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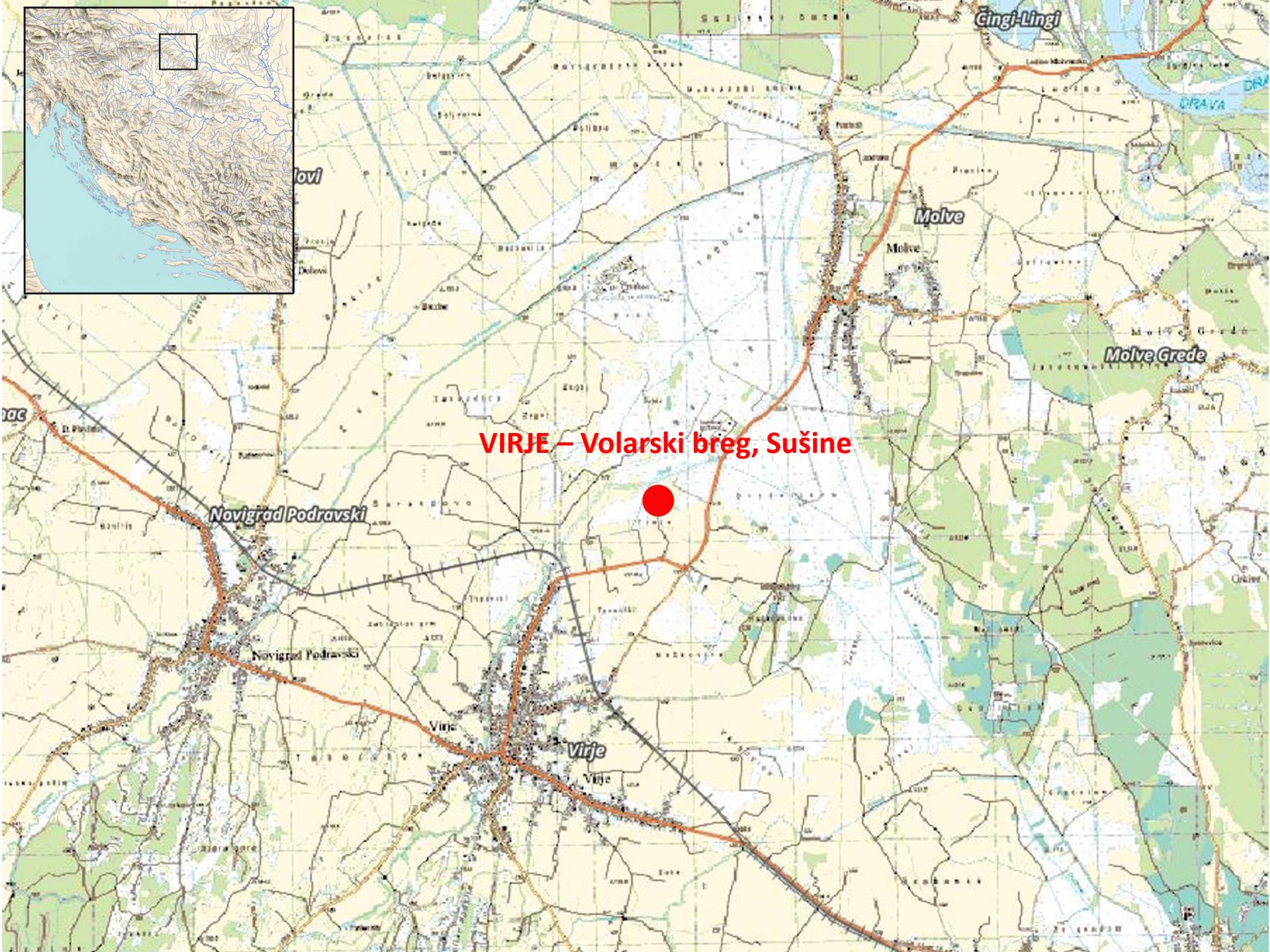
# In which part of the year did the iron smelting in the Drava valley occur?

THE RURALIA XIII CONFERENCE  
“Seasonal Settlement in the Medieval and Early Modern Countryside”  
Stirling (Scotland, UK); 9th – 15th September 2019



**Research project TransFER (IP-06-2016-5047) - Croatian Science Foundation:  
*Production of Iron Along the Drava River During Antiquity and Middle Ages:  
Creation and Transfer of Knowledge, Technology and Commodities***





**VIRJE – Volarski breg, Sušine**

Virje – Volarski breg, 2007. (T. S. Ivančan, IARH)



