

New research at Tata-Kálváriadomb, Hungary

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Abstract: Tata-Kálváriadomb is one of the first flint mines known from Hungary. It was excavated in the 1960-ies and 1970-ies. The quarry is situated in the Jurassic layers of unique geological settings turned into a geological park. Recent maintenance work on the site allowed the discovery of new mining features yielding fresh osseous material suitable for C-14 dating. 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.

Keywords: flint mine, Tata, Hungary, Baden Culture, Lengyel Culture

Introduction

Tata and its environs is a classical locality for Hungarian lithic research. The valley of the stream Átal-ér has been a home and also raw material source for the prehistoric communities since the Lower Palaeolithic (Dobosi 1999). In the city of Tata itself we can find one of the oldest Palaeolithic sites known as a Pleistocene find-spot since the XVIIIth century (Cseh 2004). The excavation of the site proper, Tata-Porhanyó was again one of the first Palaeolithic excavations (Kormos 1912), very advanced even to current standards, and there has been a continuum of research till our days (Vértes 1964, Dobosi 2004 and in progress).

Equally famous is the geological section of Tata-Kálváriadomb, also within city limits. 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 József Fülöp, geologist and

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; Fig. 2). An open-air presentation site was established here, mainly to show the geological attractions. As the layer sequence comprises the prehistoric mining features, they were also presented to the general public, supplied with protecting wall and roof and a modest exhibition to show the essentials on prehistoric mining. This way Tata is among the very few visitable prehistoric open-air sites, one of the two prehistoric quarries open to public in Hungary.

Recent maintenance works in the quarry

The maintenance of the geological park means a heavy duty. As a small part of it, in 2011 we undertook the cleaning of the prehistoric site with a group of volunteers working one week on the quarry site. The revitalisation of the whole park has formed the subject of a major project entitled 'Reconstruction of geological key sections on the territory of the Tata Nature Reserve area' ('Földtani alapszelvények rekonstrukciója a Tatai Természetvédelmi Területen',

