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ACADEMIA ROMÂNĂ  
INSTITUTUL DE ARHEOLOGIE „VASILE PÂRVAN”

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## SUMAR / SOMMAIRE / CONTENTS

### PALEOLITIC / PALÉOLITHIQUE / PALAEO LITHIC

Adrian DOBOȘ, Silviu GRIDAN Recente descoperiri paleolitice în sud-estul Transilvaniei: microzona Rupea – Homorod – Ungra, județul Brașov .....	5
Recent Palaeolithic discoveries in southeastern Transylvania: Rupea – Homorod – Ungra micro-area, Brașov County	

### NEOLITIC / NÉOLITHIQUE / NEOLITHIC

Adina BORONEANȚ, Cristian VIRAG, Ciprian ASTALOȘ, Clive BONSALL Sourcing obsidian from prehistoric sites in northwest Romania .....	13
Adina BORONEANȚ, Vasile DIACONU, Clive BONSALL Obsidian finds from the Early Neolithic site at Grumăzești – <i>Deleni</i> , Neamț County .....	25
Raluca KOGĂLNICEANU, Angela SIMALCSIK Cernavodă – <i>Columbia D</i> puzzle: the Skull Complex .....	33

### EPOCA BRONZULUI / L'ÂGE DU BRONZE / BRONZE AGE

Alin FRÎNCULEASA, Bianca PREDA, Angela SIMALCSIK, Octav NEGREA Peisaje și contexte actuale: un tumul de pământ cercetat în localitatea Coadă Izvorului, județul Prahova	77
Present landscapes and contexts: a burial mound excavated at Coadă Izvorului, Prahova County	

### EPOCA FIERULUI / L'ÂGE DU FER / IRON AGE

Dorin SÂRBU Despre obiceiurile funerare ale nomazilor timpurii din stepele est-europene (sec. X–VIII î.Hr.) .....	101
On the burial customs of the early nomads from the east-European steppes (10 <sup>th</sup> –8 <sup>th</sup> century BC)	
Adrian BĂLĂȘESCU, Alexandru MORINTZ A case of cynophagy at Radovanu – <i>Gorgana a doua</i> settlement, Călărași County (2 <sup>nd</sup> –1 <sup>st</sup> centuries BC) ...	133

### EPOCA GREACĂ / ÉPOQUE GRECQUE / GREEK PERIOD

Pierre DUPONT Céramiques anatoliennes du littoral nord du Pont-Euxin archaïque. Problèmes en suspens .....	149
Pottery finds of Anatolian type from the northern Black Sea shore. Problems of origin and delivery routes	

### EPOCA ROMANĂ / ÉPOQUE ROMAINE/ ROMAN PERIOD

Iulia ILIESCU, Valentin BOTTEZ Late Roman African Red Slip Ware from the <i>Acropolis Centre-South Sector</i> (Histria) .....	155
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Corneliu BELDIMAN, Valentin BOTTEZ, Alexandra ȚÂRLEA, Diana-Maria BELDIMAN Histria – <i>Acropolă Centru-Sud</i> . Date asupra artefactelor din materii dure animale (I) .....	169
Histria – <i>Acropolis Centre-South</i> . Data on bone and antler artefacts (I)	
Alexandra ȚÂRLEA, Migdonia GEORGESCU, Aurel VÎLCU The compositional analysis of copper and bronze Greek coins found at Histria ( <i>Acropolis Centre-South Sector</i> ) using a portable X-Ray fluorescence spectrometer .....	197
Theodor ISVORANU, Mircea DABÎCA Descoperiri monetare la Histria – <i>Sectorul Sud</i> (2013–2017) .....	211
Monetary discoveries at Histria – <i>South Sector</i> (2013–2017)	
Theodor ISVORANU Monede și „vârfuri de săgeți” descoperite recent la Argamum și Enisala .....	231
Coins and “arrowheads” recently discovered at Argamum and Enisala	

#### EPOCA MIGRAȚIILOR / ÉPOQUE DES MIGRATIONS / MIGRATIONS PERIOD

George BALTAG, Radu HARHOIU Sondajul din anul 1979 de la Albești – <i>Școală</i> , județul Mureș .....	237
The 1979 test pits at Albești – <i>Școală</i> , Mureș County	

#### EPOCA MEDIEVALĂ / ÉPOQUE MÉDIEVALE / MIDDLE AGES

Daniela MARCU ISTRATE Biserica evanghelică din Saschiz, județul Mureș. Cercetări arheologice (II): cimitirul exterior .....	249
The Evangelical church at Saschiz, Mureș County. Archaeological research (II): the cemetery around the church	

#### EPOCA CONTEMPORANĂ / ÉPOQUE CONTEMPORAINE / CONTEMPORARY PERIOD

Radu-Alexandru DRAGOMAN, Sorin OANȚĂ-MARGHITU, Tiberiu VASILESCU, Mihai FLOREA, Cătălin NICOLAE Ruinele unui proiect modernist: cercetări arheologice în fosta colonie de muncă forțată din perioada comunistă de la Galeșu/Nazarcea, canalul Dunăre – Marea Neagră .....	265
The ruins of a modernist project: archaeological surveys in the communist-era former forced labour colony at Galeșu/Nazarcea, the Danube – Black Sea Canal	

