

# Network in Eastern European Neolithic and Wetland Archaeology

Scientific Cooperation between Eastern Europe and Switzerland

Albert Hafner  
Ekaterina Dolbunova  
Andrey Mazurkevich  
Yana Morozova  
Goce Naumov  
Ebbe Nielsen  
Pavlo Shydlovskyy  
Valentina Todoroska (eds.)





# **Network in Eastern European Neolithic and Wetland Archaeology**

**Scientific Cooperation between Eastern Europe and Switzerland**

Albert Hafner

Ekaterina Dolbunova

Andrey Mazurkevich

Yana Morozova

Goce Naumov

Ebbe Nielsen

Pavlo Shydlovskiy

Valentina Todoroska (eds.)



Project's Title: Network in Eastern European Neolithic  
and Wetland Archaeology for the improvement of field techniques and  
dating methods (NEENAWA)



Funding: Swiss National Science Foundation  
Project No IZ74Z0\_160469



<sup>b</sup>  
UNIVERSITÄT  
BERN

Project management: Prof. Dr. Albert Hafner  
Institute of Archaeological Sciences, Prehistory  
University of Bern  
Switzerland

#### Impressum

Series ISSN: 2297- 8607  
DOI 10.7892/boris.146724  
e-ISBN: 978-3-03917-017-3 (e-print)  
ISBN: 978-3-03917-016-6

Editors: Albert Hafner and Caroline Heitz  
Institute of Archaeological Sciences, Prehistory  
University of Bern  
Mittelstrasse 43  
CH-3012 Bern



This work is licensed under a Creative Commons 4.0 International  
Licence.

English language editing: Amelie Alterauge, Ariane Ballmer  
Layout: Designer FH in Visual Communication Susanna Kaufmann

Photograph (front page): Diving below the platform of the reconstruc-  
ted pile-dwelling settlement at Lake Ohrid, Ploča Michov Grad, North  
Macedonia (photo: Marco Hostettler; University of Bern, 2017)

Photograph (back page): Underwater photograph of wooden piles at  
Lake Ohrid, Ploča Michov Grad, North Macedonia (photo: Johannes  
Reich; University of Bern, 2018)



## Acknowledgements

We would like to thank:

- the Swiss National Science Foundation (SNSF) for the generous support of the SCOPES Institutional partnership project “Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating methods (NEENAWA)”, SNSF project number IZ74Z0\_160469 in the years 2015-2018;
- the participants of the various workshops and field-weeks;
- the speakers of the public lectures and the contributions to various scientific conferences held within the project.

We would also like to thank:

- Jasmine Parker who created the logo of NEENAWA;
- Dr. Martin Mainberger from TERAQUA, Staufen i. Brsg., Germany (training facility for scientific divers) and Micho and Jovan Sekuloski from Amfora Dive Center in Ohrid, Ploča, North Macedonia for conducting the scientific diver training of NEENAWA participants at Lake Ohrid in autumn 2017;
- the NI Institute for the Protection of Monuments of Culture and Museum-Ohrid, North Macedonia, for their support;
- the directorate and staff of the Kaniv Nature Reserve of Taras Shevchenko National University of Kyiv, Kaniv, Ukraine for their kind hospitality and hosting the NEENAWA final conference in September 2017;
- the directorate and staff of the National Historical and Ethnographic Reserve «Perejaslav», Perejaslav, Ukraine, for exciting guided museums and sightseeing excursions.

Many thanks go to Amelie Alterauge and Dr. Ariane Ballmer for editing the numerous manuscripts and to Susanna Kaufmann for the graphic design of the booklet (all Institute of Archaeological Sciences of the University of Bern).



SWISS NATIONAL SCIENCE FOUNDATION



DIVING CENTER  
**AMFORA**  
OHRID MACEDONIA



## Foreword

The aim of this book is to document the activities performed during and arising from the Institutional Partnership of the NEENAWA (Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating methods) project. Over the course of four years, public lectures, research exchanges, organization of workshops, conferences and scientific sessions led to an intense transfer of knowledge between the involved researchers. This book can be considered as a contemporary historical document, how Swiss and Eastern European researchers from Russia, North Macedonia and Ukraine came together in the scope of the NEENAWA partnership. Activity and experience reports keep record of the various actions and events that took place in the partner countries but they also witness to the scientific and structural development of wetland and underwater archaeology in Eastern Europe. Even beyond the partner countries, contacts were established and intensified with other Eastern European states (e.g. Greece, Albania, Lithuania).

During the intense weeks spent together on excavations, excursions or in seminars, friendships developed apart from close scientific collaborations. For both the partners as well as the participants, NEENAWA has been an enriching and fruitful experience. The structural changes affecting institutions or individual researchers reflect important steps in their development and career.

A special emphasis was put on the integration of undergraduate students; many of them continued their scientific career in archaeology, with a special focus on the topics taught during the project. The international collaboration between students ultimately resulted in independent research projects.

Most importantly, during the project, an understanding and appreciation of cultural and structural differences, but also similarities was gained by all involved participants. What started as cooperation between institutions, ended as an equal partnership to the gain of prehistoric archaeology in general and wetland archaeology in particular.

### Disclaimer

The editors assume no responsibility or liability for any errors or omissions in the content of this book. The authors are responsible for the content of their individual contributions. The opinions, views and ideas expressed in this book are solely those of the authors. The editors do not endorse any such opinions, view and ideas, and cannot independently verify and have not verified the accuracy of the information presented.

The information contained in this book is provided on an «as is» basis with no guarantees of completeness, accuracy or quality.

The choice of names or spelling of names used in this volume reflects in no way any sympathy for a particular political or national orientation. Transliteration of Cyrillic names into English was done by the individual authors and might therefore vary between contributions.



# Table of Contents

<b>Acknowledgements</b>	<b>3</b>
<b>Foreword</b>	<b>4</b>
<b>Part I: INTRODUCTION, FRAMEWORK</b>	<b>9</b>
<b>I.1 The NEENAWA Project</b>	<b>10</b>
Editors	
<b>I.2 SCOPES: Scientific Cooperation between Eastern Europe and Switzerland</b>	<b>12</b>
<b>I.3 Output, Dissemination</b>	<b>13</b>
<b>I.4 Center for Prehistoric Research</b>	<b>18</b>
Goce Naumov	
<b>I.5 Centre for Underwater Archaeology</b>	<b>20</b>
Yana Morozova	
<b>I.6 Th. Vovk Center for Paleoethnological Research</b>	<b>21</b>
Pavlo Shydlovskiy	
<b>I.7 Annual Field School of the State Hermitage Museum Saint Petersburg</b>	<b>23</b>
Ekaterina Dolbunova, Andrey Mazurkevich	
<b>I.8 Conclusion and Programmatic Statement</b>	<b>24</b>
Albert Hafner	
<b>Part II: ACTIONS</b>	<b>27</b>
<b>II.A.1 Pile-dwellings of North-Western Russia</b>	<b>28</b>
Andrey Mazurkevich	
<b>II.A.2 Report on Activities during Sertaya Fieldweek</b>	<b>35</b>
Albert Hafner	
<b>II.A.3 Palaeoenvironmental Changes in the Serteya Region (NW Russia)</b>	<b>39</b>
Piotr Kittel, Andrey Mazurkevich	
<b>II.A.4 Bone, Antler and Teeth Items in the Dnepr-Dvina Area (NW Russia)</b>	<b>51</b>
Anna Malyutina	
<b>II.A.5 Field Conservation of Waterlogged Organic Archaeological Finds</b>	<b>62</b>
Natalia A. Vasilyeva	
<b>II.B.1 Wetland Archaeology in Macedonia</b>	<b>80</b>
Goce Naumov	
<b>II.B.2 Report on Activities Skopje and Ohrid</b>	<b>87</b>
Goce Naumov, Valentina Todoroska, Albert Hafner	
<b>II.B.3. Dendrochronology: A Vision of Possibilities</b>	<b>93</b>
John Francuz	
<b>II.B.4 SUISS Hydra – a GPS-based Surveying Device Used</b>	<b>105</b>
Andreas Mäder	

<b>II.C.1 Lake Ohrid 2017, Course “European Scientific Diver”</b>	<b>111</b>
Johannes Reich, Lea Emmenegger, Marco Hostettler, Corinne Stäheli, Martin Mainberger	
<b>II.D.1 Regional Introduction: Neolithic of Ukraine</b>	<b>115</b>
Pavlo Shydlovskiy, Yana Morozova	
<b>II.D.2 Report on Activities in Kyiv 2016-2017</b>	<b>127</b>
Pavlo Shydlovskiy, Yana Morozova	
<b>II.D.3 Kyiv Conference – The Organiser’s Experience</b>	<b>131</b>
Marta Andriiovych	
<b>II.D.4 Student Participation in a Conference in Kiev/Kaniv</b>	<b>135</b>
Gjore Milevski	
<b>Part III: KNOWLEDGE TRANSFER, SCIENTIFIC EXCHANGE 2015–2018</b>	<b>137</b>
<b>III.1 Internship at the Laboratory for Dendrochronology at the City of Zurich</b>	<b>138</b>
Andrej Machkovski	
<b>III.2 Participation in the Excavation at Burgäschi, Switzerland</b>	<b>140</b>
Gjore Milevski, Aleksandar Murgoski	
<b>III.3 22<sup>nd</sup> Neolithic Seminar at the University of Ljubljana, Slovenia</b>	<b>142</b>
Goce Naumov	
<b>III.4 Journée thématique: Wetland settlements in Europe</b>	<b>143</b>
<b>III.5 Workshop “Formation and Taphonomy of Archaeological Wetland Deposits”</b>	<b>144</b>
Ekaterina Dolbunova, Andrey Mazurkevich	
<b>III.6 Session “Settling Waterscapes in Europe” in EAA Conference in Vilnius</b>	<b>145</b>
Ekaterina Dolbunova, Andrey Mazurkevich, Albert Hafner	
<b>III.7 International Open Workshop: The Creation of Landscapes V</b>	<b>152</b>
Pavlo Shydlovskiy, Ekaterina Dolbunova	
<b>III.8 Neolithic Seminar at the University of Bern</b>	<b>153</b>
Goce Naumov, Pavlo Shydlovskiy	
<b>III.9 Research Stays at the University of Bern</b>	<b>157</b>
Goce Naumov	
<b>III.10 International Summer School in Pelagonia</b>	<b>160</b>
Goce Naumov	
<b>III.11 Students experience reports</b>	<b>162</b>
Johannes Reich, Corinne Stäheli, Lea Emmenegger, Marco Hostettler, Helena Wehren, Noah Steuri, Dmytro Zhelaha, Ivan Radomskiy	



<b>Part IV: EPILOGUE 2018-2020</b>	<b>171</b>
<b>IV.1 A Keen Look into the Past: the Archaeology of Lakes and Bogs</b>	<b>172</b>
Albert Hafner, Martin Hinz	
<b>IV.2 PhD Project: The Neolithic Ceramic from the Mariupol Type Cemeteries</b>	<b>175</b>
Marta Andriiovych	
<b>IV.3 Postdoc Project: From the Mediterranean to the Black Sea</b>	<b>177</b>
Olha Demchenko	
<b>IV.4 ERC-Synergy Project EXPLO</b>	<b>178</b>
Albert Hafner, Ariane Ballmer	



*Overview of the Bay of Bones site with reconstructed pile dwelling  
at Lake Ohrid, Ploča Mičov Grad, North Macedonia  
(photo: Marco Hostettler; EXPLO, University of Bern, 2019)*



# Part I: INTRODUCTION, FRAMEWORK



## I.1 The NEENAWA Project

The “Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating methods” (NEENAWA) was an Institutional Partnership (IP) project between four archaeological heritage management and research institutions in Switzerland, Russia, North Macedonia and Ukraine. Project partners were the Institute of Archaeological Sciences of the University of Bern (Switzerland), the Department of the Archaeology of Eastern Europe and Siberia at the State Hermitage Museum in Saint Petersburg (Russia), the Taras Shevchenko National University in Kyiv (Ukraine) and the Center for Prehistoric Research in Skopje (North Macedonia). The project was led by Prof. Dr. Albert Hafner of the University of Bern together with colleagues from the above-mentioned institutions and included activities between 2015 and 2018. The IP consortium consisted of eight members coming from the four concerned countries in an equal way. A good gender and age mix was given (three senior researchers, five junior researchers; five male, three female researchers):

### **Switzerland:**

Prof. Dr. Albert Hafner, University of Bern, full professor for prehistoric archaeology and director, Institute of Archaeological Sciences and Oeschger Centre for Climate Change Research (OCCR).