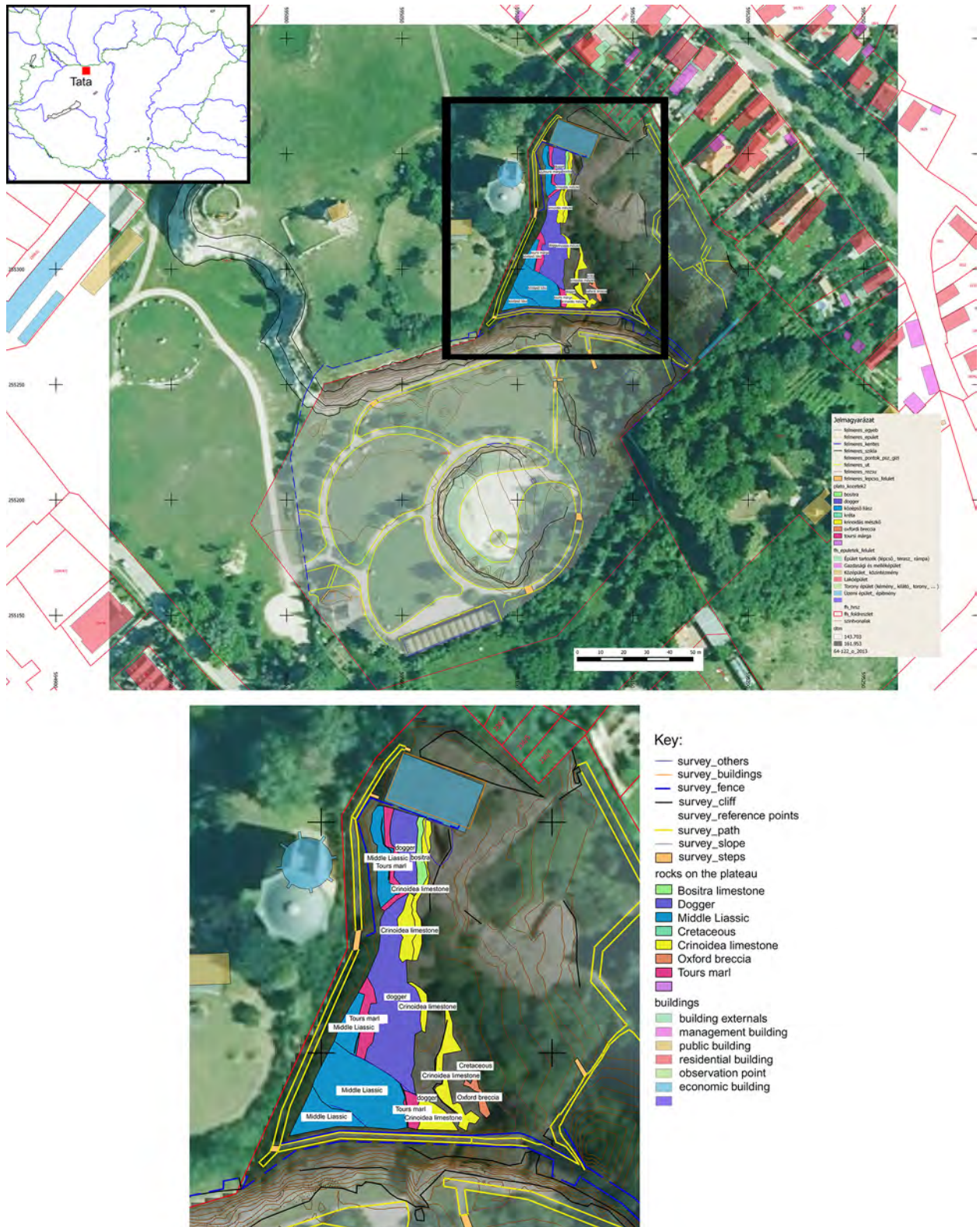


Fig. 1. Location of the Tata Geological Garden of the Eötvös Loránd University. 2015 detailed surveying of the area and projection to aerial photograph by Bence Takács (Budapest University of Technology and Economics).