#### RECENZII / COMPTES RENDUS / BOOK REVIEWS

Erick Robinson and Frédéric Sellet (eds.), <i>Lithic Technological Organization and Paleoenvironmental Change. Global and Diachronic Perspectives</i> , Studies in Human Ecology and Adaptation 9, Springer International Publishing AG, Cham, 2018, 341 p. (Alexandru Ciornei) .....	287
<i>Novae: Legionary Fortress and Late Antique Town – volume 1: A companion to the study of Novae: history of research; Novae in ancient sources, historical studies, geography, topography, and cartography, bibliography 1726–2008</i> / published by T. Derda, P. Dyczek, J. Kolendo, with contributions by R. Ciołek et alii, Warsaw, 2008, 375 p.; volume 2: R. Ciołek, P. Dyczek, <i>Novae, Legionary Fortress and Late Antique Town</i> / P. Dyczek, <i>Coins from Sector IV</i> , Warsaw, 2011, 291 p. (Adriana Panaite) .....	288
Alin Frînculeasa, Angela Simalcsik, Bianca Preda, Daniel Garvăn, <i>Smeeni – Movila Mare. Monografia unui sit arheologic regăsit</i> , Biblioteca Mousaios 13, Editura Cetatea de Scaun, Târgoviște, 2017, 381 p., 35 fig. în text, 136 pl. color (Daniel Spânu) .....	291
Vasilica-Monica Groza, <i>Cercetări paleoantropologice privind populația lașului medieval. Referire specială la necropola din secolul al XVII-lea de la Curtea Domnească</i> , Scripta Archaeologica et Historica Dacoromaniae VIII, Editura Universității „Alexandru Ioan Cuza”, Iași, 2015, 441 p. (Gabriel Vasile) .....	292
<b>Abrevieri / Abréviations / Abbreviations</b> .....	295

# OBSIDIAN FINDS FROM THE EARLY NEOLITHIC SITE AT GRUMĂZEȘTI – DELENI, NEAMȚ COUNTY

Adina BORONEANȚ<sup>a</sup>, Vasile DIACONU<sup>b</sup>, Clive BONSALL<sup>c</sup>

<sup>a</sup> "Vasile Pârvan" Institute of Archaeology, Romanian Academy; e-mail: boro30@gmail.com

<sup>b</sup> History and Ethnography Museum, Târgu Neamț; e-mail: diavas\_n82@yahoo.com

<sup>c</sup> University of Edinburgh, School of History, Classics and Archaeology; e-mail: Clive.Bonsall@ed.ac.uk

**Keywords:** pXRF, obsidian sourcing, Early Neolithic, Romania

**Abstract:** The site of Grumăzești – Deleni (Neamț County) was excavated by Silvia Marinescu-Bîlcu during the late 1960s and 1970s. The excavations unearthed the remains of an Early Neolithic (Starčevo-Criș) settlement, as well as traces of occupation during the Bronze Age (Komariv and Noua cultures) and the 3<sup>rd</sup>–4<sup>th</sup> centuries AD. The excavator's field notes mention abundant obsidian finds associated with the Early Neolithic occupational layer. However, these original obsidian finds have been mislaid and were not available for analysis. During field surveys undertaken in the general area of the site in 2011 and 2017–2018, a further ten obsidian artefacts were recovered. Non-destructive Energy Dispersive X-ray Fluorescence (EDXRF) analysis of these new obsidian finds was undertaken using a Niton 'XL3t ultra' handheld portable XRF analyzer. Based on their geochemical and macroscopic characteristics they likely all originated in the Carpathian 1 source area.

**Cuvinte-cheie:** pXRF, surse de obsidian, neolitic timpuriu, România

**Rezumat:** Situl arheologic de la Grumăzești – Deleni (Județul Neamț) a fost cercetat de Silvia Marinescu-Bîlcu la finalul anilor '60 și pe durata anilor '70 ai secolului trecut. Cercetările au pus în evidență existența unui sit neolitic timpuriu atribuit culturii Starčevo-Criș și urme de locuire asociate epocii bronzului (culturile Komariv și Noua) precum și secolelor III–IV p. Chr. Notele de șantier ale Silviei Marinescu Bîlcu menționează numeroase piese de obsidian asociate nivelului neolitic timpuriu, care, din păcate, nu au putut fi regăsite. Periegezele desfășurate în 2011 și 2017–2018 au dus la recuperarea a 10 piese de obsidian. Pentru analiza EDXRF a acestor piese a fost utilizat un XRF portabil Niton 'XL3t ultra'. Pe baza caracteristicilor macroscopice și geo-chimice, obsidianul din care au fost făcute piesele provine din sursa carpatică C1.

## INTRODUCTION

The site of Grumăzești – Deleni (Neamț County, 47°09'19" N, 26°24'42" E) is situated on the left bank of the Netezi creek, a tributary of the Topolița River (Fig. 1). The site was discovered in 1966, excavations started in 1968 and continued intermittently until 1978. During five field seasons nine trenches (SI–SIX) with four extensions (Cas 1 - Cas 4) were excavated (Fig. 2). The excavations unearthed the remains of an Early Neolithic (Starčevo-Criș) settlement, as well as traces of occupation during the Bronze Age (Komariv and Noua cultures) and the 3<sup>rd</sup>–4<sup>th</sup> centuries AD (Marinescu-Bîlcu 1975; 1993; Marinescu-Bîlcu, Beldiman 2000). A field survey undertaken by Vasile Diaconu aimed at establishing the full extent of the site took place in 2011 (Diaconu 2012), followed in 2017–2018 by further fieldwork with emphasis on geomagnetic survey carried out in collaboration with Regensburg University.

