

# Pottery production in prehistoric cultures of Croatian and Austrian Danube regions

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## Bilateral Croatian – Austrian Project:

# Pottery production in prehistoric cultures of Croatian and Austrian Danube regions



**Mileusnić, M. ; Wriessnig, K. ; Kudelić, A. ; Miloglav, I. ; Grzunov, A. ;  
Ottner, F. ; Mayrhofer, M.; Durn, G. ; Borojević-Šoštarić, S.**

## **Rudarsko-geološko-naftni fakultet Sveučilišta u Zagrebu**

Mileusnić, M. Grzunov, A. Durn, G. ; Borojević-Šoštarić, S.



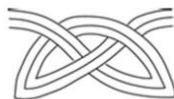
## **Universität für Bodenkultur, Institut für angewandte Geologie**

Wriessnig, K. ; Ottner, F. ; Mayrhofer, M.



## **Institut za arheologiju**

Kudelić, A.



## **Filozofski fakultet Sveučilišta u Zagrebu**

Miloglav, I.



## **Goals:**

to determine the availability and types of raw materials and the reconstruction of technological processes at selected archaeological sites

## **Purpose:**

to determine to what extent Danube can be seen as a unique area in prehistoric times

- (1) did the exchange of material goods included the exchange of technology (at the level of cultural horizon or at the level of smaller communities), or it is always related to the production center
- (2) to which extent technological processes were conditioned by landscape (availability of raw materials), economic or social factors (matter of choice).

# Spatial context



Arhiva Gradskog muzeja Vinkovci  
voditeljica istraživanja: dr.sc. Ivana Iskra Janošić

# Temporal context

Neolithic

Copper age

Bronze age

Iron age

Hallstatt

1500-800 BC

Turopolje i Podravina

1400-1150 BC

Virovitica

Tell Damića Gradina i Ervenica

cca. 5000-4000 BC

2860-2480 BC

5. – beginning 3. c. BC

Sopot

Baden Vučedol

Vinkovci

Bosut La Tené

3630-3500 BC

2460-2200 BC

sec. half of 2. – 1. c. BC

Steps in archaeoceramic investigations	Objectives
<b>Typological classification and statistical analysis</b>	<ul style="list-style-type: none"> <li>• easier orientation during processing material and forming typology of the vessels</li> </ul>
<b>Chronological - typological analysis</b>	<ul style="list-style-type: none"> <li>• set ceramic material in the spatial and temporal context at the level of cultural groups</li> </ul>
<b>Macroscopic analysis of technology</b>	<ul style="list-style-type: none"> <li>• determine the composition and type of clay pastes and to determine pottery production techniques and methods of final processing vessels</li> <li>• determine firing methods</li> </ul>
<b>Archaeometry</b>	<ul style="list-style-type: none"> <li>• <b>Determine composition of ceramics – firing method; raw material</b></li> </ul>
<b>Experimental archaeology</b>	<ul style="list-style-type: none"> <li>• <b>experimental studies</b></li> </ul>
<b>Ethnoarchaeology</b>	<ul style="list-style-type: none"> <li>• ethnographic analogies</li> </ul>

## Types of analyses

### **Mineralogical analysis:**

- . X-ray diffraction (XRD)
- . Fourier transform infrared spectroscopy (FTIR)

### **Petrographic analysis:**

- . Thin section optical microscopy

### **Thermal analyses:**

- . differential scanning calorimetry - DSC
- . thermogravimetry – TG

### **Grain size analysis:**

- . wet sieving
- . sedimentation analysis (sedigraph)

### **Chemical analysis**

- . Inductively coupled plasma mass spectroscopy (ICP-MS)
- . inductively coupled plasma optical emission spectrometry (ICP-OES)