Prof. Dr. Ebbe Nielsen, University of Bern, honorary professor Institute of Archaeological Sciences, member of the working group Palaeoecology and Oeschger Centre for Climate Change Research (OCCR), vice-director of the Cantonal Archaeology unit Lucerne.

### **North Macedonia:**

Asst. Prof. Dr. Goce Naumov, Goce Delcev University, Stip, lecturer.

Valentina Todoroska BA, Archaeological Museum of Struga, underwater archaeologist in pile-dwelling sites.

### **Russia:**

Prof. Dr. Andrey Mazurkevich, The State Hermitage Museum, senior scientific researcher, general curator of the Department of Archaeology of Eastern Europe and Siberia.

Dr. Ekaterina Dolbunova, The State Hermitage Museum, junior scientific researcher, curator of the Department of Archaeology of Eastern Europe and Siberia.

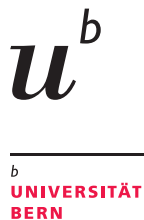
### **Ukraine:**

Yana Morozova MA, Taras Shevchenko National University of Kyiv, head of the university laboratory "Centre for Underwater Archaeology, Archaeological and Ethnological Research", archaeological heritage protection.

Prof. Dr. Pavlo Shydlovskyy, Taras Shevchenko National University of Kyiv, Department of Archaeology and Museum Studies, associate professor, lecturer and specialist in Palaeolithic and Neolithic archaeology.

Funding was provided by the SCOPES programme of the Swiss National Science Foundation (SNSF). The project was focused on the enhancement of scientific infrastructure and training of students and professionals dealing with prehistoric archaeology, especially the Neolithic and the settlements near lakes, rivers and marshes. Neolithic and Bronze Age wetland sites around the Alps (so called pile-dwellings, Pfahlbauten or palafittes in German/French) are of outstanding universal value (UNESCO-world heritage since 2011). Typical sites are located in lakes, rivers and bogs, dating between 5300 and 800 BC. Of common character is the perfect conservation of wood, textiles from plant fabrics and many other organic materials. Larger quantities of sub-fossilized wood, as in the peri-alpine sites, offer the possibility of high-precision dating by dendrochronology. Research in these wetland sites started in the mid-19th century. Through large scale rescue excavations since the 1970s and the evolution of underwater archaeology in the same period, Swiss archaeologists accumulated a thorough experience with these specific sites. Research in wetland sites is shared between cantonal institutions and universities and led to a worldwide unique accumulation of knowledge. Comparable sites exist outside of the Alpine area, but in much smaller quantities. Regions like Russia (small lakes in NW-Russia) and North Macedonia (medium to large size lakes in the border zones of North Macedonia, Albania and Greece) have a high scientific potential; rivers in Ukraine are supposed to have the same type of sites.

The general aims of the IP were to build up a scientific network in Neolithic and wetland archaeology and the transfer of knowledge from Switzerland, as one of the worldwide leading countries in this field, to the participating Eastern European (EE) countries. Further aims were to concentrate on an improvement of archaeological field techniques (mainly underwater archaeology/documentation under water/diving security) and dating methods. Dendrochronology is by far the most precise dating method available, but this method is not yet applied in Russia, Macedonia and Ukraine. The combined application of locally developed dendrochronological calendars and radiocarbon dating is most promising. All EE-sites have the potential to give new insights on the process of the Neolithisation of Europe. In order to achieve these goals, joint activities, such as workshops, seminars, public lectures, field trips, diving courses and study weeks, were organised in the individual countries within framework of the NEENAWA project.





It has been thirty years since the fall of the Iron Curtain that for decades divided Eastern Europe and the Soviet Union from the West. Once the borders had been opened, a period of intensive scientific cooperation with Eastern Europe began. The SCOPES programme was launched in 1990, first on a small scale, but with growing interest further funding schemes were established. It was organised in four-year phases and jointly funded by the Swiss Agency for Development and Cooperation (SDC) and the Swiss National Science Foundation (SNSF). Though rather unusual, this cooperation between a research funding organisation and a development agency has proven fruitful in view of pursuing the dual goals of scientific excellence and developmental support. Until 2016, 'SCOPES' has been supporting scientific collaborations between Switzerland and countries in Eastern Europe in order to boost scientific cooperation between research groups, build research capacities and networks with Swiss research institutions. SCOPES projects often emerged out of existing contacts or networks between individual researchers in Eastern Europe and Switzerland. The programme has offered benefits for both sides: Eastern Europe received funds to carry out research of high quality as well as impulses to reform its science system and generate opportunities for the future. Switzerland in turn benefited from the wealth of knowledge that exists in Eastern Europe. Swiss scientists had the option to expand their network of contacts and increase their international presence in an area of Europe where Switzerland has been underrepresented in the past.

The main funding schemes were Joint Research Projects (JRPs) and Institutional Partnerships (IPs). JRPs were focused on research itself, IPs on the development and modernisation of institutional aspects of research and higher education in Eastern Europe. Research costs were covered only for the participating Eastern European teams, the Swiss research teams obtained a modest lump sum. The financial support from SCOPES was important to improve the salaries of Eastern European researchers, but also to enable research stays abroad and participation in international workshops, conferences and field trips.

Considerable improvements were made within the research institutions in terms of research equipment, information and communication technologies and, to a lesser extent, basic infrastructure, services, libraries and teaching equipment. A large proportion of researchers from Eastern Europe claimed that their handling of new methodologies and approaches in research improved to a great extent. All in all, the Eastern European partners had the impression that the project management skills in their departments had clearly improved, especially communication skills, dissemination of research results, project coordination, reporting and building of networks. Swiss researchers, on the other hand, have benefited from SCOPES by expanding their research network and exploring new research areas. They could establish and maintain presence on site and access up-to-date information. By experiencing the local challenges, awareness and understanding of the project partners' entanglements have arisen, which ultimately led to more successful collaborations. Joint conferences and workshops in the frame of JRPs and IPs have not only led to an intense transfer of knowledge, but also to publications in peer-reviewed international journals.

For many years, SCOPES has provided efficient instruments and mechanisms for encouraging joint research on issues of common interest and for promoting institutional development. In the meanwhile, SCOPES has been replaced with research programmes dedicated to individual partner countries.

## I.3 Output, Dissemination

### Scientific publications

Dolbunova, E., Hafner, A., Nielsen, E., Mazurkevich, A., Dolbunova, E., Naumov, G., Morozova, Y., Shydlovskiy, P. (2015). NEENAWA: Network in Eastern European Neolithic and Wetland Archaeology: first steps. *The European Archaeologist* 46, 68-70.

Mazurkevich, A., Kulkova, M. A., Dolbunova, E. (eds.) (2016). *Radiocarbon Neolithic Chronology of Eastern Europe in the VII-III millennium B.C.* Smolensk.

Naumov, G. (ed.) (2016). *Prehistoric Wetlands and Lakes: bringing forward dendrochronology in archaeology.* Book of abstracts from NEENAWA conference in Ohrid. Skopje: Center for Pre-historic Research.

Terpylovskiy, R.V., Shydlovskiy, P.S. (eds.) (2017). *Human & Landscape : Prehistoric Archaeology of Eastern Europe.* Collection of scientific works. *Vita Antiqua* 9. Kyiv: Center for Paleoethnological Research. <https://doi.org/10.37098/VA-2017-9>

Hafner, A., Brunner, M., Laabs, J. (2017). *Archaeology in Switzerland: research from under water to high-altitude mountains.* *Vita Antiqua* 9, 16-37.

Shydlovskiy, P., Diachenko, A., Dolbunova, E., Hafner, A., Mazurkevich, A., Morozova, Y., Naumov, G., Todoroska, V. (2018). *Prehistoric Networks in Southern and Eastern Europe.* Collection of scientific works. *Vita Antiqua* 10. Kyiv.

Morozova, Y., Shydlovskiy, P. (2018). *STEP AHEAD: NEENAWA 2017 International Scientific Conference report.* *Vita Antiqua* 10, 192-211.

### Academic events

Archaeological field-week "Prehistory and underwater archaeology in Russia. Methods, history and perspectives of underwater archaeology", Serteya, Russia, 09-16.08.2015

International Scientific Conference "HUMAN & LANDSCAPE: Geographical approach in the Pre-historic Archaeology", Kyiv, Ukraine, 03-05.02.2016  
<http://vitaantiqua.org.ua/en/archives/200#more-200>  
<http://vovkcenter.org.ua/en/2016-hl>

Archaeological workshop "Prehistoric Wetlands and Lakes: bringing forward dendrochronology in archaeology", Skopje and Ohrid, North Macedonia, 11-17.05.2016  
<http://www.neenawameeting.cip-cpr.org/pages/program.html>

Scientific Seminar “Neolithic Archaeology in Eastern Europe”, Institute of Archaeological Sciences, University of Bern, Switzerland, 23-30.05.2017 (Hafner, Albert; Naumov, Goce; Shydlovskiy, Pavlo)

[vovkcenter.org.ua/en/2018/02/21/scientific-seminar-neolithic-archaeology-in-eastern-europe/](http://vovkcenter.org.ua/en/2018/02/21/scientific-seminar-neolithic-archaeology-in-eastern-europe/)

International Conference “Wetland Archaeology and Prehistoric Networks in Europe”, Kyiv/Kaniv, Ukraine, 15-18.09.2017

<http://vovkcenter.org.ua/en/2017-wa/>

Workshop “Southeast European and Swiss Network in Wetland Archaeology”, Bern, Switzerland, 02-04.05.2018

## Talks

“Modelling the Processes of Neolithization”, 22<sup>nd</sup> Neolithic Seminar, University of Ljubljana, Slovenia, 06.11.2015

Neolithisation of Pelagonia: chronology and identity of tell societies in the Republic of Macedonia (Naumov, Goce)

“Modelling the Processes of Neolithization”, 22<sup>nd</sup> Neolithic Seminar, University of Ljubljana, Slovenia, 07.11.2015

The first pottery in the communities of hunter-gatherers and long-lasting dawn of Neolithic in Eastern Europe (Mazurkevich, Andrey)

Journée thématique: “Wetland settlements during Neolithic and Bronze Age in Europe”. Trajéctoi-res UMR 8215. Université Paris, Nanterre, France, 11.12.2015

Neolithic wetland settlements of the Alpine foreland (Switzerland, Germany). Evolution, chronology, patterns (Hafner, Albert)

Journée thématique: “Wetland settlements during Neolithic and Bronze Age in Europe”.