The archaeological evidence relating to the Early Neolithic settlement has been summarized in previous publications: Marinescu-Bîlcu (1975; 1993) and Dumitrescu

et alii (1983) provided brief descriptions of the site, the general chronology and the Early Neolithic pottery finds; A. Boroneanț (2012) presented a detailed account of the excavations with descriptions of the Early Neolithic features; while V. Diaconu (2012) reviewed the evidence from all the archaeological sites in the area, and the main categories of (published) Early Neolithic finds.

The general stratigraphy of the site (Fig. 3), which slopes from west to east, may be summarized as follows:

1. Vegetal topsoil containing a mixture of finds from different periods, resulting from plough disturbance;
2. Dark brown soil with very few features/finds, mostly dating to the 3<sup>rd</sup>–4<sup>th</sup> centuries AD;
3. Light brown soil containing mainly Early Neolithic and some Noua culture features and finds;
4. Yellow clayey soil, archaeologically sterile.

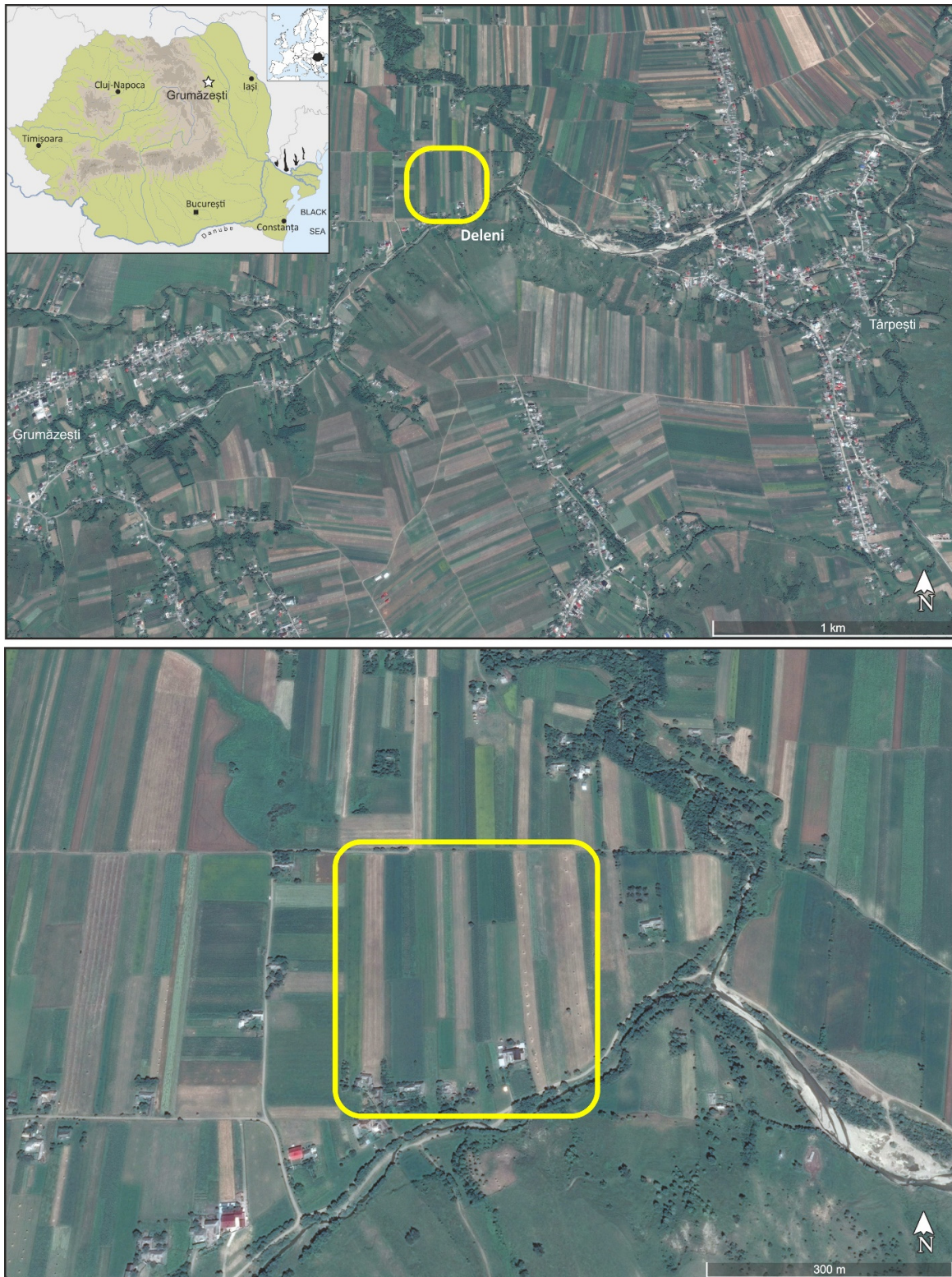
Most of the Early Neolithic material came from the 12 features that were clearly identified as Early Neolithic<sup>1</sup>, and many fewer finds from the supposed 'cultural layer' (Boroneanț 2012). According to S. Marinescu-Bîlcu's field notes, the dwellings appeared as spatial concentrations of

<sup>1</sup> For a detailed description of the Early Neolithic features, see Boroneanț 2012, p. 27–32.

