Iraqi Kurdistan sites
- Foresta Martin, F. – Acquafredda, P. – Larocca, F. – Micheletti, F. – Pallara, M.: Archaeometric characterization of the obsidians from the Late Roman site of Casa dei Francesi at Tramontana in Ustica (Palermo, Italy)
- González, C. & Mangado, X.: Raw material analyses of Catalonian Late Neolithic - Chalcolithic chert grave goods: macroscopic approach
- Kerneder-Gubała, K. & Buławka, S.: Siliceous rocks of the Tatra Mountains (Southern Poland) as a potential source of raw materials in the Stone Age
- Moscone, D. – Eramo, G. – Caggiani, M. C. – Pallara, M. – Acquafredda, P. – Conati Barbaro, C.: Local and exotic raw materials for blade-knapping during the Late Chalcolithic and Early Bronze Age in the Northern Iraqi Kurdistan: the case of chert and obsidian
- Sztáncsuj, S. J. – Biró, K. T. – Kasztovszky, Zs. – Szilágyi, V.: Nuclear analytical investigations on the chipped lithic industry of the Copper Age Ariuşd group in South-Eastern Transylvania

Lithotheques: collections of comparative raw materials

Doronicheva, E.: Representing Lithotheque of siliceous rocks from the Northern Caucasus

Raw material exploitation strategies: mining and surface collecting

Soares-Remiseiro, M. – Gómez de Soler, B. – Arteaga-Bribea, A. – Borràs, G. – Cámara, J. – Campeny, G. – Chacón, M. G. – Fernández-Marchena, J. L. – Guinart, V. – López, G. – Mas, B. – Soto, M. – Suesta, A. – Shkarinska, K. – Ramírez, I. – Val-Peón, C. – Vallverdú, J.: La Guinardera quarry (Sant Martí de Tous, Barcelona). An example of chert exploitation in modern times

Ancient lithic trade and economics

Gómez de Soler, B. – Bustos-Pérez, G. – Chacón, M. G. – Picin, A. – Rufà, A. – Rivals, F. – Blasco, R. – Rosell, J.: An approximation to the Neanderthals lithic procurement at Teixoneres Cave (Moià, NE Iberian Peninsula)

Loponte, D. – Silvestre, R. – Acosta, A.: Design and reduction sequences of projectile points from the Low Paraná river basin, Argentina

Stone tool production and processing techniques

Petrović, A. & Mitrović, M.: Production and use: Beyond stone tools. Example of house 32, Lepenski Vir (Serbia)

Lithic technology of recent periods: Modern and Mediaeval

Hajnal, Zs. – Markó, A. – Biró, K. T.: Recycling of the Prehistoric items: 'fire-stones' from a Longobardian cemetery

Use-wear analysis of different stone raw materials: specific features and variability

Doronicheva, E. – Poplevko, G. – Golovanova, L. – Doronichev, V. – Nedomolkin, A.: Flint and obsidian tools from Saradj-Chuko grotto, Northern Caucasus, Russia: preliminary results of use-wear analysis

Skakun, N. – Terekhina, V. V. – Longo, L. – † Leonova, N. B. – Pantyukhina, I. E. – Vinogradova, E. E. – Shulga, D. M.: Functional use of large stone objects in the Paleolithic sites of the Russian Plain

Polished / ground stone tool production: knapping before polishing / grinding

Antoni, J. & Falchetto, A.: Vaitehii: the cradle of the basalt adze-blades on Nuku Hiva, Marquesas Islands

Antoni, J. & Falchetto, A.: Knife in the wall: three examples of a rare tool-form on Nuku Hiva, Marquesas Islands, Eastern Polynesia.

Starnini, E. & Szakmány, Gy.: Knapping before and after polishing: technological evidence in the Neolithic polished stone tools from Hungary

15:40-17:10: Coffee break

17:10-18:00: 150 years old Geological Institute: a guided tour in the museum

Day 4 (21 November)

Venue: Hungarian National Museum, 14-16 Múzeum körút, Budapest

9:00-10:40: lectures

Experimental flint knapping

Kilpatrick, J.: Weber Fractions and the Ability to Perceive Three-Dimensional Size Differences in Stone Tools

Grøn, O. – Tayong, R. – Boldreel, L. O. – Nørmark, E. – Madsen, B. – Blondel, Ph.: Knapping of siliceous materials, some new perspectives and possibilities

Bachelier, J. & Schmidt, P.: Did Solutrean flint knappers control the heating environments to heat-treat raw materials?

Bebber, M. R. & Eren, M. I.: Experimental assessment of knapped stone vs. copper knife blades

Eren, M. I. & Bebber, M. R.: Experimental assessment of knapped stone vs. copper projectile points

10:40-10:50: discussion

10:50-11:20: Coffee break

11:20-12:40: lectures

Use-wear analysis of different stone raw materials: specific features and variability

Viallet, C.: Flint vs. Limestone – A comparative analysis on the development of macro-wears. Implications for the analysis of old lithic toolkits

Petrović, A. – Lemorini, C. – Mihailović, D. – Nunziante-Cesaro, S.: *Behind the scenes.* Introduction to the human activities in the Iron Gates region. Preliminary use-wear analysis of chipped stone artefacts from Lepenski Vir and Padina (Serbia)

Gurova, M. & Bonsall, C.: A pilot study of use-wear on pitchstone

Shulga, D. M. – Skakun, N. N. – Bostanova, T. M. – Terekhina, V. V.: Traceological studies of the production inventory of the Gulikandoz site (Gissar Neolithic culture, Tajikistan)

12:40-12:50: discussion

12:50-13:50: lunch break

13:50-18:00 Conference excursion

18:00-21:00 Conference dinner

Day 5 (22 November)

Venue: Hungarian National Museum, 14-16 Múzeum körút, Budapest

9:00-11:00: lectures

Stone tool production and processing techniques I

Bourguignon, L. – de Weyer, L. – Viallet, C. – Ivorra, J. – Cuartero, F. – Barsky, D. – Rios, J. – Bello P.: Raw material adaptation and human choices according to the production methods at the beginning of the Acheulean in Europe: The example of the US4 of Bois de Riquet (France)

Clément, S.: Like a prehistoric knapper... Experimental knapping facing archaeological assemblage

Fusco, M. & Spinapolice, E. E.: “*Chaînes opératoires*” and raw material choices at the MSA site of Gotera, Southern Ethiopia

Mathias, C. – Bourguignon, L. – Ivorra, J. – Barsky, D. – Viallet, C. – Grégoire, S.: Adaptation to raw materials intra-variability: example from the Middle Palaeolithic open-air stations of the Hérault valley, France (Les Geissières, Saint-Saturnin and Camillo)

Mihailović, D.: Quartz component in the Middle Paleolithic industries of the Central Balkans

Djindjian, F. – Iakovleva, L. – Sapojnikova, G. – Grégoire, S. – Moigne, A. M.: An integrated lithic analysis of the flint artefacts of the mammoth bone dwelling site of Gontsy (Ukraine)

11:00-11:10: discussion

11:10-11:40: Coffee break

11:40-13:20: lectures

Stone tool production and processing techniques II

Herrera, K. A.: Procurement, management of raw material and lithic production by the Late Pleistocene peoples of the Atacama desert, Northern Chile

Tupakhin, D.S.: The characteristics of the stone industries in Western Siberia Subarctic zone

Terekhina, V. V. – Skakun, N. N. – Agakhanova, V. A.: Manufacturing technology of stone miniature columns from Gonur-Depe Bronze Age site (Southern Turkmenistan)

Benoit, M.: The role of quartz and silicified sandstone in Late Holocene lithic industries in the North East Kimberley, Western Australia

Manclossi, F.: Between prehistory and modern era: Flint technologies in early historic times

13:20-13:30: discussion

13:30-14:30 lunch break

14:30: Closing 12th ISKM

Day +1 (23 November)

Post-Conference tours

9:00-17:00 Tour 1: Tata - Vértesszőlős

9:00-18:00 Tour 2: Ipolytarnóc - Bér

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Abstracts

Petroarcheometric analysis on obsidian artefacts found within some prehistoric caves of Southern Italy

Authors:

Acquafredda, Pasquale (Dipartimento di Scienze della Terra e Geoambientali, Università degli Studi di Bari Aldo Moro, Bari, Italy - pasquale.acquafredda@uniba.it)
 Larocca, Felice (Centro Regionale di Speleologia "Enzo dei Medici" – Commissione di ricerca per l'Archeologia delle Grotte, Roseto Capo Spulico, Italy / Centro di ricerca speleo-archeologica – Laboratorio di Paleontologia, Sant'Agata di Esaro, Italy)
 Minelli, Antonella (Dipartimento di Scienze Umanistiche, Sociali e della Formazione, via De Sanctis, Università del Molise, Campobasso, Italy)
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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:40-15:20

In the last twenty years, from 2000 to 2018, an intense activity of exploration of archaeological deposits in caves was carried out in close collaboration between the University of Bari Aldo Moro (Bari, Italy), the Regional Speleology Center "Enzo dei Medici" (Cosenza, Italy) and the University of the Studies of Molise (Campobasso, Italy). Obsidians were found in important and often extensive karst cavities in Southern Italy: three located in Calabria (Grotta della Monaca, 54 obsidians, and Grotta del Tesoro, 11 obsidians, in Sant'Agata di Esaro, Cosenza; Grotta Pietra Sant'Angelo in San Lorenzo Bellizzi, Cosenza, 46 obsidians), one in Puglia (Grotta di Santa Barbara in Polignano a Mare, Bari, 54 obsidians) and another in Campania (Grotta di Polla, Salerno, 6 obsidians). All these sites, that have returned a total of 151 obsidian tools, were connected to human frequentation of the underground environments that occurred during the Holocene, which can be precisely located in the vast period between the Neolithic and the Eneolithic (VI-IV millennium BC). They are mainly blades and lamellas, but also burins together with scrapers and cores, generally of small dimensions. SEM-EDS and WD-XRF absolutely non destructive analyses carried out on these findings have shown that all samples have source area in the obsidian outcrops of the island of Lipari (Messina, Italy). These data confirm that the Aeolian island of Lipari furnished the privileged obsidian extraction outcrops for most of the Neolithic and Eneolithic archaeological sites of Southern Italy.

Keywords: obsidian provenance, prehistoric caves, Southern Italy, SEM-EDS, WD-XRF, non-destructive analyses

Flint procurement in Switzerland during the 4th Millenium B.-C.

Authors:

Affolter, Jehanne (Archeological Institute University Bern, Ar-Geo-Lab, Switzerland - affolterjs@bluewin.ch)

Wehren, Helena (Archeological Institute University Bern, Switzerland)

Heitz, Caroline (Archeological Institute University Bern, Switzerland)

Stapfer, Regine (Archeological Institute University Bern, Switzerland)

Hinz, Martin (Archeological Institute University Bern, Switzerland)

Thierrin-Michael, Gisela (Department of Geosciences, University of Fribourg, Switzerland)

Emmenegger, Lea (Archeological Institute University Bern, Switzerland)

Hafner, Albert (Archeological Institute University Bern, Switzerland)

Form of communication: oral lecture

Session: Ancient lithic trade and economics II

Day 2 (19 November) 11:30-12:50

We will present the flint component of the SNSF-project 'Mobilities, entanglements and transformations in Neolithic societies on the Swiss Plateau (3900-3500 BC). This project is conducted since 2016 by the University of Bern (Switzerland) on Swiss dwelling sites, most of which have a dendrochronological dating that allows a detailed approach to the evolution of phenomena over time. Starting with the concrete example of the site of Hornstaad, we will explain the approach adopted to obtain a visual representation of the contact directions indicated by the origins of flints in Swiss sites of the 4th millennium BC. Then we will quickly compare them with the directions pointed out by the ceramics.

Keywords: Neolithic, Flint, Influence area

Vaitehii: the cradle of the basalt adze-blades on Nuku Hiva, Marquesas Islands

Authors:

Antoni, Judit (independent researcher, Budapest)

Falchetto, Alfred (Budapest Historical Museum, Budapest, Hungary -
falchettoalf@gmail.com)

Form of communication: poster

Session: Polished / ground stone tool production: knapping before polishing / grinding

Day 3 (20 November) 14:20-15:20

Vaitehii, Terre Déserte, is a well-known district by the hunters of Nuku Hiva, as an adze-production site. In Judit Antoni visited the region with Alfred Falchetto, who helped in our archaeological investigations: we wanted to collect objects for a future researches.

In this paper, apart from the presentation of this quarry and some pieces (flakes and half-products) from these workshops, there are two habitation sites to mention, where we found finished blades, probably originated from Vaitehii: one in the Bay of Ha'ahinani and a remains of a stone structure and a depot find (three blades) at Pipiheiei.

In private collections of local people we can find everywhere mainly finished and used blades, and the greatest collection of artefacts is deposited in the Bishop's Office at Taiohae, the administrative center of the Marquesas Islands.

Taking the opportunity, we try to show a little overview on these objects.

Keywords: basalt, workshop, Vaitehii

Knife in the wall: three examples of a rare tool-form on Nuku Hiva, Marquesas Islands, Eastern Polynesia

Authors:

Antoni, Judit (independent researcher, Budapest)

Falchetto, Alfred (Budapest Historical Museum, Budapest, Hungary -
falchettoalf@gmail.com)

Form of communication: poster

**Session: Polished / ground stone tool production: knapping before polishing /
grinding**

Day 3 (20 November) 14:20-15:20

Between 1994 and 1998 Judit Antoni worked on Nuku Hiva, under the direction of Pierre Ottino, archaeologist of the O.R.S.T.O.M. (Institut français de recherche scientifique pour le développement en coopération) It was in 1998, that the permanent archaeological technician of the staff, the Marquesan Alfred Falchetto discovered a crescent-shape basalt tool, hidden in the wall of one of the structures on Kamuihei site, near Hatiheu village. Later on J. Antoni found another tool of the same shape (but made of different raw material) in the Bishop's Office collection at Taiohae and in 2002 she had the chance to take photos and drawings from a third one.

Because of the lack of any possibility to investigate these tools in-depth (for example analysis of the raw material's provenance) the current communication is intended only to make them acquainted for the public and to suggest opinions on the method of their use.

Keywords: basalt, Polynesia, Nuku Hiva, Taiohae

Did Solutrean flint knappers control the heating environments to heat-treat raw materials?

Authors:

Bachelier, Julie (University Toulouse Jean Jaurès, Toulouse, France - jbachelle001@gmail.com)

Schmidt, Patrick (Eberhard Karls University of Tübingen, Department of Prehistory and Quaternary Ecology, Tübingen, Germany / Eberhard Karls University of Tübingen, Department of Geosciences, Applied Mineralogy, Tübingen, Germany)

Form of communication: oral lecture

Session: Experimental flint knapping

Day 4 (21 November) 9:00-10:40

The Solutrean (25.5-23 ky cal BP) is a period of transformations of the stone tool equipment. Hunting implements become more specific and two new techniques appear: pressure retouch and heat treatment. These innovations appear in the Upper Solutrean and have been interpreted as proxies of high technical skill and social learning. Unfortunately, many aspects of Solutrean heat treatment are still poorly understood. Here, we investigate the Solutrean heating technique. We examine a series coming from the perhaps most important Solutrean sites in southwestern France, where heat treatment was first described in the 1960s: Laugerie-Haute. We use non-destructive infrared spectroscopy to estimate heating temperatures of 15 Solutrean tools (mostly laurel-leaf points) to obtain data on the used heating environments and conditions. We found a well-calibrated heating temperature close to 300°C, suggesting that a dedicated heating environment was used to recreate similar conditions during successive heating cycles. Such standardised conditions cannot be maintained if heat-treatment was an opportunistic technique relying on open-air fires. Rather, a specialised structure, perhaps underground, must have been used. This finding has implications for our understanding of the investments in terms of time and resources, Solutrean knappers were capable and willing to invest in producing their highly specialised tool-kit.

Keywords: Lithic technology; Early transformative technology; Upper Palaeolithic; Pyrotechnology; Feuille de laurier

The study of competitive relationships between raw material sources in a regional context: an approach based on the joint analysis of paired fall-off curves

Authors:

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Catella, Luciana (División Arqueología, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata. CONICET. CEAR (FHyA, UNR), La Plata, República Argentina)

Presentaion format: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting I

Day 1 (18 November) 14:00-15:20

Small-scale societies usually exploit, simultaneously or sequentially, different lithic raw materials collected from diverse sources available within a region. The concept of "competition" between sources refers, figuratively, to a situation in which two or more sources of the same or different raw materials have a differential probability of being used by humans, as a function of their intrinsic properties plus the cultural preferences and strategic/tactical/operational decision rules applied by people on a situational basis. It is expected that in the long run (i.e. hundreds or thousands of years), the cumulative effects of individual decisions will result in an uneven regional distribution of rocks under the form of artifacts and manuports. It is also expected that aspects of such distributions like quantity and volume of transported and deposited rock will be proportional to the relative importance of the respective sources within a regional context. The methodology proposed to analyze the competition between rock sources is based on the joint analysis of pairs of distance-decay or fall-off curves (relative frequencies) of toolstones represented in georeferenced artifact assemblages. The theoretical-methodological foundations of the approach are, on the one hand, the revised concept of lithic landscape and, on the other hand, the ideas and analytical methodologies developed by I. Hodder and colleagues in the 1970's for the archaeological study of competition between production centers for consumer goods. This contribution represents an attempt to set a standard approach to the problem of recognizing and describing competitive relationships between toolstones on a regional scale, using spatial analysis performed with GIS tools. The analysis takes into account four simple parameters, which can be considered as gross measures of the relative competitive fitness of each raw material or source. The approach will be exemplified with data from east-central Argentina (southern South America) referring to seven raw material sources.

Keywords: competition, distance-decay, hunter-gatherers, GIS, Pampas of Argentina

Preliminary data on the utility and provenance of the lithic tools in the Neolithic settlement of Dërsnik (Albania)

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

Neolithic settlement of Dersnik, is situated in Korca region, south-eastern of Albania. The aim of this paper is to present the preliminary data on utilization and provenance of knappable stone tools discovered in the Neolithic settlement of Dërsnik. 30 artifacts found during the excavation of this site, implemented in the framework of a large development project, were analysed. Macroscopic, stereomicroscopic and petrographic analyses were used to characterize the knappable stone tools manufacture, utility and identify their provenance. Based on the typological features of the artefacts, 5 categories were distinguished: debitage, edges, knives, nuclei, arrowheads. According to the raw material used for the production of the lithic tools, the following types are evidenced: a) grey – beige semi-transparent to opaque flint and light beige, semi-transparent to transparent flint; b) represented by grey to black, opaque to semi-transparent flint; c) white, opaque siliceous limestone; d) brown to red, opaque flint; e) grey to beige, opaque flint. Type a, b, c are flints probably related with Triassic – Jurassic limestone which compose the Mali i Thate anticline, while type e and d probably come from Upper Cretaceous limestone in Mali i Thate and Zemblak sites and Burdigalian terrigenous formation or Quaternary proluvial – deluvial formations, respectively.

The results showed that the first category (debitage) represented by gray-beige, semi-translucent to opaque strains is more representative.

Keywords: Lithic, Dërsnik, Neolithic, artefact, petrographic analysis

Experimental assessment of knapped stone vs. copper knife blades

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Form of communication: oral lecture

Session: Experimental flint knapping

Day 4 (21 November) 9:00-10:40

Most prehistoric societies that experimented with copper as a tool raw material eventually abandoned stone as their primary medium for tool making. However, after thousands of years of experimentation with this metal, North American hunter-gatherers of the Old Copper Complex (4000-1000 B.C.) abandoned it and returned to the exclusive use of stone. Why? We experimentally confirmed that replica copper knives are inferior to stone ones when each is sourced in the same manner as their archaeological counterparts and subjected to identical tasks. Why, then, did copper consistently lead to more advanced metallurgy in most other areas of the world? We suggest that it was the unusual level of purity in the North American copper sourced by North American groups, and that naturally occurring alloys yielded sufficiently superior tools to encourage entry into the copper-bronze-iron continuum of tool manufacture in other parts of the world.

Keywords: experimental archaeology, blades, cutting, efficiency, stone knives, copper knives

The role of quartz and silicified sandstone in Late Holocene lithic industries in the North East Kimberley, Western Australia

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Form of communication: oral lecture

Session: Stone tool production and processing techniques II

Day 5 (22 November) 11:40-13:20

In current studies of Northern Australian lithic assemblages, the way Aboriginal people used specific stone raw materials is under-researched. The link between the economic and cultural organisation of past Aboriginal populations and their specific raw material choices has only been partially investigated in previous archaeological regional studies. In this presentation, I will use lithic artefact assemblages and survey data, collected from archaeological sites in the Kimberley, to explore how quartz and silicified sandstone were employed in specific reduction sequences during two different time periods. At DRY025 and KGR037, two archaeological sites situated in the North East Kimberley, hyaline quartz crystals, and to a lesser extent, vein quartz, were the only materials used to produce bladelets between 3,600 and 1,700 cal BP. Bladelets were used without further modifications or transformed into microlithic points, contributing in variable proportions to a broader industry of points and scrapers, made on igneous rocks and chert. Two different methods and techniques of reduction were used to manufacture bladelets, showing technological adaptation to inherent raw material properties. This industry of bladelets and points is subsequently replaced with the exclusive production of bifacial points on local silicified sandstone during the last 1,000 years. While locally abundant silicified sandstone has been used to make grinding implements, pebbles for percussion and ad-hoc flakes from the late Pleistocene to the present, recent bifacial point production is tied to specific, and non-generalised, use of the landscape. By reviewing the data linked to the changing use of quartz and local silicified sandstone, I will illustrate how these two raw material reduction pathways are indicative of changes in behaviour and particular cultural choices of late Holocene populations within the North East Kimberley.

Keywords: quartz, silicified sandstone, Late Holocene, Northern Australia

Mining knappable stone resources during the Bronze Age: Examples from the Caucasus and Sindh (Pakistan)

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting II

Day 1 (18 November) 16:00-17:00

The scope of this paper is to discuss the role played by knappable stone resources in the economy of two of the most important cultural aspects of Eurasia: the Kura-Araxes Culture of the Caucasian mountains, and the Indus Civilization of the Indian Subcontinent. Broadly speaking both aspects belong mainly to the Bronze Age. They both are well known because of the impressive structural remains excavated by archaeologist that are represented mainly by *kurgan* tombs in the first case, and sophisticated urban complexes, in the second. The discovery of groups of hundreds of mining pits opened to extract obsidian, in the case of the Caucasus, or chert, in that of the Subcontinent has opened new perspectives to the study of these two important cultural aspects, whose material culture was known mainly thanks to the study of ceramic or metal artefacts and everyday use objects. In contrast, the new discoveries remark the importance played by stone resources exploited by members of the complex societies under study, a topic that very rarely has been taken into consideration by most archaeologists.