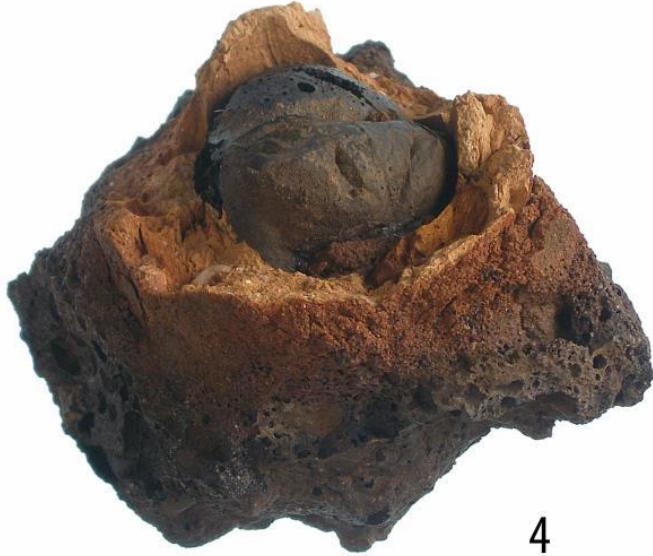


1

2



3



4

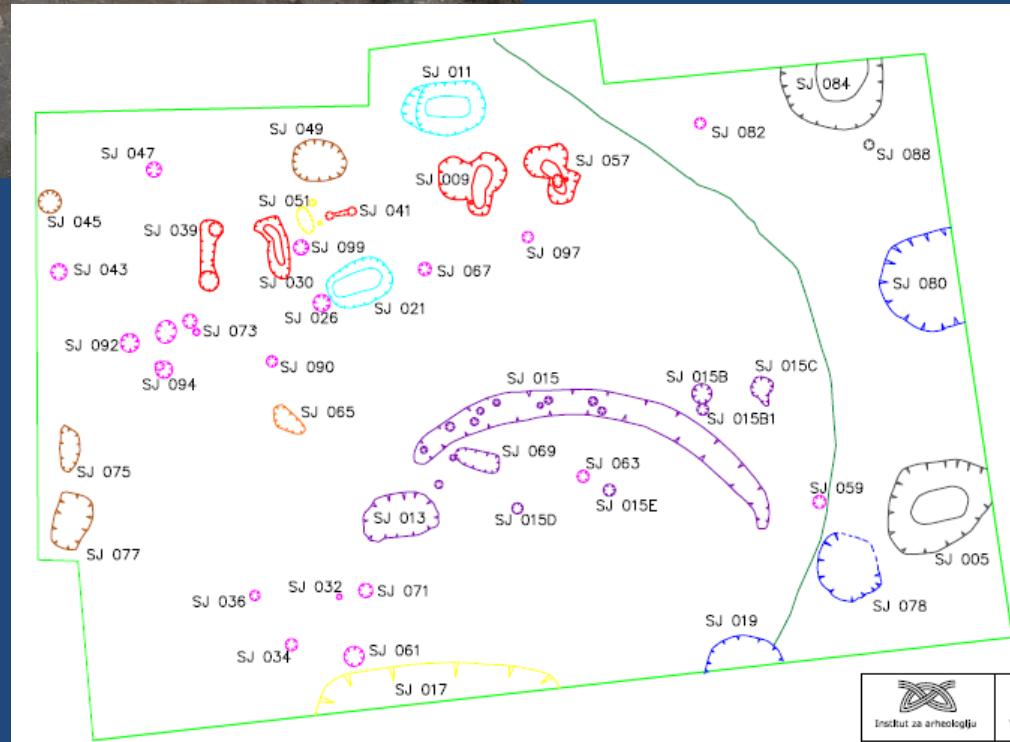
Surface material  
collected during the  
first field survey (I.  
Zvijerac).  
Photo: T. Sekelj Ivančan,  
IARH



Virje –  
Volarski breg 2008.

Photo: T. Tkalčec, IARH  
Plan: K. Jelinčić, IARH

Trench 1 – 230 m<sup>2</sup>:  
• 5 smelting furnaces *in situ*  
• 4 dislocated remains of destroyed furnaces  
• 5 pits with burned bottoms  
• 1 fence and numerous postholes

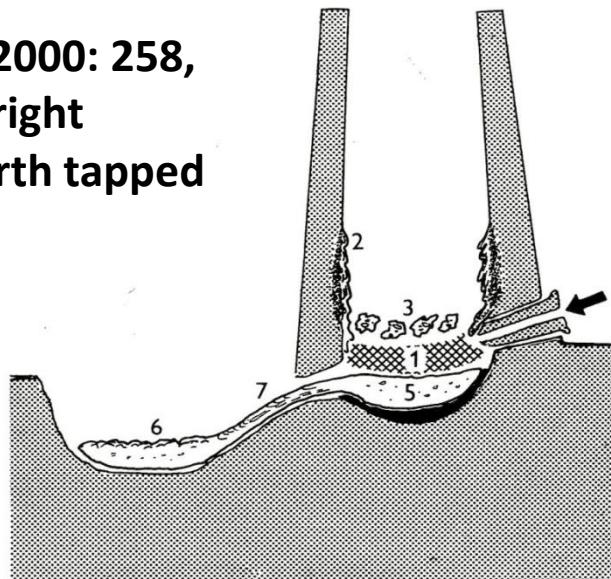


## Virje – Volarski breg

- Preventive excavations in 2008., 2010., 2012. **Late 8th – late 9. century**

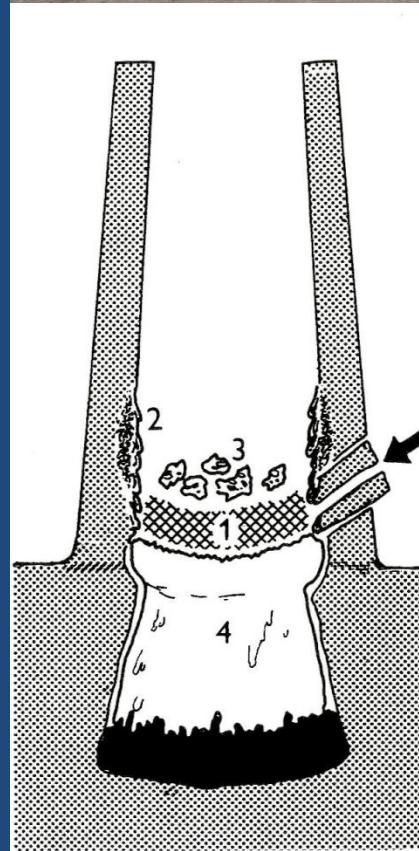


Pleiner 2000: 258,  
Fig. 67, right  
flat-hearth tapped  
furnace



## Virje - Sušine

- Preventive excavations in 2012., 2013., 2014. **8. century**



Pleiner 2000: 258,  
Fig. 67, left  
sleg pit furnace

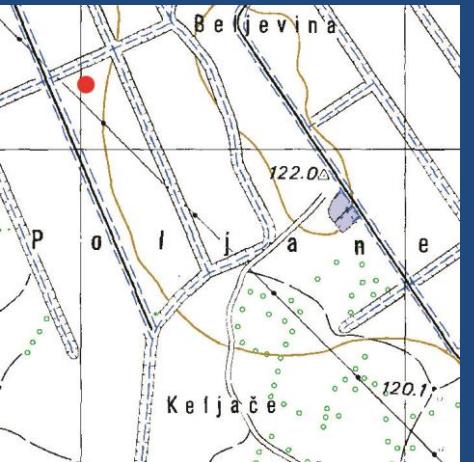


## Delovi - Poljane 1

**Mjesto:** Delovi

**Općina:** Novigrad Podravski

**Županija:** Koprivničko-križevačka



TK 1:25 000  
Novigrad Podravski 272-4-4

**Položaj:** G.Š.  $46^{\circ} 07' 20''$

G.D.  $16^{\circ} 58' 26''$

Oko 1,4 km zapadno od farme za tov junadi koja se nalazi na sjevernom izlazu iz Delova i oko 350 metara jugoistočno od zapuštene plinske stanice Molve 13, na mjestu nekadašnjeg hangara.

**Geografske karakteristike:** ravničarski prostor; na mjestu talioničke radionice je blaga padina prema sjeverozapadu, prema manjoj potolini kroz koju je nekada tekao potok (n.v. 120 m).