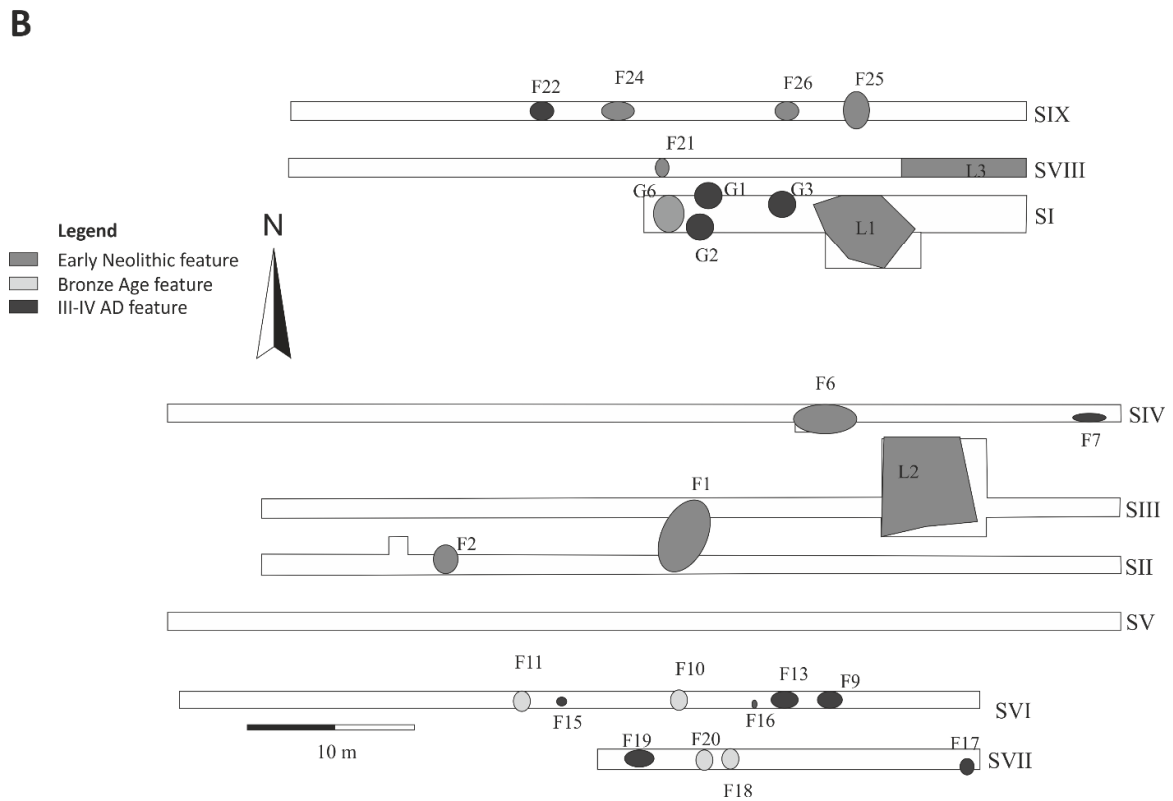
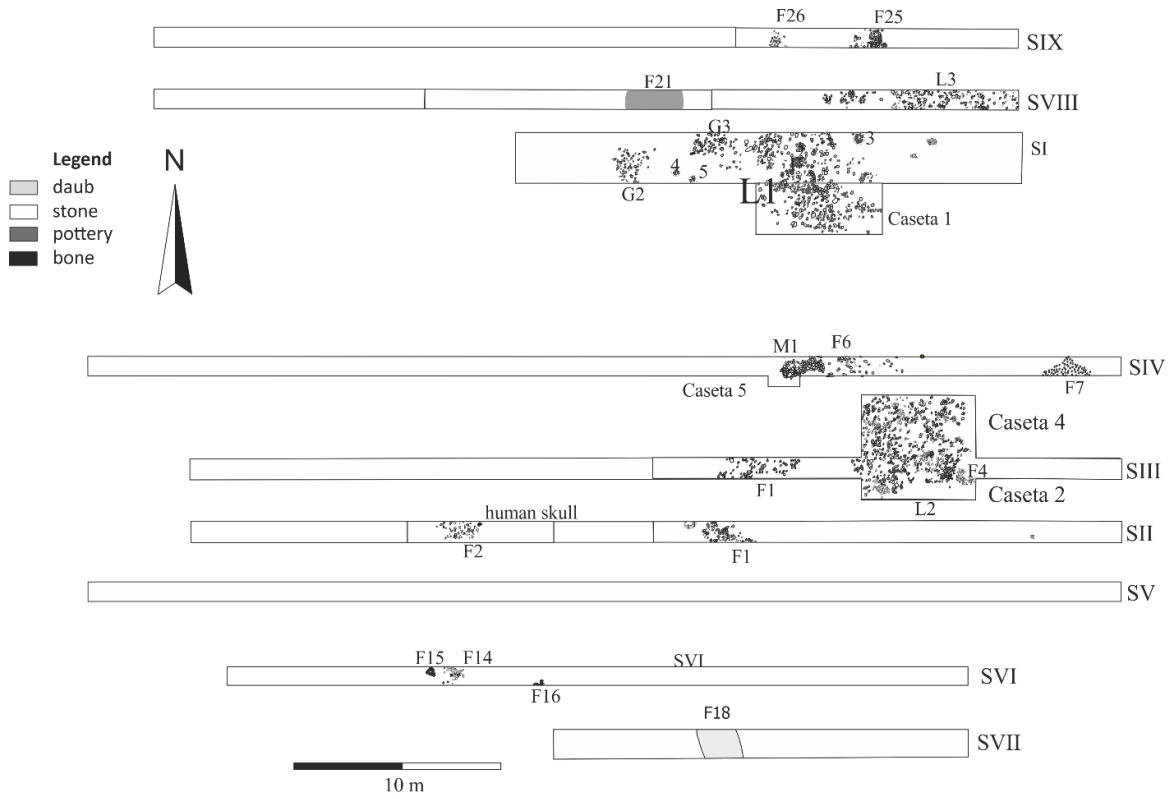