Keywords: Bronze Age, mining, obsidian, chert, Caucasus, Indian Subcontinent

Role of 'phenotypes' in petroarchaeological characterisation

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Form of communication: oral lecture

Session: Characterising lithic sources II

Day 3 (20 November) 9:30-11:10

We cannot be better than our tools. The main tool for petroarchaeological source characterisation, however, is still the naked eye, supported with modest non-destructive equipment, typically hand-held, magnifying glass, in more fortunate cases, stereomicroscope and a kappameter; and hopefully, an adequate knowledge on possible sources. Looking at large number of lithics for the identification of provenance is starting with a proper macroscopic description – that can be, and should be, further refined by (hopefully non-destructive) analytical methods. It is important to have clear and well defined categories and use them consistently within the same geographical region.. The present lecture will concentrate on these aspects, both for the archaeological lithic assemblages and the comparative raw material collections, centred on present-day Hungary and its immediate surroundings.

Keywords: raw material characterisation, petroarchaeology, phenotypes

33 years of the Lithotheca in the Hungarian National Museum

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Form of communication: oral lecture

Session: Lithotheques: collections of comparative raw materials

Day 3 (20 November) 11:50-13:10

In 1986, an international conference was organised on flint mining and lithic raw material identification in the Carpathian Basin at Sümeg, Western Hungary. This meeting was an important event in the history of Hungarian petroarchaeology. On the occasion of this conference, a reference collection was compiled from knappable raw materials occurring and used in the territory of prehistoric Hungary. The collection comprised results of systematic fieldwork in Hungary, coordinated by the Hungarian Geological Institute in the early 1980-ies and donations, gifts from specialists all over Europe and even beyond. The new collection was received and hosted by the Hungarian National Museum as organic part of the Prehistoric (more specifically, Palaeolithic) collection. Regular fieldwork and donations have remained the two basic sources of incrementing the Lithotheca, completed by evidences of systematical petroarchaeological studies. The scope was extended, first to polished stone artefacts, later also the variety of other stone utensils in prehistory. Two catalogues of the collection were compiled; the Lithotheca is one of the few, completely digitised parts of the HNM.

The present lecture will concentrate on trends and problems in operating the comparative raw material collection.

Keywords: Lithotheca, Hungarian National Museum, comparative raw material collection

From quarry to settlement in the central Balkans: test of the origin of stone raw materials based on LA-ICP-MS and microanalysis

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Form of communication: oral lecture

Session: Characterising lithic sources I

Day 2 (19 November) 14:00-15:20

At the Lojanik quarry, located in a Neogene basin in west central Serbia, quarrying and processing of chert, opal and silicified wood from the Paleolithic to present times was recorded. The existence of local exchange networks involving materials from Lojanik was established from the Early Neolithic settlement of Crkvine as well as from the Late Neolithic settlement of Divlje Polje, which provides a diachronic perspective on the exploitation of this source. The identification of artefacts macroscopically corresponding to raw materials from Lojanik outside the quarry's immediate catchment area, e.g. settlements in north Šumadija, brought back into focus a more detailed re-examination of prehistoric lithic raw material circulation, as well as the recognition of more complex, and especially extra-local, social exchange networks.

Besides the determination of basic raw material types and sub-types based on petrological examination, petrographic samples of both, frequent and more untypical varieties were produced. Additionally, a series of geochemical analyses, including LA-ICP-MS, was performed. LA-ICP-MS allows for the detection of main-, trace- and ultra-trace element concentrations in rock materials and is well established in lithic provenance research. Three significant outcomes from these efforts can be reported: First, the new results enabled the creation of a database for stone materials from different archaeological contexts such as mines and quarries, specialized settlements, and large sites with complex activities in the region of western central Serbia. Second, it represents an evaluation of analytical techniques that serve for archaeological interpretation, when basic elements in the relationship between quarry(s) vs. settlement(s) are known. Third, and in our opinion the most important contribution, is strengthening the scientific basis for a broad insight and comparison between different systems of communication in the territory of the central Balkans and neighboring areas, during an extensive period of time and on various scales.

Keywords: provenance, Paleolithic, Neolithic, Copper Age, LA-ICP-MS

Extraction and quantification of alteration due to use from stone tool surface: the “how to”

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Debates and doubt around the interpretation of micro-wear on stone tools called for the development of quantitative analysis of surfaces to complement the qualitative description. Recently, more and more studies showed that quantitative characterization of alteration due to use can allow discriminate the activities carried out with stone tools. However, stone tool surfaces are microscopically very heterogeneous and the calculated parameters may highly vary depending on the areas selected for measurement. The choice of these points of interest of the surfaces are usually guided by the a priori interpretation of the wear analyst based on the qualitative observations. This procedure is relevant to ensure the measurement of surfaces bearing wear but it limits the objectivity of such quantitative analyses at the first step. Depending on the scale, the parameters calculated on these selected areas may also include effects from the raw material topography and not from the altered zones only. Moreover, it prevents more automatic protocols of stone tool surface analysis. We propose here to discuss this issue and present metrological parameters and workflow which could help extracting the areas of the surface topography altered by use. The objective is to build a step by step protocol which would be reproducible on different artifacts by different analysts. The effect of the raw material topography would also be decreased. This represents the basis for future automatic routines allowing the detection, extraction and characterization of wear on stone tools.

Keywords: Use-wear, metrology, quantitative analysis, surface measurement

Back to use “micro-polishes” nature and formation processes. What new chemical analyses tell us?

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Microwear analysis aims at characterizing alterations of archaeological artifact surfaces resulting from production, use and/or natural or accidental processes. In this approach, the identification of the contact material during use rely mainly on the description of the so called “micro-polishes” observed on the surface of the tool but their processes of formation and nature are still not clear. Different results showed the presence, as overlayers on the tool surface but also diffused into it, of chemical elements coming from the worked material. However, cleaning procedures of these studies have been criticized and their results have been neglected or rejected in favor of a model of development by attrition and smoothing only. We propose here to investigate again the nature of the “micro-polishes” in the light of the technological advances in RBS and PIXE as well as MEB EDX and analyzing tool surfaces after soft, medium and harsh cleaning. First results show that Ca and P can be detected after soft cleaning on the tools used to work bone or antler. If these chemical elements remain within the “polish” matrix, even after harsh cleaning, we will be able to provide a new method to infer past tool use based on direct evidence from the contact material.

Keywords: Use-wear, micro-polish, formation process, PIXE, RBS, MEB

Raw material adaptation and human choices according to the production methods at the beginning of the Acheulean in Europe: The example of the US4 of Bois de Riquet (France)

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-11:00

The Bois-de-Riquet site, located in a basalt quarry at Lézignan-la-Cèbe (l’Hérault, France), contains two stratigraphical levels that have yielded archeological and paleontological materials. Level US2 is already known for its rich paleontological record in association with a basalt stone tools dating to around 1 Ma Level US4, corresponds to a mudflow event containing stone tools attributed to the early phase of the Acheulian techno-complex at the beginning of lower Middle Pleistocene.

In total, four raw materials are identified in the assemblage: basalt, quartz, aplite and quartzite. These materials have all been identified in the Pleistocene alluvial deposits close to the site (3 potential terraces). First, the petrographic spectrum analysis shows an anthropic selection of raw materials in the US4 (all of the raw materials more or less represented in the local alluvial deposit are or inexistent -silex, gres granit-or very few represented -quartz, quartzite, gneiss-).

The lithic assemblage from BDR US4 is composed of divers’ raw materials exploited in accordance to specific reduction schemes for some, like the quartz, where the bipolar on an anvil method was used. Aplite was apparently privileged for percussive activities, even if it sometimes displays evidence of knapping.) and the Basalt, the preferred raw material, shows a wider variety of production methods, such as; bipolar on an anvil, polyhedral or exploitation of a sub-volume of the matrix -Type ‘C’-, “giant core” production, as well as shaping processes.

We describe here the role played by each of these raw materials in the US4 assemblage, and the production patterns that were developed for their reduction and use.

Keywords: Raw Material, lithic technology, first Acheulean

Analysis of gunflints from Modlin Fortress in Nowy Dwór Mazowiecki, central Poland

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Form of communication: oral lecture

Session: Lithic technology of recent periods: Modern and Mediaeval

Day 1 (18 November) 11:40-12:40

Modlin Fortress is located approximately 50 kilometers north of Warsaw. That main citadel was built in 1806-1812 by Napoleon Bonaparte's engineers. Initially it was intended to serve as a supply center for French forces operating in controlled Polish and Imperial Russian territory. In 1810, this concept was changed and Modlin Fortress was fortified as a pivotal strategic point against Russian forces, however, it was never fully completed.

The Fortress was conquered by the Russians on December 1st in 1813 after being defended by French, Polish, Saxon and Württembergian troops. In the years 1815-1831, during the period of Congress Poland, Modlin Fortress was a part of the Russian Empire and manned by Russian troops, and in 1830-1831 by the Polish army, preparing to defend themselves against the Russians. After the Polish uprising, Modlin Fortress was again under strict control of the Russian Empire and many times rebuilt until 1915.

In 2019, a collection of 64 gunflints was obtained from one of the corridors from Modlin Fortress. It is most likely part of a gunflint deposit for flintlock weapons, which was replaced by percussion cap weapons in the middle of XIX century and no longer of use by then. It is possible to differentiate 3 types of gunflints varying in size, shape and material. 12 gunflints from the collection, comprising 4 specimens of each characteristic raw material type, were analyzed for the current study. We present the results of detailed raw material and typological investigations, which sheds light on a gunflint assemblage of probably Russian origin using state of the art analytical techniques for the first time.

Keywords: Gunflints, Imperial Russia, lithic typology, Modlin Fortress, Imperial Russia, Poland, raw material provenance

Gunflints flint mine „Lysinka” in Nyzhniv, Iwano-Frankiwska oblast (Ukraine)

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Form of communication: oral lecture

Session: Lithic technology of recent periods: Modern and Mediaeval

Day 1 (18 November) 11:40-12:40

The gunflint manufacturing center in Nyzhniv (*Nizniow* in historical documents) was already described by Balthasar Hacquet and Marcel de Serres at the end of the 18th century and at the beginning of the 19th century. Although the sites they recall were visited by archaeologists a hundred years ago, they never sparked further interest and finally fell into oblivion. Their modern research has been initiated by a scientific trip of M. and G. Lazarovici, I. Kochkin, T. Tkachuk and G. Trnka in 2006. A local regionalist and collector, Dmytro Lupypysiv, guided the group to the Lysinka Hill at the southern periphery of Nyzhniv where the traces of raw material exploitation were preserved. During the following seasons, the attention of Viennese researchers focused on searching for the most famous mines in the region - the Lichostivne Hill (Brandl and Trnka - 2013 and 2018). In May of this year, a Polish team joined the research concerning the Galician gunflints production region. During the short surface prospection, the current state of the *Lysinka* “pingen” (quarrying pits) was verified. Also a small sample of characteristic materials from flint workshops was obtained. They allow us to recreate the full *chaîne opératoire* of this gunflint industry, which represents the most important supplier for the Austrian army during the Napoleonic wars. Raw material analysis will also be conducted to characterize and “fingerprint” the Turonian flint used at this locale. For this task, the Multi Layered Chert Sourcing Approach, which has successfully been used for the characterization and provenance studies of e.g. Scandinavian flint, will be applied.

Keywords: Gunflint production, flint mines, Austrian Galicia, Nyzhniv

Protocol for geochemically sourcing secondary deposits of siliceous rocks

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Form of communication: oral lecture

Session: Characterising lithic sources II

Day 3 (20 November) 9:30-11:10

For reconstructing prehistoric economic behavior, provenance studies have become essential tools for archaeologists. Prehistoric resource management includes the procurement, processing, use and distribution of materials used for tool production. The mandatory foundation of any further considerations is the understanding of the processes involved in the initial stage of this economic sequence, i.e. raw material procurement. Provenance analyses of siliceous rocks used for chipped stone tool production are a challenging undertaking, however, archaeometric techniques for tracing SiO₂ materials back to their primary sources have been established. Nevertheless, there exist numerous factors constraining such sourcing attempts, a situation which is significantly exacerbated when dealing with raw materials from secondary (i.e. river) deposits. River sources constitute the most important and widely used lithic raw material sources throughout prehistory, and can thus not be disregarded.

Through the application of the Multi Layered Chert Sourcing Approach (MLA) combining visual grouping, petrographic and geochemical analyses applying LA-ICP-MS with data evaluation by Compositional Data Analysis (CODA), we were able to demonstrate clear possibilities to source lithic materials from primary deposits. Recently, we started to include secondary materials in our analyses, which illustrated the potential and limitations of such sourcing attempts. Here we show that it is possible to source archaeological materials from river deposits using the MLA in four case studies from different archaeological and geological contexts: Lower Paleolithic stone tools from Karain Cave (Turkey), deposits exploited by Early Neolithic communities in south Serbia, selected lithic artefacts from Late Neolithic Platia Magoula Zarkou (Thessaly, Greece), and beach flint used as ship ballast in Scandinavia. Since sourcing efforts have to be performed in a systematic and reproducible way, we will present the analytical protocol we established for provenance analyses involving secondary deposits.

Keywords: Prehistoric resource management, provenance studies, geochemistry, secondary sources

Prehistoric flint exploitation at catchment-area of upper Dniester and Zolota Lypa rivers

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting II

Day 1 (18 November) 16:00-17:30

The catchment-area of the Dniester and Zlota Lypa rivers was known as one of the largest gunflint manufacture centres in Europe in the 18th and 19th centuries. This fact has attracted the attention of archaeologists because of the local rich deposits of Turonian flint. First traces of their prehistoric exploitation were discovered in the 1930s by the Ukrainian researcher J. Polanskij on the Zbuczi range in the village of Lazarivka, Tarnopol oblast. In the autumn of 1940, S. Krukowski carried out test trenches and made 1:1000 scale map of the site. These studies have never been published. Manuscripts by S. Krukowski has been discovered in recent years in Lviv and Warsaw. They show that the "Zbuczi" site was used both in prehistory and in modern times.

In the eighties of the last century, W. Konoplja researched on the occurrence and prehistoric use of local flints. In the village of Bukivna, Ivano-Frankivsk oblast, he discovered a flint exploitation site. Although initially considered as Neolithic, it turned out to be a remnant of modern gunflint activity.

In May of this year, the authors attempted a surface survey of both sites. As a result, we managed to find a forgotten mine in the village of Lazarivka. The original anthropogenic relief of the site is well preserved. Unfortunately, advanced vegetation prevented from obtaining of distinctive flint materials. In the village of Bukivna in the vicinity of the site published by W. Konoplja, a mining site was located with an anthropogenic relief and flint workshops dated to the Neolithic period.

Random verification survey carried out this year suggest that the catchment-area of upper Dniester and Zolota Lypa rivers has extremely numerous and well-preserved remains of ancient flint exploitation which require the undertaking of systematic research in the future.

Keywords: Turonian flint, flint mines, Dniester, Zolota Lypa

Raw materials circulation as an indicator of cultural change in early MIS 3 in Central Europe

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Form of communication: oral lecture

Session: Ancient lithic trade and economics I

Day 2 (19 November) 9:30-10:50

Abstract. In most cases, attempts at reconstruction of Middle Paleolithic mobility patterns (as based on the study of stone raw materials transport) encounter one serious obstacle. It is the fact, that on many territories of Central Europe raw materials were moved from their geological outcrop at a serious distance by the activity of ice sheet in the Pleistocene. Therefore some territories, where no such disturbance ever occurred, can help us understand some of the issues concerning Neanderthal mobility and lifeways. As such a territory we should treat Carpathian mountains – even though in the highest parts local glaciers formed in cold climatic periods, mostly the area was free of the ice sheet, and so the long-distance raw materials had to be brought to the sites by intentional action of humans. Also, Western Carpathians are placed at the border of two inhabited lowland parts of the Neanderthal ecumene. Some stones from distant outcrops were recorded at the site of Oblazowa cave, their transport dating back to MIS3. The most interesting part of it is that the direction of transport changes through time, possibly depicting the actual alternation in directions of contact or mobility, which could be linked with climatic or cultural change. This issue will be further discussed based on the archaeological and paleontological material from the site.

Keywords: Middle Palaeolithic, Central Europe, raw materials, Neanderthal land-use patterns

Like a prehistoric knapper... Experimental knapping facing archaeological assemblage

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-11:00

Raw material in African and European Acheulean assemblages is very often composed of grained and tough stones like lava (basalt, phonolite) or quartzite. However, those raw materials were used and knapped like flint and, sometimes, sought-after for their physical attributes. To understand the place of percussion techniques in bifacial shaping during Acheulean in Kenya, we realized some experimental works on phonolites that lead us to define some specific scars on that kind of material, different from those we can find on flint. We can also estimate possibilities and limits of each percussion technique. The new frame of reference we obtained helps us to understand physical reaction and technical answers found by prehistoric knappers to face some matter issues.

At the same time, the study of archaeological material from southern France and experimental shaping on quartzite revealed some more information. First, the raw material is a deciding factor for the structure of bifacial tools. It also determines how to remove flakes to get the expected tool. Second, even if the modern knappers led the experimental shaping with defined *chaînes opératoires* and presumed similar goal than hominins, replications are very different from archaeological tools especially in the structural analysis. All these results question the role of tool's function, choices of technical method and percussion technique in relation to raw material, culture and environment.

Keywords: percussion technique, grained and tough raw material, Acheulean, structural analysis

Sourcing obsidian using SEM-EDS and WD-XRF analyses: new data from Northern Iraqi Kurdistan sites

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

As attested by a large amount of data for the Near East, obsidian consumption took place over a long period of time from the Palaeolithic to the Bronze Age, across Anatolia, Caucasus, Northern Mesopotamia and surrounding regions.

The artifacts selected for characterization analysis, 46 samples, come from 15 Pottery Neolithic to Middle Bronze age sites located in the area of the Land of Nineveh Archaeological Project (LoNAP) including the site of Tell Gomel, which is currently under excavation by the LoNap team.

Artefacts are represented by fragments of blades and bladelets, although the presence of cores and flakes may suggest different modalities of transport from the sources: as a finished product, raw blocks or pre-form cores.

SEM-EDS and WD-XRF analyses allow the identification of 6 different groups of obsidians, according to their chemical composition, that were compared with literature data of 9 possible source outcrops: Sakeli Orta, Acigöl, Gollu Dağı, Hasan, Nenezi Dağı, Bingöl, Meydan Dağı, Nemrut Dağı and Süphan Dağı.

The chemical plots of the Iraqi Kurdistan samples allow the attribution of provenance from Nemrut Dağı, the prevailing source, followed by that of Meydan Dağı source; minor possible source area are Bingöl, Acigöl or Süphan.

This study indicates that the majority of the materials analysed originates from the Lake Van area across all periods; the Nemrut sources were integrated by other far-distance sources during certain periods suggesting an increased interaction between groups.

The obsidian diffusion could have had direct links with transhumant movements from the mountains to the plain; mountain paths across the Zagros could have facilitated the transport of this raw material or finished products towards the Mesopotamian plains where a major role of the fluvial systems is assumed.

Keywords: obsidian provenance, Iraqi Kurdistan, SEM-EDS, WD-XRF, non-destructive analyses

**Towards an Integrated lithic analysis (ILAN) : ontology, typology,
manufacturing process, artifact refitting, raw material sources, intrasite
spatial analysis, use-wear traces, experimental knapping**

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Form of communication: oral lecture

Session: Ancient lithic trade and economics I

Day 2 (19 November) 9:30-10:50

The potential knowledge of artifact studies in archaeology is enhanced with the correlation of multiple intrinsic information (such as morphology, techniques, raw material, use-wear traces, etc.) and extrinsic information (refitting links, intrasite location of artifacts, distance to sources, distance between settlements, etc.). By integrating all this information, artifact studies allows implementing various methods as typologies, manufacturing process (the so-called “chaîne opératoire”), intrasite spatial organization, intrasite working areas, identification of raw material sources and diffusion of artifacts, culture identification, circulation of hunter-gatherer groups in a territory, etc.

The conceptual plate-form of such lithic studies is obviously the iterative definition of the ontology, identifying and describing the characters of each intrinsic information (morphology and technology for manufacturing process, geological and physic-chemical data for raw material, unambiguous identification of traces) and the measure for each extrinsic information (artifact location, distance to sources, location and distance between settlements, etc.). The ontology is not limited to a vocabulary (thesaurus) but also the non ambiguous definition of the character and its eventual measure.

The main step is a formalization step in creating a data table to search structures (partition, seriation, spatial structure, etc.) or in creating a graph (for example a Petri network for a manufacturing process), and then to apply the methods of multidimensional data analysis. Examples are given of such an integrated lithic analysis, at different scales: artifact, settlement, territory, with associated methods and best practices.

Keywords: lithics, methods, ontology, process

An integrated lithic analysis of the flint artefacts of the mammoth bone dwelling site of Gontsy (Ukraine)

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-11:00

The mammoth bone dwelling site of Gontsy has revealed after 25 years of excavations, an exceptional spatial organization centered around six mammoth bone dwellings and their surrounded pits, external hearths and/or fire cleaning areas, working areas, dumping areas, butchering areas and finally the mammoth bone bed areas inside the paleoravines near the settlement. The lithic industry is differently present in all those areas, as it is showed by the results of an integrated analysis using the information from spatial analysis, manufacturing process (knapping and tooling), raw material procurement and use-wear analysis.