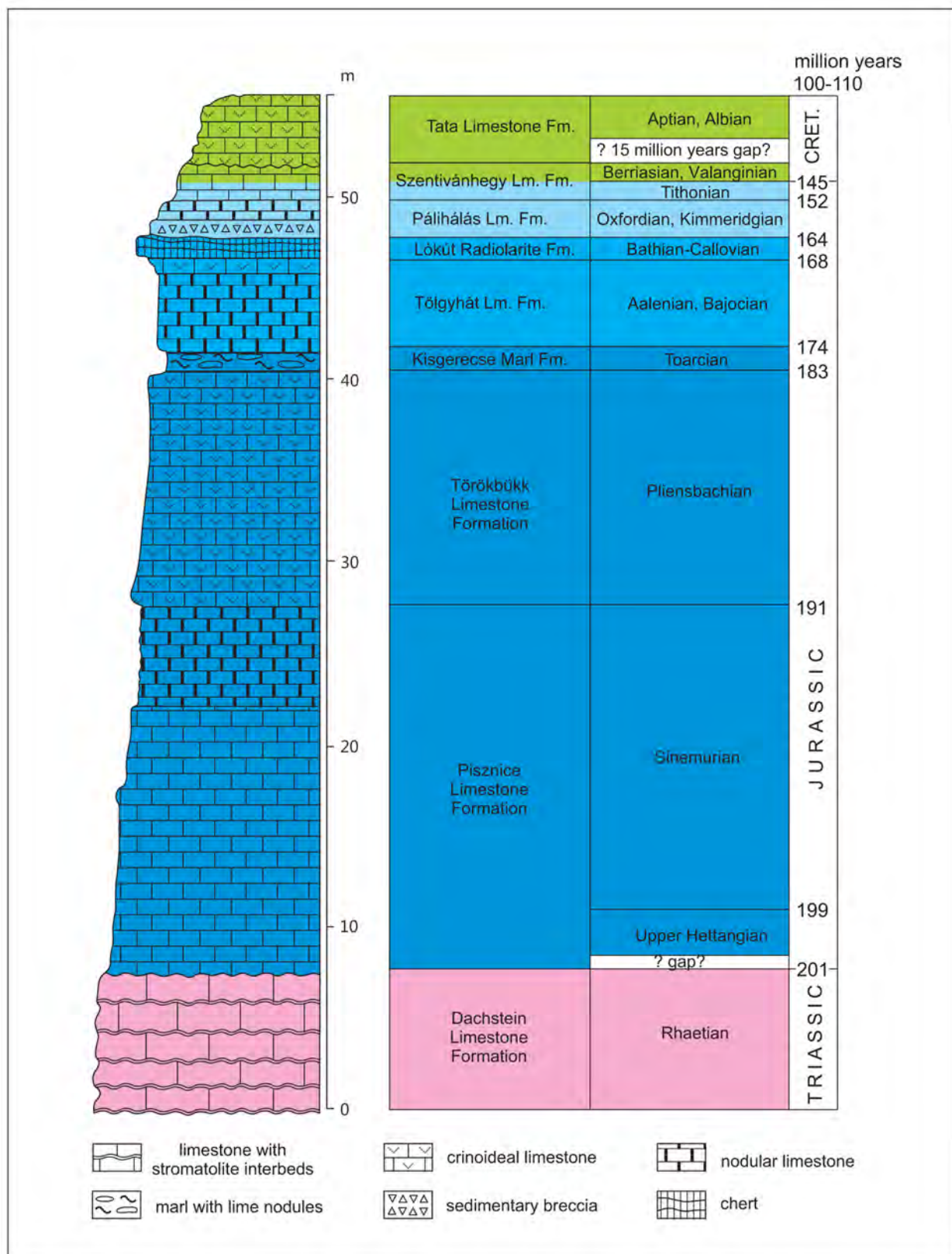


Fig. 2. Geological section of the Tata-Kálváriadomb main layers. Slightly modified after Haas 2010. Geological ages taken from Cohen *et al.* 2013.