pottery sherds (in some instances including fragmented vessels), daub fragments with wattle impressions, a significant number of polished stone tools (axes, adzes,

chisels), coarse stone tools (grinders, punches and hammers), chipped stone artefacts (made of flint, chert, obsidian and quartzite), and ceramic loom weights.



**Figure 1.** Location of the Grumăzești – Deleni site. Google Earth imagery 21/10/2017 (accessed 14/03/2018).



**Figure 2.** Grumăzești – Deleni 1968–1978: A. Plan of trenches showing the principal archaeological features (after Boroneanț 2012). B. Separation of archaeological features by period (after Boroneanț 2012).



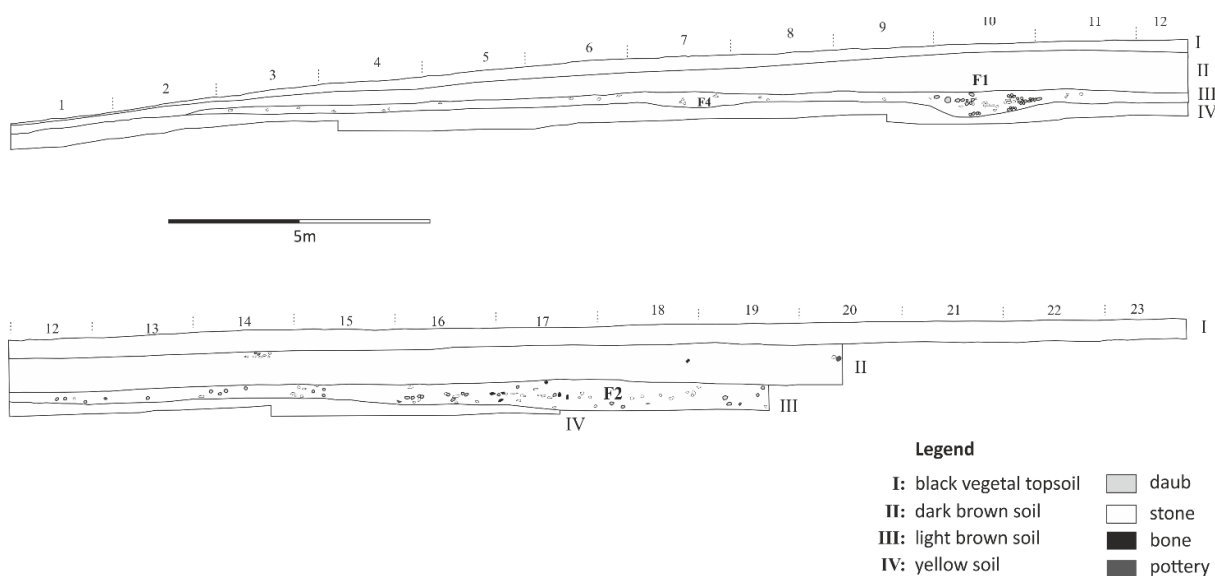


Figure 3. Grumăzești – Deleni 1968–1978: South profile of trench SII (after Boroneanț 2012).

### OBSIDIAN FINDS

A summary of the obsidian finds from S. Marinescu-Bîlcu's excavation, as described in her field notes, is presented in Table 1, where contexts L1, L2 and L3 were interpreted as dwellings and F18 as a large pit. Unfortunately, these original obsidian finds have been mislaid and so were not available for XRF analysis.

During the field surveys undertaken in the general area of the site in 2011–2017, a further ten obsidian artefacts were recovered. These ten pieces were described, measured and photographed (Table 2, Fig. 4) prior to XRF analysis. One (**Grm.004**) is a thick flake with cortex over the whole of the dorsal surface. The other pieces are interior flakes and blades with no traces of cortex. Two of these are retouched: **Grm.007** is a mesial fragment of a blade, partially backed on one lateral margin, while **Grm.002** has partial light retouch on one lateral margin. The obsidian is highly translucent with distinctive light and dark bands and has a strong, glassy lustre (best seen in Fig. 4/1–3).

### XRF ANALYSES

Non-destructive Energy Dispersive X-ray Fluorescence (EDXRF) analysis of the ten new obsidian finds from Grumăzești – Deleni was undertaken using a Niton 'XL3t ultra' handheld portable XRF analyzer. Two sets of measurements were taken on each piece – with the instrument operated in 'mining mode' and 'soil mode', respectively (for an explanation and discussion of these two matrix correction methods, see Frahm *et alii* 2014).