Keywords: upper palaeolithic, integrated analysis, lithic industry

Representing Lithotheque of siliceous rocks from the Northern Caucasus

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Form of presentation: poster

Session: Lithotheques: collections of comparative raw materials

Day 3 (20 November) 14:20-15:20

Lithotheque of siliceous rocks from the Northern Caucasus is created since 2007 and today consists of more than 1000 samples from 60 outcrops that are stored in the Laboratory of Prehistory in St.-Petersburg, Russia. The study of the regional sources is just in the beginning. Symbol nomenclature was applied to all types of rock samples for consistency of data presentation (for example, KR-1 where KR means flint). We identified first of all flint sources based on published geological reports, references in the archaeological literature and initial discoveries in the course of specific surveys. Surveying of geological outcrops in the Northern Caucasus was done using geological maps created by the A.P. Karpinsky Russian Geological Research Institute (VSEGEI, St. Petersburg), as well as data from the portal <http://www.onegeology.org/portal/home.html>. These maps allow comparison of the age and distribution of different geological strata containing flints in different territories. Coordinates of outcrops were identified using a GPS navigating device Garmin eTrex–Vista. Because flints can vary within the same outcrop, although flints from different outcrops often have a similar composition, we collected several visually distinguishable flint samples from different parts of each outcrop. Petrography and geochemical analyses were done for groups of samples from the studied outcrops. The chemical composition of flint and composition of trace elements were determined by X-Ray Spectral Fluorescent Analysis, using the Spectroscan MAX device. The final data reflect the concentration of such elements as V, Cr, Fe, Co, Ni, Cu, Zn, Sr, Pb, Rb, Ba, La, Y, Zr, Nb, As, as well as the oxides of TiO₂, MnO, CaO, Al₂O₃, SiO₂, P₂O₅, K₂O, MgO, Na₂O in percent by weight.

Research of raw material sources in the North-Central Caucasus were supported by the Russian Scientific Foundation grant No. 17-78-20082, "Human-nature interaction in ancient in the Central Caucasus: dynamics of environmental change and technological innovations, and adaptations of subsistence strategies".

Keywords: lithotheque; flint; siliceous rocks; Northern Caucasus

Variants of raw materials exploitation in the Middle Paleolithic in the Northern Caucasus

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting I

Day 1 (18 November) 14:00-15:20

Thirteen main stratified Middle Paleolithic sites are known in the Northern Caucasus: the open-air sites of Il'skaya I-II, Hadjoh-2, Besleneevskaya-1, Baranakha-4 and Tinit-I and the cave sites of Matuzka and Mezmaiskaya, Monasheskaya and Barakaevskaya caves, Gubs I Rockshelter, Saradj-Chuko grotto, and Weasel cave. Several different cultural entities are represented in the region in the Middle Paleolithic: specific Early Middle Paleolithic industry in Matuzka cave, the Eastern Micoquian in the western part of the Northern Caucasus and the Laminar Levallois Mousterian industries in the eastern part of the Northern Caucasus.

Results of a comparative petroarchaeological study of samples from raw material sources in the region and Middle Paleolithic sites will be reported. Sixty flint and chert outcrops were studied since 2007. Samples were collected and analyzed by means of petrography and geochemistry in several different laboratories. Our research of raw material exploitation in the Middle Paleolithic of the Northern Caucasus shows that different raw material strategies are represented in the region.

Researches in Saradj-Chuko Grotto and raw material sources in the North-Central Caucasus were supported by the Russian Scientific Foundation grant No. 17-78-20082, "Human-nature interaction in ancient in the Central Caucasus: dynamics of environmental change and technological innovations, and adaptations of subsistence strategies".

Keywords: Raw material exploitation, flint sourcing, obsidian, Middle Paleolithic, Northern Caucasus

Flint and obsidian tools from Saradj-Chuko grotto, Northern Caucasus, Russia: preliminary results of use-wear analysis

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Form of communication: poster

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 3 (20 November) 14:20-15:20

Saradj-Chuko Grotto is located ~70 km north-east of the highest Caucasian volcanic mountain peak of Mount Elbrus (5642 m asl) and about 4 km south from the town of Zayukovo in the Baksan river valley (Terek river basin), close to which rich obsidian sources are known, on the territory of the Kabardino-Balkaria Republic (Russia), about 20 km north-west of the city of Nalchik. The site was discovered in 2016 and a multi-disciplinary research began here in 2017. A large lithic assemblage excavated from Layer 6B represents the first obsidian laminar Mousterian industry in the Northern Caucasus. The study indicates that this layer represents the level of most intensive (on average about 200 lithic artefacts per m²) Neanderthal occupation in Saradj-Chuko Grotto. Preliminary results of analysis of lithic and faunal assemblages show that in Layer 6B Neanderthals were engaged in intensive knapping of obsidian, and production and use of tools made mostly from obsidian for butchering and consumption of hunting prey that was represented mainly by ungulate animals. Technical characteristics of industry from ly. 6B allow to define this industry as laminar faceting Mousterian. The retouched tools include tool types, such as prevailing simple side-scrapers, rare diagonal, angular, and convergent scrapers, and characteristic Levallois retouched and Mousterian points. The authors report first preliminary results of use-wear analysis of flint and obsidian tools from ly. 6B at Saradj-Chuko grotto. The study allowed us to distinguish different categories of tools for use as hunting weapons, as well as butchering of hunting prey, which was brought to the site by the Middle Paleolithic inhabitants of Saradj-Chuko grotto. Excavations at Saradj-Chuko Grotto were supported by the Russian Scientific Foundation grant No. 17-78-20082, "Human-nature interaction in ancient in the Central Caucasus: dynamics of environmental change and technological innovations, and adaptations of subsistence strategies".

Keywords: Middle Paleolithic, obsidian industry, use-wear analysis, Northern Caucasus

Experimental assessment of knapped stone vs. copper projectile points

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Form of communication: oral lecture

Session: Experimental flint knapping

Day 4 (21 November) 9:00-10:30

North America's Old Copper Complex (4000-1000 B.C.) is a unique event in archaeologists' global understanding of prehistoric metallurgic evolution. For millennia, Middle and Late Archaic hunter-gatherers around the North American Upper Great Lakes region regularly made utilitarian implements out of copper, only for these items to decline in prominence and frequency as populations grew and social complexity increased during the Archaic to Woodland Transition. Yet, it may be reasonably asked whether these demographic and social factors are the only, or predominant, factors contributing to this evolutionary pattern. To answer this question, we initiated an extensive archaeological experimental program comparing replica copper tools versus analogous ones made of stone to better understand whether relative functional efficiency also contributed to the decline of utilitarian copper implements. In this presentation we present a controlled ballistics study that examined how well copper projectile points penetrated a target relative to stone points. Our results showed that on average, copper projectile points did not penetrate our experimental target significantly shallower than stone ones; indeed, when mass is controlled there is evidence that copper points can penetrate substantially deeper. These results are consistent with the hypothesis that functional efficiency did not play a role in the decline of utilitarian tools at the end of the Old Copper Culture, although future assessments of functional efficiency should consider the role, costs, and benefits of production efficiency and skill acquisition in copper- and stone-tool making.

Keywords: Experimental archaeology; Projectile points; Ballistics

Archaeometric characterization of the obsidians from the Late Roman site of Casa dei Francesi at Tramontana in Ustica (Palermo, Italy)

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

At Ustica island (Palermo, Italy), in the area of “Casa dei Francesi”, 119 fragments of obsidian were collected on the surface of an agricultural area at an altitude of 50 m asl. In the same area there are also abundant fragments of late Roman ceramics (IV-VI century AD) and does not appear, at least until now, that it was the site of a prehistoric settlement. The nearest and most important prehistoric settlement, the Faraglioni Village (Middle Bronze Age) is located only 700 meters further north, overlooking the sea.

Obsidian provenance determination, with absolutely non-destructive techniques, WD-XRF or SEM-EDS, on the 119 samples of the Ustica “Casa dei Francesi a Tramontana” site indicate exclusively two source areas: 93 samples from Lipari (78%) and 26 samples from Pantelleria (22%); concerning the obsidians from the island of Pantelleria it was possible to establish also the sub-source of Salto la Vecchia.

The typological and functional analyses of the 119 obsidian finds, point out that 112 are splinters, but 7 are tools with micro-retouching. Some fragments show percussion bulbs that suggest the existence of a lithic workshop where chipping was practiced, aimed at the production of blades and bladelets. Bladelets with a triangular and trapezoidal section, are represented by three fragments and other three fragments are micro-gravers, with more or less pronounced beaks. Only one beautiful specimen of a scraper, have obvious marginal micro-retouching.

Ultimately the lithic complex shows features suggesting that the Roman site of “Casa dei Francesi a Tramontana ” was built on an earlier prehistoric site.

Keywords: obsidian provenance, Ustica Italy, SEM-EDS, WD-XRF, non-destructive analyses

An insight into human mobility in South Patagonia through information from lithic raw materials availability areas, artifacts distribution and characteristics, Linkage Pathways and Least Cost Paths analysis

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Form of communication: oral lecture

Session: Ancient lithic trade and economics I

Day 2 (19 November) 9:30-10:50

Detailed recording of the extension of potential secondary sources of lithic raw materials is important to understand human mobility and circulation, especially in regards to hunter-gatherer societies. Here we will analyze the case of the area located between the Southern Deseado Massif and the Upper and Middle Santa Cruz River Basin (Patagonia, Argentina), which has had a discontinuous human occupation between the Pleistocene-Holocene transition and the Late Holocene.

Three secondary sources of black obsidian with a similar geochemical composition and differences in the size of the cobbles available have been found at the North of our study area and to its Northwest. Their primary source remains unknown. Siliceous rocks of very good and excellent quality have been recovered both as primary and secondary sources at the Southern Deseado Massif, only some of them have a localized distribution, which has allowed us to establish general availability areas. Although sampling has been carried out in the plateaus and basaltic canyons to the South of the study area, none of these raw materials have been discovered until the moment.

In this case, we analyze the frequency, size and characteristics of artifacts made from black obsidian and other siliceous rocks recovered between the Southern Deseado Massif and the North of the Santa Cruz River Basin. Results obtained are compared with models developed using Geographical Information Systems in order to understand human circulation and utilization of these spaces. We use topography based Linkage Pathways between ecological zones which may have attracted human populations in these semiarid environments, as well as Least Cost Paths analysis between archaeological sites, which are based on the slope, presence of basaltic plateaus, water sources and snow load. Results are complemented with those coming from other lines of evidence.

Keywords: Patagonia, human mobility, raw material availability, Linkage Pathways, Least Cost Path Analysis

“*Chaînes opératoires*” and raw material choices at the MSA site of Gotera, Southern Ethiopia

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-11:00

This paper presents the study of lithics collected in the Gotera area, Oromia-Borena region, within the frame of (H)ORIGIN Project (PI Enza E. Spinapolice). The aim of this research is to investigate the exploitation strategies of the available raw material at Gotera and to test the hypothesis of two distinct reduction sequences according to different raw material choices and availability.

The assemblage is composed by 321 pieces: 25 cores, 277 flakes and 19 tools on basalt and quartz, the main local raw materials exploited by Pleistocene hominines in the area. The artefacts are fresh and, when occurs, patina is whitish or reddish. The assemblage integrity, despite coming from a surface context, is confirmed by the presence of refits. Levallois method is frequently attested by cores and centripetal, bipolar and unipolar convergent flakes. A volumetric exploitation of cores is also reported by the recurrence of elongated flakes with a wide platform angle. The number of formal tools (denticulates and irregular or alternate retouched flakes) is overall scanty. The combination of Levallois methods and other flake removal patterns contributes to produce substantial variability within the exploitation strategies for flake production and it places them within the MSA complexes. Results from technological analysis clarifies the exploitation dynamics of basalt and quartz, resulting in two separate *chaînes opératoires*, showing a more opportunistic reduction strategy on basalt artefact with the exploitation of natural convexities on cobbles to produce flakes and tools. The quartz lithic assemblage shows a more accurate preparation of core striking platforms. These results have been compared through multivariate analyses, Principal Component Analysis and Cluster Analysis. The analyses performed confirm the existence of two separate reduction sequences.

Keywords: East Africa, Ethiopia, Middle Stone Age, Lithic analysis, quantitative approaches

An approximation to the Neanderthals lithic procurement at Teixoneres Cave (Moià, NE Iberian Peninsula)

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Form of communication: poster

Session: Ancient lithic trade and economics

Day 3 (20 November) 14:20-15:20

Teixoneres Cave is located northeast of the Iberian Peninsula at 760 m a.s.l., near the town of Moià at 50 km north of the city of Barcelona. The cave belongs to the karstic system of the Toll caves developed on the Neogene limestone of the Collsuspina Formation, and has a size of approximate 30 m length. The sedimentary sequence is 8 m thick and 10 different stratigraphic units have been identified. The upper part of the sequence is dated from ~16 ky BP at the top (stalagmitic crust over unit II) to more than 100 ky BP at the base (stalagmitic layer under unit III). Unit III, which is the focus of this work, is radiocarbon dated from greater than 51,000 to 44,210 cal. BP.

From a geomorphological perspective, Teixoneres Cave is located in the Moianès plateau, between two fluvial systems, the Llobregat at the south and the Ter at the north. This plateau is situated in the Catalan Central Depression, and near the contact with the Prelittoral range, a region with a great diversity of raw materials including sedimentary rocks, located in the marine and lacustrine sediments of the Eocene and Oligocene of the Catalan Central Depression, and sedimentary, igneous and metamorphic rocks of the Paleozoic and Mesozoic materials from the Prelittoral ranges. Moreover, the river systems Llobregat and Ter provide an additional variability of raw materials from Pyrenean origin. Most of the lithotypes identified at Teixoneres Cave (eg., quartz, cherts, limestones, hornfelds, slates) can be found in one of these areas, situated at a distance of ~20-25 km. In the archaeological assemblages, the most represented lithologies are located no further than

12 km. Quartz pebbles are abundant in the surroundings of Moia, whereas chert nodules are found in the Lower Muschelkalk facies at the Prelittoral range.

Keywords: Lithic procurement, Texioneres Cave, Neanderthals, quartz, chert

Sant Martí de Tous: a chert ‘self-service’ for the Catalan Central Depression (Northeast of the Iberian Peninsula)

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Form of communication: oral lecture

Session: Characterising lithic sources I

Day 2 (19 November) 14:00-15:20

The Sant Martí de Tous chert (SMT) is located in the Sant Genís formation, at the NE margin of the Ebro Basin (Catalonia, Spain) being part of La Noguera Lacustrine system. It is dated to the Priabonian age (Upper Eocene), and it is defined succession of 100 m of evaporitic lacustrine deposits such as gypsums, sandstones, lutites and carbonates.

Nowadays, it appears in a maximum 1.5 km fringe weigh, with a NE-SW orientation, from the locality of Sant Genís (Jorba) through the locality of Fillol (Sant Martí de Tous), with a surface area about 5.6 km².

Macroscopically this chert is very heterogeneous, presenting a great variability of colours, fine to medium grained textures, opaque and translucent at the edges. Thin-sections show a microcrystalline quartz matrix with secondary gypsum, disseminated sparitic carbonates and dissolution-nodulization structures.

The Abric Romaní rockshelter (Capellades, Barcelona) is one of the main Mousterian sites in the NE of the Iberian Peninsula attesting Neanderthal occupations between 110 to 40 kyr BP. The yielded assemblages show us the important role that this chert outcrop played in the lithic procurement strategies at that time. The SMT chert is the most represented

lithotype at the site with percentages over the 50% and in many cases about the 80% of the all lithic assemblage, being almost always caught in primary and sub-primary position. The abundance of the SMT chert and its relatively small area, make this outcrop a mandatory passage zone for many of the prehistoric hunter-gatherer groups that lived close to the Catalan Central Depression.

Keywords: Sant Genís formation, Sant Martí de Tous chert, procurement areas, macroscopic characterization, thin-section characterization

Raw material analysis of catalonian Late Neolithic – Chalcolithic chert grave goods: macroscopic approach

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

The presence of large blades and arrowheads made in chert in funerary contexts in Europe has been widely described by many authors. This phenomenon, which appeared in the northeast of Iberian Peninsula during the third millennium BC, has aroused great interest due to its functional, economic and symbolic nature. Likewise, the absence of other stages of the *chaîne opératoire* show us that many of these elements were made in other places and later deposited as grave goods.

Considering the archaeological remains preserved, it is necessary to apply non-destructive methods to analyse these pieces. In the case of provisioning siliceous raw material studies, the best way to work with them could be by macroscopic characterization. This kind of research has made it possible to know the materials exogenous nature, giving evidences of the existence of vast intergroup contact.

In the present work we will expose the current state of the research carried out in Catalonia, focusing in the macroscopic analyses made to large blades and arrowheads amortized as grave goods during the Late Neolithic – Chalcolithic period.

Keywords: large blades, funerary context, Late Neolithic, Chalcolithic, Catalonia

Lithic knapping, Acoustics, Resonance, Survey Methods

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Form of communication: oral lecture

Session: Experimental flint knapping

Day 4 (21 November) 9:00-10:40

A series of experiments and studies have demonstrated that knapped flint pieces respond to specific acoustic signals around 10 kHz even if they are embedded in the sea floor sediments. This has led to an engagement in finding a better understanding of the flint knapping process, that can explain the development of this interesting acoustic feature as well as find similar features for other knapped materials. Such acoustic characteristics are practical, because they can make it possible to locate sites with knapped lithics embedded into the sea floor, even at great depths. As the sea level during the glaciations went down to around – 120 m and the marine coasts appear to have played an important role for humans through time, this opens for the detection of interesting old sites.

Keywords: Lithic knapping, Acoustics, Resonance, Survey Methods

A pilot study of use-wear on pitchstone

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 4 (21 November) 11:20-12:20

Pitchstone is a very distinctive raw material, chemically and geologically very similar to obsidian, but with inferior knapping qualities. This perhaps is one reason why its use as a raw material for prehistoric chipped-stone industries is much more restricted in Europe than that of obsidian. Within the British Isles, however, pitchstone circulated widely, with artefacts made from this material being found over 400 km from the primary sources on the Isle of Arran in western Scotland.

Our paper focuses on the first ever use-wear analysis of several Neolithic pitchstone assemblages from Scotland, including sites on Arran as well as the Scottish mainland. A major challenge of this research was to design and conduct experiments in producing a definitive complex of wear patterns and to compare them with archaeological pieces. The experiments were made with: i) natural pieces of pitchstone, collected on coastal beaches of the island of Arran where the most numerous and accessible pitchstone outcrops are located and obviously exploited in middle and later prehistory; and ii) a few artifacts knapped by Bruce Bradley specially for the experimental work. The experiments included processing of dry and fresh wood, pig hide, reed, and fresh meat and bones. The results are considered based on empirical and interpretive data acquired in numerous studies on obsidian.

Detailed photo and microphoto documentation of the edges of the archaeological, virgin and experimental pitchstone pieces offers evidence for discussion of whether this particular raw material was put to functional use by Neolithic people in Scotland, or played some more aesthetic, ideological and/or ritual role in Neolithic life.

Keywords: Pitchstone, Neolithic, Scotland, use-wear, experimentation

Revisiting flint raw materials from Bulgaria (Shumen district): petrography and LA-ICP-MS analyses

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Form of communication: oral lecture

Session: Geology and mineralogy of knappable materials

Day 3 (20 November) 10:50-13:10

The Bulgarian prehistoric sequence reveals a distribution and use of particular raw materials in a distinct ‘cultural’ context. The Early Neolithic chipped stone industries of the Karanovo I and II cultural alliance (part of a supra-regional technocomplex in the Balkans) are recognisable by formal toolkits made of Balkan flint. The Chalcolithic period is famous for its unique superblades made of high quality Ludogorie flint, which attains a broader Balkan scale of distribution and use in both the domestic and mortuary domains. In spite of a solid corpus of reliable results from our previous field surveys in northern Bulgaria and subsequent laboratory analyses, there are still questions and problems requiring further analysis, comparative study and contextual interpretation.

This paper presents the results of petrographic observations and chemical analysis (LA-ICP-MS) of a new series of archaeological artefacts and raw material samples collected during a survey in northeast Bulgaria (Shumen district). The data acquired allow us to: i) distinguish two new types of flint (Shumen I and II) which are represented in both flint raw materials and artefacts previously referred to as Moesian flint; ii) affirm that the Shumen I type, which in terms of its colour and whitish spotted inclusions resembles the Balkan flint from the Mezdra Formation in the Pleven–Nikopol region, offers another possible source of what archaeologists think of as ‘Balkan Flint’; iii) complete the analysis of the Kriva Reka type of Ludogorie flint and confirm its substantial role in prehistoric flint production, distribution and use. Thus, our results allow us to assume alternative provenances and pathways of distribution for the most frequent and important raw materials in prehistory.

Keywords: Prehistory, diagnostic artefacts, Balkan flint, Moesian flint; Ludogorie flint, petrography, LA-ICP-MS

Recycling of the Prehistoric items: 'fire-stones' from a Longobardian cemetery

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Form of communication: poster

Session: Lithic technology of recent periods: Modern and Mediaeval

Day 3 (20 November) 14:20-15:20

In the graves of the 6th century cemetery excavated at Szentendre (north of Budapest, Hungary) pieces of Buda hornstone (chert), radiolarite, quartzite and siliceous pebble were regular elements of the fire-kindling set. In some cases the presence of characteristic artefacts of the Bronze Age (saw-blade with intense use-wear shine) and Late Neolithic or Copper Age bladelet cores, as well as Prehistoric sherds shows that during the Early Medieval period nearby Prehistoric settlements were used as (secondary) sources of 'fire stone' material.

Keywords: Prehistoric stone tools, saw blade, Longobardian grave

The Spirit of Stones

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Form of communication: poster

Session: Bedrock and alluvial: primary and secondary raw material sources

Day 3 (20 November) 14:20-15:20

The author has been collecting pebbles passionately for 12 years. A large part of her collection comes from the Danube region. The same gravel beds might have served as raw material sources for prehistoric artefacts or simple collectibles for all periods. A selection of pebbles with high esthetic value will be presented with a lot of nourishment for the imagination.