**Tip lokaliteta:** naselje, talionička radionica

**Vrsta nalaza:** keramika, talionička zgura, metal

**Datacija:** rani srednji vijek (9.-11.st.), kasni srednji vijek

**Uvjeti nalaza:** rekognosciranje, 1973. g., S. Kolar, MGKc; probno iskopavanje, 1974. g., voditelj S. Kolar, MGKc, istr. pov 70 m<sup>2</sup>; zaštitno iskopavanje, 1983. g., voditelj Z. Marković, MGKc, istr. pov 110 m<sup>2</sup>; rekognosciranje I. i Z. Zvijerac; zaštitno iskopavanje, 2016. g., voditelj R. Čimin, MGKc, istr. pov. 500 m<sup>2</sup>.

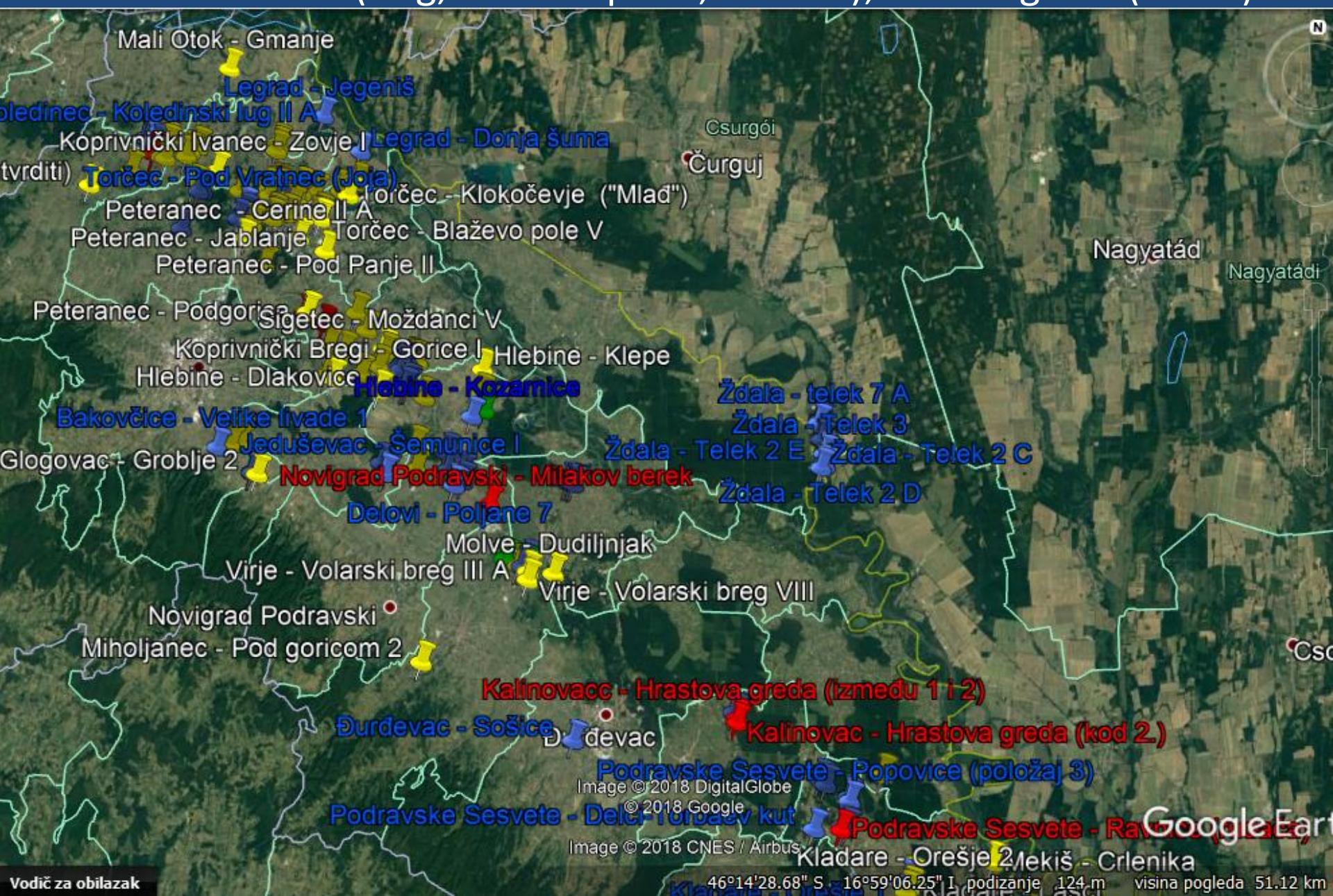
**Smještaj nalaza:** MGKc; Zbirka obitelji Zvijerac, Torčec

**Literatura:** Kolar-Sušanj 1973:172-173, T. XCI-XCIII; 1974: 58-60; Kolar 1976: 106,112; Marković 1980b: 324-330; 1984: 296-298,301; 1986c: 84; 1990b: 108; 1994: 113; 1997e:151; Sekelj Ivančan 1995: 137; 2001a, Pl. XVIII, 116; 2010: 21; Zvijerac 2000: 51, 56; 2008: 72; 2010: 12, 17, 18, 20, 22, 26; Valent 2016: 132; Valent et al. 2017: 15-16

**Dodatna napomena:** Na temelju prikupljenih površinskih nalaza i provedenih zaštitnih arheoloških istraživanja, na lokalitetu Delovi-Poljane 1 zabilježena su naselja iz kasnog brončanog doba, starijeg i mlađeg željeznog doba, te ranog i kasnog srednjeg vijeka. Tijekom triju provedenih istraživanja istraženi su objekti iz brončanog i starijeg željeznog doba te mlađeg srednjeg vijeka.