# NEXT PRESENTATION!

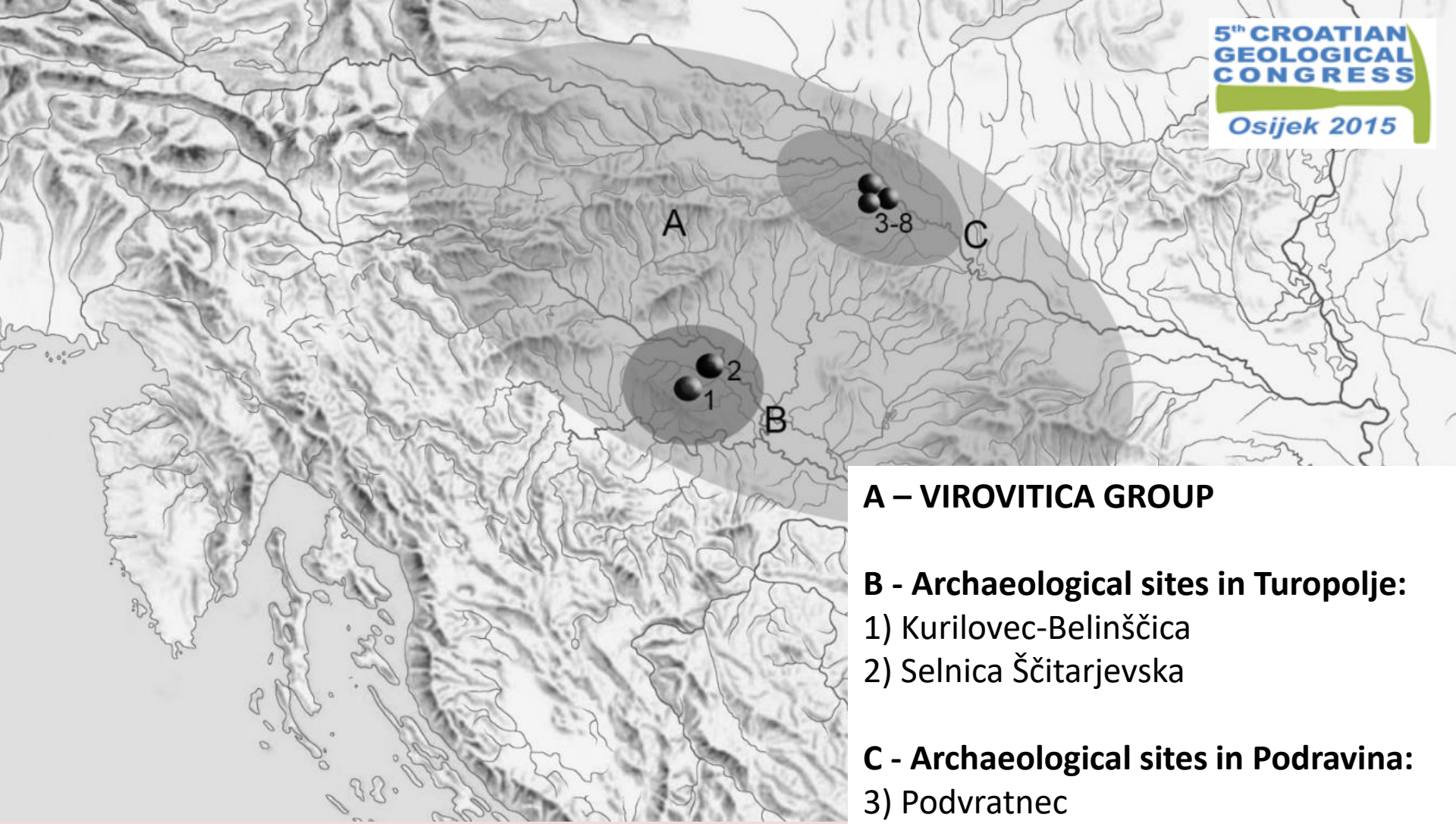


Samples:  
30 ceramic sherds  
4 clayey sediments  
4 experimental  
ceramic

About 1,000 miles (1,609 km) across



About 1,000 miles (1,609 km) across



**A – VIROVITICA GROUP**

**B - Archaeological sites in Turopolje:**

- 1) Kurilovec-Belinščica
- 2) Selnica Ščitarjevska

**C - Archaeological sites in Podravina:**

- 3) Podvratnec
- 4) Vratnec
- 5) Podgorica
- 6) Podpanje
- 7) Močvar
- 8) Jablanec

**Samples:**

26 ceramic sherds

8 clayey material

21 experimental ceramics

# PRELIMINARY CONCLUSIONS:

## 1) Raw material

- local material

## 2) Preparation of clay paste

- clays refined by decantation  
- addition of temper material, dominantly grog!