For both sets of analyses, 'spot size' (the diameter of the analysis area) was set to 8 mm, and the measurement time per sample to 180 seconds. Elemental concentrations were measured for a range of minor and trace elements including Ti, Fe, Zn, Rb, Sr, Y, Zr, Nb, Pb, Th and U. The same instrument (with the identical settings) was previously used to measure geological samples from known obsidian sources in the Carpathians, the Aegean, Central Anatolia and the Central Mediterranean curated at the Vienna-Lithotek (VLI) managed by Dr. Gerhard Trnka and the Lithoteca of the Hungarian National Museum in Budapest (Biró, Dobosi 1991; Biró *et alii* 2000; Biró 2014).

### DISCUSSION AND CONCLUSIONS

XRF provides a quick, accurate and non-destructive means of analyzing the chemical composition of obsidian, and the introduction of portable handheld analyzers (pXRF) has enabled measurements to be taken 'in the field', i.e. on site or in a museum. By using pXRF it is often possible to analyze all artefacts from a site whereas studies done using laboratory-based instruments have tended to be restricted to a small subset of artefacts from a site (for curatorial reasons, presumably) which may not reflect the full range of sources represented within the total assemblage.

Obsidian sources in Europe and neighbouring parts of Southwest Asia (Anatolia) are few and relatively well studied. Each source has a unique chemical signature, which allows for the provenance of archaeological obsidian pieces to be determined by comparing their elemental

compositions to those of geological samples collected from known sources.

Context	Trench	Square	Depth (m)	Type	Quantity
L1	SI/Cas 1	3–5	0.55–0.65	unknown	several fragments
	SII	?	0.75–0.80	flake	one fragment
L2	SIII/Cas 2/Cas 4	4–6	0.65	unknown	several fragments
	SIV	7–15	1.10?	unknown	several fragments
L3	SVIII	1–5	0.50–0.60	fragments of small blades, blade-like flakes	many fragments
	SIX	?	?	unknown	large number of fragments
F18	SVIII	9–10	1.05–1.75	unknown	several fragments

**Table 1.** Summary of Early Neolithic (Starčevo-Criș culture) obsidian finds from Silvia Marinescu-Bîlcu's excavations at Grumăzești – Deleni (adapted after Boroneanț 2012).

Sample ID	Type	Blank	Dimensions (mm)			Wt (g)	Cortex	Remarks
			Max L	Max B	Max Th			
Grm.001		F	14.2	13.5	3.1	0.47	0%	Snap fractures (natural) along one lateral edge
Grm.002	ER	B	-17.9	10.0	2.5	0.42	0%	Distal mesial break, possibly accidental during retouching
Grm.003		B	18.6	9.6	2.1	0.34	0%	
Grm.004		F	34.1	40.9	6.0	5.90	>90%	
Grm.005		B	-25.6	11.5	2.9	0.90	0%	Faceted butt; distal mesial break; ED
Grm.006		F	19.3	10.7	4.3	0.92	0%	
Grm.007	BB	B	-19.6	10.0	3.0	0.85	0%	Mesial fragment of a blade, partially backed
Grm.008		F	14.0	7.9	3.9	0.41	0%	
Grm.009		F	12.4	9.6	2.5	0.26	0%	ED
Grm.010		B	-9.3	7.5	2.3	0.22	0%	Mesial fragment of a blade; ED on left lateral margin

**Table 2.** Details of obsidian artefacts discovered in field surveys in 2011–2017 at Grumăzești – Deleni and analyzed by pXRF (cf. Figure 6). Key: B – blade, F – flake, BB – backed blade, ER – edge-retouched piece, ED – macroscopic edge damage; a minus sign before a measurement indicates that the dimension is affected by a break.



**Figure 4.** Photographs of obsidian artefacts (Grm.001–010) measured by pXRF. Scale in cm. Grm.001–003 were photographed against a white background with a DSLR camera, while the images of Grm.004–010 were created using a flatbed scanner.

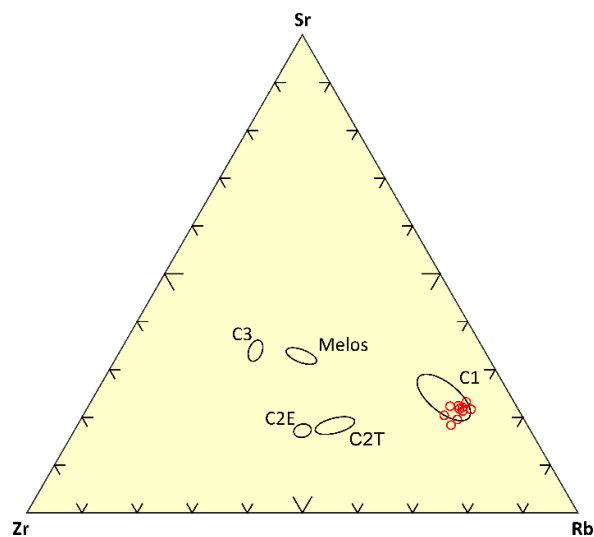


**Figure 5.** Location of Grumăzești – Deleni and major obsidian sources in Europe and central Anatolia. Google Earth imagery, 14/12/2015 (accessed 7 June 2016).