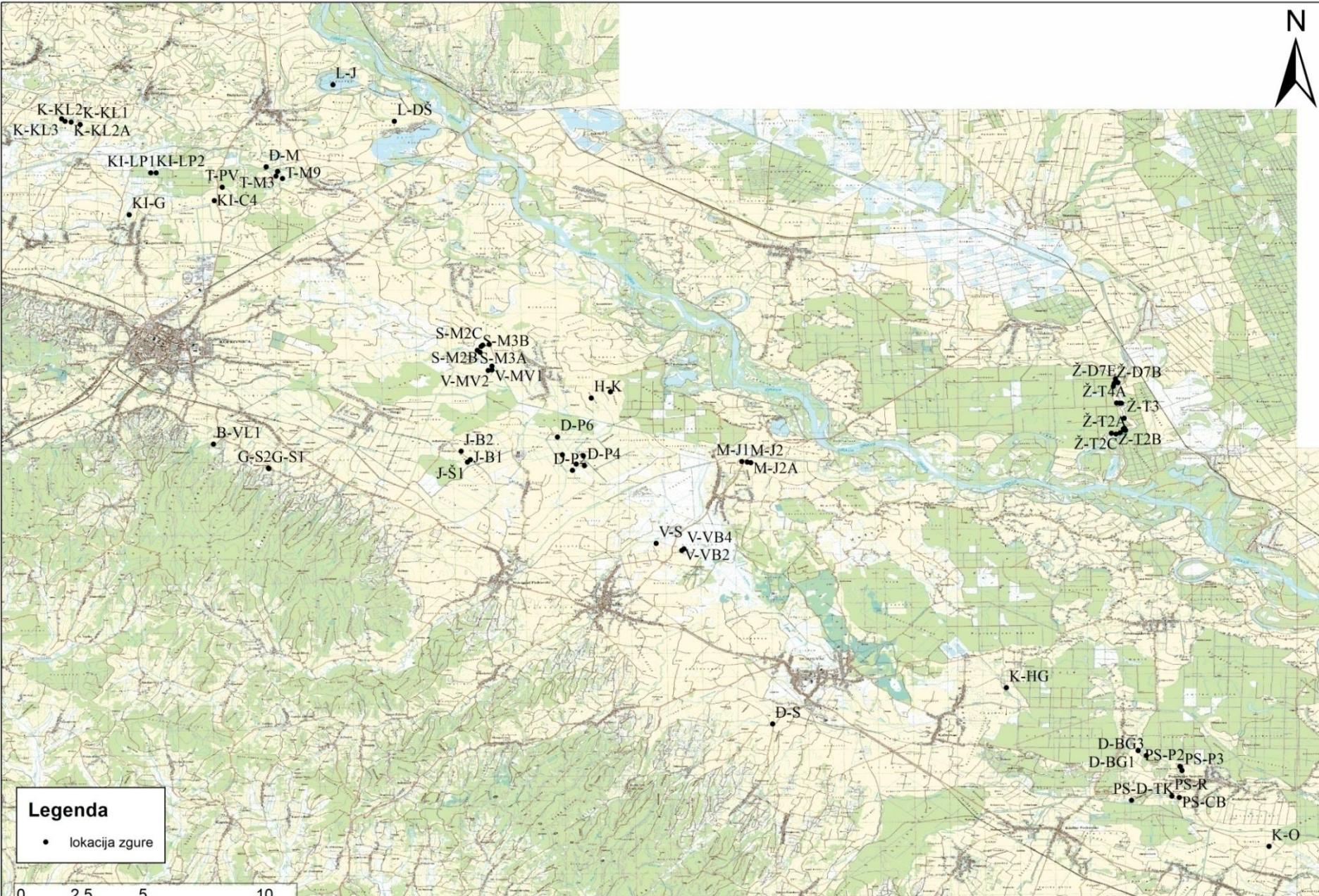


# Field survey and reambulation results: 157 sites with metallurgical characteristics (slag, furnace parts, nozzles); smelting: 56 (2017.)

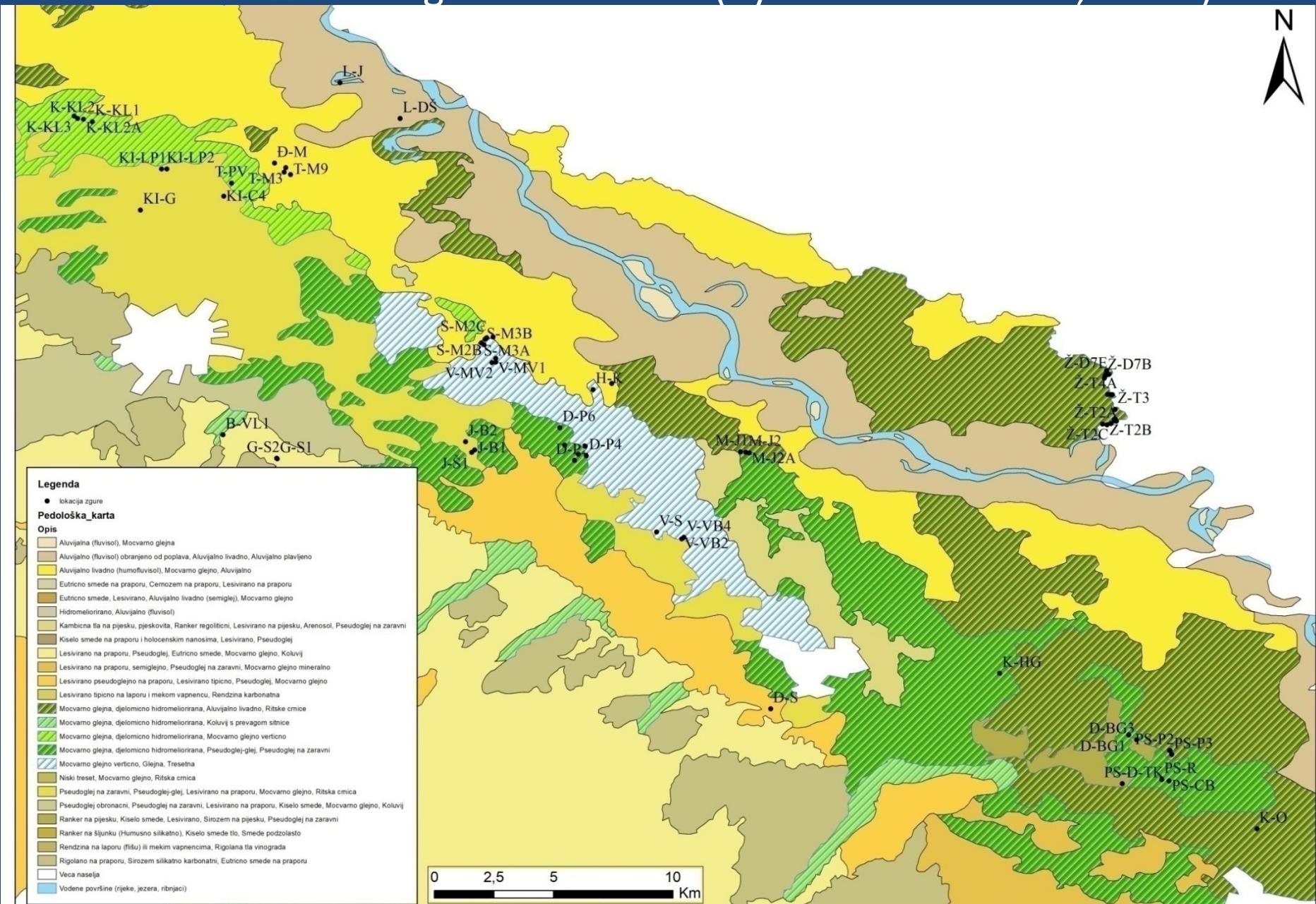


# Topographic map of the River Drava Basin with archaeological sites with recorded smelting characteristics (by Tomislav Brenko 2017.)