Keywords: pebble, manuport, collecting, aesthetic value

Procurement, management of raw material and lithic production by the Late Pleistocene peoples of the Atacama desert, Northern Chile

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Form of communication: oral lecture

Session: Stone tool production and processing techniques II

Day 5 (22 November) 11:40-13:20

The site Chipana-1 reflects the adaptation of ancient human societies to a hyper-arid environment, the Atacama Desert (1200 m.a.s.l.), contributing new data to the debate on the first human settlements in South America. The good stratigraphic conservation and thirteen ¹⁴C dating show that the site was frequented around 11.480 Cal BP. Chipana-1 is a lithic production site, specifically a bifacial industry, in a large quarry of silicified rock. This type of site is unprecedented in northern Chile, as it documents initial stages of extraction and preparation of the raw material, unseen elsewhere. In addition, it characterizes the technical knowledge (method, technique and technical procedures) of the knappers, focused into the elaboration of stone artifacts. It also illustrates the role of the quality of the raw materials in the production reflected in: a) the choice of best quality of rock for complex artifacts versus the low quality for faster manufacturing tools, and b) the lithic knapping mistakes mainly associated with poor rock quality. Overall, Chipana-1 complements the information of the groups that populated Atacama and provides technical aspects about the manufacturing that had not been explored in northern Chile.

Keywords: Human settlement of South America, lithic technology, *chaîne opératoire*, quarry

Speckled Senonian Flint Artefacts in Southern Jutland. An example for flint provenancing in Denmark and Northern Germany

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Form of communication: oral lecture

Session: Ancient lithic trade and economics I

Day 2 (19 November) 9:30-10:50

Flint from the Upper Cretaceous and the Paleocene (Danian) is very abundant in Denmark and Northern Germany. Large amounts of flint are easily accessible at primary chalk and limestone outcrops (fx. Møns Klint) as well as at secondary deposits along beaches and riverbeds, where Saalian and Weichselian moraines are being eroded. During the Neolithic flint was both collected on superficial deposits and extracted from primary outcrops by mining. In Denmark, the determination of provenance of the flint used for local artefacts was assumed almost impossible, as one usually cannot find out if an artifact was made out of flint from distant primary sources or from local moraine flint. The presence of Red Helgoland Flint in Denmark, Northwestern Germany and the Netherlands proves the opposite. It was so far the only known example for successful provenancing of flint in this region. A quick survey of the readily accessible flint Daggers found in Southern Jutland suggest that a rough determination of provenance of the flint used for manufacturing some of the daggers is possible. These daggers are made of very fine-grained tabular flint with lots of light spots in a dark grey or sometimes almost black matrix. Often the spots form clusters and resemble a sky full of stars. This special type of flint known as Speckled Senonian Flint derives from outcrops in the Limfjord region of Northern Jutland. During the Weichselian this material was not transported to the middle and southern parts of Jutland and is not readily available in the moraine till. It is therefore highly probable that these daggers were produced in Northern Jutland and brought south as gifts, merchandise or personal equipment.

Keywords: Speckled Senonian Flint, Southern Jutland, provenancing

Dispersal and use of knappable materials in Georgian territory

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Form of communication: oral lecture

Session: Ancient lithic trade and economics

Nowadays Caucasus region is represented with large diversity of landscape types. In this region the climate and environment are quite various. Here one can find glacier, deep forests, steppe, even desert and etc. Main volcanic processes, the tectonic, erosive and more has influenced the formation of the relief. These different kind of landscapes are rich with its geological sources. All this was the main reason why Caucasus was occupied by early stages of human development. Caucasus region is rich with its plenty of knappable raw material sources, which was used by prehistoric people in different chronological periods.

The most used and valuable knappable material especially in Late Prehistory is obsidian, which exists in Javakheti highlands in South Georgia. Obsidian in Paravani lake area is so abundant. The quality of obsidian is excellent. Because of this, the territory was occupied by different chronological period. It is interesting, that obsidian from Paravani lake was transported also around 200 km to the West direction near black sea, where in 60's was excavated Neolithic settlements. People who lived on these settlements close by had flint excellent sources, but the value of obsidian was so high that they transported obsidian permanently.

As we mentioned, in West Georgia there are also represented different flint sources, which was used during whole Paleolithic and was distributed in different directions.

In Lesser Caucasus of Georgia there are another knappable materials, which was used in Prehistoric times. First of all, by different archaeological surveys it was found big number of Basalt and Andesite artefacts. Most of this artefacts are hand axes, Massive tools, which was especially used in Early stages of Paleolithic.

To Analyze the dispersal of knappable raw material in limited areas and the archaeological records together will help us to understand more about transportation and exploitation strategy of different sources in Prehistoric times.

Keywords: Prehistory, exploitation, lithic raw material

Final Palaeolithic exploitation strategies in Orońsko region, Central-Southern Poland

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting II

Day 1 (18 November) 16:00-17:00

Orońsko is located in the northernmost part of the chocolate flint deposits in Central-Southern Poland. Chocolate flint is one of the best quality flint in Poland, used widely during the Stone Age since Middle Palaeolithic, and exploited with the use of mining methods from primary sources at least from Late Palaeolithic. Orońsko mine was discovered by Stefan Krukowski in the beginning of the XX century. The shafts were sunk in karstic clays. The recent research conducted in this region as part of the project „Exploitation and processing of chocolate flint during Paleolithic and Mesolithic in the north-western part of its deposits based on non-invasive archeological and geophysical research and test-trenches” (2015/17/N/HS3/01279, financed by the National Science Centre), led to the discovery of shafts, that are sunk also in the primary limestone level that contains the primary, tabular bed of flint. They were dated with the use of radiocarbon dating to the Late Pleistocene (the border of Allerød and Younger Dryas). Among finds, there were mining tools made of flint, bones and antler. The presentation will be focused around the problem of exploitation strategies in Final Palaeolithic in the Orońsko region. The main attention will be given to the interpretation of the shafts sunk in primary and secondary beds, but also on the analysis of flint artefacts found on the surface of the mining fields.

Keywords: mining, chocolate flint, Orońsko, Palaeolithic

Siliceous rocks of the Tatra Mountains (Southern Poland) as a potential source of raw materials in the Stone Age

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

Tatra Mountains are the highest mountains of the Carpathian Arc. The highest peak is *Gerlachovský štít*, which reach 2655m a.s.l. Tatra Mountains are located in the Central Western Carpathians in the territory of Poland and Slovakia. In the Tatra Mountains there are still less archaeological sites than in surrounding areas. Recent new archaeological evidences from this region confirmed, that human occupied Tatra Mountains at least from the Late Palaeolithic. As we can presume on the base of findings coming from neighbouring areas, it might have been even earlier.

In the Tatra Mountains several outcrops with good quality siliceous rocks are known, but still this topic requires more studies. The main aim of this poster is to present all of the known deposits of siliceous rocks, that could had been used during the Stone Age. Also the perspectives of future studies will be indicated.

Keywords: Tatra Mountains, Siliceous rocks

Weber Fractions and the Ability to Perceive Three-Dimensional Size Differences in Stone Tools

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Form of communication: oral lecture

Session: Experimental flint knapping

Day 4 (21 November) 9:00-10:40

Three-dimensional (3D) scanning was used to capture the 3D geometry of an asymmetrical Levallois core and a symmetrical Acheulean handaxe in order to examine if Weber fractions (limitations in sensory abilities) affect the perception of size differences in 3D objects.

Both the handaxe and Levallois core were scaled down to about 20% of their original size to save time.

The original scaled version of each object is considered here to represent the object at 100% size.

Each object was scaled down in 1% increments from 100% to 90%.

Ten handaxes and 10 Levallois cores were 3D printed at 100%, 99%, 98%, etc.

The 3D printed objects were sanded and spray painted brown to appear more natural.

A random naming system was then applied onto the 3D printed objects in order to keep track of them.

The experiment was conducted using 30 participants including undergraduate and graduate students at the University of Toronto.

The experimental procedures included four tests as follows:

1. Objects with 3% size differences were placed at 1 meter intervals from each other on a flat surface and the participants were asked which of the two objects was larger. This procedure was repeated 7 times with different pairs of objects for both cores and handaxes;
2. The same procedure was repeated with objects with a 2% size difference;
3. The same procedure was repeated with objects with a 3% size difference; and,
4. All of the cores were given to the participants who were asked to place them side by side from largest to smallest. This procedure was repeated with the handaxes.

All the results were logged into an Excel spreadsheet as 1 for a correct answer and 0 for an incorrect answer. Statistical analysis of the results demonstrate that our ability to differentiate size difference diminishes quickly when the size difference is less than 3%.

Keywords: Weber fractions, human error, standardisation, variation, physiology, lithic tools, handaxe, Levallois core

Design and reduction sequences of projectile points from the Low Paraná river basin, Argentina

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Form of communication: poster

Session: Ancient lithic trade and economics

Day 3 (20 November) 14:20-15:20

Lithic projectile points coming from pre-hispanic archaeological sites from the low Paraná wetland (LPW), are artifacts that only recently have been analyzed with some detail on local studies. The first analysis that included several specimens recovered on this area, identified a unique basic design with almost null morphological differences. This basic design comprises stemless points with small triangular blades, straight or slightly concave bases and were manufactured in high quality cherts and orthoquartzites from Sierras Bayas Formation. On that study, it was also observed that projectile points on this last raw material, were thicker than the rest, probably related to the resilience of quartzite to flaking. At the same time, we analyzed thrusting systems in relation to size and weight, later revisited by Silvestre et al. (2013). In that paper, we also included experimental data on projectile point performance and use-wear analysis of both experimental and archaeological specimens. Systematic excavations carried out on the area the last ten years allowed us to improve the number of cases studied, strengthen hypotheses previously stated, and perform more robust statistical and morphometric studies. Here, we analyze an assemblage of 40 projectile points recovered from hunter-gatherer archaeological sites coming from the low Paraná wetland dated on late Holocene. We examine raw materials properties and variety, lithic reduction sequences, morphometric variability, as well as thrusting systems. We conclude evaluating that projectile points were part of an extended exchange system that included other goods and raw materials.

Keywords: lithic projectile points; morphometrics, low Paraná wetland; hunter-gatherers

Between prehistory and modern era: Flint technologies in early historic times

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Form of communication: oral lecture

Session: Lithic technology of recent period: modern and Mediaeval

With the advent of metals, chipped-stone tools seem to decline. However, although the first metal objects appear during the Chalcolithic, flint tools continued to be produced and used through the Bronze Age and the beginning of the Iron Age. The coexistence of these two large scale technologies for more than three millennia represents a complex phenomenon, which can be analyzed from different perspectives recognizing the various factors in the history of technology, and the trajectories and the rhythms of technological change.

In the Southern Levant, lithic industries survive until the beginning of the 1st millennium BCE. In the shadow of metallurgy, flint chipped-stools reflect specific socioeconomic systems which do not merely mirror expedient and opportunistic productions, “cheaper” and “simpler” than those involved in bronze and iron technologies. On the contrary they perfectly integrate with the general organization of the society. The analysis of chipped-stone tools from early historic time, of their technologies and production systems represent a promising field of research for observing if and how modern knapping activities directly derivate from them, or rather, they represent new and original inventions.

Keywords: Lithic Technology, Early historic period; Iron Age; Southern Levant

Protohistoric flint exchange system: The case of the Canaanean blades

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Form of communication: oral lecture

Session: Ancient trade and economics II

Day 2 (19 November) 11:30-12:50

Canaanean blades are large standardized flint blades mainly used as sickle inserts, and are one of the lithic hallmarks of the Early Bronze Age in the Southern Levant (4th-3rd millennium BCE). Recent studies combining a detailed technological analysis and spatial distribution of the entire range of Canaanean production waste, debitage and tools offer new insight on the organization of its production and consumption system. In the Southern Levant, Canaanean blades were produced using the lever-pressure technique, one of the most complex and sophisticated knapping techniques. Given the time required to master the pressure technique, and the necessity to maintain the knapping skills with regular practice and elevated productivity, only a few expert knappers were contemporaneously active, supplying the mass consumption of Canaanean blades in the region. The limited number of specialists involved in their manufacture seems to suggest that the production/distribution system of Canaanean blades was more complex than previously thought. As indicated by the spatial segmentation of the *chaîne opératoire*, itinerant knappers moved from their workshops to other places, villages and cities, exchanging and producing blades along their routes.

Keywords: Lithic technology, Early Bronze Age, Canaanean blade, specialization

Use of quartzite pebbles during the LGM: a case study from Mogyorósbánya (Hungary)

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Form of communication: oral lecture

Session: Bedrock and alluvial: primary and secondary raw material sources

Day 1 (18 November) 10:00-11:00

The raw material types collected from pebble formations clearly dominate the assemblages excavated at Mogyorósbánya (Northern part of the Transdanubia, Hungary) well dated to the Last Glacial Maximum. More than 8 percent of the excavated lithics are made of different quartzite pebbles. The studied pieces were partly used as hammerstones, but even these pieces were systematically used as cores for blade or flake removals. The presence of pre-cores (described as chopping-tools of the specific Pebble Gravettian industry) and numerous blanks make possible the reconstruction of the reduction of this coarse grain raw material type.

Finally, the spatial data from the refit studies document the transport of the same poor quality raw material block in the excavated part of the settlement spots.

The research was supported by Bolyai János Kutatási Ösztöndíj (Bolyai János Research Scholarship).

Keywords: quartzite, pebble, LGM, refitting

Procurement of raw material in the Middle Palaeolithic at Šalitrena pećina (Serbia)

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting I

Day 1 (18 November) 14:00-15:20

The site of Šalitrena pećina is located in Western Serbia, in the canyon of the Ribnica river. Its stratigraphic sequence includes late Mousterian, Aurignacian, Gravettian as well as Neolithic and more recent periods. Our focus was on the Middle Palaeolithic occupation of this site and the raw material exploitation strategies during that period, especially considering the local zone of procurement.

Since the provenance studies for Šalitrena pećina have never been done until now, our first aim was to locate and sample sources of knappable stone. As a result, significant deposits of a good-quality cherts were found in the surroundings of the cave. The first results after comparing raw materials and artefacts from the Mousterian layers suggest a strong reliance on those local sources. Presence of pebble and nodular cortex indicates the exploitation of both primary and secondary deposits.

The abundance of raw material in the vicinity of Šalitrena Pećina could possibly explain the long-term occupation of this site and it is yet to be confirmed in the future research.

Keywords: Middle Palaeolithic, procurement, sourcing, chert, deposits, Šalitrena pećina

Adaptation to raw materials intra-variability: example from the Middle Palaeolithic open-air stations of the Hérault valley, France (Les Geissières, Saint-Saturnin, and Camillo)

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-11:00

Up to now, little was known about the Middle Palaeolithic from the Hérault valley (France). Recently, systematic surveys lead to the discovery of several open-air stations (surface collections). Some of these have yielded stone tools made from unusual raw materials such as brecciated quartzites and jasper-like rocks. These rocks are found in primary position in the *Montagne Noire* area, and are also available in the alluvial deposits of the Hérault valley in the form of cobbles (with more or less rounded edges). These raw materials are very heterogeneous even within a single cobble. Their inter and intra-variability has been found to have induced specific knapping strategies as hominins adapted to or took full advantage of their special petrographic characteristics. We present here data from three Middle Palaeolithic open-air stations to illustrate these adaptive knapping strategies (Les Geissières, Saint-Saturnin, and Camillo). Experiments were also conducted in order to test some of the identified methods, such as bipolar-on-anvil, with the aim of: 1) evaluating its efficiency for flake production and 2) recognizing specific traces left by this method on the products. This enabled us to better identify archaeological artefacts in this particular alluvial context. This study is part of larger project whose aim is to know better the Middle Palaeolithic from the Hérault valley and its surroundings.

Keywords: Middle Palaeolithic, non-flint raw materials, lithic technology, adaptation, debitage

From Bedrock to Alluvium: Considerations on raw material sources

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Form of communication: oral lecture

Session: Bedrock and alluvial: primary and secondary raw material sources

Day 1 (18 November) 10:00-11:00

From an anthropological point of view, the raw material acquisition and use in prehistoric societies are influenced by a range of factors. Without being exhaustive, these are: the presence of siliceous rock outcrops on the territory and in the landscape they live in; the accessibility of these outcrops in the landscape; the exploitability of these outcrops (required extraction techniques); the ability of the siliceous rock to be raw material (form, quantity, quality, etc.); the necessary technical and social investments for the exploitation (distance from the frequented places, energetic costs, organizational problems, etc.); technical system of tool production (toolkit, know-how); cultural tradition (constraints, habitudes, etc.). These factors were weighted by prehistoric people to decide about outcrops as being potential raw material source or not. The siliceous rocks have their own history prior to human impact, from the original bedrock to the alluvial deposits, of which the outcrops represent certain stages. The details of this history may help to determine their capacities to be a potential raw material source for a given prehistoric period. In this presentation we overview the correlations between the rock history and raw material source types in relation to human exploitability. We formulate considerations for the archaeological investigation of provenience studies, using new results of French scholars and our field observations.

The “Lithic resource management dynamics from the Middle Palaeolithic to the Middle Neolithic in Northern Hungary” project is financed from the NRDIFund (grant no. K 124334).

Keywords: siliceous rock outcrops, raw material source types, exploitation forms, Palaeolithic, Neolithic, Northern Hungary

Quartz component in the Middle Paleolithic industries of the Central Balkans

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Form of communication: oral lecture

Session: Stone tool production and processing techniques I

Day 5 (22 November) 9:00-10:00

Most of the Middle Paleolithic industries in the Central Balkans display a significant quartz component. This component is present in the industries of the Lower to Middle Paleolithic transition (Velika and Mala Balanica), in those that can be linked to the SE Charentian (Petrovaradin fortress, Pešturina), as well as in those industries that do not display Charentian elements (Hadži Prodanova pećina). Production techniques show many common characteristics, but also certain differences, which are most evident in the frequency and modalities of application of the Quina method. The question is whether the use of quartz in the Middle Paleolithic of the Central Balkans is due to a lack of quality raw materials or if it represents a technological tradition associated with the application of specific models in techno-economic behavior. This problem has been examined in each individual case where this type of industry occurs.

Keywords: quartz, Middle Palaeolithic, Charentian, Quina, Balkans

Heat-induced changes in cherts and location of Magdalenian hearths

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Form of communication: poster

Session: Geology and mineralogy of knappable materials

Day 3 (20 November) 14:20-15:20

Heat-treatment of cherts and flints to improve their flaking quality has not been demonstrated for Central European Upper Palaeolithic so far. The goals of our new research were to identify heat changes in one of Moravian cherts (Olomučany type), i. e. whether it was usable at all for such mechanical improvement and, secondly, the plotting of heated artefacts in map so that eventual settlement features (e. g. hearths) could be distinguished in selected Magdalenian sites. The results have shown, on one hand, that the loss of pore space within the material is rather retarded (i. e. occurs only at potentially destructive temperatures of $>300^{\circ}\text{C}$; Fig. 1) when compared to (e. g.) finer-grained French flints so that other mechanisms would have to be present in order to improve the material's flaking quality at lower temperatures. Secondly, a number of Magdalenian sites (e. g. Kůlna Cave, layers 5 and 6) have shown only scattered remains of heated artefacts so that they may only comprise of disturbed contexts, representing palimpsests of several occupations.

Keywords: Olomučany chert, heating, mechanics, macroscopic observations, Magdalenian

The late Upper Palaeolithic assemblage from the recent prehistoric explorations in the Manjira river valley of Telangana, India

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Form of communication: oral lecture

Session: Stone tool production and processing techniques

The prehistoric explorations in the Manjira river valley of Telangana started in 1957-58 by A.V.N. Murthy. Until now, no one has been carried out any systematic explorations in the study region except finding the new sites and reporting them, The recent prehistoric explorations which were carried out in the Manjira river basin of the Telangana resulted in a discovery of stone-age tools in the study region. An extensive archaeological survey has been carried out in the districts of Sangareddy, Medak and Nizamabad. This assemblage will help in the understanding of the Prehistoric Cultures of the study region and also in the reconstruction of the past life and Prehistoric climate.

Keywords: Flakes and Blades, Upper Palaeolithic Cultures, Manjira river valley, Telangana, India

Local and exotic raw materials for blade-knapping during the Late Chalcolithic and Early Bronze Age in the Northern Iraqi Kurdistan: the case of chert and obsidian

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

From the fifth to third millennia B.C. several blade-knapping traditions coexisted across the Northern Mesopotamia. The identification of distinctive traits of each lithic tradition is not only a technological matter – e.g. large blades and smaller blades produced by different pressure and/or percussion techniques and methods – but regards also distinct networks of raw materials supply and circulation. The northwestern region of Iraqi Kurdistan, by far being little investigated through years, represents an outstanding case-study to investigate these cultural and socio-economic dynamics.

Among the wide spectrum of locally available lithic raw materials, the Eocene chert from the newly discovered mining district of the Jebel Zawa represents the main rock source used to produce the so-called “Canaanite blades” during this long-time span. The Zawa blade-knappers probably served the eastern Tigris settlements as the main productive centre, as testified by a large number of blades distributed in the surrounding sites.

Concurrently, the imports of obsidian originated from the Lake Van sources were active, in continuity with earlier periods. This paper will focus on the characterization data of the Zawa chert and the adopted research protocol. The relationship between chert and obsidian lithic productions will also be discussed taking into account the main features of the two networks, tangible differences and possible relationships.

Keywords: chert characterization, non-destructive analyses, multi parametric protocol, Northern Iraqi Kurdistan

Sourcing chert artifacts in order to determine prehistoric pilgrims? at the Poverty Point site, a UNESCO World Heritage site in Louisiana, USA

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Form of communication: oral lecture

Session: Characterising lithic sources I

Day 2 (19 November) 14:00-15:20

The provenance of chert artifacts recovered from cultural deposits at the enigmatic Poverty Point site, Louisiana is crucial in order to understand the prehistoric people who visited the site and/or their social networks evidenced by the abundance of multiple chert types present. Reflectance spectroscopy is applied as a chert provenance technique to determine the geologic and geographic source of chert artifacts at the site that sits within a lithic poor region. Chert provenance gives us important information regarding the possible home ranges where many hunter gatherer groups traveled from in order to participate in communal gatherings at the site. Though, due to issues with equifinality, the data cannot rule out trade networks as an explanation for the presence of multiple exotic chert types, the results demonstrate that far ranging groups visited the site bringing with them chert lithic resources. Sources of chert consist of materials from north of the site along the Mississippi River drainage, northeast along the Highland Rim province, and alluvial gravel deposits found in the lower Mississippi River coastal plain. The results coupled with other datasets, including morphometrics, will improve our understanding of the inhabitants or pilgrims at the Poverty Point site.