The nearest geological sources of obsidian to Grumăzești – Deleni are in the Carpathian Mountains to the west-northwest, where three main source areas have been identified (Biró 2006; 2014; Rosania *et alii* 2008). The site lies c. 270 km straight-line distance from the Carpathian 3 (C3) source area in the Transcarpathian region of southwest Ukraine, c. 380 km from the C1 source area in the Zemplín Hills of eastern Slovakia, and c. 400 km from the C2 source area in the Tokaj Mountains of northeast Hungary (Fig. 5). However, the Aegean Islands have also been suggested as the source of some of the obsidian found in Neolithic contexts in Romania (Vlassa 1965; Maxim 1995; Constantinescu *et alii* 2014).

The elemental concentrations of zirconium (Zr), strontium (Sr) and rubidium (Rb) have been found to be particularly useful for discriminating between the different European and Anatolian obsidian sources. Fig. 6 plots the Zr-Sr-Rb coordinates of the Grumăzești – Deleni finds against the distributions of geological samples from the various Carpathian sources (C1, C2E, C2T, C3) and from the island of Melos in the Aegean, represented on the graph by ellipses. The Zr-Sr-Rb profile of the Grumăzești – Deleni finds corresponds very closely with that previously determined for the Carpathian 1 source in eastern Slovakia, although several archaeological pieces have coordinates that fall at or just outside the boundary of the C1 ellipse. These pieces are all relatively small and

thin, which tends to reduce measurement accuracy. The ternary plot provides a means of visualizing the data in a way that allows such archaeological samples to be confidently attributed to their geological source.



**Figure 6.** Ternary diagram of Zr-Sr-Rb data for 10 obsidian artefacts from Grumăzești – Deleni (red circles) plotted against the compositional ranges of infinitely thick samples from geological sources in the Carpathians and on Melos (grey ellipses) – all measured by pXRF.

In summary, based on their geochemical and macroscopic characteristics (cf. Biró 2006), the obsidian pieces from Grumăzești – Deleni found in 2011–2017 likely all originated in the Carpathian 1 source area. Further research is planned on the Neolithic obsidian assemblages from Moldova, which will include technological analyses of the obsidian artefacts and, we hope, the acquisition of new AMS radiocarbon dates. This research will be the subject of future publications.

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## ABRÉVIATIONS / ABBREVIATIONS / ABREVIERI

- AA – Archäologischer Anzeiger. Deutsches Archäologisches Institut, Darmstadt, München, Tübingen–Berlin  
ACMI – Anuarul Comisiunii Monumentelor Istorice, București  
ActaMN – Acta Musei Napocensis, Cluj  
ActaMP – Acta Musei Porolissensis, Zalău  
ActaTS – Acta Terrae Septemcastrensis, Universitatea Lucian Blaga, Sibiu  
Acta Siculica – Acta Siculica. Anuarul Muzeului Național Secuiesc, Sfântu Gheorghe  
l'Anthropologie (Paris) – l'Anthropologie, Paris  
Antiquity – Antiquity. A Quarterly Review of Archaeology, University of York  
Anuarul MJIAP – Anuarul Muzeului Județean de Istorie și Arheologie Prahova, Ploiești  
ARA – Annuaire Roumain d'Anthropologie  
Archaeometry – Archaeometry, Research Laboratory for Archaeology and the History of Art, Oxford University  
ArchBulg – Archaeologia Bulgarica, Sofia  
Area – Area, Royal Geographical Society, London  
ArheologijaKiiv – Arheologija. Nacional'na akademija nauk Ukraini. Institut arheologii, Kiiv  
ArheologijaSSSR – Arheologija SSSR. Svod Arheologičeskikh Istočnikov, Moskva  
ArhMold – Arheologia Moldovei, Iași  
BA – Biblioteca de Arheologie, București  
BARIntSer – British Archaeological Reports. International Series, Oxford  
BiblThrac – Bibliotheca Thracologica, București  
BMC – *Coins of the Roman Empire in the British Museum*, London. I, *Augustus to Vitellius*, 1923; II, *Vespasian to Domitian*, 1930; III, *Nerva to Hadrian*, 1936; IV, *Antoninus Pius to Commodus*, 1968; V, *Pertinax to Elagabalus*, 1950 (H. Mattingly); VI, *Severus Alexander to Balbinus and Pupienus*, 1962 (R.A.G. Carson)  
BMJT – Buletinul Muzeului Județean Teleorman, Alexandria  
BMJTAG – Buletinul Muzeului Județean „Teohari Antonescu”, Giurgiu  
BSNR – Buletinul Societății Numismatice Române, București  
Bull. et Mém. de la Soc. d'Anthrop. de Paris – Bulletins et Mémoires de la Société d'Anthropologie de Paris  
CA – Cercetări Arheologice, București  
Caiete ARA – Caietele ARA, Revistă de Arhitectură, Restaurare și Arheologie, Asociația ARA, București  
CCA – Cronica Cercetărilor Arheologice din România, București  
CercNum – Cercetări Numismatice, București  
Dacia / Dacia NS – Dacia / Dacia Nouvelle Série. Revue d'archéologie et d'histoire ancienne. Académie Roumaine. Institut d'archéologie « Vasile Pârvan », Bucarest  
DOW, I – *Dumbarton Oaks Catalogues*. A. Bellinger, Ph. Grierson (eds.), *Catalogue of the Byzantine coins in the Dumbarton Oaks Collection and in the Whittemore Collection*, I, *Anastasius to Maurice (491-602)*, Washington, 1966 (A. Bellinger)  
EAIVR – C. Preda (ed.), *Enciclopedia Arheologiei și Istoriei Vechi a României*, vol. I-III (1994, 1996, 2000), București  
EphemNap - Ephemeris Napocensis. Academia Română, Institutul de Arheologie și Istoria Artei, Cluj-Napoca  
Estiot, TM 5 – Sylviane Estiot, *Le trésor de Maravielle (Var)*, în *Trésors Monétaires*, V, 1983, p. 9-115  
Estiot, *Venèra* – Sylviane Estiot, *Ripostiglio della Venèra. Nuovo Catalogo Illustrato* II/1, *Aureliano*, Roma, 1995  
FI – File de Istorie, Bistrița  
FolArch – Folia Archaeologica, Budapest  
Giard, *Venèra* – J.-B. Giard, *Ripostiglio della Venèra. Nuovo Catalogo Illustrato*, III/1, *Gordiano III-Quintillo*, Roma, 1995  
Göbl – R. Göbl, *Die Münzprägung der Kaiser Valerianus I. / Gallienus / Saloninus (253/268), Regalianus (260) und Macrianus / Quietus (260–262)*, Viena, 2000  
IJO – International Journal of Osteoarchaeology  
IstMitt – Istanbuler Mitteilungen, Istanbul  
Istros – Istros, Muzeul Brăilei, Brăila  
JAS – Journal of Archaeological Science, London  
JEA – Journal of European Archaeology  
JFA – Journal of Field Archaeology