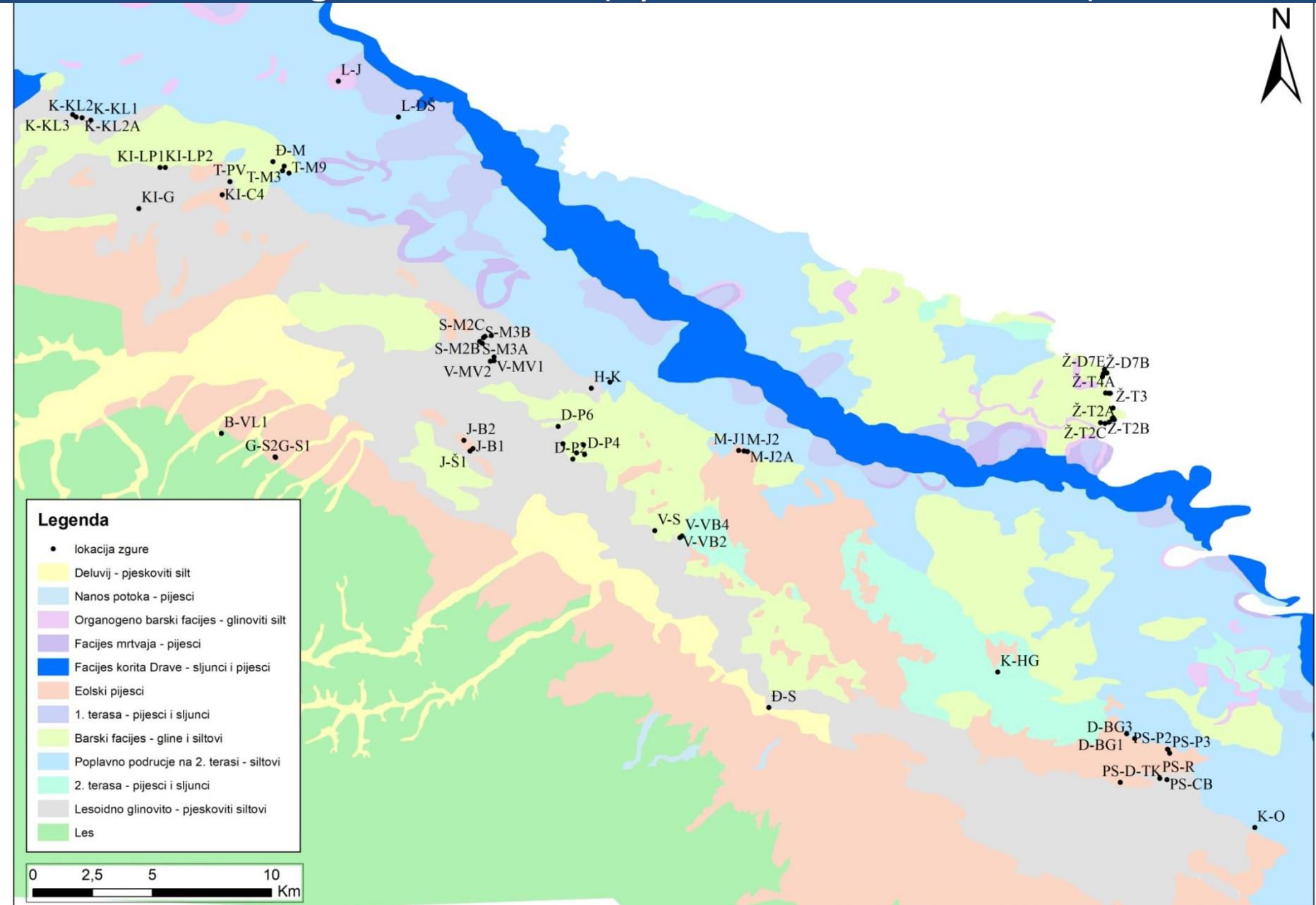
N



# Pedology map of the River Drava Basin with archaeological sites with recorded smelting characteristics (by Tomislav Brenko, 2017.)



# Geologic map of the River Drava Basin with archaeological sites with recorded smelting characteristics (by Tomislav Brenko, 2017.)



## Smelting predispositions:

- Raw material - ore
- Other resources – water, clay, wood

## Questions:

- Acquirement of raw material (ore)? - import or local
- If local – recognition of the deposits?



Molve – Topolova, 2013.  
Photo: T. S. Ivančan, IARH

Virje – Sušine  
October 2014.  
Photo: T. S. Ivančan, IARH





Mijo Kovačić  
Zima – poplava (Winter – flood)  
Oil on glass, 2006.  
64 x 94 cm  
Mijo Kovačić Gallery, Zagreb



Mijo Kovačić  
Zima na selu  
(Winter in the countryside)  
Oil on glass, 2010.  
60 x 83 cm  
Mijo Kovačić Gallery, Zagreb

WINTER



Podravina (around the village of Peteranec) in  
March 2016; Photo: I. Valent, MGK



Ivan Generalić  
Poplava 1 (Flood 1)  
Oil on glass, 1960.  
365 x 520 mm  
The Croatian Museum  
of Naive Art, INV 401

EARLY SPRING



Mijo Kovačić

Ribar sa žabom (A fisherman with a frog)

Ulje na staklu, 1997

50 x 60 cm

Mijo Kovačić Gallery, Zagreb

## LATE SPRING

Mali Otok, Gmanje,  
March 2017.