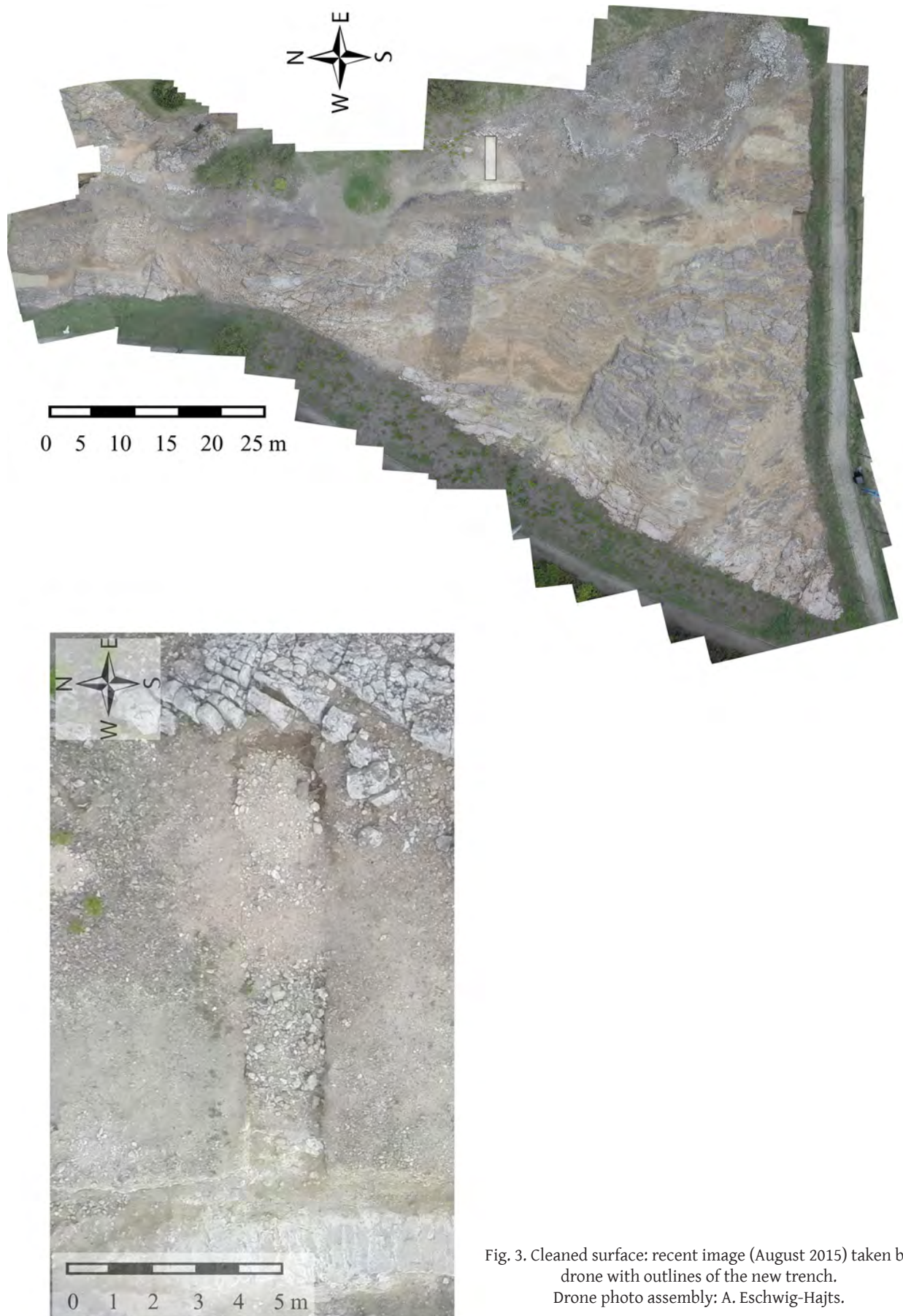


Fig. 3. Cleaned surface: recent image (August 2015) taken by drone with outlines of the new trench.
Drone photo assembly: A. Eschwig-Hajts.

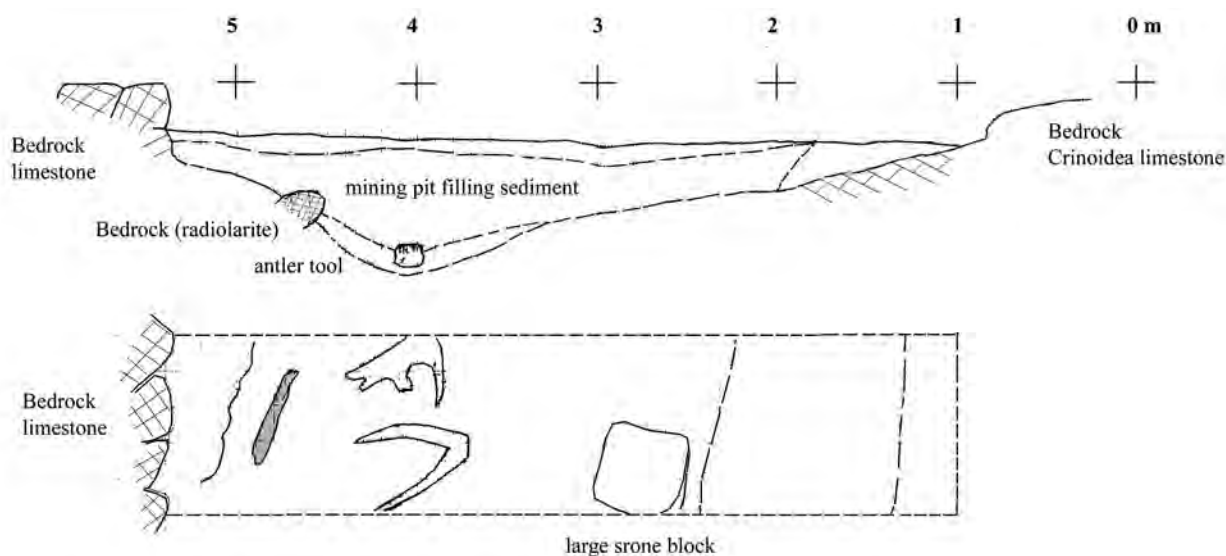


Fig. 4. Exploring trench (section and ground plan) 2015. Drawn: K. T. Biró.

KEOP-3.1.2/2F/09-11-2013-0053). The complete surface of the exposed geological section was cleaned and rejuvenated (Fig. 3).

New mining features at Tata-Kálváriadomb

In course of this work, while cleaning the Jurassic surface, details of a new mining pit were found (Fig. 4). The rock surface was transected by a sondage of 5 x 1 meter deepened into loose sediment of chert (radiolarite) flake debris. The trench opened a shallow exploitation pit with traces of an antler tool. At this point, Katalin. T. Biró from the Hungarian National Museum was informed (Fig. 5). Together with the team of the Tata Geological Garden (Erzsébet Harman-Tóth, Tibor Steiner, Zoltán Varga), we opened the trench till the bedrock surface, documented the features and have found altogether three antler tools and many radiolarite flakes.