Trajéctoi-res UMR 8215. Université Paris, Nanterre, France, 11.12.2015

New results of research on the wetland settlement Serteya II (Mazurkevich, Andrey)

Workshop “Formation and Taphonomy of Archaeological Wetland Deposits”, Amt für Denkmal-pflege & Archäologie, Zug, Switzerland, 28.01.2016

Results of analysis of layers’ formation on Neolithic wetland sites in NW Russia (Mazurkevich, Andrey)

22<sup>nd</sup> Annual Meeting of the European Association of Archaeologists (EAA), Vilnius, Lithuania, 03.09.2016

Wet, wet, wet: Neolithic wetland and lakeside settlements in the Balkans (Naumov, Goce)

22<sup>nd</sup> Annual Meeting of the European Association of Archaeologists (EAA), Lithuania, Vilnius, 03.09.2016

Settling waterscapes in Europe: the archaeology of Neolithic and Bronze Age pile-dwellings (Hafner, Albert; Mazurkevich, Andrey)

## Media relations

### Radio, television

В Смоленской области в бассейне реки Сертеи впервые обнаружены останки людей эпохи неолита, gtrksmolensk, 2015

<https://gtrksmolensk.ru/news/v-smolenskoj-oblasti-v-bassejne-reki-sertei-vpervy/>

Се анализира староста на Заливот на коските, Македонска Радио Телевизија, 2018

TVM ДНЕВНИК, TVM Ohrid , 2018

<http://tvm.mk/video/category/33-dnevnik/2091-tvm-dnevnik-13-06-2018>

### Print media, online media

Подводная археология в Швейцарских Альпах, Нептун (Neptun), 2016

<http://neptunworld.com/2016/02/novyj-nomer-1-za-2016-god/>

Меѓународен собир за водоземна археологија, a1on, 2016

<http://a1on.mk/wordpress/archives/611443>

Научен собир за предисториските заедници, daily, 2016

<http://daily.mk/zabava/nauchen-sobir-predistoriskite-zaednici>

## Follow-up projects

A keen look into the past. The archaeology of lakes and bogs in Russia and Switzerland

SERI Starter Grant, Albert Hafner, Andrey Mazurkevich, Igor Garbuz, 2018-2019.

<https://unige-leadinghouse.ch/projetsarchives/a-keen-look-into-the-past-the-archaeology-of-lakes-and-bogs-in-russia-and-switzerland/>

Swiss Government Excellence Scholarships

PhD project Marta Andriiovych, Kyiv, Ukraine, 36 months, 2018-2021.

Postdoc project Olha Demchenko, Odessa, Ukraine, 12 months, 2019-2020.

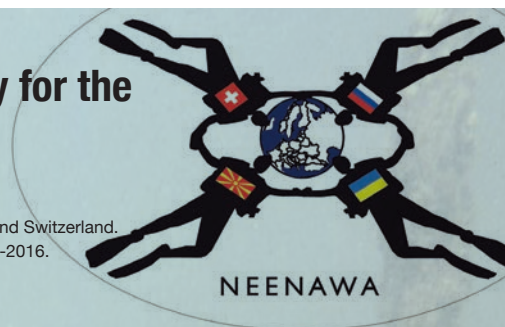
Exploring the dynamics and causes of prehistoric land use change in the cradle of European farming (EXPLO).

ERC-Synergy Grant No. 810856, Universities of Bern, Oxford and Thessaloniki, 2019-2024.

For full output list see: <http://p3.snf.ch/project-160469>

# Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating methods (NEENAWA)

Scientific cooperation between Eastern Europe and Switzerland.  
SCOPE Institutional Partnership program 2013-2016.



**Bern, University of Bern, Main Building,  
lecture room 106, 18:15**

**14. 4. 2016**

**Valentina Todoroska**, National Museum Dr. Nikola Nezlobinski, Struga, Republic of Macedonia  
Archaeological underwater excavations in lakes of Macedonia

**Goce Naumov**, Museum of Macedonia, Skopje, Republic of Macedonia:  
First Farming Societies in Macedonia and the Process of Neolithization.

**6. 10. 2016**

**Pavel Shydlovskiy**, Taras Shevchenko National University of Kyiv, Kiev, Ukraine  
Early agricultural communities of the Southwest Ukraine  
Ранньоземлеробські спільноти Південно-Західної України – ukr.  
Раннеземледельческие общности юго-западной Украины – rus.  
Раните земјоделски заедници во Југозападна Украина – мкд.

**Iana Morozova**, Development and Challenges of Ukrainian Underwater Archaeology  
Развитие и проблемы подводной археологии Украины – rus.  
Розвиток і проблеми підводної археології України – ukr.  
Развиток и предизвици на украинската подводна археологија – мкд.

**10. 11. 2016**

**Andrey Mazurkevich**, The Hermitage State Museum, St. Petersburg, Russia  
Archaeology in The State Hermitage Museum  
Археология в Государственном Эрмитаже.  
Археологијата во Државниот музеј „Ермитаж“

**Andrey Mazurkevich, Ekaterina Dolbunova**, The Hermitage State Museum, St. Petersburg, Russia  
Lacustrine settlements in North-Western Russia (7–3 Millennium BC)  
Озерные поселения Северо-Запада России (7–3 тыс. до н.э.)  
Езерски населби во Северозападна Русија (7–3 милениум п.н.е.)

**u<sup>b</sup>**

UNIVERSITÄT  
BERN

**FNSNF**  
FONDS NATIONAL SUISSE  
SCHWEIZERISCHER NATIONALFONDS  
FONDO NAZIONALE SVIZZERO  
SWISS NATIONAL SCIENCE FOUNDATION

**Kiev, Taras Shevchenko National University of Kyiv,  
Red Building, Volodymyrska 60, room 349**

**4. 2. 2016, 16:00**

**Albert Hafner**, University of Bern, Bern, Switzerland  
Archaeology in Switzerland between lakes and mountains. Public evening lecture within the International Scientific Conference HUMAN & LANDSCAPE: Geographical approach in the Prehistoric archaeology, February 3–5, 2016, Kyiv, Ukraine  
Альберт Хафнер, Бернський університет, Інститут археологічних досліджень, відділ первісної археології, Берн, Швейцарія:

Археологія у Швейцарії: поміж озерами та горами. Вечерня лекція в рамках Міжнародної наукової конференції «ЛЮДИНА ТА ЛАНДШАФТ: Географічний підхід в первісній археології», 3–5 лютого 2016, Київ, Україна  
Археологијата во Швајцари помеѓу езерата и планините. Вечерно предавање во рамки на меѓународната научна конференција ЛУЃЕ и ПЕЈСАЖ: Географски пристап во предисториската археологија, февруари 3–5, Киев, Украина – мкд.

**15. 10. 2016**

**Valentina Todoroska**, National Museum Dr. Nikola Nezlobinski, Struga, Macedonia  
Archaeological underwater excavations in lakes of Macedonia  
Археологічні підводні розкопки в озерних Македонії

**15. 4. 2017**

**Goce Naumov**, Museum of Macedonia, Skopje, Republic of Macedonia:  
First Farming Societies in Macedonia and the Process of Neolithisation.  
Перші землеробські суспільства в Македонії та процес неолітизації

**13./14. 9. 2017**

**Andrey Mazurkevich**, The Hermitage State Museum, St. Petersburg, Russia  
Archaeology in The State Hermitage Museum  
Археология в Государственном Эрмитаже – ukr.

**Andrey Mazurkevich, Ekaterina Dolbunova**, The Hermitage State Museum, St. Petersburg, Russia  
Lacustrine settlements in North-Western Russia (7–3 Millennium BC)  
Озерні поселення Північного Заходу Росії (7–3 тис. до н.е.) – ukr.



## Skopje, Museum of Macedonia/Archaeological Museum of Macedonia

**23. 3. 2016**

**Pavel Shydlovskiy**, Taras Shevchenko National University of Kyiv, Kiev, Ukraine  
Yevgenii Sliesarev, Kyiv-Mohyla Academy, Kiev, Ukraine  
Early agricultural communities of the Southwest Ukraine  
Раните земјоделски заедници во Југозападна Украина

**11. 5. 2016, 12:00**

**Andrey Mazurkevich**, The Hermitage State Museum, St. Petersburg, Russia  
Archaeology in The State Hermitage Museum.  
Археологијата во државниот музеј „Ермитаж“

**11. 5. 2016, 19:30**

**Albert Hafner**, University of Bern, Bern, Switzerland  
Archaeology in Switzerland between lakes and mountains.  
Археологијата во Швајцарија помеѓу езерата и планините

**17. 5. 2016, 12:00**

**Andrey Mazurkevich, Ekaterina Dolbunova**, The Hermitage State Museum, St. Petersburg, Russia  
Lacustrine settlements in North-Western Russia (7–3 Millennium BC).  
Езерски локалитети во Северо-западна Русија (7–3 милениум п.н.е.)

**Lectures in Bern, Kiev and Skopje are in English, lectures in St. Petersburg will be in English with simultaneous translation into Russian.**

**Mac.:** Предавањата во Берн, Киев и Скопје ќе бидат на англиски, додека предавањата во Санкт Петербург ќе бидат на англиски со симултан превод на руски – мкд.

**Rus.:** Лекции в Берне, Киеве и Скопје - на англиском языке, лекции в Санкт-Петербурге - на англиском языке с синхронним переводом на русский язык.

**Uk.r.:** Лекції в Берні, Києві та Скоп'є читатимуться англійською, лекції у Санкт Петербурзі - англійською з синхронним перекладом російською

Neolithic and Bronze Age wetland sites around the Alps are of outstanding universal value (UNESCO-World Heritage since 2011). Typical sites are in lakes, rivers and bogs, dating between 5300 and 800 BC. Around the Alps more than 750 sites exist, whereas Switzerland owns 430. Of common character is the perfect conservation of wood, textiles from plant fabrics and many other organic materials. Larger quantities of sub-fossilized wood offer the possibility of high-precision dating by dendrochronology. Large scale rescue excavations since the 1970ies and the evolution of underwater archaeology in the same period accumulated a thorough Swiss experience with these specific sites. Comparable

## St. Petersburg, The State Hermitage Museum, The Hermitage Lecture Centre, 18:00

**18. 4. 2016**

**Iana Morozova**, Sergey Zelenko  
Development and Challenges of Ukrainian Underwater Archaeology.  
Развитие и проблемы подводной археологии Украины.

**13. 9. 2016**

**Albert Hafner**, University of Bern, Switzerland  
Archaeology in Switzerland between lakes and mountains.  
Озерная и ледниковая археология в Швейцарии.

**07. 10. 2016**

**Goce Naumov**, Museum of Macedonia, Republic of Macedonia:  
First Farming Societies in Macedonia and the Process of Neolithization  
Первые земледельческие общества в Македонии и процесс неолитизации

**15. 3. 2017**

**Valentina Todoroska**, National Museum Dr. Nikola Nezlobinski, Struga, Macedonia  
Archaeological underwater excavations in lakes of Macedonia  
Археологические подводные раскопки в озёрах Македонии

**2017**

**Pavel Shydlovskiy**, Taras Shevchenko National University of Kyiv, Kiev, Ukraine  
Neolithic communities of Middle Dnieper region  
Неолитические общности Среднего Приднепровья

sites exist outside of the Alpine area, but in smaller quantities. Regions like Russia (small lakes in NW-Russia) and Southern Balkans (medium size lakes in the boarder zone of the Republic of Macedonia, Albania and Greece) have a high scientific potential and rivers in Ukraine are supposed to have the same type of sites. The general aims of this Institutional Partnership is to build up a scientific network in Neolithic and Wetland Archaeology and the transfer of knowledge from Switzerland, as one of the worldwide leading countries in this field, to the participating Eastern European countries. The further aims are to concentrate on an improvement of archaeological field techniques and dating methods.



Center for  
Prehistoric Research

## I.4 Center for Prehistoric Research

One of the major achievements of the NEENAWA project was the establishment of the Center for Prehistoric Research (CPR), the first organization of archeologists in North Macedonia entirely focused on prehistory and wetland archaeology. The lack of the particular study of tell sites in wetlands and pile dwellings in Macedonian archaeology revealed a necessity for a more scientifically based implementation of current archaeological methods and consequently a group of archaeologists that will incorporate such principles in their research and promote them in North Macedonia. Therefore, with the support of the SNSF, the project group succeeded to make a significant step forward in improving the knowledge on prehistory and wetland archaeology by organizing courses, lectures, conferences and workshops, and sending students and professionals to broaden their scientific horizons in Switzerland, Russia and Ukraine. Gradually, CPR became involved in many other projects and established collaborations with institutions from Serbia, Slovenia, Czech Republic, Poland, Spain, Switzerland, Germany, Italy and Russia. These collaborations contribute to a further thorough research of cultural heritage associated with wetlands and lakesides and to the promotion of archaeological science in North Macedonia.