Keywords: Poverty Point site, reflectance spectroscopy, chert provenance

Production and use: Beyond stone tools. Example of house 32, Lepenski Vir (Serbia)

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Form of communication: poster

Session: Stone tool production and processing techniques

Day 3 (20 November) 14:20-15:20

Lepenski Vir, located in the Iron Gates region (SE Serbia), is a well-known site for its monumental sculptures and numerous trapezoidal houses dated to the Mesolithic/Early Neolithic period, c. 6200-5900 cal BC. Absolute dates indicate that prehistoric communities have been inhabiting the site in wider chronological span, c. 9400-7600 cal BC, but they hadn't left extensive material remains.

Detailed raw material and techno-typological analysis of knapped stone industry were undertaken by Kozłowski and Kozłowski (1984). However, recent revisions of Lepenski Vir material and documentation have required a new examination of the chipped stone artefacts and the implementation of advanced methods. New analysis included a vast study of the techniques used for knapping, as well as crossing the raw material and techno-typological data with the contexts of the artefact origin and the use-wear analysis. The results drew attention to houses 32, 35 and 36 regarding the quantity and technological characteristics of grey flint artifacts. Our attention here is drawn to explore the activities performed in the house 32, where the only one retouched artefact – a perforator was uncovered while other stone remains indicate that grey flint was knapped while blanks of Balkan and grey flint with white spots were stored and used.

Use-wear analysis of the proposed sample consisted both from artefacts coming from ash-place but also from house floor was conducted and indicates variety of used materials and activities, and also implies the presence of thermal stress on some of the artefacts.

Interesting is that some of the tools have traces of a complex nature, e.g. they were used for divergent activities in different periods, indicating the character of the house 32 itself.

There is presence of activity on mineral material and working on large fish, which was a very important part of human diet of prehistoric communities of Lepenski Vir.

Keywords: Lepenski Vir, Mesolithic/Neolithic, technology analysis, use-wear analysis, grey flint, Balkan flint

Behind the scenes. Introduction to the human activities in the Iron Gates region.

Preliminary use-wear analysis of chipped stone artefacts from Lepenski Vir and Padina (Serbia)

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 4 (21 November) 11:20-12:20

For decades, a closed eco-niche like Iron Gates in Eastern Serbia enabled specialists to explore the transition to a sedentary life, with an exceptional record of human occupation during the Late Glacial and Early Holocene. Following the series of published analysis from the architecture to the prehistoric diet of the Iron Gates inhabitants, our research aims to present the newest results regarding the use-wear analysis of chipped stone artefacts from Lepenski Vir and Padina site with a broader focus on the transition from Mesolithic to Neolithic in this region. Applying the use-wear analysis is done by using both low and high-power approach together with FTIR analysis. Gained results were interpreted in light with the already stated hypotheses focused on daily routine, but also addressing some long-term aspects like changes in the economy.

We observed both function and technology of chipped stone artefacts coming from houses, middens, hearth areas, and open-air spaces. Based on the results, some of the main activities that took part in Iron Gates are processing of hide, bone, antler, fish and vegetable-based plants. It is very important to highlight the complexity of various processes, which make this already specific area more peculiar. Variety of both simple, but overall more complex and composite activities are recorded with the elaborate preparation of the used materials, for example, hide. Particular processes, as butchering was noted both inside the houses, and also concentrated in precise, specific areas in the settlements, where only tools involved in the processing of hide and meat, connected strictly to butchering were found. Obtained data highlights the activities of these advanced hunter-gatherers and fishermen, and first farmers, together with spatial analysis revealed the dynamics and processes in Late Mesolithic and Early Neolithic, but also posed many questions regarding the specialization of the prehistoric settlements on the Danube.

Keywords: use-wear analysis, FTIR analysis, raw materials, Iron Gates, Mesolithic, Early Neolithic

Quartzite catchment not only on fluvial deposits: raw material characterisation of the lithic assemblage of the layer XXII-R from el Esquilleu, Cantabrian Region, Spain

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Form of communication: oral lecture

Session: Bedrock and alluvial: primary and secondary raw material sources

Day 1 (18 November) 10:00-11:00

The consideration of quartzite by prehistorians as a secondary raw material has avoided in-depth research of this raw material as other rocks, such as flint or obsidian. The two latter ones are the better studied raw materials because of the information derived from its study: long-transport of rocks and mobility of people. In contrast, the information derived from researches that took into account quartzite generally proposed near to the site catchment areas mainly related to secondary river deposits. This idea, together with the variability of rocks named as quartzite by archaeologists, influences the absence of research on the second most-often used raw material during the Palaeolithic. To overcome these narrow perspectives, it is necessary to put in the centre of the debate the quartzite as raw material using an inductive proposal based on geoarchaeological methodologies.

This presentation tries to tackle this question by the application of a geoarchaeological methodology that combines thin section analysis, stereomicroscope observation, and X-Ray Fluorescence compositional analysis of the quartzites from the layer-XXII-R from El Esquilleu. In this work, we also present the characterisation of potential areas where quartzite could be caught, especially river beaches. The results show complex mechanisms of quartzite catchment on river deposits based on intensive and selective searching, not only in near river deposits, but also in more distance fluvial deposits and conglomerate formations. Finally, and through the combination with techno-typological criteria, we proposed complex mechanisms of exploitation depending on each quartzite type. All these data open new perspectives to the characterisation of the second better represented raw material in Europe, but also to deep into catchment mechanism on fluvial deposits and quartzitic conglomerate formations.

Keywords: Middle Palaeolithic, Raw material catchment, Quartzite, Petrography, Stereomicroscopy

Classification of siliceous rocks in Central Europe

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Form of communication: oral lecture

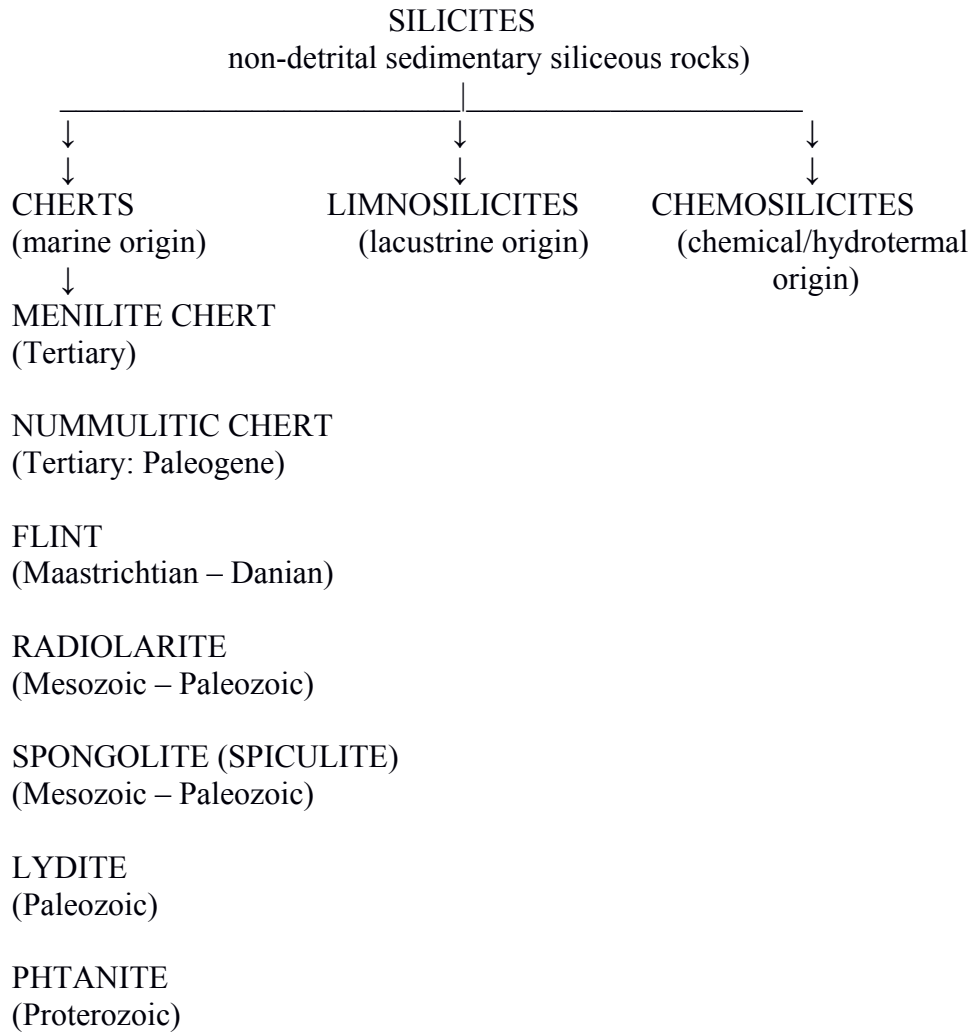
Session: Geology and mineralogy of knappable materials

Day 3 (20 November) 11:50-13:10

Raw material for chipped tools has to be hard on the one hand, on the other hand suitable to form homogeneous flakes or blades with sharp edges. Silica rich rocks or minerals fill usually the both requirements. Collections of prehistoric chipped artefacts can have sometimes hundreds or even thousands items. Evaluating such a collection, it is necessary first of all to make a basic division of used raw materials into five basic groups:

1. Silicites (non-detrital sedimentary siliceous rocks) – chert and its variety, flint, limnosilicite, chemosilicite (hydrosilicite);
2. Silica rich minerals – quartz and its varieties, opal, chalcedony, jasper, plasma;
3. Natural glasses – volcanic glasses especially obsidian and pitchstone, tektites;
4. Clastic (detrital) sedimentary rocks rich in quartz or chert – orthoquartzite, chert breccia, quartz sandstone;
5. Special rocks – porcellanites, silica rich fine-grained or amorphous volcanic rocks, silicified wood, silicified corals, silicified limestone.

Silicites as the most important group of raw materials in Central Europe can be divided according to the following scheme:



Keywords: silicite, chert, flint, limnosilicite, chemosilicite

Lithic raw material procurement at Chaves Cave (Huesca, Spain). A geochemical approach to define Palaeolithic human mobility

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Form of communication: oral lecture

Session: Characterising lithic sources I

Day 2 (19 November) 14:00-15:20

Chaves Cave (Bastarás, Huesca, Spain) is located at 640 m asl in the central Pre-Pyrenean range, in NE Iberia. The huge cave opens to the east and measures 60 m width, 30 m height, and 225 m length. The site was systematically excavated by a team from the University of Zaragoza and the Museum of Huesca since 1975, documenting several human occupations from the Upper Palaeolithic and the Neolithic periods with a calculated potential surface of about 1000 m². Archaeological works had affected barely a tenth of the total area when they were abruptly interrupted after the emptying of most of the archaeological levels in 2007 by an assault that destroyed all the Neolithic preserved levels not yet excavated.

Despite being the Neolithic occupations the most important prehistoric occupation of the cave, several human occupations during the Upper Palaeolithic were also recognized and partially excavated until 2007. Thus, the recovered lithic tools as well as the obtained radiocarbon dates revealed that Chaves Cave was frequented by hunter-gatherer groups during the Upper Solutrean and the Late Magdalenian.

Lithic raw materials recovered at the Palaeolithic levels from Chaves Cave are diverse, with several chert types being identified. The archaeopetrological analysis of the recovered lithic set has comprised micropalaeontological, petrographical and geochemical analyses (energy dispersive X-ray fluorescence and laser-ablation inductively coupled plasma mass spectrometry). Results have allowed determining several origins for rocks, not only from the southern Pyrenees but also from the northern versant of this mountain range, demonstrating that the Pyrenees were regularly crossed during the Upper Palaeolithic.

Keywords: Human mobility, Pyrenees, geochemistry, chert characterization

Heat treatment and the mechanical properties of rocks

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Form of communication: oral lecture

Session: Geology and mineralogy of knappable materials

Day 3 (20 November) 11:50-13:10

Heat treatment of stone to produce tools by controlled fracturing (stone knapping) is commonly understood as one of the earliest efforts of humankind to deliberately alter the properties of naturally available materials. Such early heat treatment has important implications for the cultural evolution of anatomically modern humans and it has been interpreted to be a proxy for archaeological concepts such as “modernity” or “complexity”. Such inferences must, however, be based on solid interpretations of what stone heat treatment actually implied for past human behaviours, fire use or tool knapping. Most available archaeometric studies on heat treatment concern mineralogical or crystallographic transformations in the rocks and relatively few detailed data on the thermal evolution of fracture mechanics are actually available to date. In this paper, I present data on the thermal evolution of four mechanical properties (fracture strength, fracture toughness, elastic modulus and Weibull modulus) of flint and silcrete, comparing them to the chemical transformations taking place in these rocks. The results allow to propose a comprehensive theory of the transformations of tool stone quality upon heat treatment that allows to explain the crystallographic factors and mechanisms that cause them. Apart from the obvious implications for our understanding of the motivations to heat-treat stone in the past, this theory will shed further light on the concepts of tool stone quality and the mechanics associated with stone tool knapping.

Keywords: Heat treatment, Tool stone quality, Fracture mechanics, Flint, Silcrete

A Preliminary Study of a Knapped Basalt Stone Axe Head from Jibei Island, Penghu Archipelago, Taiwan

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Form of communication: oral lecture

Session: Polished stone tool production: knapping before and after polishing

Day 1 (18 November) 11:40-12:20

A basalt stone axe collected from the Jibei Island, Penghu County, Taiwan, is intriguingly of a very rare shape with pronounced flaring blade with two corners protruding outwards and with a thin body. The shape is unlike other knapped stone axes with trapezoidal in shape and straightish two sides of the blade found from those Neolithic archaeological sites in Penghu Archipelago and Taiwan around 4000 years ago, on the contrary, very similar to those *yue* axes made of nephrite found from the Liangzhu Culture Sites (ca.5300-4200), Southeast China. How could the basalt stone raw material knapped into this shape and why Stone Age people made such an effort to shape basalt stone raw material into this particular shape. This paper discusses the manufacture of this particular type of stone axes and shed a new light on the study of Neolithic stone axes.

Keywords: Basalt stone axe, Liangzhu *yue* axe, Modern axe, Neolithic Taiwan, Neolithic China

Traceological studies of the production inventory of the Gulikandoz site (Gissar Neolithic culture, Tajikistan)

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 4 (21 November) 11:20-12:20

The Gissar Neolithic Culture (6–4 thousand BC, Tajikistan) was discovered by A. P. Okladnikov in 1948. There are few large stratified sites, mainly small temporary habitats without a cultural layer, containing 20-100 objects. The inventory includes the Upper Paleolithic pebble element (flakes, large blades, choppings, choppers) and the Mesolithic element (flint microblades, geometric microliths).

The Gulikandoz site belongs to the local variant of the Gissar culture. It does not have a cultural layer, but contains a large number of artifacts.

1490 items were subjected to the traceological analysis: 211 pebble (72 with use-wear traces), and 1279 flint artifacts (356 with traces). Most of them are flakes without use-wear traces. This waste of the stone-working, as well as numerous highly utilized flint and pebble chopper-like cores, indicate that the site was used as a workshop to obtain blanks for tools. The utilized tools show various types of activity: composite knives with flint-blade inserts for meat; flint scrapers and borers for skin processing; pebble scrapers and choppings for the primary processing of hides; flint saws, burins, planning knives, drills for woodworking; large pebble scrapers and choppings for bone processing. The functional classification completes with a single pebble flake used as a knife for cutting grass. The hunting tools, probably, are represented by the inserts for arrows – microblades and geometric microliths of various forms, which, as a rule, have no use-wear traces for objective reasons.

Many implements are made on blanks without secondary processing.

Thus, a traceological analysis shows that the Gulikandoz site, which, due to the abundance of stone processing waste, was considered only as a workshop, was in fact a place where various types of production activities characteristic of long-term settlements were practiced.

The work was performed according to the program 0184-2018-0006 “Production and use of tools in the Paleolithic, Neolithic and Bronze Age (technological, traceological and experimental study of archaeological materials”

Keywords: traceology, Gulikandoz, Gissar culture, the Neolithic of Tajikistan

Functional use of large stone objects in the Paleolithic sites of the Russian Plain

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Form of communication: poster

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 3 (20 November) 14:20-15:20

The materials of many European Paleolithic sites contain large pebbles of various rocks, which, due to the inexpressiveness of their forms, rarely become objects of special study. Some of them retain their natural shape, others have a slight artificial processing.

In the course of our research, artifacts from Paleolithic sites of different times were subjected to a comprehensive study: Kostenki 14, 16 (Voronezh Region); Kamennaya Balka II (Rostov Region). Technical-morphological and experimental-traceological studies allowed us to characterize the methods of processing these artifacts and establish their purpose.

Among the studied collection, stone trapezoidal tile from the bottom layer of a multilayer Late Paleolithic site Kamennaya Balka II (21,000–20,000 years ago) has a slight artificially treated surface with clearly distinguishable use-wear signs. Its base, sides and slightly recessed working part bear faint traces of knapping, picket and grinding. The working area demonstrates signs of grinding from work that leveled picket processing along the entire diameter of the recess, as well as polishing spots, on top of which multidirectional thin shallow linear traces with soft, blurry edges are fixed. These use-wear traces are typical of tools used to grind plant materials. To verify the obtained observations by experimental means, the dried roots of cattail were grinded on a stone, the central part of which was treated with a light picket. As a result, a thin, light substance, “flour”, was obtained. Use-wear traces on the working part of the experimental tool turned out to be similar to the signs found on the original tool.

The definition of this tile as a tool used to grind plant materials was also confirmed by the discovery on the working surface of mineralized starch grains belonging to the wild forms of the cereal Triticeae, the subfamily Pooideae, rhizomes of cattail (*Typha* sp), etc.

Thus, thanks to a comprehensive research technique, it was possible to identify new artifacts among unmodified stone objects – tools for grinding plant materials, which are indisputable evidence of the existence of collecting practice in the Paleolithic era.

The work was supported by the Russian Foundation for Basic Research, the project 19-59-25002, partly.

Keywords: Russia, Late Paleolithic, stone tile, use-wear analysis

La Guinardera quarry (Sant Martí de Tous, Barcelona). An example of chert exploitation in modern times

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Form of communication: poster

Session: Raw material exploitation strategies: mining and surface collecting

Day 3 (20 November) 14:20-15:20

In 2014 an accumulation of chert material that could correspond to a quarry was documented in the town of Sant Martí de Tous (Barcelona, NE Iberian Peninsula). As a

consequence, in 2018 a first archaeological intervention was carried out in the place called La Guinardera, where two chert workshops, La Guinardera and La Guinardera Nord, were documented.

These workshops are located in the St. Genís formation, included in La Noguera Lacustrine system and dated to the Priabonian age (Upper Eocene). It is formed by a succession of 100 m of evaporitic lacustrine deposits of gypsums, sandstones, lutites and carbonates. In the St. Martí de Tous area this formation presents shallow lacustrine conditions typical of sabkha environments, in which the layers of gypsums and sandy lutites interspersed with tabular red sandstone levels yield different chert varieties.

The archaeological assemblage from La Guinardera Nord site allowed us to identify a chert workshop for the production of gunflints. However, in La Guinardera site the heterogeneity of the assemblage could not assign it to a unique chronocultural period or use.

The presence of these two deposits within the mentioned formation shows us a repeated landscape use pattern as a place for raw material extraction. There are references of this use at least from the Middle Paleolithic (e.g. Abric Romaní) to the modern period (e.g. La Guinardera Nord).

Keywords: Sant Martí de Tous, chert, quarry, La Guinardera, gunflints

Creating an online database for lithic materials – a preliminary review

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Form of communication: oral lecture

Session: Lithotheques: collections of comparative raw materials

In the collection of the Institute of Archaeology and Ethnology of Polish Academy of Sciences there are many examples of the lithic raw materials collected over the years from different sources. In Poland and in the neighbouring countries we have outcrops of a very good siliceous rocks e.g. flints, obsidians, quartzites and radiolarites. These raw materials were widely used through the whole prehistory and were found on many polish archaeological sites.

There are many valuable collections of lithic raw materials at the territory of Poland and many publications describing briefly the sources of them, but they are not wide or not easily accessible. However, we wanted to combine all the data we have, digitize the lithic materials and make an open access database.

In creating our “Atlas of Rocks” database, we wanted to systematize all the information we have and we had to decide which of them include in it and what kind of terminology should be used. We have added detailed photographs of each lithic raw material and even some 3D models. We hope that our database will become an important implement in understanding of prehistoric human activities such as range of acquisition, distribution, trade, mobility, etc.

This is possible thanks to the three years project entitled *Open Resources in Digital Repository of Scientific Institutes* (OZwRCIN) whose beneficiary is our Institute, together with other 15 scientific institutions since 1st August 2018, as a part of the *Operational Program Digital Poland, 2014-2020 Measure 2.3; Digital accessibility and usefulness of public sector information; fund from the European Regional Development Fund and national co-financing from the state budget*. Agreement number: POPC.02.03.01-00-0029/17.

Keywords: online database, raw materials, siliceous rocks, 3D, EU project, Poland

Lithic economy in South Western France during Neolithic, a case study from a coastal site: La Lède du Gurp

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Form of communication: oral lecture

Session: Ancient lithic trade and economics II

Day 2 (19 November) 11:30-12:50

South-western France prehistory is known worldwide for its rich record of Palaeolithic sites, especially from the Dordogne region. However, while research on the Palaeolithic is extremely prolific, the Neolithic was at the same time relegated to the background. Since the beginning of the discipline, few researchers worked on the Neolithic from SW France. Besides, they focus on ceramic typological analyses to describe cultural groups, rarely considered lithic tools and armatures, and never performed any techno-economical study of lithic productions. Since almost thirty years, Neolithic research remains little developed in relation to its potential. As part of my PhD thesis, the aim will be to fill this gap by characterizing lithic productions through techno-economical analyses, in order to describe the cultural groups existing in Northern Aquitania during the 4th and the 3rd millennia. With the example of La Lède du Gurp, a littoral occupation site dated to the middle and recent Neolithic, I will try to highlight in this paper what the study of lithic industries can tell about a cultural group at a local scale.

As it's known, Neolithic societies are distinguished by the complexity of their economic, social and symbolic structure. Expertise is furthermore another important factor to take into consideration to characterize those populations and their way of living. For lithic industries, expertise is for example evidenced in the strong investment in the extraction of raw materials and the manufacture of polished axes. Those types of exploitation highlight long distance diffusion and trade networks all over the territories of a cultural group. At La Lède du Gurp, a littoral and salt producer site, we will try to define how lithic resources influenced their choices and what is the impact of lithic trades in the local economy of lithic production.