Antler tools in the mining pits can be considered as the most prominent proofs of mining activity, offering at the same time a possibility for radiocarbon dating on fresh and authentic evidence. The antler tools were carefully removed and transported to the Hungarian National Museum for conservation. Unfortunately, the pieces of the antler tools were in very fragmented state because the shallow pit was exposed to surface climatic conditions for a long time. We tried to lift the tools separately. The cleaning and refitting of the antler fragments was performed by Krisztina Dúzs, conservator of the Hungarian National Museum.

Prior to the conservation, a suitable piece of antler was separated for C-14 dating, untreated by chemicals. The conservation procedure was presented on the 40th

International Conservator Seminar by Krisztina Dúzs (Dúzs *et al.* 2015; Fig. 6).

The antler tools were cleaned, refitted and conserved. During the cleaning process, chert (radiolarite) splinters were observed stuck into the osseous matter; also, traces of utilisation could be observed on the antler tools (Fig. 7). The tools received individual container boxes and have been recently inventorised in the Hungarian National Museum.

The detailed archaeozoological analysis of the antler tools has not been accomplished as yet; the forms, however, fit well into the categories known for prehistoric antler tools presented by István Vörös for the Sümege-Mogyorósdomb flint mine (Vörös 2007: Fig. 2.).

New dates for Tata-Kálváriadomb

The most important new result of the current work, apart from extending the known quarry area of the Tata-Kálváriadomb site, however, is the extension of the temporal dimensions of flint mining here. The antler piece separated from the new finds was transported to the Hertelendi Laboratory of Environmental Studies, Debrecen, where they made a new AMS C-14 dating on the tools proper. The new development of the laboratory, making possible more exact dates from a smaller amount of samples is the development of the last few years (Molnár *et al.* 2013a, 2013b).

The new dates are presented in Table 1:

This date is essentially older than the formerly known Late Copper Age one. By regional chronology, this is



Fig. 5. Antler tools in the exploring trench.
Photo: Z. Varga.



a.



c.



b.



d.

Fig. 6. Conservation of the antler tools: antler tool nr 3; a-as received from field; b-cleaned, sorted; c-refitting in progress; d-completed and in its own storage box. Photo: K. Dúzs



Fig. 7. Cutmarks on the antler tool Nr. 1. Photo: K. Dúzs.

Table 1. 14-C date for the new trench obtained from one of the antler tools (M. Molnár and colleagues)

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

extending the age of the mining activity to the Late Neolithic, culturally, to the Lengyel culture. This is not surprising, however, as the Lengyel culture is known for its intensive artisan activity. The main period of the Szentgál radiolarite exploitation can be associated with this culture and period (Biró and Regenye 1991) on the basis of indirect evidence (activity of workshop sites) and most probably, the Mecsek radiolarite exploitation had its acme also during the existence of Lengyel culture (Bácskay and Biró 1984; Biró 1989, 1990). The most intensive exploitation of the only Hungarian flint (s.s.) source, Nagytevel can be also dated, on the basis of indirect evidence (distribution data) to this period (Biró 2003, Biró *et al.* 2010). Production of polished stone tools is documented for Lengyel Culture settlements and workshops at Aszód (Biró 1992), Sé (Harcos 1997), Zengővárkony (Biró *et al.* 2003) and most recently, in the internal basins of the Bakony Mountains (Biró *et al.* 2014). We also suspect that Lengyel Culture had an intensive drive to collect and trade exotic raw materials like obsidian and greenstone. Nevertheless, none of the known Hungarian flint mines were dated, by direct evidence, to the Lengyel Culture as yet.

The distribution of the raw material is, unfortunately, no clue. Tata type radiolarites (liver-coloured dark red and grey) 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.

Further plans

The obvious next step is further excavations on the site. We hope to realise it in the near future. When excavating Tata, however, we have to plan also maintenance and presentation as we are in the middle of the practically only functioning open-air prehistoric quarry site within Hungary.