Photo; I. Valent, MGK





Areal photo of fields  
around the village of  
Torčec, July 2006.  
Photo: T. Tkalc̆ec, IARH

Dražen Tetec  
Dravski zlatari  
Naive Art Gallery, Hlebine  
HLB - 568

SUMMER

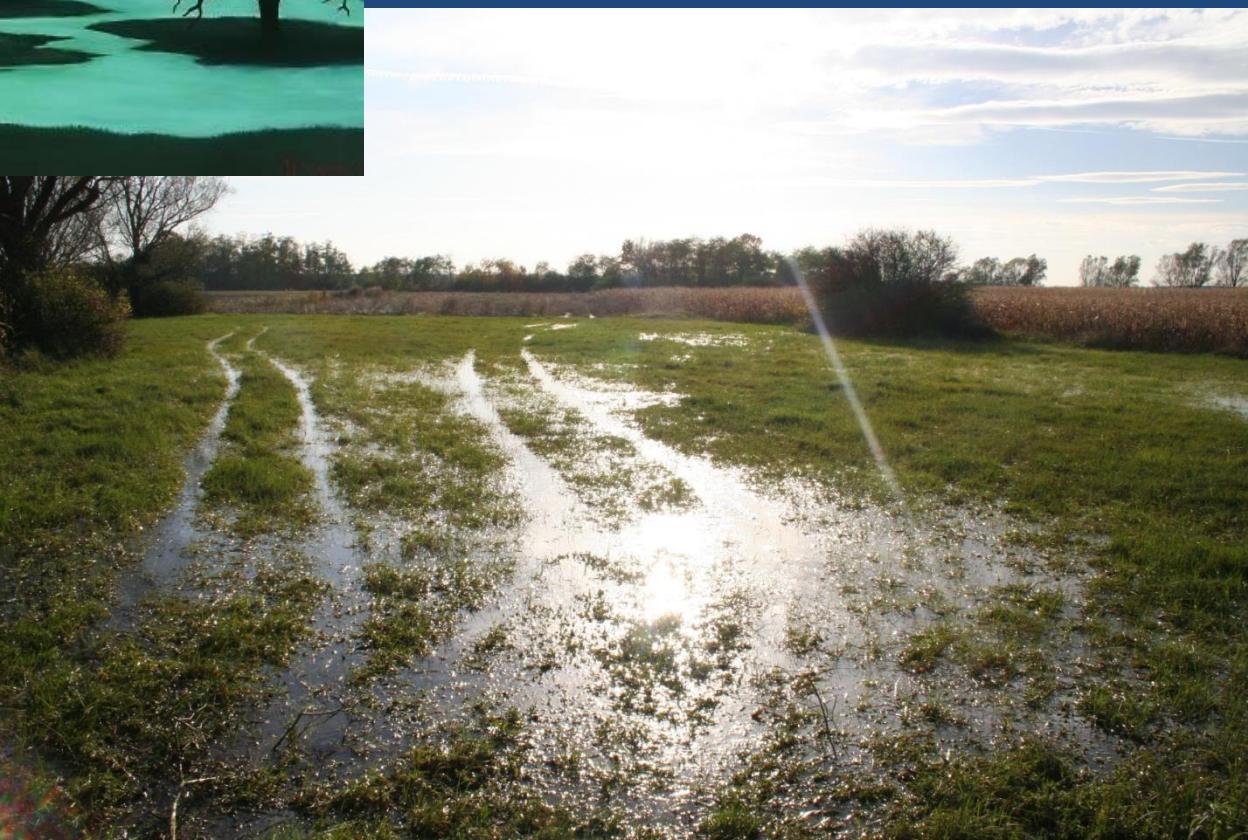




Ivan Generalić  
Poplava (Flood)  
Oil on glass, 1959.  
460 x 640 mm  
The Croatian Museum of  
Naive Art, INV. 1642