Keywords: littoral site, South-western France, Neolithic, lithic industry, trade impact, lithic resources

Knapping before and after polishing: technological evidence in the Neolithic polished stone tools from Hungary

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Form of communication: poster

Session: Polished stone tool production: knapping before and after polishing

Day 3 (20 November) 14:20-15:20

The poster presents the evidence gathered during the interdisciplinary study of several polished stone tools from some Neolithic sites in Hungary (Méhtelek, Pitvaros, Endrőd, Szarvas, Bicske-Galagonyás, Ecsegfalva, Hódmezővásárhely-Gorzsa, Tápé-Lebő). In particular, the cutting-edged tool production (axes, adzes, chisels) involves knapping at several stages of the operational-chain within an artefact's *'life cycle'*—from raw material procurement, its manufacture, use, and discard.

Some specific fine-grained and non-siliceous raw materials, among which especially are hornfels, “white stones” and a few greenstones, show evidence of being worked by knapping as shown by the recovery of rough-outs, flaked similarly to biface artefacts, reworked pieces during retooling attempts, and several flakes detached before and after polishing the artefact surfaces. These latter demonstrate that re-sharpening and re-working polished cutting-edged tools was a common practice within the settlements during the Neolithic. These flakelets, that sometimes look like true bladelets, have been often confused with, and published as, chipped stone tools. Therefore, it is important to get a holistic view of the whole stone industry during the study of the lithic assemblages. As in the case of chert and flint in N Europe, which have been intensively exploited for the production of polished axes and adzes, some other lithic raw materials could be easily worked by knapping for the production of polished tools, especially micro-crystalline rocks that have technical response and physical properties very similar to true flint and chert. On the other side, there are indeed implications regarding social organization among Neolithic communities, not only from the point of view of raw material procurement. Notably, the technical capability of producing and maintaining in efficiency the polished stone tools had to be acquired by individuals belonging to each household within the community, since stone axe-adze were polyfunctional tools for mundane and multiple tasks. Therefore, as an important mean for survival, the production of stone tools, both chipped and polished, was a knowledge certainly transmitted from generation to generation, although we still have to understand the modes and social implications of the transfer in detail.

Keywords: Neolithic polished stone tools, micro-crystalline non-siliceous rocks, knapping

Beyond the macroscopic phenotypes: knappable siliceous raw materials in the Carpathian Basin. Selectivity and limits of PGAA-based chemical characterization

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Form of communication: oral lecture

Session: Characterizing lithic sources II

Day 3 (20 November) 9:30-11:10

Macroscopic description and categorization is a classical and essentially necessary step in the petroarchaeological investigation of chipped stone tool assemblages. Categorization of SiO₂-rich raw materials and archaeological findings in Hungary (in a broader sense, in the Carpathian Basin and its surroundings) was published earlier and is presented also on this conference. After twenty years of systematic research on silex raw materials (mainly from the Lithotheca of the Hungarian National Museum) and siliceous raw material finds from Hungary, we collected Prompt Gamma Activation Analytical (PGAA) data of more than 600 pieces. This method was selected for consideration because of its non-destructive character and high precision. We aim to consider a comprehensive characterization, based on macroscopic and analytical features. We investigate the selectivity potentials and limitations of PGAA, due to its sensitivities for various major, minor and few trace elements. The complementarity of geochemical characteristics with the generalized macroscopic phenotypes is demonstrated, too.

Keywords: phenotype, geochemical analysis, PGAA, characterisation

Nuclear analytical investigations on the chipped lithic industry of the Copper Age Ariuşd Group in South-eastern Transylvania

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Form of communication: poster

Session: Characterising lithic sources

Day 3 (20 November) 14:20-15:20

According to our current knowledge, the Ariuşd Group, representing the South-Western branch of the great Ariuşd–Cucuteni–Trypillia cultural complex, has emerged and flourished in the periods of the Early and Middle Copper Age, in the second half of the 5th millennium and the beginning of the 4th millennium BC. Spread in the eastern part of Transylvania, the settlements of this cultural unit are grouped on a territory of approx. 12000 square km. From this area, characterized by a great variety of geographical forms, we know so far a number of 90 settlements. Thanks to archaeological research for more than a century, the Ariuşd group is one of the most well-known cultural components of Transylvanian prehistory. Nevertheless, some elements of this rich archaeological heritage are still unknown in their entirety. So it is with the stone tools: archaeological research and professional publications concentrated, for a long time, on other components of material culture, and besides these, the quantitatively much less numerous material of lithic industry did not enchant the archaeologists' attention. More, although we know a few attempts from the past, the issue of raw materials has caught the attention of archaeologists even less. During the last years, the authors of this presentation have endeavored to identify the main sources of raw materials used in making the chipped lithic artefacts utilized by the communities of this cultural group. The aim of the following presentation is to provide a brief overview of this research project, with particular focus on the nuclear analytical investigations carried out on the lithic artefacts of certain settlements. So far, we have managed to analyze 103 objects, coming from 11 settlements using non-destructive Prompt Gamma Activation Analysis (PGAA). Reference samples used for the comparison of the geochemical components were obtained from the Lithotheca, the comparative raw material collection of the Hungarian National Museum from Budapest. The experiments have been done at the Budapest Neutron Centre.

Summarizing the main results, based on the geochemical composition of the analyzed samples, we are able to determine the main long-distance trade lithic materials used in the Copper Age Eastern Transylvania, which are the Moldavian Prut flint and the Volhynian flint, located in the distribution area of the related Cucuteni and Trypillia cultures. Beside them, we can document the trade of the Carpathian obsidian (exclusively de C1 type), provenancing most probably from South-Eastern Slovakia and some varieties of the Balkan and/or Banat flint of North-Balkan or Lower-Danube origin. In addition to these long distance raw materials, it was much more problematic to identify the quite diverse varieties of lithics with local origin: opals, sandstones, silicified rhyolite, marlstone,

radiolarite etc., which also occur in large quantities in the lithic industry of different sites. Most of these raw materials are probably found in the Eastern Carpathians. But in order to identify and locate these objects more precisely, it is necessary to collect and analyze in the future several samples from this geographical region.

The financial support for these investigations was provided by the consecutive CHARISMA and IPERION CH projects of the European Community between 2013 and 2018.

Keywords: Copper Age, Ariuşd Group, Transylvania, lithic industry, Prompt Gamma Activation Analysis

Manufacturing technology of stone miniature columns from Gonur-Depe Bronze Age site (Southern Turkmenistan)

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Form of communication: oral lecture

Session: Stone tool production and processing techniques II

Day 5 (22 November) 11:40-13:20

The technology of production of stone objects is currently not studied enough. This applies fully to the Bronze Age materials of Southern Turkmenistan, where long-term settlements of the proto-city type are studied. These include the Gonur-Depe settlement, the administrative and religious center of Ancient Margiana. Among its materials are the so-called miniature columns, which are most often found in sacral complexes. The raw materials for them were gypsum, onyx, marble, marbled limestone, talc-chloride. They are large in size, resemble a chess piece in shape — a rook, the upper part of some specimens has a mushroom-like cap. Due to the fact that there are several unfinished artefacts in the collection, we managed to find out the sequence of operations for their manufacture. First, large pieces of stone were processed by percussion, then with the help of pecking extra material was removed, the column received the form, then the surface was ground with coarse and fine abrasives. The processing was completed by polishing, which on the finished products covered the traces of previous operations and made the surface glossy. Most of the columns has shallow groove cut on the upper and lower circumferences, which sometimes covering their sides. The depth of the grooves does not exceed 0.1 cm, some of them have an oval, and others rectangular profile. Specific traces of cutting and removing material from the grooves indicate that it was made with metal tools.

The purpose of the grooves remains unknown. Perhaps the columns, which had a significant weight, for convenience of processing were fixed with the help of side grooves in a special device. In the future, an experimental reproduction of the columns manufacturing technology is assumed, which will allow to detail the characteristics of this process.

The work was supported by the Russian Foundation for Basic Research, the project “Antiquities” No. 18-09-40082.

Keywords: Turkmenistan, Bronze Age, stone processing production, columns, use-wear analysis

Archaeometric tracing of thermal alterations produced on silicites quarried by fire setting

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Form of communication: oral lecture

Session: Raw material exploitation strategies: mining and surface collecting I

Day 1 (18 November) 14:00-15:20

During the excavations in 2002 at the Palaeolithic quarries of Avas-Tűzköves in Miskolc, located at the eastern foot of the Bükk Mountains, Northeast Hungary, signs of thermal alteration were observed on many of the finds. This indicates the possibility that prehistoric miners quarried the benches of limnic origin (in fact, postvolcanic siliceous rock, i.e. – limnosilicite) not only with traditional tools but with fire setting also.

We examined the available finds from the excavations carried out on the same region in 1928–1935, 1961, 2001 and 2002. Since a relatively high ratio of the lithics from the last excavations shows macroscopic signs of thermal alteration, samples were subjected to archaeometrical analysis in the University of Miskolc, Department of Mineralogy and Petrology.

Scanning electron microscope (SEM), X-ray diffraction analyses (XRD) and thermoanalytical techniques did not give satisfactory answer to the question if the samples had ever been affected by heat or how high had been the temperatures transmitted to them. Contrarily, three discrete variants of Avas limnosilicite could have been distinguished by applying SEM and thermoanalytical methods (MOM Derivatograph-C). Systematic heating experiments allowed to quantify the mineralogical transformations, which enabled the application of infrared spectroscopic analysis (ATR-FTIR) to observe and track thermal alterations. With this method at hand, we could distinguish several pieces with greasy luster from the assemblage of the 2002 excavations at Avas-Tűzköves, which might have been made after being subjected to thermal alteration.

Keywords: fire setting, thermal alteration, infrared spectroscopy

The characteristics of the stone industries in Western Siberia Subarctic zone

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Form of communication: oral lecture

Session: Stone tool production and processing techniques II

Day 5 (22 November) 11:40-13:20

Most researches during their investigation of the earliest history of the North and Arctic regions, outline a certain contrast in the richness of the biological variety and the deficiency in mineral resources. This contrast leads to such specific changes as changes in stone carving practices, or replacement of one method (eg., knapping for flint) with another (development of the abrasive schist treatment).

In this paper the authors examine materials geographically referred to the Northern part of the Western Siberia (Russia), and chronologically – the Bronze Age at the end of the Eneolithic era.

While researching the abovesaid materials, the authors arrived at several peculiar conclusions closely related to the physical properties of the raw materials accessible for the ancient people. The key and the most accessible raw materials for the Siberian region (as well as for the Arctic regions in general) are quartzites and schist. In the case of the quartzites – the primary material makes it possible to get sharp cutting edges on simple nondescript quartzite flakes under low work efforts. However, the detailed form making, and controlled splitting are almost impossible for quartzite treatment. At the time, the use of schist assumes other treatment methods – the mixed approach, when the split stone is preformed using chopping off, and the final form is achieved using the abrasive grinding method.

It is worth noting, that existing artifacts include some amount of flint items. Taking into consideration the regional flint deficit, one can tell about its foreign origin.

In general the authors made two critical conclusions:

5. Deficiency of the “quality” raw material leads to refocusing to the local resources of the raw materials less suitable for treatment, however more widely spread within the area.
6. Typologically nondescript artifacts possess the “versatility” and “situational adaptability” features, when simple items of the same type can be used as various tools.

This research was conducted under support of RFFI 18-09-4011

Keywords: Quartzite, schist, knapping, Russian Arctic, Yamal peninsula

Flint vs. Limestone – A comparative analysis on the development of macro-wears. Implications for the analysis of old lithic toolkits

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Form of communication: oral lecture

Session: Use-wear analysis of different stone raw materials: specific features and variability

Day 4 (21 November) 11:20-12:20

Namely for the Lower Palaeolithic, the traceological analysis are very difficult to carry out due to bad conservations and to the diversity of raw materials used for tool production. Due to the problem of conservation, focusing the functional analysis on the observation of macro-wear appears to be a good solution to obtain functional data.

We propose thus to present the results of a large experimentation (up to 300 experimental tools), conducted with limestone and flint flakes. Controlled parameters were used to dispose of replicative criteria for comparison. Three movements were performed systematically (longitudinal translation, and transversal translation both unidirectional and bidirectional), and two durations (equal to 4 and to 10 minutes). In the first stage, actions were realized on the same worked material: dry wood calibrated. Each raw material for each action was represented by 48 experimental tools. In the second stage (63 experimental tools), same actions were realized on different worked materials such as fresh wood, skin, bone, meat... The macro-wears produced (mainly scars and edge rounding) were described relatively to their position on the edge and their morphology.

The comparison between the two raw materials was made using a statistical approach. The results were discussed under the influence of different parameters: morphology (plan, profile, section) and edge-angle of the active part. These results confirm firstly that the macro-wears were reliable to determine the tool movement. Moreover, considering the chosen criteria, only few differences exist for macro-wears development between flint and limestone. We finally will discuss on this quasi similarity of mechanical behavior, between the two raw materials tested.

Keywords: macro-wear; quantitative analysis; controled experiment

The chipped stone industry of the Copper Age settlement from Malnaş Băi (Covasna County, Romania). The reduction and use of local stones vs long-distance raw materials

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Form of communication: oral lecture

Session: Ancient lithic trade and economics II

Day 2 (19 November) 11:30-12:50

The prehistoric site at Malnaş Băi (*Málnásfürdő* in Hungarian) is known since the beginning of the 20th century. The research carried out at the site by Ferenc László and Hubert Schmidt in 1909 and by Attila László in 1976-1989 has brought to light a fortified settlement belonging to the Copper Age Ariuşd Group, consisting of at least four habitation levels and several dwellings, as well as the remains of a large defense ditch with an internal rampart. Since 2014, systematic investigation has been resumed by a research group from several museums and academic institutions in Romania and abroad. The aim of our presentation is to review the main results of the analysis on the lithic material discovered in 2014-2016.

This chipped stone collection comprises 134 specimens. Non-destructive PGM analysis, carried out in the research facility of the Budapest Neutron Centre, on 34 artefacts, has demonstrated the existence of long-distance raw materials (obsidian and Prut flint), but also a number of rocks of local origin (sandstone, siliceous shale) that were purchased from geological sources in the Eastern Carpathians.

Differences in the techno-typological structure of the assemblages made from particular raw materials were observed. The sandstone industry is composed of *plein débitage* blades, with regular edges and non-cortical flakes. On the other hand, the obsidian and siliceous shale collections are typical for a knapped-in-side the settlement assemblage containing cores and blanks from all stages of reduction. The use-wear analysis of the artefacts showed discriminations in the use of tools made of different rocks.

The chipped stone industry from Malnaş Băi, through its diversity of raw materials and débitage particularities, is typical for the Copper Age from the Carpathian basin. This specific space was a corridor of interaction between different populations and cultural traditions, interactions that lead to the intense circulation of materials and technologies.

Keywords: Copper Age, Carpathian Basin, reduction sequences, local raw materials, long-distance, use-wear analysis

Sedimentary microfacies for the determination of the raw material provenance of artefacts

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Form of communication: oral lecture

Session: Characterising lithic sources II

Day 3 (20 November) 9:30-11:10

We present the first results of a study for provenience of raw materials of silicite tools using the sedimentary microfacies examination. This completely non-destructive method is used to link the artefact found in an archaeological site to the outcrop from which it originates. We compare this method to our results obtained by using p-XRF as alternative sourcing method.

As case study archeologic artefacts from central Ukraine were compared to few geologic outcrops. Different directions of raw material supply between 7400 and 4000 BC are shown, where a noticeable change in the raw material supply can be seen in LBK time.

Keywords: sourcing, silicite raw material, linking of artefact and outcrop, sedimentary microfacies, p-XRF

How can the raw material characterization be more satisfactory? A Comparative Mechanical Approach

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Form of communication: oral lecture

Session: Characterising lithic sources II

Day 3 (20 November) 9:30-11:10

Formal crudeness of lithic tools is significantly influenced by coarseness and mechanical poorness of raw material. Quartz and quartzite are main candidates to inevitably produce simple tools and have been listed low quality material. We do not have, however, any solid evidence to support these two rocks are really “hard-to-deal” resource. In order to secure objective criteria to classify low and high quality raw material, a comparison of mechanical properties between high-quality raw material—flint and chert—and low-quality material—quartz and quartzite—is made. The high-quality raw material samples were obtained from well-known classic palaeolithic sites of Europe: St. Acheul and the vicinity of the Somme River, Les Eyzies and the vicinity of the Vezere River. Somewhat mediocre materials are categorized medium-quality one and relevant sample were taken at Atapuerca of Spain, and at the vicinity of Kara-bom site, Russian Altai. Low quality material samples—quartz and quartzite—were collected from the Imjin-Hantan River Area, Korea. The indices measured for quantifying mechanical properties include 1) wave velocity, 2) elasticity, 3) tensile strength and 4) anisotropy. The preliminary result is that categorization of low/medium/high quality raw material is somewhat meaningful in terms of elastic factor and average tensile strength; the difference in anisotropy is not clearly discerned across these raw material categories though. This result introduces a new hypothesis that striking pulse and solidity of raw material might have been principal factors responsible for the way how hominids cognized the mechanical properties of available raw materials. In this regard, the casual dichotomy of low/high quality material is no more than based on subjective attribution and should be manifested with full consideration of contextual feasibility of given raw materials.

Keywords: quality of raw material, isotropy, tensile strength, Young's modulus

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Excursions

Field Guide

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Conference excursion

21 November: Excursion to Buda Hornstone sites and localities (E1)

Post-Conference tours

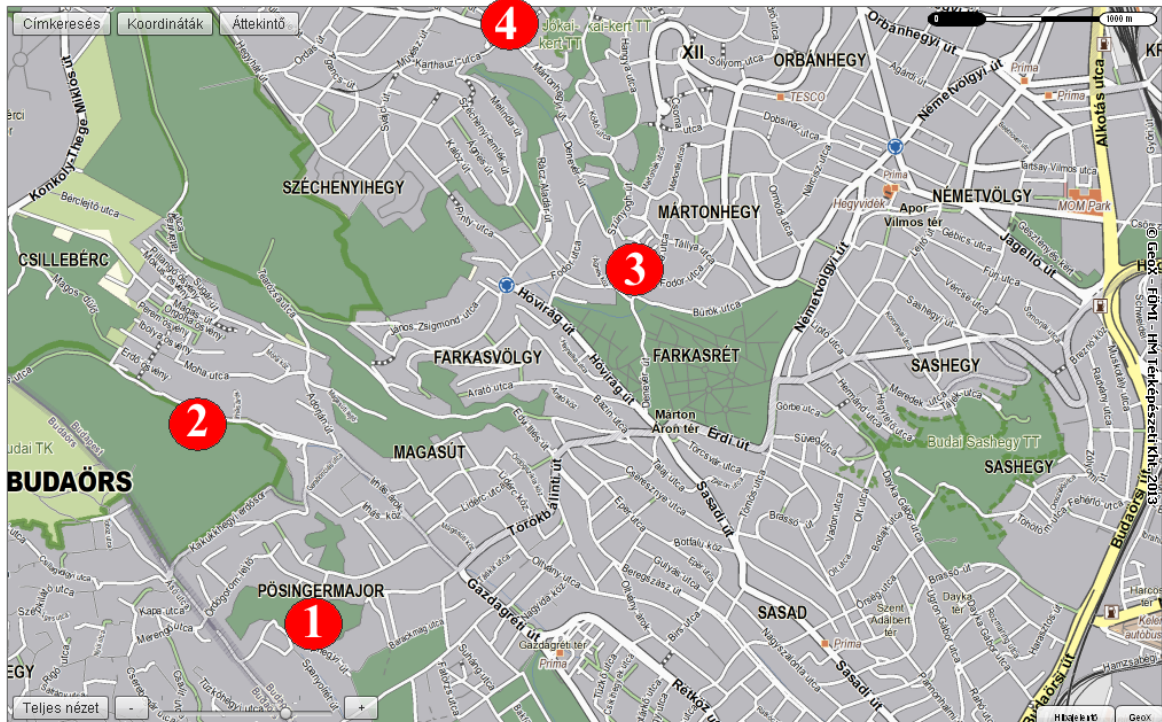
23 November: 2019: Tour 1: Tata and Vértesszőlős (P1)

23 November: 2019: Tour 2: Ipolytarnóc (P2)

Route overview



Tour E1 Buda Mts.- Buda Hornstone, outcrops and prehistoric quarry



1. Rupp-hill (Ördögrom lejtő)
2. Irhás árok
3. Farkasrét, Denevér utca (hornstone quarry)
4. Bajai Halászcserda (Bp. Hollós út 2.) – Conference Dinner

Outcrops of the Buda hornstone

Outcrops of the cherty Upper Triassic pelagic dolomite (Sashegy Dolomite Member of the Mátyáshegy Formation) are known since the end of the 20th century from the northern and southern part of the Buda Hills, Transdanubia, western Hungary.

The first data on the used of the chert (traditionally called as 'horstone' following the German term Hornstein) dates back to the Middle Palaeolithic (Érd, west of Budapest) and it was widely used in the Copper and Bronze Age.

The sources are known both in compact and friable Upper Triassic dolomite, in Upper Eocene breccia / conglomerate beds and finally, in slope deposits. The age of the chert was known for a long time only from petrographic and stratigraphic data, as very few macrofossils were preserved (brachiopods belonging to the *Lingula* genus, a single shell of *Ostrea montiscapralis* and internal casts of bivalves from the dolomite and the chert). The recent investigations of the conodont fossils place the age of the southern range of this formation to the Late Carnian and the Early Norian stage, while in the northern range and on the Gellért hill (lying at the directly at the Danube the Middle and Late Norian fossils were also indicated.

The age of the conglomerate and breccia is documented by bivalve and fish fossils (*Pecten Thorenti*, and *Lamna elegans*, *L. crassidens*, *L. compressa*, *L. longidens*).

The nature conservation area of the Rupp hill is found in the southern range of the pelagic dolomite. On the hilltop large chert nodules are found in the solid dolomite blocks, frequently fragmented by tectonic events. In the NW slope of the hill the layer sequence of non-cherty dolomite with laminated structure, underlying by the clayey dolomite with large chert nodules was earlier observed.