The Center for Prehistoric Research is dedicated to the study and presentation of all prehistoric periods in the Balkans and North Macedonia in particular. Considering the rich cultural heritage from this period, CPR's primary goal is to enable a thorough understanding of life of prehistoric communities while applying numerous scientific methods. CPR's members are archaeologists who study different aspects of the Paleolithic, Neolithic, Chalcolithic, Bronze Age and Iron Age period. Within their activities, archaeological sites are being studied and presented, as are the material culture, chronology and the geographical features of prehistory, so they could be interpreted applying the current theoretical models. Apart from the research activities, CPR organizes scientific round tables, workshops, lectures and conferences that actualize the problems of prehistoric archaeology. Moreover, CPR publishes editions that present the latest knowledge regarding the prehistoric cultural heritage in North Macedonia.

CPR cooperates with several domestic and international institutions and creates a platform for a future networking in projects that will thoroughly examine and present the prehistoric period. Within these cooperations students and young professionals are being trained through inclusion in field research, lab analyses, expert publications and public scientific events. As a result of these activities, CPR significantly impacts the application of new scientific approaches and ethical norms in the Macedonian archaeology. Thus, by presenting the cultural heritage through research, scientific debates and publications, CPR has a direct influence over the popularization of prehistory and the protection of sites and material culture from this period. CPR's aim is to enhance the cooperation among experts and institutions that will strengthen the scientific ethics and the research methods applied in prehistoric archaeology.

Lately, CPR has been involved in the excavation of two tells and one pile-dwelling; geomagnetic scanning of ten settlements and survey of about hundred archaeological sites. Reports and theoretical scientific articles regarding all these activities were published in Macedonian and in international journals and edited books. Moreover, the aforementioned research encompassed digital topographic measurements and 3D site modeling. Besides field work, radiocarbon, zooarchaeological, archaeobotanical and lithic use-ware analyses were being made with the collaborators from various countries, to be followed by isotopic, paleodemographic, anthropological and geological analyses, as well as analysis of lipids found on vessels.

Besides the individual cabinet research of neolithization, ceramography, semiotics, human presentations, funerary archaeology and the hominid evolution, through international cooperation CPR members also perform a photogrammetric 3D documenting of archaeological finds and architecture. These results were presented at two exhibitions in Serbia and Italy, where CPR was invited to present the prehistoric figurative art as well.

As previously mentioned, CPR also organizes lectures and conferences. The conference entitled 'Neolithic in Macedonia' had five editions so far, while the event 'Prehistoric Wetlands and Lakes' lasted a week and consisted of a conference, lectures, workshops and diving. Numerous lectures of distinguished European archaeologists were organized within educational activities, but also CPR members held lectures at the universities of Bern, Ljubljana, Vilnius, Modena, Kiev, Koper, Zurich and the Hermitage Museum in Saint Petersburg. Moreover, CPR members held seminars on Macedonian prehistory for Swiss and Slovenian students; the field research in Pelagonia also encompasses a training of Czech and Swiss students. Macedonian students had the opportunity to get acquainted with new archaeological methods in Switzerland, Russia and Ukraine, so they could implement their latest experience in their future scientific work. A prestigious European course for scientific diving was also organized, which provided licenses for underwater archaeology for participants from Macedonia and abroad.

Publishing is one of CPR regular activities, resulting in five publications so far. The edited book 'Neolithic in Macedonia' was published in five volumes and composes of articles presented at the conferences with the same name. The conference 'Prehistoric Wetlands and Lakes' resulted in publication of a leaflet with abstracts. In 2017, CPR published two monographs: (a) Macedonian bronzes by Nikos Čausidis and (b) Grnčarica by Darko Stojanovski, both significant contributions to the insight of Neolithic and Iron Age in Macedonia and the Balkans. Upon an invitation of the German Archaeological Institute, there was an exchange of publications focused on prehistory, so numerous Macedonian editions can now be found in their libraries, but also rare European magazines, journals and monographs are to be found in the library of CPR.

All activities have been successfully performed due to the excellent cooperation with the Archaeological Museum of Macedonia and the museums in Prilep, Bitola, Ohrid, Skopje and Štip, as well as due to the research performed with the Institute of Old Slavic Culture in Prilep, the Universities of Bern and Basel, BioSense Institute, Hermitage Museum, University of South Bohemia, Principat Krakow, University of Kiev, Spanish National Research Council, Free University of Berlin, Archaeological Museum of Udine and the German Archaeological Institute. Due to the collaboration with these institutions, there is much more thorough insight of the Macedonian prehistory that opens completely new scientific horizons.

CPR continues with the intense activities in all aspects, i.e. research, publication and education. Lectures and use-wear analyses are commenced with the colleagues from the Spanish National Research Council in several Macedonian museums and also the trainings in Macedonia and in Switzerland continue, as well as the organization of lectures and conferences, publication of a monograph and an edited book, participation at international conferences, giving guest lectures, but also prospection, geomagnetic scanning and excavation of prehistoric sites in the regions of Pelagonia and Ohrid, followed by analyses of vessels, figurines, tools, animal, human and organic remains with our collaborators from the aforementioned Macedonian and European museums and universities. CPR members are convinced that fruitful research will continue in the following years that will provide a plethora of new information regarding prehistory in Macedonia.



Yana Morozova, Taras Shevchenko National University of Kyiv

## I.5 Centre for Underwater Archaeology

There is only one educational organization which combines both research and educational programmes on underwater archaeology in Ukraine: the Centre for Underwater Archaeology (CUA). The Centre was founded within the National Taras Shevchenko University of Kyiv in 1991. It is a research and educational university unit that focuses mainly on nautical archaeology throughout the Black Sea region and underwater archaeology in Ukraine in particular. The main aim of the CUA is to involve students, amateurs, sport divers and members of the general public in maritime archaeological field excavations and surveys, as well as educate them regarding this fascinating field and the preservation of underwater resources. Here they can study theory, methodology and the techniques of underwater archaeology, and acquire practical experience during summer excavations.

The Centre is currently carrying out its overview learning and training programmes for first year students, as well as developing a master's curriculum, which is a part of the general master's course in archaeology at the Department of Archaeology and Museum Studies. In addition, lectures on underwater archaeology are given to all interested members of the general public – amateur and professional divers alike. After attending the theoretical portion of the programme, they can actively participate in underwater archaeological expeditions carried out by the Centre. The expeditions are a very important part of the educational programme. While participating, the students who attended prior preparatory lectures and training sessions can implement their knowledge and practice their skills in a hands-on environment. For those participants who do not have a diving certification, attending the practical and theoretical classes provided by CMAS certified dive instructors is an excellent opportunity to obtain one.

The Centre works in close cooperation with the scientific committee of CMAS and the Ukrainian Federation of Underwater Sport and Underwater Activities.

Another significant undertaking of the Centre is the Underwater Archaeology Summer Field School. The field school participants learn how to excavate underwater and how to handle, preserve and record artifacts in the field. Students learn the practical aspects of underwater archaeology by taking part in the underwater excavation of the shipwrecks. All activities are held in shallow water under the supervision of professional underwater archaeologists and dive masters. Students are given lectures and are taken on excursions to various places of Ukraine.

Further information: <https://www.facebook.com/CUAKNU/>



## I.6 Th. Vovk Center for Paleoethnological Research

The “Th. Vovk Center for Paleoethnological Research” is a non-governmental organization, founded in 2015. It groups young researchers: students, alumni and young scientists who have gathered together for solving scientific, education and heritage protection problems in contemporary archaeological, anthropological, and ethnological research and other adjacent disciplines. Young researchers are engaged in interdisciplinary investigations of human collectives’ activities and how they connected to the natural and cultural environment in the past. The Center is affiliated with the Department of Archaeology and Museum Studies of Taras Shevchenko National University of Kyiv, Ukraine.

Membership in the Center can be only voluntary and individual. According to the regulations, that young scientist can be a person up to 35 years of age. Statutes foresee that members of the Center above 35 years of age can be scientific consultants, if they have considerable scientific achievements.

The main tasks of the Center’s activity are archaeological research of prehistoric sites on the territory of Ukraine, popularization of the scientific results, preservation and protection of the cultural and natural heritage. Also, the Center strives to represent Ukrainian culture and nature, and to integrate Ukrainian social studies worldwide.

### **Tasks which the Center sets itself:**

- Overcoming segregation in modern science, which is mirrored in the official institutions, and because of the high specialization research is becoming increasingly isolated from society. Because of this, paleoethnology provides integrated approaches to the study of historical events using the methods of natural sciences and humanities.
- Carry out complex studies of ancient societies to demonstrate relationships between human communities themselves and with the environment at different stages of historical development. Development of new ideas and views on modern society through the study of the history of its formation.
- Following the principles of research ethics in studies, which provides a complete rejection of dogmatism, indoctrination, authoritarianism and falsification of facts. Instead, in priority are the principles of teamwork, universalism, unselfishness and verification of the findings.
- Be actively involved in the process of protection of cultural and natural heritage in the territory of Ukraine through direct participation and in cooperation with state administration, scientific and other non-governmental organizations.
- Exchange the experience in field and laboratory research with colleagues from abroad; use international experience in the field of protection of cultural and nature heritage;
- Organizational joining the European and world organizations, whose purpose is the study and protection of monuments of prehistoric culture and environment.

Its members actively participate in field research on archaeological sites and reconstruction of living activities of prehistoric societies in their environmental context. The worldwide-known Mezhyrich site, an Upper-Paleolithic settlement of mammoth hunters, is one of the most interesting sites which the members of the Center have been investigating for a long period.

They also investigate archaeological sites of the Neolithic and Trypillya archaeological cultures. Such archaeological sites of the Neolithic - Bronze Age in the territory of Eastern Europe are of great interest for scientists in the context of the spread of agriculture and new technologies in the early Holocene. Already amazing discoveries have been made in the Middle Dnieper and Dniester



basins, and exploration goes on. Every year the Center's specialists carry out investigations of prehistoric sites of the Dniester river valley – Bernashivka, Vasylivka, and Ozheve. These sites demonstrate different stages of development of the Trypillian-Cucuteni cultural unity. The Center is involved in international cooperation and exchange of experiences in field and laboratory research. Its members organize exhibitions, take part in the international conferences with presentations, and work with their colleagues from abroad on the archaeological collections and data. Archaeologists and students from the Center participate in international projects and programs, and seek any good opportunity to gain and share knowledge in the field of protection and study of cultural heritage in future projects.

Recent activities of the Center are:

- organizing the exhibition “Ukrainian-French cooperation in the investigation of the Palaeolithic sites of Middle Dnieper region”,
- publishing a book “Prehistoric archaeology of Lower Desna region”,
- providing a course of video lectures “Popular Anthropology” etc.

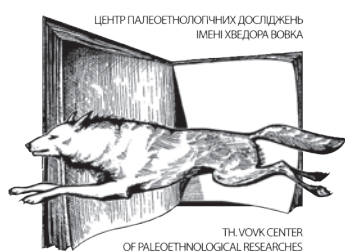
Since 2016, the Center is founder and publisher of the periodical scientific journal VITA ANTIQUA.

**More information:**

<http://vovkcenter.org.ua/en/main/>

<http://vitaantiqua.org.ua>

<https://www.facebook.com/th.vovk.center>



## **I.7 Annual Field School of the State Hermitage Museum Saint Petersburg**

The State Hermitage Museum is one of the leading archaeological centres in Saint Petersburg as well as in Russia as a whole. In 1850, interest in excavations led to the formation of the Imperial Archaeological Commission, which reported directly to the Ministry of the Imperial Court. This Commission made a huge contribution to the organisation and development of archaeology across Russia. After the 1917 Revolution, the Archaeological Commission became a separate institution but the Hermitage continued to support and conduct archaeological expeditions. Today, archaeological research is one of the museum's key areas of activity and the geographical reach of the excavations it runs or participates in is vast. Twenty Hermitage expeditions conduct excavations in the south, northwest and central regions of Russia, in Siberia and the Altai, Crimea, in Ukraine, Uzbekistan, Tajikistan, Kyrgyzstan, Kazakhstan and Italy. They work on sites dating from the Neolithic Age, Antiquity and the medieval period. The museum also conducts archaeological research of its own territory. Expedition strategy is determined by the museum's Archaeological Commission, headed by its Director.