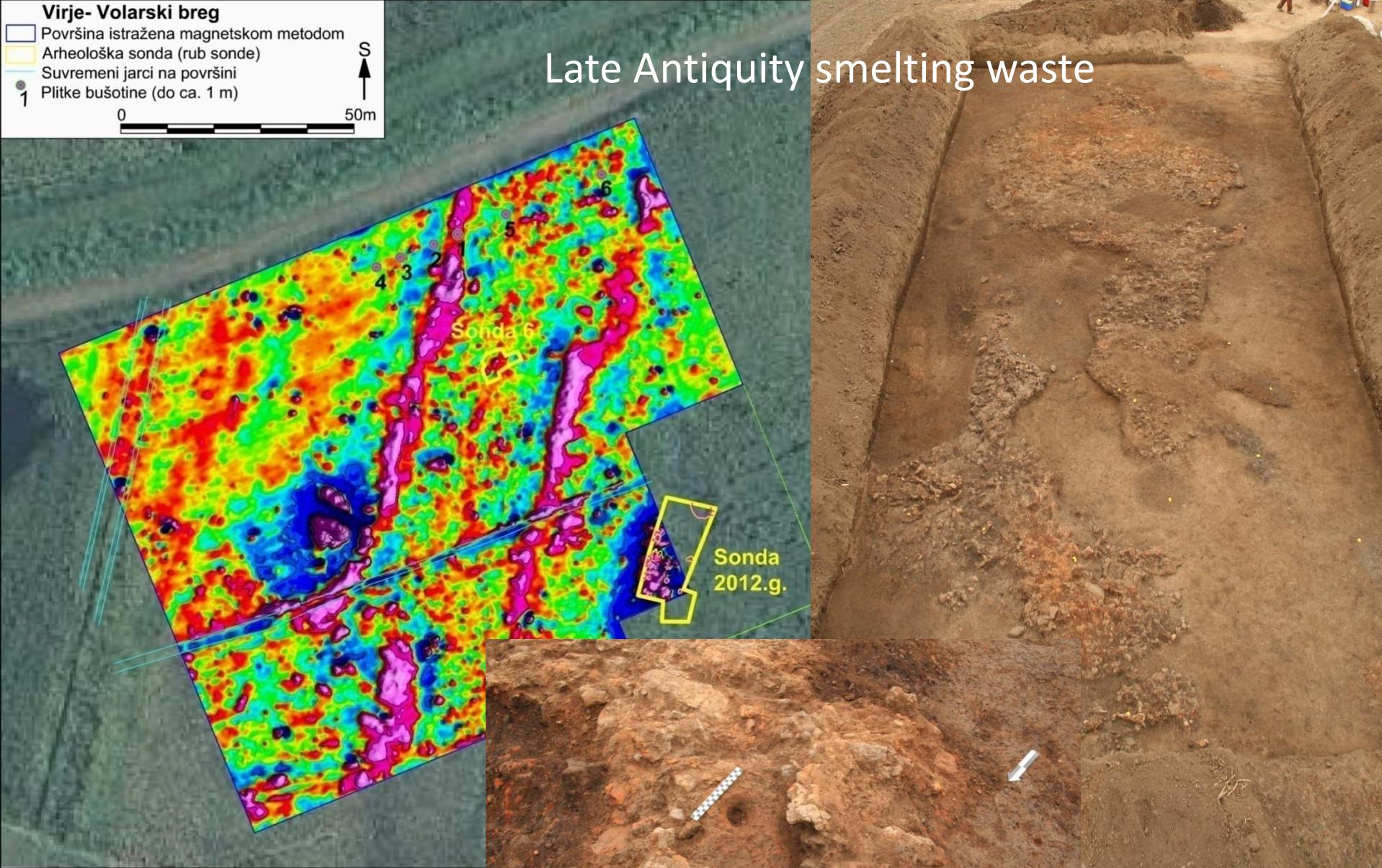
AUTUMN

Virje – Sušine  
October 2014.  
Photo: T. S. Ivančan, IARH

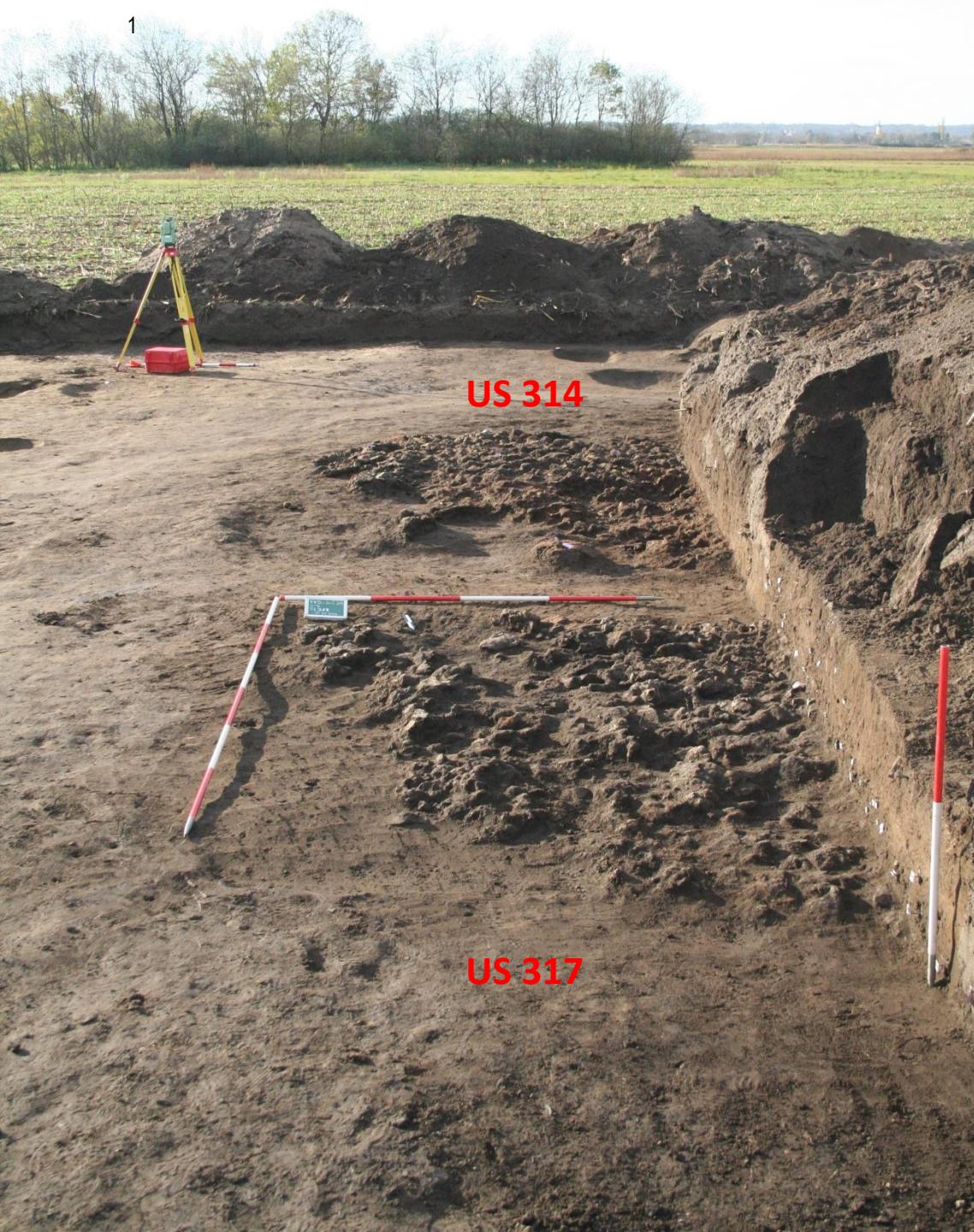


# Virje – Volarski breg and Sušine

- 5 campaigns (2008., 2010., 2012. – 2014.)
- 10 trenches
- Investigated surface of 3561,6 m<sup>2</sup>
- Multi - layered archaeological sites: Ha, Lt, Antiquity, Late Antiquity, Early and High Medieval period, Early Modern period



Virje – Sušine  
2012.



Virje – Sušine 2013.

US 314, Sample No. 190

Beta 374147

Conventional Radiocarbon Age:  
BP  $1620 \pm 30$

**Calibrated Age Cal AD 420**

One Sigma Calibrated result (68 %):

**Cal AD 400-425**

Two Sigma Calibrated result (95 %):

Cal AD 385-475

Cal AD 485-535

Online CalPal: calAD  $456 \pm 5$



Virje – Sušine 2013.

US 314

N – 295

Possibilities:

deciduous trees

- 1) Common Hornbeam (*Carpinus betulus*)
- 2) Wild cherry (*Prunus avium*)
- 3) Alder (*Alnus glutinosa*)