## 3) Shaping of vessels

- combination of coiling, slab building, pinching

## 4) Firing conditions

- temperatures: 600-850°C  
- firing atmosphere: oxidisable to oxidisable/reducible

# VISIT POSTER: P-43

## Bronze Age pottery in NW Croatia – raw materials and technology

Brončanodobno lončarstvo u SZ Hrvatskoj – sirovine i tehnologija

Andreja Kudek, Marta Mikušević, Adriana Grzunović, Karin Wriessing, Maria Mayerhofer, Franz Otterl

Institute of Archaeology, Uspjenjska cesta 12, HR-20000 Zadar, Croatia  
Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Ferićevegačest 6, HR-10000 Zagreb, Croatia  
Institute for Rock and Soil Mechanics, Institute for Engineering Geology, Peter Jordanovačest 70, A-1070 Vienna, Austria



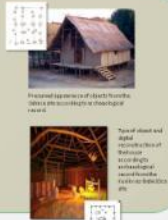
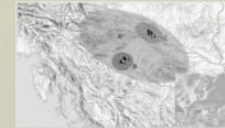
5<sup>th</sup> CROATIAN GEOLOGICAL CONGRESS

Osijek 2015

23-25. september 2015.  
Osijek, CROATIA

### INTRODUCTION

A Bronze Age pottery technology in the area of Tarupole (Sava valley) and Podravina (Drava valley) in northwest Croatia has been studied. The main goal of this study is to determine the availability and types of raw materials, as well as reconstruct the technological processes (preparation of raw material and firing techniques) of pottery making. The study was carried out on ceramic material from the settlements remains on the sites Kraljevec-Belačica and Selava in Tarupole and Podravac, Vratiec, Podgorica, Podgorac, Mobar and Jarkovac in Podravina. For the purposes of this study clayey material was collected (potential raw material) from the vicinity of archaeological sites. The pottery found within the remains of Bronze Age settlements belongs to the cultural group Vinčka, which dates to the period from the 15th to the 12th century BC.



### MATERIALS AND METHODS

THE COURSE OF THE POTTERY ANALYSIS OPERATIONAL SEQUENCE

Typological classification and statistical analysis	Objective
Chronological- typological analysis	<ul style="list-style-type: none"> <li>define ceramic material in the spatial and temporal context on the level of cultural groups</li> </ul>
Macroscopic analysis of technology	<ul style="list-style-type: none"> <li>determine the composition and type of clay paste and determine pottery production techniques and methods of their processing (coils)</li> </ul>
Archaeometry	<ul style="list-style-type: none"> <li>determine composition and origin of the raw material and temper</li> </ul>
Experimental archaeology	<ul style="list-style-type: none"> <li>experimental studies</li> </ul>
Ethnoarchaeology	<ul style="list-style-type: none"> <li>ethnographic analogies</li> </ul>

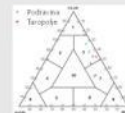


### ARCHAEOOMETRY

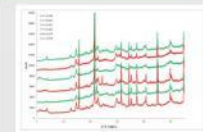
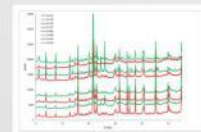
Type of analysis
Mineralogical analysis: X-ray diffraction (XRD)
Texture analysis: scanning electron microscopy (SEM)
Petrographic analysis: Thin section optical microscopy
Thermal analysis: differential scanning calorimetry (DSC)
Thermogravimetry (TG)
Grain size analysis: wet sieving
Surface analysis: scanning electron microscopy (SEM)
Textural analysis: Inductively coupled plasma atomic emission spectrometry (ICP-AES)
Inductively coupled plasma optical emission spectrometry (ICP-OES)



### RESULTS

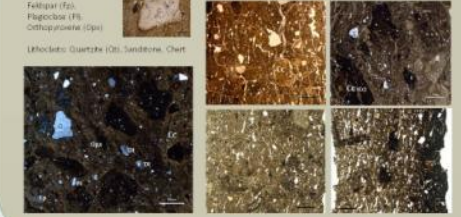


Samples of clay materials from the vicinity of the archaeological sites were collected. Comparison between the data obtained from the analysis of the archaeological remains suggests that local clay can be used for pottery making in this type of site. It is determined that the local clay material from Tarupole is typical of the Vinčka group. Clay material from Podravina is clay of the Vinčka group.