- KSIA (Kiiv) – Kratkije Soobščeniija Instituta Arheologij Akademij Nauk SSSR, Kiiv  
 KSIA (Moskva) – Kratkije Soobščeniija Instituta Arheologij Akademij Nauk SSSR, Moskva  
 Ktèma – Civilisations de l'Orient, de la Grèce et de Rome antiques, Strasbourg  
 MCA – Materiale și Cercetări Arheologice, București  
 MemAnt – Memoria Antiquitatis, Piatra Neamț  
 MIAR – Materialy i issledovanija po arheologii Rossii  
 MIBE – W. Hahn, M.A. Metlich, *Money of the Incipient Byzantine Empire (Anastasius I – Justinian I, 491–565)*, Viena, 2000  
 Mousaios – Buletinul Științific al Muzeului Județean Buzău  
 MuzNaț – Muzeul Național, București  
 NZ – Numismatische Zeitschrift, Viena  
 Peuce – Peuce, Studii și cercetări de istorie și arheologie, Institutul de Cercetări Eco-Muzeale, Tulcea  
 Pick, Regling – B. Pick, K. Regling, *Die antiken Münzen Nord-Griechenlands*, I, *Die antiken Münzen von Dacien und Moesien*, Berlin, 1, 1898 (B. Pick), 2, 1910 (B. Pick, K. Regling)  
 Pink, NZ – K. Pink, *Der Aufbau der Römischen Münzprägung in der Kaiserzeit*. VI/1, *Probus*, NZ, 71, 1946, p. 13-74  
 Pontica – Pontica. Studii și materiale de istorie, arheologie și muzeografie, Muzeul de Istorie Națională și Arheologie Constanța  
 PZ – Prähistorische Zeitschrift, Berlin-Mainz  
 RA – Revue Archéologique, Paris  
 Radiocarbon – An International Journal of Cosmogenic Isotope Research, Cambridge  
 REA – Revue des Études Anciennes, Bordeaux  
 RevBistr – Revista Bistriței. Complexul Muzeal Bistrița-Năsăud, Bistrița  
 RevMuz – Revista Muzeelor, București  
 RIC III – H. Mattingly, E.A. Sydenham, *The Roman Imperial Coinage*, III, *Antoninus Pius to Commodus*, London, 1930  
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 Quaternary International – Quaternary International. The Journal of the International Union for Quaternary Research  
 SAA – Studia Antiqua et Archaeologica, Iași  
 SCA – Studii și Cercetări de Antropologie, București  
 SCIV(A) – Studii și Cercetări de Istorie Veche (și Arheologie), București  
 SCN – Studii și Cercetări de Numismatică, București  
 SNG IX, BM – Silloge Nummorum Graecorum, IX, The British Museum, I, *Black Sea*, London, 1993  
 SNG XI, *Stancob* – Silloge Nummorum Graecorum, XI, *The William Stancob Collection of coins of the Black Sea Region*, Oxford, 2000  
 SovArh – Sovetskaja Arheologija, Moskva  
 SP – Studii de Preistorie, București  
 Stratum(Plus) – Stratum (Plus), Școala Superioară de Antropologie, Chișinău, Sankt Petersburg, București  
 StudCom Satu Mare – Studii și comunicări Satu Mare  
 StudCom Sibiu – Studii și Comunicări, Sibiu  
 Th-D – Thraco-Dacica, București  
 Tyragetia – Tyragetia. Anuarul Muzeului Național de Istorie a Moldovei, Chișinău  
 Vărbanov – I. Vărbanov, *Greek Imperial Coins and their Values (The Local Coinage of the Roman Empire)*, I, *Dacia, Moesia Superior, Moesia Inferior*, Burgas, 2005  
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