References

- Bácskay, E. 1980. Zum Stand der Erforschung prähistorischer Feuersteinbergbau. In G. Weisgerber, R. Slotta and J. Weiner (eds), *5000 Jahre Feuersteinbergbau: die Suche nach dem Stahl der Steinzeit*: 179–182. Bochum, Deutsches Bergbaumuseum. Veröffentlichungen aus dem Deutschen Bergbaumuseum 77.

- Bácskay, E. 1984. Prehistoric flint mines (exploitation sites) in Hungary and their role in the raw material supply. In K. Kanchev (ed.), *Proceedings of the 3rd International Seminar in Petroarchaeology*: 127–14. Plovdiv.
- Bácskay, E. 1986. La minería prehistórica en Hungría. *Cuadernos de Prehistoria de la Universidad de Granada*: 273–325. Granada 11.
- Bácskay, E. and Biró, K. 1984. A lengyeli lelőhely pattintott kőeszközzeiről. *Szekszárd* 12: 43–67.
- Bácskay, E. and T. Biró, K. 2003. Raw materials, mining and trade. In Zs. Visy (ed.), *Hungarian Archaeology at the turn of the Millennium*: 117–123. Budapest.
- Biró, T., K. 1989. A lengyeli kultúra dél-dunántúli pattintott kőeszköz-leletanyagainak nyersanyagáról I. *Communicationes Archaeologicae Hungariae*: 22–31. Budapest.
- Biró, T., K. 1990. A lengyeli kultúra dél-dunántúli pattintott kőeszközök nyersanyagáról 2: 66–76. Budapest, *Communicationes Archaeologicae Hungariae*.
- Biró, T., K. 1992. Adatok a korai baltakészítés technológiájához. *Acta Musei Papensis (Pápai Múzeumi Értesítő Pápa)* 3–4: 33–79.
- Biró, T., K. 2003. Tevel flint: a special constituent of the Central European LBC lithic inventories. In L. Burnez-Lanotte (ed.), *Production and Management of Lithic Materials in the European Linearbandkeramik*. Acts of the XIVth UISPP Congress, University of Liège, Belgium, 2–8 September 2001:11–17. Oxford, Archaeopress. British Archaeological Reports International Series 1200.
- Biró, T. K. 2012. Prehistoric mining in Hungary. *A Magyar Állami Földtani Intézet Évi Jelentése 2010-ről*, 149–154.
- Biró, K. and Regénye, J. 1991. Prehistoric workshop and exploitation site at Szentgál-Tűzköveshegy. *Acta Archaeologica Academiae Scientiarum Hungaricae* 43: 337–375.
- Biró, T., K., Elekes, Z., Uzonyi, I. and Kiss, Á. 2002. Radiolarit minták vizsgálata ionnyaláb analitikai módszerekkel / Investigation of Radiolarite Samples by Ion-Beam Analytical Methods. *Archaeológiai Értesítő* 127: 103–134.
- Biró, T., K., Schléder, Zs., Antoni, J. and Szakmány, Gy. 2003. Petroarchaeological studies on polished stone artifacts from Baranya county, Hungary II. Zengővárkony: notes on the production, use and circulation of polished stone tools. *A Janus Pannonius Múzeum Évkönyve*, Pécs 46–47: 37–76.
- Biró, T., K., Szilágyi, V. and Kasztovszky, Zs. 2009. Új adatok a Kárpát-medence régészeti radiolarit forrásainak ismeretéhez (New data on the characterisation of radiolarite sources of the Carpathian Basin). *Archeometriai Műhely (Archaeometry Workshop)* 6(3): 25–44.
- Biró, T., K., Regénye, J., Pusztai, S. and Thamóné, B. (eds) 2010. Előzetes jelentés a Nagytevel-Tevel-hegyi kovabánya ásatásának eredményeiről. *Archaeológiai Értesítő* 135: 5–25.
- Biró, T., K., Antoni, J. and Wolf, E. 2014. Basalt axe production sites in the Bakony Mountains. In *UISPP Congress Burgos, Abstract Volume*: 11–12. Burgos.
- Cohen, K.M., Finney, S.C., Gibbard, P.L. and Fan, J.-X. 2013 (updated). The ICS International Chronostratigraphic Chart. *Episodes* 36: 199–204. URL: <http://www.stratigraphy.org/ICSchart/ChronostratChart2015-01.pdf>
- Cseh, J. 2004. Die Forschungsgeschichte von Tata-Porhanyóbánya. In: E. Fülöp and J. Cseh (eds), *Die aktuellen Fragen des Mittelpaläolithikums in Mitteleuropa (Topical issues of the Research of Middle Palaeolithic Period in Central Europe)*: 7–32. Tata.
- Dobosi, T., V. 1999. *Ősemberek az Által-ér völgyében (Prehistoric man in the Által-ér valley)*. Tata.
- Dobosi, V. 2004. Pebble tools from Tata-Porhanyó. In E. Fülöp and J. Cseh (eds), *Die aktuellen Fragen des Mittelpaläolithikums in Mitteleuropa (Topical issues of the Research of Middle Palaeolithic Period in Central Europe)*: 65–75. Tata.
- Dúzs, K., T. Biró, K. and Tóth, E. 2015. Agancsbányászóeszközök restaurálása (Conservation of antler mining tools). In *40. International Conservator Seminar, 11-13 November 2015 (Poster)*. Budapest, Hungarian National Museum.
- Fülöp, J. 1973. Funde des prähistorischen Silexgrubenbaues am Kálvária-Hügel von Tata. *Acta Archaeologica Academiae Scientiarum Hungaricae* 25: 3–25.
- Fülöp, J. 1975. Tatai mezozoós alaphegységrogók (The Tata Mesozoic block mountains). *Geologia Hungarica Series Geologica* 16: 1–222.
- Fülöp, J. 1980. Flint mines in Hungary. In G. Weisgerber, R. Slotta and J. Weiner (eds), *5000 Jahre Feuersteinbergbau: die Suche nach dem Stahl der Steinzeit*: 544–553. Bochum, Deutsches Bergbau-Museum. Veröffentlichungen aus dem Deutschen Bergbau-Museum 77.
- Haas, J. and Hámor, G. 2001. Geological Garden in the neighbourhood of Budapest, Hungary. *Episodes* 24(4): 257–261.
- Haas, J. 2010. Kálvária-dombi Természetvédelmi Terület, Tata – egy valódi jura park ösvényein. In J. Haas (ed.), *A múlt ösvényein, Fejezetek Magyarország földjének történetéből*: 61–66. Budapest.
- Harcos, T. 1997. Kőszerszámkészítés a neolitikumban és a Savaria Múzeum Velem-Szent Vid-i kőeszközanyaga. *Panniculus* 6: 9–41.
- Kormos, T. 1912. A tatai őskőkori telep. *Magyar Állami Földtani Intézet Évkönyve* 20: 1–60.
- Lech, J. (ed.). 1995. Special theme: Flint mining. Warszawa. *Archaeologia Polona* 33.
- Molnár, M., Rinyu, L., Veres, M., Seiler, M., Wacker, L. and Synal, H.-A. 2013a. ENVIRONMICADAS: a mini 14C AMS with enhanced gas ion source interface in the Hertelendi Laboratory of Environmental Studies (HEKAL), Hungary. *Radiocarbon* 55(2–3): 338–344.