Finally, the Upper Eocene breccia-conglomerate with chert and dolomite pebbles as the result of marine abrasion is found at the eastern foot of the hill as well as in the lower section of the neighbouring valley called 'Irhás árok'. In the Upper part of the same ditch, the southern part of the valley friable, powdered dolomite with large chert nodules are found; in the northern slopes are covered by Pleistocene loess.

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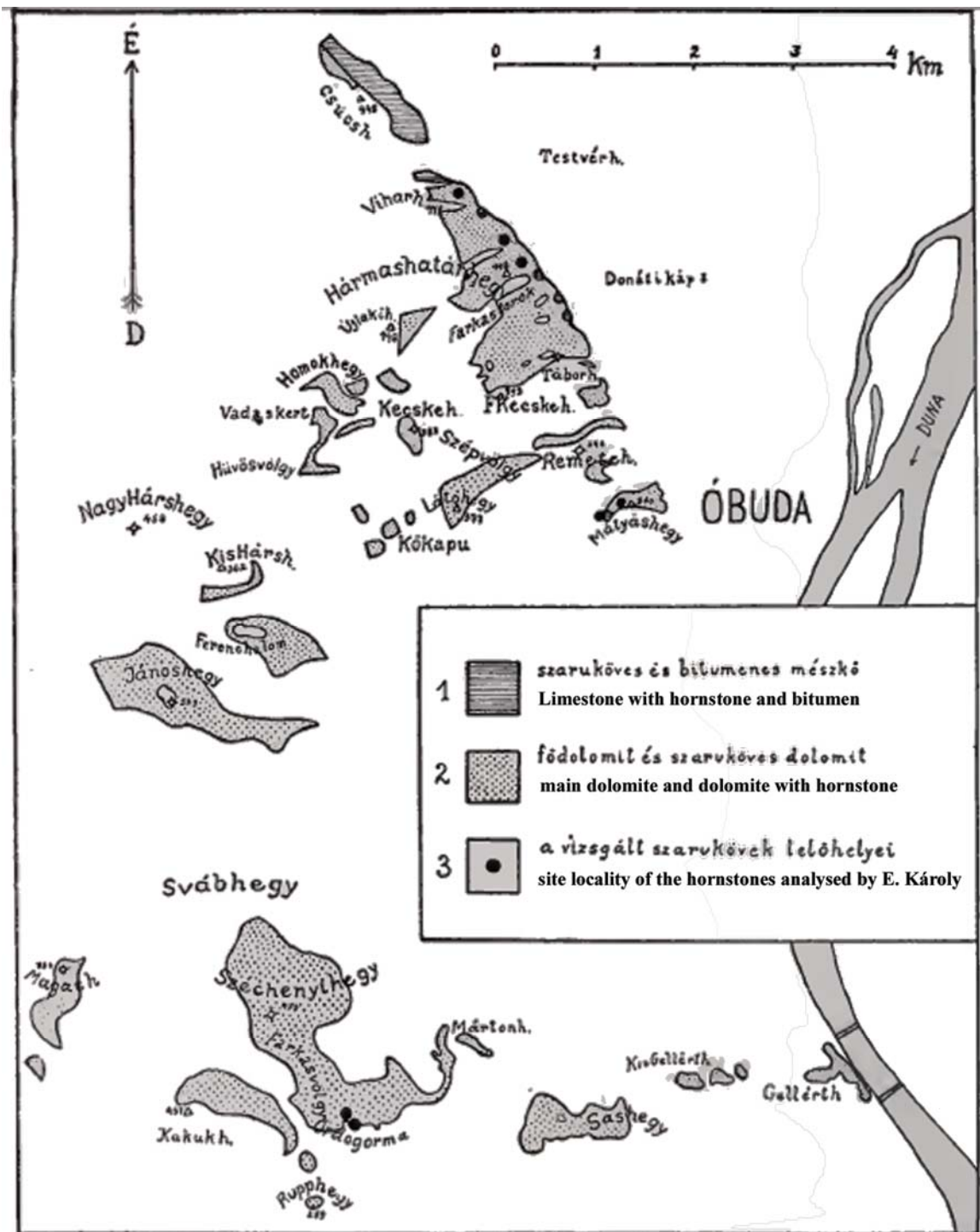


Fig. 1. Map of formations with hornstone in the Buda Mts. (after E. Károly 1936)



Fig. 2. Top of Rupp-hill with hornstone nodule



Fig. 3. Upper Eocene abrasional conglomerate, under Rupp hill



Fig.4. Bottom of the valley Irhás-árok with conglomerate embedding large pieces of hornstone



Fig.5. Crumbling dolomite in the valley Irhás-árok

The flint mine at Budapest-Farkasrét

Although the presence of a specific kind of chert, named Buda hornstone, in the Buda Mountains was already known by geological and petrographical investigations (Károly 1936; Wein 1977), its archaeological perspectives were opened by a fortuitous discovery made at the Denevér street next to the Farkasrét cemetery in the western part of Budapest (Vörös 1998–1999: 69; Biró 2002: 131). A fragment of a mining tool made of antler and a few flint pieces were found and reported to the Hungarian Geological Institute. Since the pieces indicated an archaeological site, V. Gábori-Csánk from the Budapest History Museum started investigations to verify the discovery.

At the location where the antler tool fragment had been found, the Denevér street descends in a valley cut into dolomite (Fig. 1:A). On the upper part of the northeastern slope of the valley, a reddish spot in the white dolomite was found to be an archaeological site (Gábori-Csánk 1988). Prospections by geoelectric method detected low-resistivity zones of possible extraction pits under the surface (Pattantyús-Á. 1986; Pattantyús-Á. and Simon 1986).

The excavations of the Budapest-Farkasrét site were carried out in three campaigns in 1984, 1985 and 1987 with a 7 m large and 3.5 m long trench cut in the slope (Gábori-Csánk 1988, 1989; Gábori-Csánk and Gábori 1995). Based on the morphology of the surface after excavations, the site was interpreted as a small valley which had been open during the Pleistocene but filled in before the Early Holocene. The infilling, composed by eroded slope sediments, chert detritus, pebble levels and soil lenses of torrential origin, had a complicated stratigraphy.

However the archaeological material have been found in three apparently undisturbed horizontal levels: level A in at -240–280 cm, level B at -310–380 cm, and level C at -400–480 cm (Fig. 1:B). Each level yielded mining tools made of antler, knapping waste of chert and hammerstones (Fig. 2:A). At the bottom of the excavated area, two extraction pits were also observed (Gábori-Csánk and Gábori 1995) (Fig. 2:B). Of the 260 mining tools, 250 were made of red deer antler, 10 of roe deer antler (Vörös 1998–1999, 2000). The majority of the red deer antler tools were made from crown tines and brow. For the cutting up of antlers carving and cord-cutting techniques were applied (Vörös 1998–1999) (Fig. 2:C). Concerning the lithic material, besides nine truncated flakes and three retouched flakes, the only other tool was classified as a simple sidescraper (Fig. 1:C). It was considered as to be characteristic for the Mousterian (Gábori Csánk 1989: 19; Gábori-Csánk and Gábori 1995: 31).

The age of the mining activity at Budapest-Farkasrét site is very difficult to determine. V. Gábori-Csánk and M. Gábori (1995: 39–42) argued for a Middle Palaeolithic timeframe for the following reasons: 1) the down cutting of the valley of the Denevér street dates to the Holocene, while the small valley of the site has to date to the Pleistocene; 2) there are no traces of blade production in the lithic material; 3) neither polishing nor shaft holes could be found on the antler tools; 4) not one fragment of pottery but a Mousterian side scraper was found in the lowest level (Fig. 1:C). Two inconsistent radiocarbon dates have been obtained for the mine (Gábori-Csánk and Gábori 1995: 41; Vörös 1998–1999: 96): $40,350 \pm 950$ BP (GrN 15567) from charcoal found in level A and 3470 ± 80 BP (B 4709) from an antler without clear archaeological context. The first one corresponds more or less to the radiometric age of the Middle Palaeolithic Mousterian site of Érd (Gábori-Csánk 1968: 107), while the second one is younger than the dates of the flint mine of Sümeg exploited from the Middle Neolithic to the Middle Copper Age (Bácskay 1995: 392). In the bone material, I. Vörös (1998–1999: 75) identified a fragment of a diaphysis-wall of

the metapodium of a domesticated sheep which was found in the level C according to the excavation notes.

V. Gábori-Csánk and M. Gábori (1995) concentrated on the archaeological problems of the Budapest-Farkasrét flint mine. Despite this, sedimentological analysis of the stratigraphic sequence was not carried out. Concerning the origins of the sediments filling up the small valley, they cited published geological descriptions of the area. Neither the petrography nor the geological context of the extracted raw material was discussed.

At the time of the excavations, the Buda hornstone was not known from archaeological assemblages. Its presence have been recognized first time in the Early Bronze Age Bell-Beaker Culture assemblage of Budapest-Hollandi street site by K. T. Biró (1991). Once this specific raw material had been clearly identified as Buda hornstone, it was reported from a couple of sites (Biró 2002; Horváth 2009; Faragó et al. 2018). Though the overwhelming majority of these sites date to the Early and Middle Bronze Age, some pieces were reported from the Middle Palaeolithic assemblage of Érd too (Mester 2004).

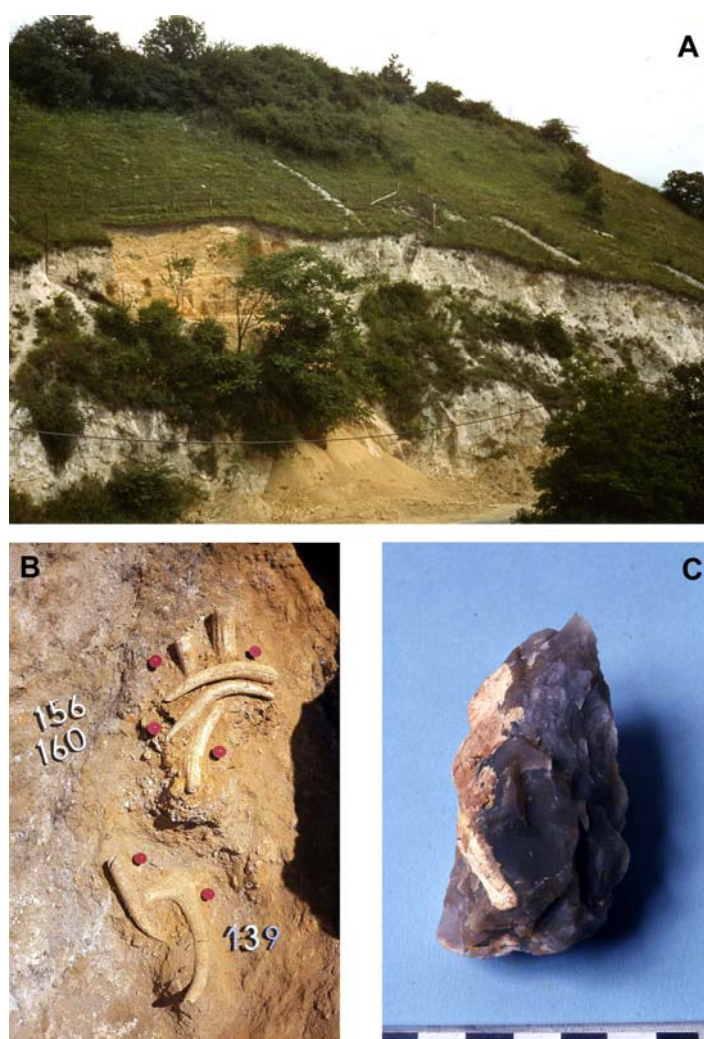


Fig. 1. Budapest-Farkasrét: A – view of the site; B – antler tools concentration in level C; C – Mousterian-like sidescraper. Photos: M. Gábori.

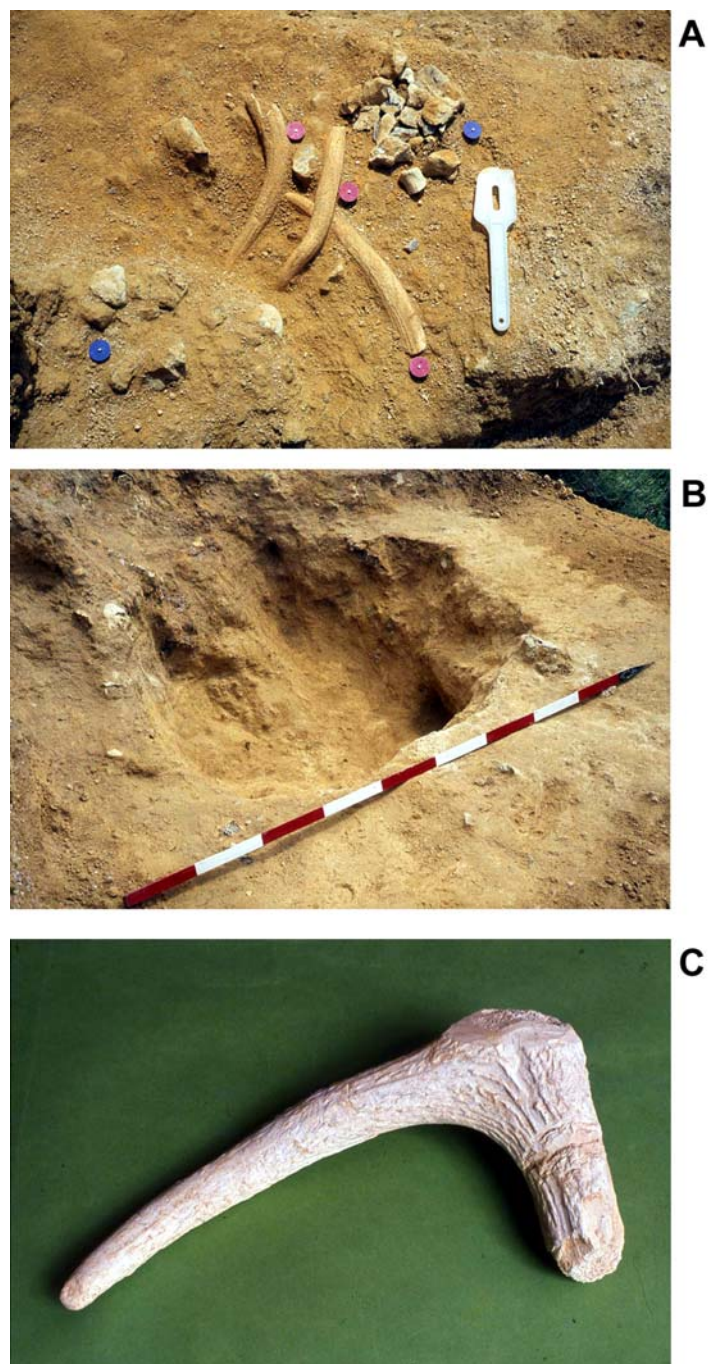


Fig. 2. Budapest-Farkasrét: A – antler tools and chert debris; B – extraction pit; C – antler tool with cutting traces. Photos: M. Gábori.

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Tour P1 Tata-Vértesszőlős



1. Vértesszőlős – Lower Palaeolithic site complex
2. Tata-Porhanyó, Middle Palaeolithic site
3. Tata-Kálváriadomb, Geological Garden and prehistoric flint mine

Vértesszőlős: Lower Palaeolithic site complex

Since the beginning of the Palaeolithic research in Hungary the lack of the Lower Palaeolithic sites had been an important question: the natural conditions with the presence of caves, travertine basins and riverbanks covered by loessic sediments would be ideal for the early occupation of this area. Moreover, the Carpathian Range prevented and prevents the influence of the extreme continental climate in the basin where a variety of high quality lithic raw material, fauna and vegetation is available. However, the conservative attempts of the chronological support of the Lower Palaeolithic occupation were not convincing until 1963, when the geographer M. Pécsi and his students from the Eötvös University, Budapest collected the first knapped lithics dated to the Middle Pleistocene in the travertine quarry near Vértesszőlős.

In the 6 hectare large stone quarry of irregular shape the archaeological artefacts were documented in eight different localities. Of these, the multi-layered sites I and III yielded rich archaeological and palaeontological collections, excavated in a total of 8 months by László Vértes, archaeologist of the Hungarian National Museum. At the same time, an open-air museum was also built for displaying this important period of the human evolution. During the field works roughly 90% of these sites were excavated, only the displayed culture layers in site I and the part sealed by the footprint layer remained unexplored.

Site II, excavated by Dénes Jánossy, palaeontologist of the Hungarian Natural History Museum, yielded the carcasses falling into a natural fissure here, associated with a few lithic artefacts.

The exposed assemblages provided research questions and problems for a number of disciplines. Human remains found at Vértesszőlős are represented by an occipital bone most probably belonging to an adult male, found in 1965 in association with the lowermost layer 1 of site I and a deciduous canine and some fragments of molars, collected from the wet sieved material of the 1964 excavations from the same layer. In the lack of comparative material (at that time the Mauer jaw, found in 1907 was the only known Middle Pleistocene human remain in Europe) the taxonomical classification of the occipital bone was *Homo erectus seu sapiens palaeohungaricus* Thoma. Due to the new finds excavated in the past decades e.g. in Germany (Bilzingsleben) and especially in Spain (Atapuerca, Sima de los Huesos) the present classification of the Vértesszőlős hominids is *Homo heidelbergensis*.

The botanical remains including more than 6600 macrofossil of leaf and seed imprints, collected from various parts of the former quarry documented the climate changes from and early phase of a glaciation (Mindel) to the great, Holsteinian interglacial. The systematic analysis of the imprints led to the description of five new arboreal species.

Concerning the palynological sequence from site III studied in details both the arboreal and non-arboreal pollens proved a moderate warm climatic period with the presence of the hackberry (*Celtis*) and grapevines *Vitis*.

The ostracods, malacological and mammal remains were basically collected from the archaeological site I and III as well as from the palaeontological site II. Among the mammal remains *Macaca sylvana* and the *Machairodus* indet. has a clear chronological importance. Originally, the site was dated to the Tarkó and Vértesszőlős phases of the Biharian stage. Using the modern terminology, the age of the site is placed to the "older Arvicola faunas" (*Mosbachium*) of the Toringian stage, dated to the Middle Pleistocene.

Importantly, there are certain differences between the species excavated in archaeological context and in the palaeontological site II: on the human settlements the herbivore horse and deer species, while in the fissure filling carnivores were dominating.

Finally, layer 3 (surface of the travertine bank) excavated in site III is absolutely unique in the Middle Pleistocene of the Carpathian basin: more than 120 footprints basically belonging to *Bison*, *Ursus*, *Rhinoceros* and *Cervus* species were preserved in a swallow swamp used as an ancient drinking and swallowing place.

From malacological point of view the site yielded the basic fauna of the early Middle Pleistocene and the new species *Helicigona vértesi* Krolopp was also recognised.

The pebble raw material of the archaeological artefacts was collected from the redeposited alluvia of the ancient Tata river (Átalér) or pediment deposits lying at a distance of some hundred meters from the settlements.

The archaeological analysis was based on the typological and stratigraphic evaluation of 8800 typical artefacts collected from sites I and III as well as the scattered lithics. The 5819 tools belong to 50 types, their average length is 26.43 mm. Among the raw material types, quartzite is represented by 51%, the diverse siliceous raw materials by 45% and the 'others' (limestone, etc.) is 4%.

The so-called non-standard tools belong to a discrete category: these pieces (half- and quarter pebbles, slices and segments, etc.) do not fit to the traditional type lists, but they were serially produced using a systematic technology.

Taking into consideration the numeric data and the stratigraphic position of the artefacts two trends are obvious: instead of the quartzite, the siliceous rocks were more frequently used and the length of the tools became larger in the younger layers.

In the lowermost artefacts bearing layers of both archaeological sites, richest in lithic artefacts, several fireplaces composed by radially arranged burned bone fragments were excavated, representing a very early instance of the intentional use of fire. The diameter of these features was 30-45 cm, their thickness was 3-5 cm.

The absolute chronological data are rather variable, depending from the sampling places, the quality and the compactness of the collected limestone, the dating procedures, their interpretation and finally, from the personal confidence of the researchers. The common view is 320-350.000 years.

The monography of the site, written by 22 authors was published in 1990.

Kretzoi, M. & Dobosi, V.T. (eds.): *Vértesszőlős, Man, Site, Culture*. Akadémiai Kiadó, Budapest. pp.1-554.

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Published 'absolute' dates from Vértesszőlős:

$^{230}\text{Th}/^{234}\text{U}$	site II, travertine site I, overlying layer 1 upper part of the quarry	225±35 ka 250-475 ka >370 ka	Cherdintsev – Kazachevski, 1965
$^{230}\text{Th}/^{234}\text{U}$	'upper third of the travertine'	>350 ka, or >270 ka	Pécsi 1973
U series	site I, above layer 4 site I, under layer 1 site I, layer 3 (lime tuff)	202+120/-63 ka 219+40/-30 ka >350 ka	Schwarcz – Latham 1980
$^{230}\text{Th}/^{234}\text{U}$ ESR $^{230}\text{Th}/^{234}\text{U}$ ESR $^{230}\text{Th}/^{234}\text{U}$ ESR $^{230}\text{Th}/^{234}\text{U}$ ESR	overlying the culture layer overlying the culture layer 'below the occipital bone' 'level of the occipital bone'	128+20/-17 ka 127±13 ka 217+40/-28 ka 245±25 ka 325+∞/-60 ka 172±17 ka >350 ka 333±17 ka	Henning et al. 1983



Fig. 1. Vértesszőlős - Travertine limestone with plant fossils



Fig. 2. Vértesszőlős – archive photo on the excavation of the cultural layer

Tata-Porhanyó: Middle Palaeolithic site

The south-north oriented valley of the Átalér streamlet, a right side tributary of the Danube is bordered by, on both sides, relatively undisturbed Pleistocene terraces and calcareous tuff outcrops, dissected by clefts. The Prehistoric utilisation of this rock ('travertine limestone') is well documented, but the first highlights attestable in Roman Pannonia when travertine was regularly used both for sacral (altars, sarcophagi) and secular (milestones, construction of buildings) purposes.

The descriptions as early as the end of the 18th century document that in the calcareous tuff remains of the geological ages were also observed. In his itinerary published in 1797, the English traveller R. Townson reported on remains of fossil 'elephants' in the quarry located on the western margin of the Átalér valley.