**Composition of clay material**  
Chertyolite (Ch),  
Quartzite (Qtz),  
Feldspar (Fs),  
Fluorapatite (Fp),  
Orthopyroxene (Opx)

**Temper added to clay paste**  
Ceramic debris (Cd) – grog  
Organic material – visible in the form of pores and voids



### CONCLUSION

#### OPERATIONAL SEQUENCE OF POTTERY PRODUCTION



Samples:  
36 ceramic sherds (each culture 6)  
2 clayey material

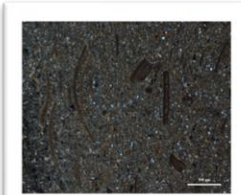
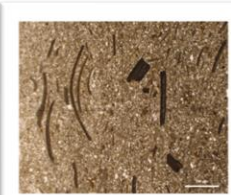


About 1,000 miles (1,609 km) across

Bosut La Tené



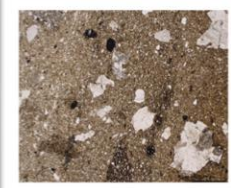
Gradski muzej Vinkovci



Vinkovci



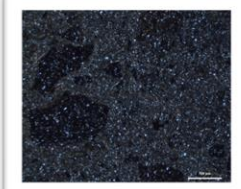
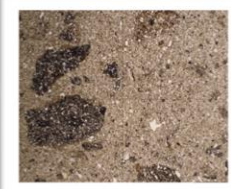
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Vučedol



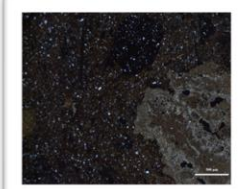
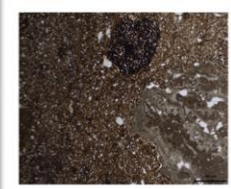
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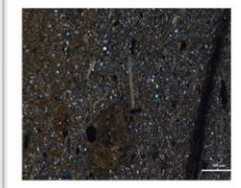
Sopot



Muzej Slavonije Osijek



Gradski muzej Vinkovci



# PRELIMINARY CONCLUSIONS:

## 1) Raw material

- should be local material

## 2) Preparation of clay paste

- big difference between cultures

VISIT POSTER: P-42

### Preliminary investigations of changes in pottery technology through prehistory on the tell site Damića gradina

Ina Miloglav<sup>1</sup>, Marta Mileusnić<sup>2</sup>, Adriana Grzunov<sup>2</sup>, Karin Wriessnig<sup>3</sup>, Maria Mayrhofer<sup>3</sup>, Franz Ottner<sup>3</sup>

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5<sup>th</sup> CROATIAN GEOLOGICAL CONGRESS Osijek 2015

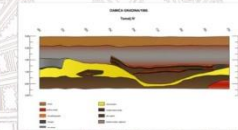


Universität für Bodenkultur Wien



#### Introduction

Archaeological site Damića gradina is situated in the centre of Stari Biljevozi in eastern Slavonia. Extensive archaeological excavations were conducted by Vinkovci Town Museum in 1980, when an important cultural horizon was identified on the site. This multi-layered tell site represents a very good example of continuous settlement on one place from the Neolithic to the beginning of the Roman period. It was occupied during Sopot, Baden, Vučedol, Vinkovci and Eozot cultures and ends with fortified settlement in the last phase of the middle La Tène period (second half of the 1st. century).



#### Aims and methods

Pottery, as other handmade artefacts, reveal a social context of man in the past – his behaviour and activities, as well as the social, economic and political context. The main goal of the study was reconstruction of technological processes of pottery production on tell site Damića gradina from different cultures who lived in the same place during ca. 6000 years and who have used the same raw material. This type of analysis requires interdisciplinary approach and the cooperation of scientists from two completely different areas, natural sciences (geology) and the humanities (archaeology).  
 Technology of pottery production is considered:  
 (1) preparation of clay paste (mixing of clay with different temper material)  
 (2) modeling techniques  
 (3) firing methods  
 (4) styles of decoration  
 The purpose of investigation was to determine different cultural recipes and to define to which extent technological processes were conditioned by economic, social or traditional factors, i.e. to which extent they were matter of choice because the influence of the landscape (availability of raw materials) is reduced to the minimum.