- Molnár, M., Janovics, R., Major, I., Orsovski, J., Göncki, R., Veres, M., Leonard, A.G., Castle, S. M., Lange, T.E., Wacker, L., Hajdas, I. and Jull, A.J.T. 2013b. Status report of the new AMS 14C sample preparation lab of the Hertelendi Laboratory of environmental studies (Debrecen, Hungary). *Radiocarbon* 55(2–3): 665–676.
- Tóth, E. 2008. Tájsebből emlékmű (From landscape scar to monument). *Élet és Tudomány* 2008(27): 848–850.
- Vértes, L. (ed.). 1964. *Tata, eine Mittelpalaeolithische Travertin-Siedlung in Ungarn*. Budapest. *Archaeologia Hungarica* 43.
- Vörös, I. 2007. Sümeg-Mogyorós dombi őskori kovabánya agancsleletei / Antler finds from the Sümeg-Mogyorós domb prehistoric quarry. *Archeometriai Műhely* 4(1): 19–30.
- Weisgerber, G., Slotta, R., and Weiner, J. (eds). 1980. *5000 Jahre Feuersteinbergbau: die Suche nach dem Stahl der Steinzeit*. Bochum, Deutsches Bergbau-Museum. *Veröffentlichungen aus dem Deutschen Bergbau-Museum* 77.