Exploitation of the limestone was abandoned in the Porhanyó quarry by the beginning of the 20th century because the mining operations endangered the building of the Tata grammar school, located on top of the Quaternary travertine sequence. However, in the barren debris of the quarry, fossil bones were found. During a survey by the palaeontologist Tivadar Kormos from the Royal Hungarian Geological Institute, evidences for a Palaeolithic habitation site were recognised and partly excavated in 1909-1910.

In spite of the scarcity of evidence known at that time, Kormos classified the finds correctly to the Middle Palaeolithic period. Moreover, his reconstruction of the physical environment of the settlement is generally accepted till our days: when the lukewarm springs depositing the calcareous tuff run dry, prehistoric humans settled into the small basins surrounded by 80-100 cm high limestone walls. After they left the scene, a loose loessy sediment covered the basins, hiding the traces of Prehistoric habitation. The re-starting spring activity covered the cultural layers by further calcareous tuff layer of several meters thickness.

The next excavations were initiated and performed by László Vértes, archaeologist of the Hungarian National Museum in 1958-59, finally, the last campaign was performed here by Julianna Cseh (Tata Museum) and Viola Dobosi (HNM) between 1995-2001. The third monographic evaluation of this important site is under preparation.

The results can be summarized as follows:

The locality is lying 120-140 m a.s.l., on the terrace classified to the IIb level by M. Pécsi and terrace 2c by G. Csillag and his colleagues

The age of the settlement is placed to the climatic zone 5 (MIS 5), i.e. to the last interglacial sensu lato (R/W period). The acceptable mean value of absolute chronological (ESR and U series) measurements is 100.000 BC.

From the three excavation campaigns and surface collections, altogether more than 25,000 artefacts got into the collection of the Hungarian National Museum. Most of them are flakes and production debris. The typological distribution of the tools is dominated by various side scrapers of Middle Palaeolithic character (68% of the formal tools). 3% of them belong to the chopper-chopping tool group of Lower Palaeolithic character, 18% of the tools have an Upper Palaeolithic character. Importantly, 11% of the typical tools were bifacially knapped.

A specific group of tools is comprised by the geometrical forms: pebble derivatives split in similar ways, forming series of halved, quartered and further split pebbles.

Among the raw materials, pebbles of siliceous rocks (69% of the typical tools) and quartzite (29%) dominate. In the case of the geometrical pebble fragments, the ratio is just the opposite: 35% of them was made of silex, while 62% is of quartzite.

The archaeological classification of the find assemblage is problematic, as no immediate antecedents or follow-up industries are known for the time being. L. Vértes outlined an epi-chopper-'circle' as a successor of the Lower Palaeolithic pebble tool industries. For the cultural classification of the finds we can support the general classification of Marie-Hélène Moncel: **Microlithic Middle Palaeolithic industry**.

$^{230}\text{Th}/^{234}\text{U}$	travertine	cca. 30 ka	J. K. Osmond
$^{230}\text{Th}/^{234}\text{U}$	bottom of the cultural layer, middle section of the travertine	70±20 ka	Pécsi 1973
$^{230}\text{Th}/^{234}\text{U}$	'Würm I, borehole 22'	95±10 ka	V. Cherdintsev – I. V. Kazachevski, 1965
U series	culture bearing layer	99,4±0,1 ka	Schwarz-Skoflek 1982
$^{230}\text{Th}/^{234}\text{U}$ ESR	overlying the culture bearing layer	101±10 ka 127±6 ka	Hennig <i>et al.</i> 1983
$^{230}\text{Th}/^{234}\text{U}$ ESR	underlying the culture bearing layer	98±8 ka 81±16 ka	

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Fig. 1. Location of the Tata-Porhanyó site under the Tata secondary school



Fig. 2. Symbol of the 12th ISKM Conference: side-scraper on split pebble from Tata-Porhanyó

Tata - Kálvária Hill

Introduction

The Tata-Kálváriadomb (Kálvária Hill, Tata) archeological site is one of the first flint mines known from Hungary. It is part of a larger complex, operating today as the ‘Tata Geological Garden’ within the limits of a former limestone quarry of outstanding geological importance.

It had been noted by the itinerant geologists of the XVIIIth century and was intensively investigated by geologists ever since (Fülöp 1975). In course of the geological sectioning, the prehistoric mining pits exploiting Jurassic radiolarite came to light (Fülöp 1973). József Fülöp also gave a detailed account on the mining features for the first survey of Hungarian flint mines (Fülöp 1980; recently summarised by Biró 2012). In the famous catalogue (Weisgerber et al. 1980), Tata was given Nr. 3 among Hungarian flint mines, amended in the 33rd volume of *Archaeologia Polona* (Lech 1995).

Research history of the Tata-Kálváriadomb prehistoric mine

The prehistoric mining features of Tata-Kálváriadomb are known since 1967. The excavations were conducted under the direction of the geologist József Fülöp by and the archaeologist Erzsébet Bácskay (Fülöp 1973, 1980; Bácskay 1980, 1984, 1986; Bácskay and Biró 2003). Altogether 3 mining pits were found that could be dated on the basis of pottery fragments of the Late Copper Age Baden Culture and an early radiometric dating (C–14 date: 3810+65 BP, Hv 1770; Fülöp 1980: 551; Fig. 1).

The locality became famous, primarily, on the strength of its exceptional geological endowments (Haas and Hámor 2001; Tóth 2008; Haas 2010). The sequence of its geological layers embrace essential periods of the Mesozoic age, starting from the Late Triassic and almost continuously covering the Tethyan sequence till the Early Cretaceous period (Fülöp 1973, 1975; Figs. 1-2). An open-air presentation site was established here in 1976, mainly to show the geological attractions. As the layer sequence comprises the prehistoric mining features, they were also presented to the public, supplied with protecting wall and roof and a modest exhibition to show the essentials on prehistoric mining (Figs. 3-4). This way Tata is among the very few visitable prehistoric open-air sites in Hungary, one of the two prehistoric quarries open to public.

New mining features at Tata-Kálváriadomb

Recent maintenance work on the site allowed the discovery of new mining features yielding fresh osseous material suitable for C–14 dating (Figs. 5-6). The new dates extended the known period of utilisation of the flint mine, formerly dated on the strength of pottery shards to the Late Copper Age Baden Culture, to the Late Neolithic/Early Copper Age Lengyel Culture (by M. Molnár and colleagues, Biró et al. 2018)

AMS 14-C measurement code	Sample name / Code	Conventional 14C age (year BP) + 1σ	Calibrated calendar age (cal BC) (1σ)
DeA-7310	Antler tool	5797 + 31	4710–4610

The archaeological finds of the site comprise the mining features (pits), traces of fire, a large number of radiolarite blocks and flakes, hammerstones and antler mining tools.

The distribution of the raw material is inadequately known. Tata type radiolarites (liver-coloured dark red and grey (Fig. 7)) are rather common and not distinctive enough for

unambiguous attribution to the source. Recently, geochemical studies on radiolarites have proved certain distinctive features for the Gerecse radiolarite sources (Biró et al. 2002, 2009), but more on the level of mountain units than on the level of individual quarries or outcrops. The proper identification of radiolarite provenance is still a long way ahead of us, if it can be accomplished at all.

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Hungarian National Museum, Budapest
Harman-Tóth, Erzsébet
Tata Geological Garden / Eötvös Loránd University, Tata / Budapest Hungary

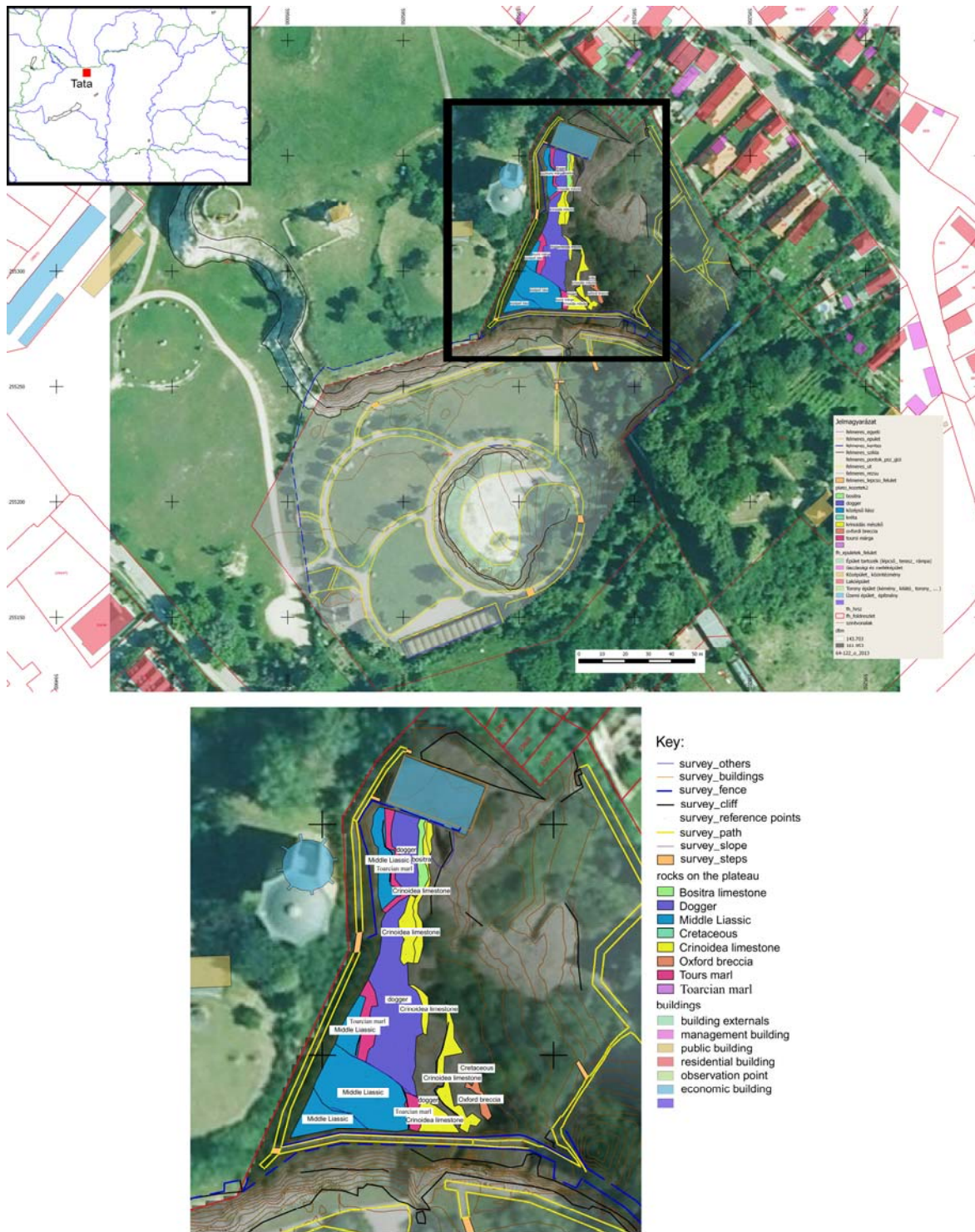


Fig. 1. Location of the Tata Geological Garden of the Eötvös Loránd University.

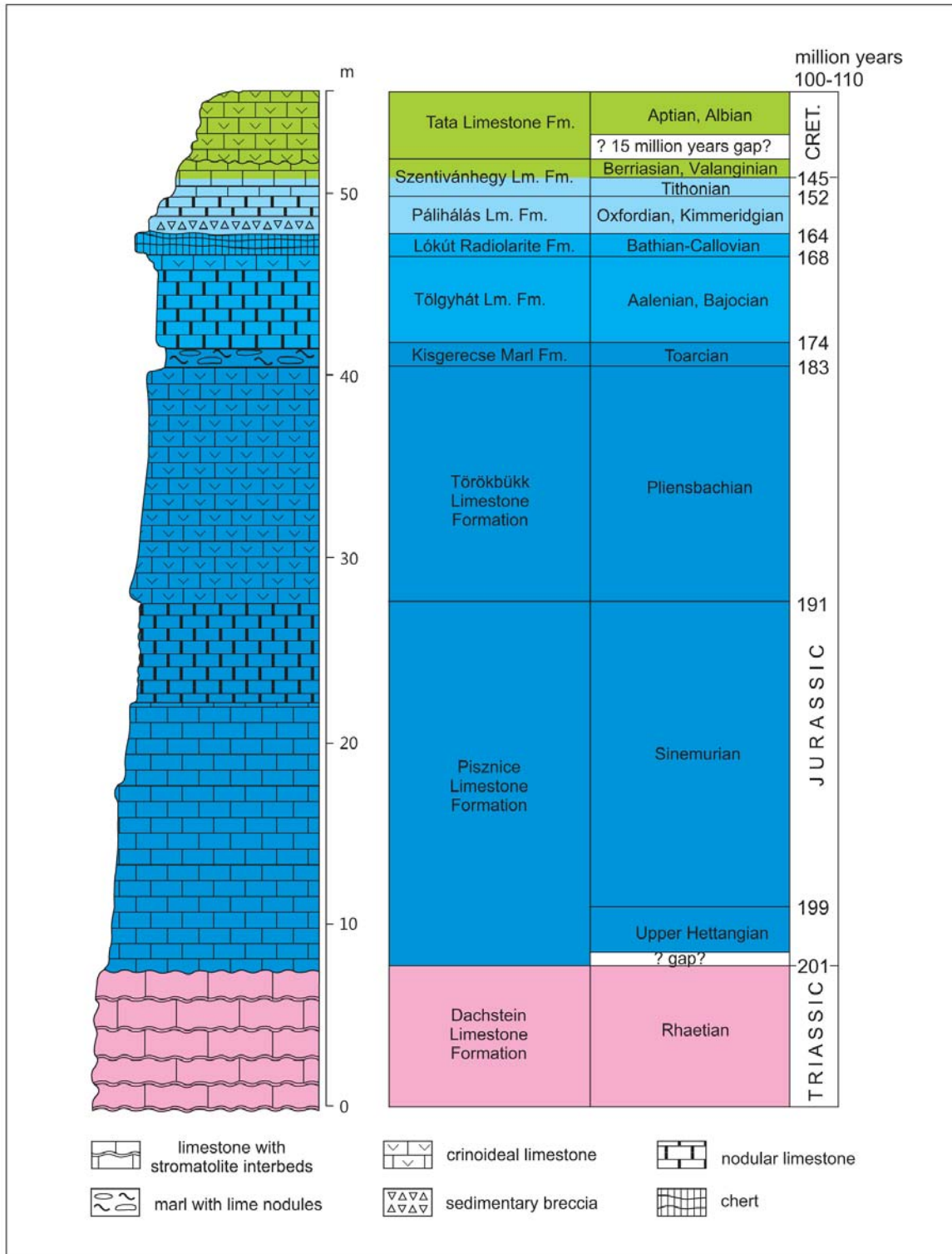


Fig. 2. Geological section of the Tata-Kálváriadomb main layers. Slightly modified after Haas 2010.



Fig. 3.
Jurassic bedrock surface in
the Tata Geological Garden
(Photo: A. Markó)



Fig. 4.
Protective building over
the remains of the
prehistoric flint mine
(Photo: A. Markó)



Fig. 5.
Antler tools in the
exploring trench of 2015
(Photo: Z. Varga)

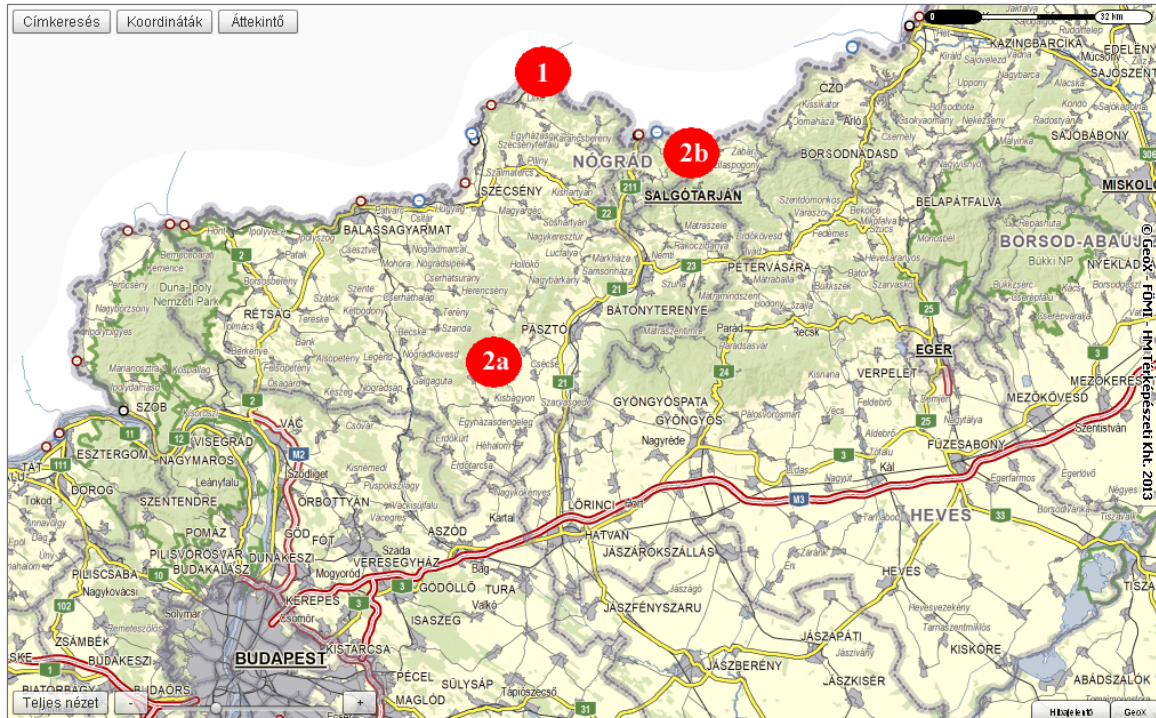


Fig. 6.
Antler tool in the process
of conservation (Photo:
K. Dúzs)



Fig. 7.
Radiolarite blocks from
the territory of the flint
mine (Photo and array: I.
Gatter)

Tour P2 Ipolytarnóc-Bér (Somoskőújfalu)



1. Ipolytarnóc – Miocene palaeontological site complex

2a Bér, andesite formations

2b Somoskőújfalu, basalt formations

Ipolytarnóc – Miocene palaeontological site complex

Ipolytarnóc is one of the most outstanding target for Hungarian geotourism. Miocene volcanic activity, notably a rhyolitic explosion producing rhyolite tuff, saturated with siliceous solutions preserved here 17 million year old plant and animal fossils, footprints (Fig. 1.) and tree trunks (Fig. 2.). The site is shortlisted for UNESCO geoscience heritage sites. Several thematical study trails unfold the wealth of information at the Ipolytarnóc Geopark (Fig.3).

More information on the website of the locality, <https://www.osmaradvanyok.hu/en/index>

References

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[Európa Diploma az Ipolytarnóci Ősmaradványoknak Archived](#) 2011. May 16 in [Wayback Machine](#) [PDF](#) (Last accessed: 2011. May 29)



Fig. 1. Ipolytarnóc Geopark



Fig. 2. Giant silicified tree trunk from Ipolytarnóc



Fig. 3. Animal footprint from Ipolytarnóc

Bér andesite columns

The andesite columns near Bér belong to the Novohrad-Nógrád Geopark. The spectacular andesite columns were formed here 18-19 million years ago in the course of the Miocene volcanic activity also responsible for the Ipolytarnóc palaeontological site. The andesitic lava rock was formed by columnar jointing. This formation is typical for basalt but rare in andesites. The columns are typically pentagonal or hexagonal and they are 8-10 meter long. The site was an active quarry till the 1980-ies. Today it is a geological presentation site with study trail.

Near the columns a so-called „kőtenger” (stone sea) can be visited from the natural fragmentation of the rock.

Visiting the site will depend on time, weather and road conditions.

Reference

Hetényi, Gy. et al., Scales of columnar jointing in igneous rocks: field measurements and controlling factors Bull Volcanol (2012) 74:457–482. DOI 10.1007/s00445-011-0534-4

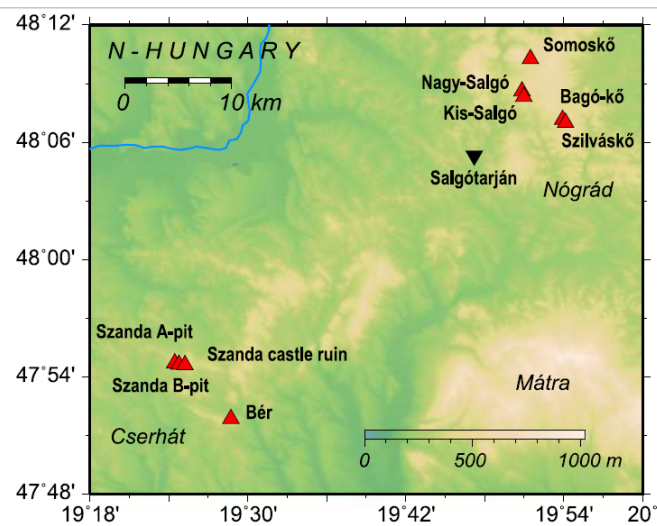


Fig.1.
Occurrence of columnar volcanic outcrops in Nógrád county. After Hetényi et al. 2012 Fig. 3.



Fig.2.
Columnar andesite outcrop at Bér

Somoskőújfalu – Fortress and Basalt Cascades

Depending on time, weather and road conditions, P2 may get to Somoskő Fortress (Fig. 1.) and the picturesque Basalt Cascades (Fig. 2.) nearby. The fortress is located on the Hungarian-Slovak border, one of the most picturesque fortifications in the Carpathian Basin. Though it is both on Slovakian territory already, the fortress and the basalt 'organs' can be visited from the Hungarian side without restrictions.

The fortress was established in the 13th century by the local clan Kacsics. It had prominent role during the Anjou period and was in use till the late 17th century. Conservation of the ruins took place in the 1970-ies.

The fortress was built from hexagonal –octagonal basalt columns of the nearby basalt lava rock (Fig.3.)

Information: https://hu.wikipedia.org/wiki/Somosk%C5%91j_u%C3%A1r (visited 10 November 2019)



Fig.1.
Somoskő
Fortress



Fig. 2.
Columnar basalt
formations at
Somoskőújfalú
(Basalt Cascade)



Fig. 3.
Basalt columns in
the wall of
Somoskő Fortress



Notes



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