5.0 mm

# Archaeological experiment: Imprints of recent young leaves on wet clay, baked on 600 °C



Virje – Sušine 2013; US 314; N – 295



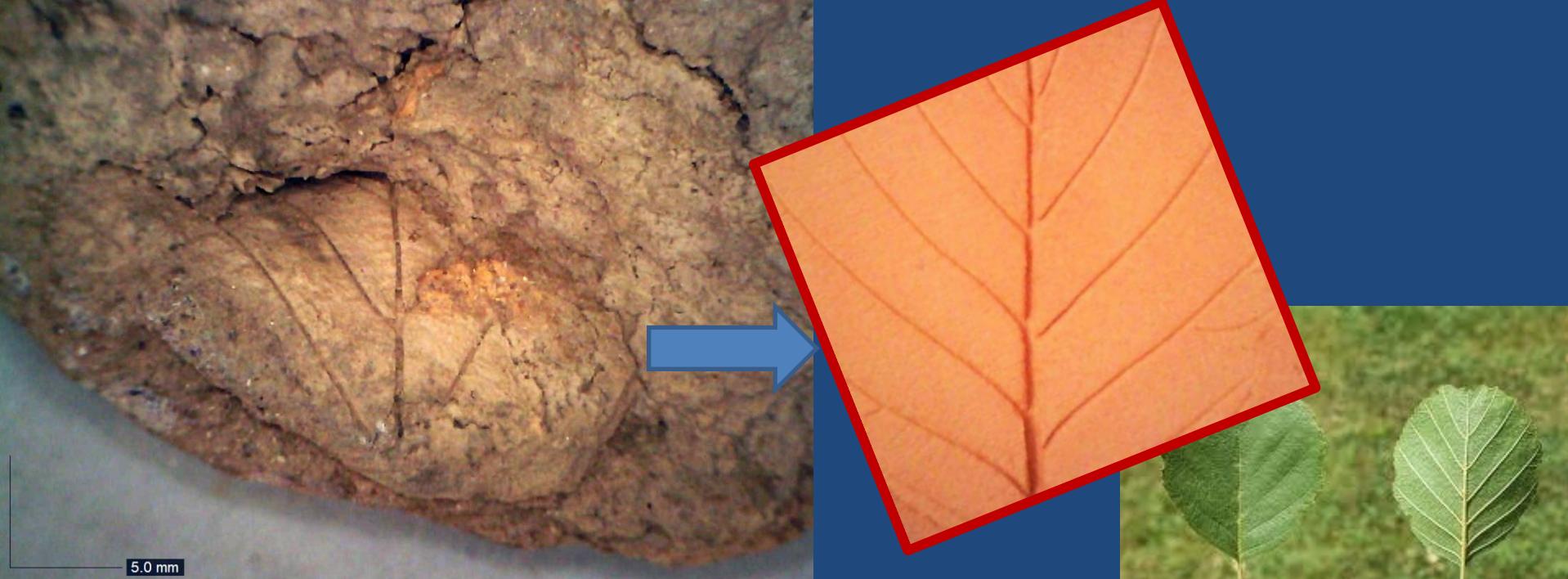
Wild cherry - *Prunus avium*



Alder - *Alnus glutinosa*



Common Hornbeam - *Carpinus betulus*



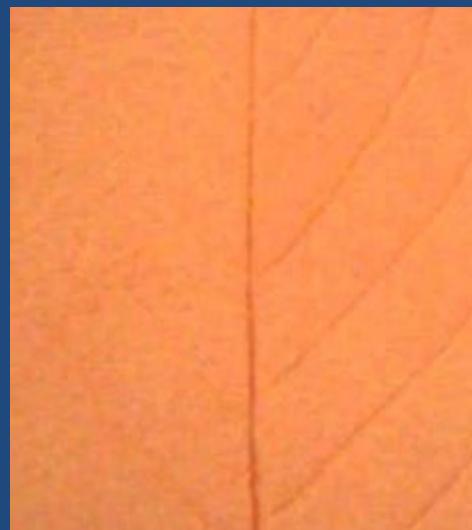
Virje – Sušine 2013; US 314; N – 295



Common Hornbeam (*Lat. Carpinus betulus*)



Alder (*Lat. Alnus glutinosa*)



Wild cherry (*Lat. Prunus avium*)



# Representation of 3 types of wood (Alder, Common Hornbeam, Wild Cherry) within the US on the sites Virje – Volarski breg and Sušine (by M. Culiberg)

No.	Site	Trench	US	Interpretation	Smelting context (Yes/No)	Type of wood	No. of samples	Datation
1	VVB 2008.	S - 1	14a	fence	Yes	Alder (Lat. <i>Alnusglutinosa</i> )	3	Late 8th - late 9th century
2	VVB 2008.	S - 1	95	well	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	2	2nd - 1. st century BC
3	VVB 2010.	S - 2	111	object	No	Alder (Lat. <i>Alnusglutinosa</i> )	3	Second half of 8th - beginning of the 9th century
4	VVB 2012.	S-3	201	feature	Yes	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	2	Late Antiquity context
5	VVB 2012.	S - 3	201	feature	Yes	Alder (Lat. <i>Alnusglutinosa</i> )	2	Late Antiquity context
6	VSUŠ2012.	S - 5	240	feature	Yes	Alder (Lat. <i>Alnusglutinosa</i> )	6	Late Antiquity context
7	VSUŠ2013.	S - 7	317	waste	Yes	Alder (Lat. <i>Alnusglutinosa</i> )	7	Beginning of the 5th century
8	VSUŠ 2013.	S - 7	321	channel/ elongated object	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	1	Late Iron age
9	VSUŠ2013.	S - 7	340	channel	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	2	Modern perion, secondary context
10	VSUŠ 2013.	S - 8	319	object/house	No	Wild cherry (Lat. <i>Prunusavium</i> )	2	8th century
11	VSUŠ 2013.	S - 8	330	fired doub	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	4	Mid 11th - begining of 12th century
12	VSUŠ2014.	S - 10	397	object	No	Alder (Lat. <i>Alnusglutinosa</i> )	2	end of 11 <sup>th</sup> - early 13 <sup>th</sup> century
13	VSUŠ 2014.	S - 10	405	object/artifact	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	6	end of 11 <sup>th</sup> - early 13 <sup>th</sup> century
14	VSUŠ 2014.	S - 10	436	object	No	Common Hornbeam (Lat. <i>Carpinusbetulus</i> )	1	8 <sup>th</sup> century

# Conclusion

Territory of the River Drava Basin was a favourable place for smelting due to natural predispositions of the area – accessibility of raw material (ore) and necessary resources (water, clay, wood)

## Seasonal activity:

- possibilities/availabilities of the extraction of bog iron ore (depended upon the seasons and weather conditions, i.e. water levels) – recognition of deposits within the banks of creeks and on the surface
- Smelting period: not too cold, not too much rain
- Resources: dry wood, low water levels – extraction of clay
- Period of smelting: late spring and summer - young deciduous tree leaf which can be formed in the period from spring to late summer time

A photograph of a wide river or lake under a clear blue sky. The water is calm, reflecting the light. In the foreground, there is a sandy and gravelly beach. The opposite bank is lined with dense trees and bushes. The overall scene is peaceful and natural.

**Thank you for your attention!**