The latest field-schools were conducted by the North-Western archaeological expedition of the State Hermitage Museum in the archaeological microregions of the Serteya River, Smolensk region, and Sennitsa and Usviaty lakes, Pskov region, both North-Western Russia. Here, pile-dwellings existed in the 4th - 3rd millennium BC, located nowadays under water and in peat bog. Since it is important to transfer knowledge and skills of excavation and conservation to the younger generation of researchers, the central part of the field school is devoted to the excavation and documentation of archaeological remains and structures. Besides, the field work is also accompanied by lectures and practical work in the field laboratory. The excavation campaign usually lasts two months.

## I.8 Conclusion and Programmatic Statement

The 2015-2018 NEENAWA Institutional Partnership (IP) was the first and only SCOPES-funded project in the field of archaeological sciences. Up to this time, Swiss research was practically not engaged in Eastern Europe. With this IP important contacts could be made, and an extensive, sustainable Eastern European-Swiss network was established.

The IP project brought together the project partners in Eastern Europe and complements in the best way possible the strategic goals of the University of Bern to fulfill the role of a hub for archaeological research on prehistoric wetland sites in lakes and bogs. While Switzerland has been a leader here for decades, wetland archaeology in Eastern Europe is still in its infancy and will offer great scientific potential in the future. Before the IP project there were only very loose contacts in the Eastern European partner countries. As a result of the two workshops held in 2018, contacts were made with other countries, in particular the Baltic States, Belarus and Russia, but also Albania, Bulgaria, Serbia and Slovenia. In addition, a Starter Grant from the Swiss-Russian Science and Technology Cooperation, supported by the Swiss State Secretariat for Education, Research and Innovation, Leading House University of Geneva, was approved as of 27 June 2018 and was used to set up a Swiss-Russian summer school project in 2019. The NEENAWA IP can be regarded as extremely successful, especially with regard to the partners in North-East Europe (Russia, Ukraine) and the Balkans (North Macedonia). These contacts have meanwhile expanded into the larger Baltic region including Belarus and Finland as well as the Balkans region including Bulgaria, Albania and Greece. In regards to transition, the Eastern European partners are taking enormous steps forward by engaging in the IP-funded topics “improvement of field techniques and dating methods”, in particular the introduction of dendrochronology and improvements and the documentation of sites underwater and in bogs.

The activities described in this volume were to document and make available this intensive cooperation and the diverse exchange between the project partners and the emergence of a functioning network, i.e. from the introductory build-up phase up to the execution of the research and establishment of organization structures. The IP project was absolutely exemplary and is regarded by many Eastern European researchers as a unique form of support for the transition. It is therefore highly desirable that these four intensive years and the many activities are synthesized and presented in one compilation. At the same time, the activities were also intended to bring the efforts and research results of the scholars involved and the great commitment of the SNSF closer to a larger audience.

The documentation of the IP also takes on a political dimension. One consequence of the NEENAWA IP, for example, is the cooperation of archaeological research centres in the southern Balkans: archaeological research in the countries of North Macedonia, Greece and Albania tended to be rather isolated in previous years. Thanks to the connecting activities within the framework of NEENAWA events and the resulting contacts, an active exchange is now taking place for the first time, resulting in striking research outcome. All participants emphasize that the mediating role of the NEENAWA project played a decisive role in this. The documentation of these diverse activities would capture the great impact of the project, inspire other Eastern European countries and thus carry the development work of Swiss research beyond the duration of the project and not least also document the generous and targeted funding by the SNSF in the Eastern European areas of transition.



Fig. 1: Excursion during Serteya field-week, Russia (photo: Andrey Mazurkevich, 2015)



Fig. 2: Visit of the Bay of Bones site at Lake Ohrid, North Macedonia (photo: Albert Hafner, 2016)



Fig. 3: Excursion to the Ukrainian flood-plains in Kaniv Nature Reserve, Ukraine (photo: Liga Palma, 2017)





Excavation and diving at the pile dwelling site of Serteya II, Western Russia (photo: Andrey Mazurkevich, The State Hermitage Museum, Saint Petersburg, 2016)



## Part II: ACTIONS



## II.A.1 Pile-dwellings of North-Western Russia

Lake sites of the forest zone of Eastern Europe constitute a part of ancient European history. Huge European territories did not comprise isolated areas, where ancient societies lived. The whole territory was pierced by cultural, trade and social relations. Such sites situated in the basin of the Upper Western Dvina River were found in the beginning of the 1960s by A. M. Miklyaev (Микляев 1969; 1995). Nowadays 30 pile-settlements in total are known in this region (fig. 1). A unique culture of pile-dwelling sites was formed here at the end of 4th mill. BC. Pile-dwellings were erected on waterlogged lake shores, occupied the most favorable parts of the landscape, mostly suitable for various economical activities. Settlements were constructed in riverside waterlogged areas, on the border of broad-leaved and coniferous forests. This location allowed conducting all-year round hunting, fishing and gathering of edible and medical plants, as well as plants, which were used for fiber preparing and organic colorant making (Mazurkevich, Dolbunova 2011a). Since the second half of the 4th mill. BC, the western part of the forest zone of Eastern Europe was under a constant influence from European cultures with productive economy. Ancient communities started to use gradually new economic strategies – agriculture and cattle-breeding. Few finds of bones of domesticated animals (horse, cattle, sheep and goat) testify it. Well situated places for settlement allowed to organize cattle grazing and cultivate small fields with cereals (*Cerealia*), whose pollen can be traced in palynological diagrammes. Such advantageous combination of different economical activities and richness of natural resources of the chosen ecological niche allowed ancient people to conserve their complex economy, based on an effective foraging economy, for a long time (Mazurkevich et al. 2009; 2010).

The appearance of pile-dwellings occurred at the moment of a very serious climatic change, on the border of Atlantic and Subboreal periods. Climate became cooler, the water level decreased (up to 2.5 m lower than modern one), the littoral zone became overgrown and waterlogged, and the water surface of the lakes decreased. The productivity of lakes and, probably, the whole ecological niche decreased. That is why the appearance of pile-dwellings can be regarded as a form of adaptation to environment, which appeared almost simultaneously in similar landscape conditions on the territory of Middle and Eastern Europe (Dolukhanov, Mazurkevich 2000; Mazurkevich et al 2009).

Long-term excavations of peat-bogs and underwater excavation of pile-dwellings allow making their reconstructions. The main information was gathered during underwater excavations of the site Serteya II (fig. 1,2) in Smolensky region, dated to the first half - middle of 3rd mill. BC. (Mazurkevich, Dolbunova 2011b; Mazurkevich 2013).

The constructions consisted of rectangular platforms of about 7 by 4.5 m, attached to piles with the aid of ropes (pieces of rope made from bilberry rhizome are often found pressed in the piles) and supported from below by 'horned' piles. The basis of the platform consisted of logs 9 to 12 cm in diameter, oriented west-east. Poles of 5 to 8 cm in diameter were densely laid on the logs in transverse position. Treated pine slabs about 6 cm thick were placed above at right angles to the poles. A layer of moss lay above, strewn with coarse-grained white sand 8 cm thick. A hearth situated on sand was formed with big stones laid out in a circle about 53 cm in diameter. Nowadays it looks like sand layer, full with small charcoals, calcined bones, fish and animal bones, pottery fragments, flint and bone tools, are lying in several layers, which are divided by the remains of wooden platforms made from bark and rods (fig. 3).



Some of the piles were pillars serving as the basis of the walls. These pile-pillars were made of tree trunks 8, 9, 10, 12, 14, 16, 18 and more than 20 cm in diameter. The walls could have been made of branches cleaned from lateral branches (fig. 3). A large amount of the latter was found in the cultural layer, generally lying near rows of piles. Pile-pillars large in diameter were installed mainly at the corners of the platform; pairs of pile-pillars smaller in diameter were placed between them along the perimeter. Parts with sandy filling for hearths were strengthened with pile-pillars and supports. Spruce and ash were generally used to make the piles, more rarely pine, elm, maple, oak, willow, birch and poplar (Колосова, Мазуркевич 1998). Also, fragments of eaves and slabs with a lateral support for floors and beams with holes were found.

The platforms were encircled by rubbish dumps full of kitchen waste located along one of the short walls and adjacent parts of long walls. Garbage could have been placed in baskets, their fragments were found on the bottom of garbage piles. The characteristics of garbage piles testify that they were flooded and were washed out later when the level of water increased, and dwellings were moved on dryer and higher places. In garbage piles, among kitchen debris (waternut, chestnut shells and acorns, animal and fish bones, shells, pottery fragments, flint flakes), there was also a fragment of net made from bilberry. Absence of finds and garbage under the remains of wooden floors, inside the dwellings, might be the evidence of raised floors. One of the most interesting artefacts found here are small fragments of tissue made from wooden fibers, represented by different details of garments.

Several dwellings existed simultaneously on the site. However, the sites have not yet been fully excavated, and the real amount of constructions cannot be identified precisely now.

Besides year-round basic settlements, seasonal sites were also investigated. One of the most interesting is Serteya I. This is the place of a specialized fishing activity, that existed during several millenniums according to the radiocarbon dates, made on the parts of different fishing constructions and objects found here (Mazurkevich et al. 2017). The remains of fishing nets and wooden fishing constructions, which locked a narrow stream, were found here (Долбунова 2014).

The chronology of pile-dwellings may be reconstructed based on stratigraphical, palynological and radiocarbon data (Микляев 1995; Зайцева и др. 2003; Mazurkevich et al. 2017). Numerous artefacts were found during underwater excavations, which can be attributed to Usviatskaya, Zhizhitskaya and North-belorussian culture.

The appearance of bearers of different western European cultures from different territories occurred in the western part of Eastern Europe at different time. It could have, probably, had a "wave" character and coincide with significant climatic changes in Europe. New-comers adapted rather successfully in the local milieu in this part of forest zone. It can be traced by the existence of "veil" of Funnel beaker, Globular amphorae and Corded ware cultures in local material culture. There are also evidences of different cultural connections with Balkan-Carpathian region in the middle of III mill. cal. BC. They can be traced by the appearance of vessels with flat bottom and trays, vessels with flattened bottoms and imitations of trays. New types of pottery appeared as well – ladles with round bottom and a wide handle, attached to the rim. This type of pottery is not typical at all for the forest zone of Eastern Europe. Clay stamps, similar to stamps of early-agricultural civilizations of the Balkans and Near East, can be also found among the materials of these sites (Мазуркевич 2007; Mazurkevich 2013).

Flint daggers, made on long blades, appeared in material culture of pile-dwellings in Dnepr-Dvina region at the beginning of 3rd mill. BC, short tanged daggers appeared in the middle of 3rd mill. BC (Mazurkevich 2013). The chronology of these types of daggers coincides with chronology of similar types of weapon on the territory of Middle Europe.

Advance to the east of community-bearers of Corded ware culture traditions was particularly important, and this process started from the middle of the 3rd mill. BC. It can be traced by numerous finds of different types of battle axes, and finds of their imitations, which were made from fragile stone rocks, for ex. gneiss, revealed on these sites. Appearance of copper and bronze artefacts at sites in the Western part of forest zone can be related with the appearance of bearers of these cultures.

Art objects, different adornments made from amber, bone and animal teeth provide information about artistic tastes of builders of pile-dwellings, as well their social organization (Микляев, Мазуркевич 1994; Mazurkevich 2013). Only one small burial ground is known for the moment, which is synchronous to pile-dwellings on the site Udviaty I, attributed to burial of Corded ware culture (Микляев 1969). Also there are human bones, sometimes with traces of cannibalism, on the sites.