#### Material and methods

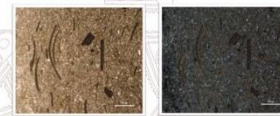
The sherds for analysis are sampled from vessels of known type (pot, bowl, cup, jug), from different parts of the vessel (base, body, rim) and different surface treatment (polished and deep textured fragments).  
 Samples of possible raw material (clayey material) is collected at several locations in the proximity of the archaeological site. Detailed mineralogical (XRD – ceramic sherds and clayey material), petrographic (optical microscopy – ceramic sherds), grain size (wet sieving and sedimentation using sedgepump – clayey material) and chemical analyses (ceramic sherds and clayey material) were performed.



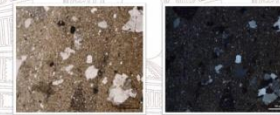
Examples of the sampled sherds

#### Preliminary results

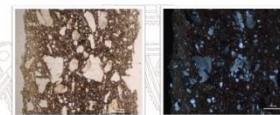
Preliminary results suggests different recipes in pottery making which can be recognizable as potter's technological choice (a.9). Temper, or inclusions that have been artificially added to the clay, plays very important role in defining technological styles. Adding different kinds of temper with different size of particles may result in different thermal and physical properties of clay and fired pottery vessel. Technological choice of the potter is also related to the functional properties of the finished vessel: for cooking, storing or serving food so the necessary performance characteristics of the vessel are thermal shock resistance, strength and toughness to survive transport storage or high level of porosity.  
 Based on the analyzed data differences in clay matrix are very recognizable between some cultures (but as temper was added only in Sopot (a) and La Tène culture (f) while in the pottery sherds from Eneolithic period (Baden, Vučedol, Bronze Age (Vinkovci) and Early Iron Age (Eozot culture) is missing: (argil, or crushed pottery sherds, together with organic material is the most common temper intentionally added in the clay since the Neolithic. It can be observed as cultural (traditional) choice as well as technological (related to the function of the vessel); (argil has a lower thermal expansion coefficient than clay so it is usually added to the cooking pots to increase thermal stress resistance. In the analyzed sherds argil is added in the pottery from Baden, Vučedol, Vinkovci and Eozot culture with the most predominant quantity in the Vučedol culture (c). Adding different amount of argil and different size of its particles in the pots showed certain differences in the clay mixture in comparison to bowls. Pots display a larger quantity of argil and its particles are coarser in comparison with bowls. This variability suggests that the utilization of argil in the Vučedol culture was technological choice related to the functional use of a pot as a vessel for thermal processing of the food. Significant amount of larger quartz grains are characteristics of Vinkovci (d) and Eozot (e) culture. Quartz sand is probably intentionally added to the clay paste.  
 Sampled clayey material is clayey silt consisting mainly of quartz, calcite, phyllosilicate, K-feldspar, illite material, smectite, kaolinite and small amount of chlorite. Differences are also visible in firing conditions – while in Neolithic we have oxidation firing in the Copper and Bronze Age vessels are fired in reduction atmosphere. Styles and decoration differentiated from each other regarding different cultural changes, trends, and traditions.



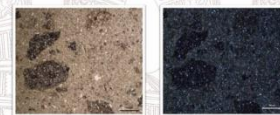
f) La Tène culture



e) Eozot culture



d) Vinkovci culture



c) Vučedol culture



b) Baden culture



a) Sopot culture

Archaeometric analyses were conducted in the frame of the bilateral Croatian-Croatian project "Pottery in prehistoric culture, with an emphasis on the Hallstatt culture, in the Croatian and Austrian Danube Region".

## **OUTLOOK:**

Tell Damića Gradina and tell Vinkovci (eastern Slavonia)

Span of cultures (from 7000 – 2000 years before present)

In addition to answering question „where?” and „how?” – test the dating using rehydroxilation





**THANK YOU FOR YOUR ATTENTION**