Sites with materials attributed to middle-late Neolithic pile-dwelling cultures can be also found on the lake Sennitsa (Микляев 1990; Долбунова, Мазуркевич 2013). Nowadays ten multilayer sites are known here, dated to early-late Neolithic, named Dubokray I-X. All these sites were located on elevated parts of the relief of the lake bottom, between which there were depressions. During recent time, some non-utilitarian stone constructions were also found, dated to the end of the existence of pile-dwellings. Several groups of big stones were found on the site Dubokray I. These stones are organized in a circle in its central part with lines of stones coming from this circle. The central part of the site was excavated; a big stone and smaller stones were found nearby, as well as accumulation of charcoals, flint tools, axe-chisel, lots of different vessels. Charcoal was dated to  $3690 \pm 50$  (Ле – 9537) BP. The major part of the material is found on the elevated central part of the site. This megalithic stone construction is located beyond the borders of pile-dwellings.

Similar construction was found on the site Dubokray X, where 83 stones of different sizes (30–80 x 40–60 x 30–50 cm) were uncovered. The stones are organized in two parallel rows in North-western direction, on the most elevated part. Material found here is concentrated in the pit, it includes bone arrowhead, stone polished axe and 11 fragments of 2-3 vessels.

The changes of last decades – natural processes, active human activity – put these sites at risk. Artificial descent of water in 1977 on the lake Sennitsa influenced negatively the remains of pile-dwellings. Piles appeared to be above the water, later in the 1980s the remains of pile-dwellings could have been found on the lake bottom, nowadays these constructions are almost completely destroyed. The placement of the sites can be determined only by material located on the lake bottom.

Further investigations on the lake Sennitsa are determined by a modern state of preservation of these Neolithic sites, which are being rapidly destroyed. Their in situ protection, documentation and preservation of material and objects is one of the aims of our researches.

The lacustrine pile dwellings, which appeared at the first half of the 4th mill. BC, were unique sites among the Middle Neolithic cultures of the forest zone of Northeastern Europe. The territory of pile-dwelling expansion includes the basin of the upper (Serteya II, Usviaty IV, and Dubokrai V) and middle Western Dvina River (sites of the Krivinsky peat bog in the territory of Belarus). To the east and north of the Dnepr–Dvina region, there were sites with Pit–Comb pottery, to the south sites with Rhomb–Pit pottery, and to the west the Late Narva Culture.



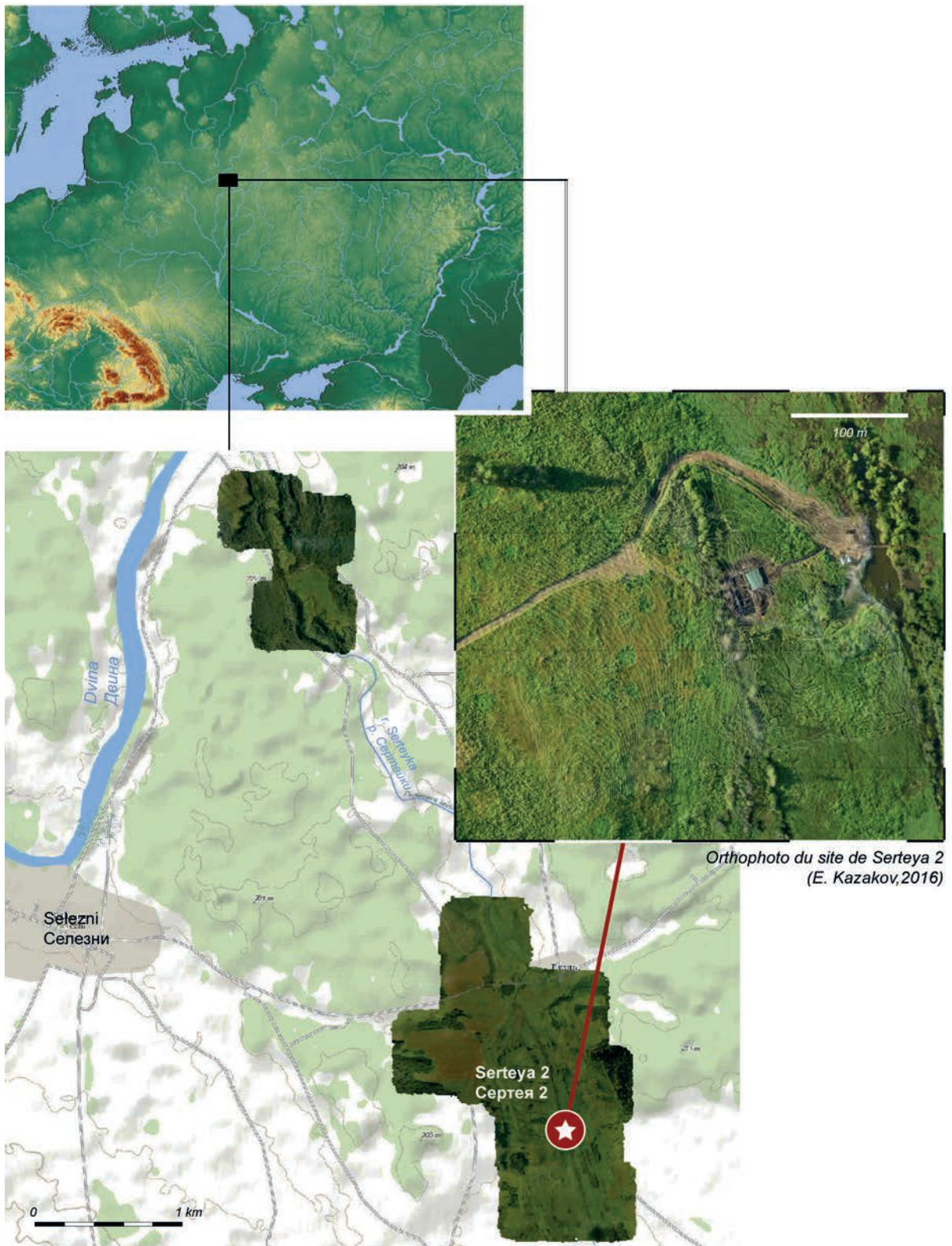


Fig. 1: Location of the Serteya II site in the Western Dvina River basin (NW Russia)

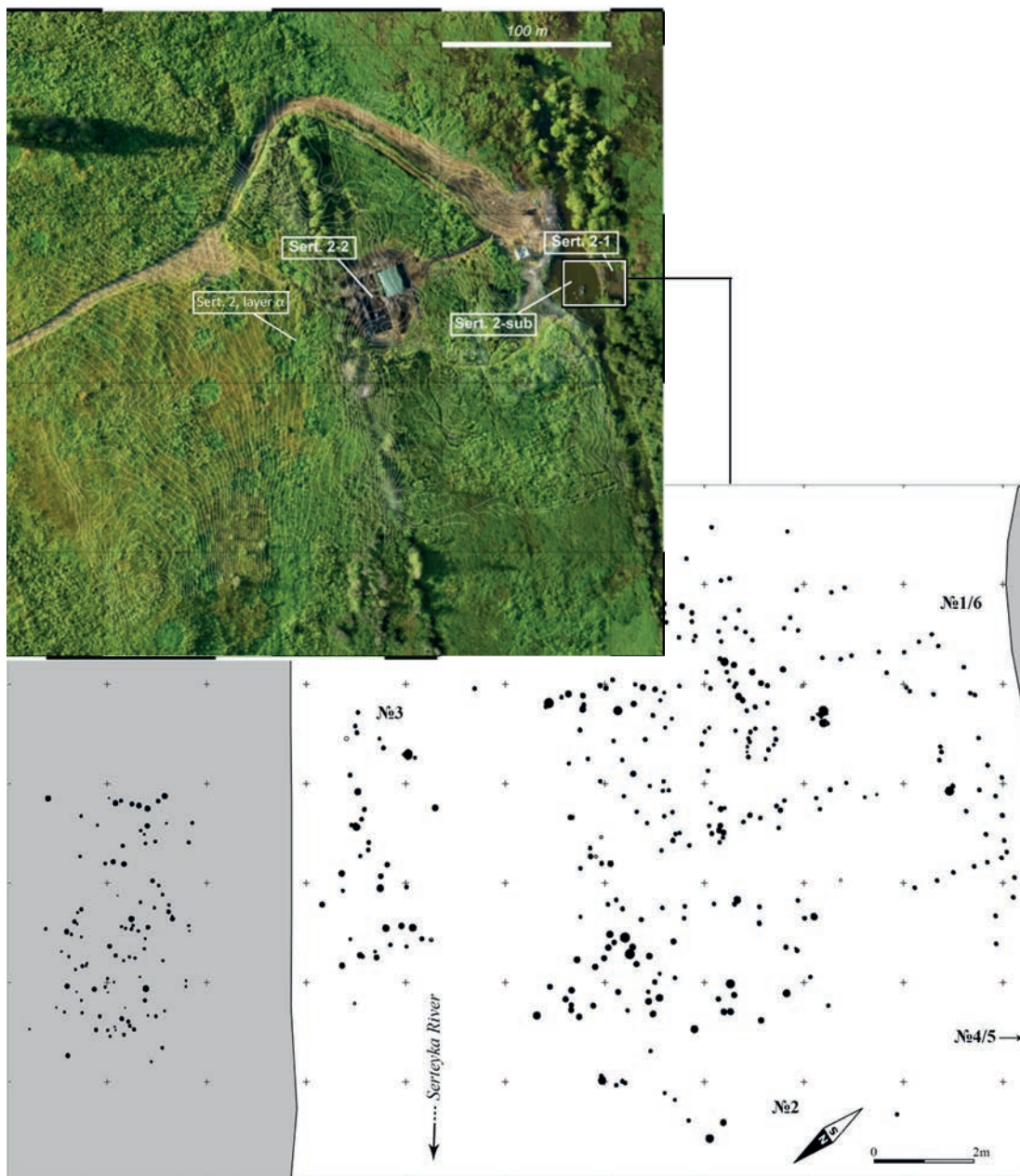


Fig. 2: Piles' distribution and location of central pile-dwelling part (Sert. 2-1, 2-sub), as well as excavation area with butchering zone and ground constructions (Sert. 2-2)





*Fig. 3: Serteya II. Part of a wall (?) made of wooden treated splinters (1); wooden pile and remains of a bark floor of the dwelling (2)*

## References

### In Russian

Долбунова, Е.В. (2014). Рыболовные конструкции среднего – позднего неолита (памятник Сертея I, Смоленская обл.). Труды IV (XX) Всероссийского Археологического съезда в Казани. Т.1. Казань.

Долбунова, Е. В., Мазуркевич, А. Н. (2013). Новые исследования памятников озера Сенница (2010-2013 гг.). Подводное наследие 2013. Международная научно-практическая конференция по подводной археологии и морской истории Сборник статей. М.

Зайцева, Г. И., Васильев, С. С., Дергачев, В. А., Мазуркевич, А. Н., Семенов, А. А. (2003). Новые исследования памятников бассейна Западной Двины и Ловати: распределение радиоуглеродных дат, корреляция с изменением природных процессов, применение математической статистики. Древности Подвinya: исторический аспект. СПб, 140-154.

Колосова, М. И. Мазуркевич, А. Н. (1998). Идентификация деревянных предметов по признакам анатомического строения древесины из неолитических торфяниковых памятников Ловатско-Двинского междуречья. Поселения: среда, культура, социум. СПб, 54-59.

Мазуркевич, А.Н. (2007). Культура свайных поселений в III тыс. до н.э. на Северо – Западе России. Радиоуглерод в археологических и палеоэкологических исследованиях. СПб.

Микляев, А.М. (1969). Памятники Усвятского микрорайона. Псковская область. АСГЭ. Вып.11.

Микляев, А.М. (1990). Подводные археологические исследования озера Сенница в 1982 – 1987 гг. СГЭ. Вып. LIV.

Микляев А.М. (1995). Каменный – железный век в междуречье Западной Двины и Ловати. ПАВ № 9. ред. Мазуркевич А.Н., Короткевич Б.С. СПб.

Микляев, А.М., Мазуркевич, А.Н. (1994). Опыт интерпретации некоторых орнаментальных мотивов посуды усвятской культуры. Проблемы археологии. Вып. 3. СПб.

### In English/French/German

Dolukhanov, P., Mazurkevich, A. (2000). Sites Lacustres néolithiques de Russie. *Archeologia* 369, 68-69.

Mazurkevich, A. (2013). Das Waldgebiet in Osteuropa am Ende des 4. - Beginn des 2. Jahrtausends v. Chr. In: *Bronzezeit. Europa ohne Grenzen. 4.-1. Jahrtausend v. Chr. Ausstellungskatalog. St. Petersburg*, 106-118.

Mazurkevich, A., Dolukhanov, P., Arslanov, Kh., Savel'eva, L., Kulkova, M., Zaitseva, G. (2009). Mesolithic and Neolithic in the Western Dvina-Lovat Area. *The East European Plain on the Eve of Agriculture. BAR International Series 1964, Oxford.*

Mazurkevich, A., Dolbunova, E., Maigrot, Y., Hookk, D. (2010). Results of underwater excavations of Serteya II and research of pile-dwellings in Northwest Russia. In: *Girininkas, A. (ed.). Underwater Archaeology in the Baltic Region. Dedicated to the 65th Birthday of Prof Habil. Dr Vladas Žulkus. Archaeologia Baltica 14. Klaipeda*, 47-64.

Mazurkevich, A., Dolbunova, E. 2011a. Reconstruction of the Early and Middle Neolithic settlement systems in the Upper Dvina region (NW Russia). *BAR International Series 1964, Oxford.*

Mazurkevich, A., Dolbunova, E. 2011b. Underwater investigations in Northwest Russia: archaeology of pile-dwellings. In: *Benjamin, J., Bonsall, C., Pickard, C., Fischer, A. (eds.). Underwater Archaeology and the Submerged Prehistory of Europe. Oxbow Books, Oxford*, 158-172.

Mazurkevich, A. N., Dolbunova, E. V., Zaitseva, G. I., Kulkova, M.A. (2017). Chronological timeframes of cultural changes in the Dnepr-Dvina region (7th to 3rd millennium BC). *Documenta Praehistorica XLIV*, 162-175.



## II.A.2 Report on Activities during Sertaya Field-Week

The main event of 2015 was the field-week “Prehistory and underwater archaeology in Russia. Methods, history and perspectives of underwater archaeology” which took place as scheduled at Serteya, Russia. The field week was organized by The State Hermitage Museum, Saint Petersburg from 9 to 16 August 2015. The field-workshop was conducted by the North-western archaeological expedition of The State Hermitage Museum in the archaeological micro regions near the Serteya River (Smolensk region of North-Western Russia) and the Sennitsa and Usviaty lakes (Pskov region of North-Western Russia). Here, not far from the city of Smolensk, in the 4<sup>th</sup>-3<sup>rd</sup> millennium BC pile-dwellings existed, which nowadays are located underwater and in peat bogs. They became known only 50 years ago due to researches conducted by A.M. Miklyaev. A.N. Mazurkevich continued this pioneering research.

Researchers, PhD students and students from Switzerland, Russia, France, Macedonia, Ukraine, Lithuania and Belarus took part in the field-week. Lectures made by Albert Hafner, Yolaine Maigrot (Trajectoires UMR 8215, Université de Paris 1-CNRS, Paris), Andrey Mazurkevich, Goce Naumov, Valentina Todoroska, Pavlo Shydlovskiy, Elena Pranckenaite (Centre of Underwater Archaeology, Vilnius/Lithuania), were devoted to underwater archaeology and investigation of Neolithic sites in wetlands (under water and in peat bogs). Several subjects were represented: underwater investigations conducted in Lithuania, pile-dwellings in Eastern Europe and Switzerland, archaeological underwater prospections in Macedonia. Part of the lectures concerned ancient artefacts presentation – Neolithic clay figurines and clay models of houses known in southern Europe and bone tools from North-western Russia in the 3<sup>rd</sup> millennium BC.

A presentation made by Natalia Vasilieva, conservator of The State Hermitage Museum, showed restoration and conservation techniques of organic finds from wetland and underwater sites. The central part of the field-week was devoted to the excavation of the site Serteya II, which has a great potential for different archaeological researches. The site occupies a vast area, parts of which are located underwater, parts of it in the peat bog with excellent preservation conditions for wooden constructions and artefacts. Besides the remains of pile-dwellings, pottery, flint tools, amber and teeth pendants, for the first time two human bodies were found.

During the field-week other archaeological sites located in neighbouring regions were also visited, among them the site of Usviaty IV with findings of anthropomorphic figurines and a rich collection of animal bone and wooden figures, and sites on the lake Sennitsa, where a Neolithic ski was found.

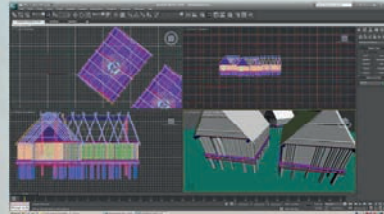
Also, the programme of the field-week included visiting of Katyn’ memorial complex from World War II, Gnezdovo Viking center and Talashkino cultural center, as well as excursions within Smolensk city, one of the most ancient Russian cities. The participants got knowledge not only of archaeological sites, materials and methods of excavations, but also got acquainted with different parts of Russian history and culture.



## Archaeological field workshop:

### Prehistory and underwater archaeology in Russia. Methods, history and perspectives of underwater archaeology

(in the framework of SCOPES Institutional Partnership Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating method)



*The workshop is organized and carried out by:*

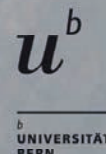
- The State Hermitage Museum, Russia
- University of Bern, Switzerland
- Taras Shevchenko National University of Kyiv, Ukraine
- Euro Balkan University, Center for Prehistoric Research, Macedonia

**Venue:** Smolensky and Pskovsky region (Russia)

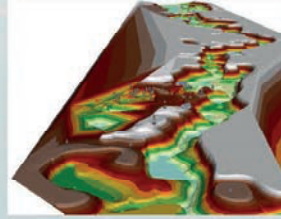
**Terms:** from 9 August to 16 August 2015.



**Description:** The field week will take place in archaeological microregions near the Serteya River and the Sennitsa and Usviaty lakes. Participants will gain insight into the paleogeography and archaeology of the area. The programme includes lectures and diving on the Serteya II site, with the aim of discussing in depth methods of underwater excavation, dating and conservation. More detailed information about the archaeology of this region can be found at <https://hermitage.academia.edu/AndreyMazurkevich/Papers?s=analytics#add>







**Lectures:**

**Albert Hafner.** Underwater and wetland archaeology in lakes and bogs of the Alpine Space. Overview and current research questions.

**Goce Naumov.** Communication between Neolithic wetland sites in Pelagonia and lakeside settlements in the Ohrid region.

**Valentina Todoroska.** Underwater excavation of the prehistoric site at Vrbnik (Ohrid Lake).

**Shidlovsky Pavel, Kirilenko Aleksandr.** Dynamics of river systems and stages of inhabitation in the Middle Dnepr river in the final Pleistocene – early Holocene.

**Elena Pranckenaite.** Underwater and wetland research in Lithuania.

**Yolaine Maigrot.** The bone industry of Neolithic pile-dwellings in France (Jura) and Russia (North-Western Russia).

**Andrey Mazurkevich.** Underwater archaeology in North-Western Russia and peat-bog sites.

**Ekaterina Dolbunova.** The most ancient pottery in Eastern Europe hunter-gatherers communities.

**Natalia Vasileva.** Restoration of objects made from organic material found on Neolithic sites.

*Tour of Smolensk city and museum (Historical department and Art gallery), visits to the Talashkino centre, Gnezdovo complex and Katyn' memorial.*









Piotr Kittel, Department of Geomorphology and Palaeogeography, Faculty of Geographical Sciences, University of Lodz, Poland

Andrey Mazurkevich, Department of Archaeology of Eastern Europe and Siberia, The State Hermitage Museum, Saint Petersburg, Russia

### **II.A.3 Palaeoenvironmental Changes in the Serteya Region (NW Russia)**

The Serteya region is situated at the boundary of Pskov and Smolensk regions of the North-Western Russia in the recently glaciated area of the Vistulian (Valdai) Ice Sheet (fig. 1). The formation of terrain relief during Vistulian Glacial Stage depended on the geological features of the region (Марков 1961). The isostatic elevations of the earth's crust in the region were most intense shortly after the degradation of the ice sheet. This process influenced the fluctuations of sea level. Therefore, the changes of water level in the lakes of the North-Western Russian Plain coincide with the transgressive-regressive stages of the Baltic Sea.

The region is characterized by a mosaic of the glacial and glaciofluvial landscapes with numerous lakes and peats, closed depressions and poorly developed valleys of small rivers. Only the Western Dvina River valley has well developed geomorphological elements of the river valley. The main relief forms of the area are: moraine plateaus, moraine hills, glaciofluvial plains, subglacial channels, kames formed during the Vistulian ice sheet expansion, and also river valleys, and biogenic plains (partly within post-lake basins) from the Holocene. The valley of the Serteya River (tributary of Western Dvina R.) occupies a subglacial channel (fig. 2), where at least two generations of water bodies existed - Late Glacial ice-melting lakes and Holocene postglacial lakes. The river presumably was draining subsequent water bodies in the Holocene. This drainage was an effect of head-ward erosion, as was confirmed by radiocarbon dating of the top most parts of biogenic deposits (Kittel et al. 2018).

The first stages of lake formation took place in the area in question in the Late Vistulian after the ice sheet was disintegrated into blocks of dead ice. Between dead ice blocks, lake basins developed in tunnel valley. Deposits that formed kames were accumulated in the bottoms of the lakes of this generation. In the Late Vistulian-Early Holocene transition, the lakes of the second generation developed after melting of buried ice. They were filled with organic deposits and the water level depended on palaeoclimatic and palaeohydrological changes. Main lake transgressions were correlated with the humid stage of the Holocene (Kulkova et al. 2015). The climatic conditions of the territory situated in the humid zone of high precipitation were favorable for lakes' developments. Small and shallow lakes turned into swamps during the Holocene because of the high rate of deposit accumulation. Fluvial systems could replace a part of the lake basins during regression phases.

The lower section of the Serteya valley covers four post-lake basins, which are 100-600 meters wide and 100-2000 meters long. The basins are filled with organic deposits (mostly gyttjas) up to 8 meters thick (Kittel et al. 2018). Radiocarbon dating and results of a pollen analysis prove that the sediments hold record of the Late Vistulian and all Holocene (Kulkova et al. 2001, Mazurkevich et al. 2009a). The archaeological context within lake deposits suggests as well a presence of short-term episodes of lakes' regression, allowing settlement introduction on post-lake plains (Kittel et al. 2018).

Changes in hydrology resulted often from climatic changes and are the main drives of the processes occurring in the lake and peatland ecosystem. Precipitation and temperature are the main climate elements affecting local humidity and hydrological conditions. Climate conditions have special significance in the area, where continental and Atlantic air masses collide.

The present-day climate of Dnieper-Dvina basin is moderately continental, with mean temperatures of  $-8^{\circ}\text{C}$  in January and  $17\text{--}18^{\circ}\text{C}$  in July, and annual precipitation of 500–700 mm, mostly in summer. The area belongs to the East European mixed broadleaved-coniferous forests. Temperate deciduous formations consist of mixed oak forests, which are found mostly on the clayey soil of the moraine plateaus. Boreal evergreen conifer (mostly pine) forests cover the sandy glacio-fluvial plains. Spruce forests are usually restricted to the lower levels of the morainic hills. An intensive felling of forests started in the 13<sup>th</sup>–14<sup>th</sup> centuries and much increased after the 1860s. The woodland currently occupies less than 20 % of the originally forested area. The secondary forests consist of birch and alder with shrubs. Bottomland floodplain meadows, bogs and mires occupy about 40 % of the total area. Agricultural plots take up the remaining 40 %. Main staple crops are rye, wheat and flax.

Detailed palaeoecological reconstructions are necessary for the understanding of the landscape evolution and human-environment relationships. Regional and local palaeoenvironmental evolution can be recognized in detail, with the use of multidisciplinary research on organic deposits. Such complex researches were conducted in the Serteya microregion (Мазуркевич 2003; Mazurkevich et al. 2009a, 2009b; Dolukhanov et al. 2004; Kulkova et al. 2001; Кулькова and Савельева 2003; Зайцева et al. 2003; Кулькова 2005; Kulkova 2006; Tarasov et al. 2019). The two main palaeolake basins with the traces of ancient settlements were studied in the Great Serteya Palaeolake Basin and Nivniki Palaeolake Basin. Both depressions are situated in the present Serteya River valley and are connected with each other by narrow erosive segment. Two cores of organic deposits (mainly gyttja) collected from the deep-water parts of two post-lake depressions – Great Serteya Palaeolake Basin and Nivniki Palaeolake Basin – were studied for a palaeoenvironmental reconstruction with the use of pollen, diatom and geochemical analyses. The age of sediments was determined using  $^{14}\text{C}$  dating.

The general trend of environmental changes in the Late Vistulian, mostly during the Alleröd and Younger Dryas, is widely known. The Alleröd (14,000 – 12,650 BP) is characterised by an amelioration of climatic conditions resulting in an increase of the intensity of buried ice and ground ice melting. In the Younger Dryas (12,650 – 11,500 BP), the climate was coldest and driest during the early Younger Dryas followed by a slight warming and a rise of humidity after ca. 12,000 cal BP. For the NW Europe, the influence of cold and dry air masses from an ice-covered Atlantic Ocean and a strong westerly circulation were reconstructed. While in Central and Eastern Europe, the climatic conditions were more continental (subarctic and boreal) with warmer summers resulting from climate further east in Europe (Ralska-Jasiewiczowa et al. 1998). Mean July air temperature inference is estimated to about  $10^{\circ}\text{C}$  for the first part of the Younger Dryas and  $12\text{--}15^{\circ}\text{C}$  for the second part in Central Poland. The reconstructions suggest summer temperatures declined to  $10\text{--}14^{\circ}\text{C}$  during the Younger Dryas in Northwestern and Central Europe. Climate stimulations indicate that Younger Dryas winter temperatures decreased to  $-20$  to  $-25^{\circ}\text{C}$ . Reactivation of permafrost took place probably during the Younger Dryas cooling in Northwestern and Central Europe (Böse 1995; Goździk 1995; Isarin 1997). Estimates of Younger Dryas wind speeds and direction in Central Poland suggest the domination of strong W and SW winds of 3 to 6 m/s, in gusts reaching 9 m/s (Krajewski 1977; Nowaczyk 1986). Strongly increased wind speeds at the Alleröd/Younger Dryas transition have been reported in Germany (Brauer et al. 2008). Wind conditions during the Younger Dryas are primarily considered in relation to aeolian morphologic processes. For the Late Vistulian, silt and clay dominated sediments resulting from intense surface erosion are typical for the lake basins in the Serteya region. The pollen of trees prevails in the spectrums of pollen profiles in Alleröd - with birch (15-50 %), pine (15-30 %), spruce (10-20 %) and significant content of weed pollen (17-39 %). The concentration of alder pollen

varies from 2 to 10 %. The *Selaginella selaginoides* occurred in mosses. The pollen spectra show the occurrence of spruce and birch forests in an open, herb dominated landscape with aquatic plants in the Alleröd/Younger Dryas transition (Kulkova et al. 2001). The concentration of pine (25-55 %) and birch (20-55 %) pollen increases, but the spruce pollen decreases (2 %) in the layers dated to the Younger Dryas. The climate cooling is evidenced.

The beginning of the Holocene (11,500 BP) is characterized by rapidly progressing changes of temperature and accompanying hydrological changes. The rapid rise of mean annual temperature by about 4°C over several decades were recorded in laminated lake deposits of the Gościąż Lake (Ralska-Jasiewiczowa et al. 1998). During the whole Holocene, the climate has not changed much but there were warmer and cooler episodes. The main factor for climate change were varying insolation, although the Earth orbital parameters (Milankovitch cycles) and thermohaline oceanic circulation played a secondary role (van Geel et al. 1999; Dergachev and van Geel 2004; Dergachev et al. 2006; Marks 2016). They resulted in cold short phases (i.e. several decades or a few hundred years), which were sufficiently fast from the point of view of human societies' development (Mayewski et al., 2004). Nine distinct 1500-year long cold or cool events of Bond cycles were recorded from North Atlantic marine deposits according to IRD (ice rafted debris) (Bond et al., 2001). Bond events are dated to ca.: 11,100, 10,300, 9400, 8200, 5900, 4200, 2800, 1400, 500 BP. The global episodes of climatic fluctuations according to the periods of lower solar activity were recorded in the Holocene at ca.: 8200 BP (6200 BC), 5800 BP (3850 BC), 5300 BP (3350 BC), 4100 BP (2150 BC); 2800 BP (850 BC); and 300 BP (17-19 c. AD) (Magny et al. 2003; Magny and Haas 2004; Magny 2004; Heiri et al. 2004; Kofler et al. 2005). Six periods of cooling and increased humidity on the global scale were defined by Starkel et al. (2013) at: 9000-8000, 6000-5000, 4200-3800, 3500- 2500, 1200-1000 and 600-150 BP.

Starkel et al. (2013) distinguished the following climatic periods in the Holocene and defined their chronology as follow:

Preboreal Period (PB: 11,500 – 10,200 BP);

Boreal Period (BO: 10,200 – 9600 BP);

Atlantic Period (AT: 9600-4850 BP) with five chronozones: AT1 (9600 – 8400 BP), AT2 (8400 – 7700 BP), AT3 (7700 – 6400 BP), AT4 (6400 – 5600 BP), AT5 (5600 – 4850 BP);

Subboreal Period (SB: 4850-2850 BP) with two chronozones: SB1 (4850 – 3700 BP) and SB2 (3700 – 2850 BP);

Subatlantic Period (SA: 2850 – present) with three chronozones: SA1 (2850 – 1500 BP), SA2 (1500 – 500 BP) and SA3 (500-present).

Preboreal and Boreal Periods are a part of Eo-Holocene (Early Holocene), Atlantic Period - Meso-Holocene (Middle Holocene or Mid-Holocene) and Subboreal and Subatlantic Periods - Neo-Holocene (Late Holocene).

The Early Holocene (the Greenland stage – see Cohen et al. 2019) is characterized by rapid increase of mean air temperature in global scale in the very beginning of the period. The Preboreal period is characterized by cool and dry conditions and the Boreal was warm and dry. High climatic variability for that period is recorded by numerous detailed multiproxy studies. This climatic variability resulted in a sequence of rapid palaeoecological changes, as well as phases of intensified geomorphological processes and a clustering of extreme events (Starkel 2002).

Based on the Greenland Ice Core Chronology 2005 time scale (GICC05) (Rasmussen et al. 2006), three main periods of distinct oscillations in the stable oxygen isotopic record were recognized: the Preboreal Oscillation (PBO, 11,520-11,340 BP), the 9300 BP event, and the 8200 BP event.

The Early Holocene oscillations are revealed in Europe by numerous proxies: oxygen isotopes of lake sediments, speleothems and from carbonate deposits (Makhnatch et al., 2000).

The Early Holocene oscillations were also recorded in deep marine deposits (Mertens et al., 2009). The Early Holocene climate fluctuations were caused by changes in the Gulf Stream (Bond et al. 1997). The main factors of Late Weichselian and Early Holocene climatic oscillations are indicated above all as: fresh water influx from the Baltic Ice Lake and Lake Agassiz into the North Atlantic, accompanied by changes in the intensity of thermohaline circulation and declines in solar activity. The influx of freshwater during the 8.2 ka BP also resulted in a sea level rise, including Baltic Sea (the former Ancylus Lake) (Schmölcke et al. 2006).

The PBO was recorded in the vegetation history of the Mediterranean and of western and central Europe, it is termed the Youngest Dryas. The PBO oscillation was characterized by Björck et al. (1997) as a short cool and drier period with more open plant cover, dominated by herbaceous taxa. The reduction of vegetation cover due to a short, colder phase (ca. 10.2-10.0 ka BP) was revealed by the study of lacustrine deposits in NW Russia (Subetto et al., 2002). The very distinct 8200 BP event was recorded for the first time by Alley et al. (1997) and von Grafenstein et al. (1998). Dry and cool climatic conditions in the Northern Hemisphere have been reconstructed as having lasted just 160.5 years, with peak of cooling taking place at 69 years in this interval (Thomas et al., 2007). Alley and Ágústsdóttir (2005) characterized the 8200 BP event as cold and dry, especially in winter, broadly throughout the Northern Hemisphere. The decrease of mean temperature is estimated at ca. 1°C and the decline in mean precipitation at ca. 0.4-0.8 % during the event that persisted 150-100 years in Europe (Morrill et al., 2013). Beside the palaeobotanical evidences, the Early Holocene ecological oscillations have also been recorded by palaeozoological proxies. Notebaert and Verstraeten (2010) emphasize fluvial system stability in the Early Holocene in Europe, although episodes of increased fluvial activity have been recorded in that period. Evidence of Early Holocene fluvial activity has been found sporadically in mid-Europe (Kalicki 2006).

During the period from the Preboreal to the early Atlantic, the gradually increasing in the rates of the accumulation of organic deposits within deep-water lake basins in the Serteya region is observed. In that time, calcareous and olive-colored gyttja with decreased content of clastic matter was deposited (fig. 3). Cold water diatom species typical for the Early Holocene, as well as a rise of the lake-level are evidenced for the end of the Boreal period (Kulkova et al. 2001). The deposits from the Preboreal period contain the pollen grains above all of birch (65-80 % and letter 55-60 %) and pine (15-25 %). The concentration of spruce and deciduous tree pollen is low. The herb pollen concentration reaches 5 %. The climate during the Preboreal was cold and dry in the region. The appearance of deciduous forest is the typical trait for the late Preboreal. In the Boreal period climate became more humid and warmer and the forest predominates because of the climate improvement. The curve of pine pollen increases sharply (30-60 %) and birch pollen concentration decrease (to 25-35 %). The sum of deciduous tree pollen makes up 20-25 % and in the late Boreal period makes up 30 %. The herb pollen concentration is not more than 8 % (Кулькова and Савельева 2003).

The Mid-Holocene (the Northgripian stage) is the Holocene climatic optimum, but above all in higher latitudes. The transition to the Atlantic period about 7600 BC is characterized by warmer and more humid climate. The Atlantic period can be divided into five stages: AT1 (7600-6400 BC) – humid phase; AT2 (6400-5700 BC) – warm and drier phase, AT3 (5700-4400 BC) – warm phase, AT4 (4400-3600 BC) – humid phase, AT5 (3600-2900 BC) – warm phase (Starkel et al. 2013). In this period, forests became more multifarious. The deciduous forests with oak, elm, linden and hazel prevailed. Forests were spread into the river valleys. The pollen analysis results in Serteya region show a gradual spread of pine dominated forest with hazel in underwood, and an increasing admixture of broad-leaf species starting with the beginning of the Atlantic period.



The beginning of Atlantic period is characterized by maximum of deciduous trees pollen (elm 12-18 %, oak 7-12 %, linden 2-7 %) and also increase of hazel pollen concentration (up to 36 %) simultaneously with a decrease of pine, birch and spruce pollen concentration (<15 % in total). The herb and spore pollens were single. The climate is reconstructed as warmer and more humid and the lake transgression was recorded for AT1. In the AT2 stage, evidences of drier climate and lowering of lake level were noticed (Кулькова and Савельева 2003). Maximum percentages for temperate deciduous taxa are recorded by Tarasov et al. (2019) at ca. 6600-4900 BC and this warm interval was earlier compared to the eastern Baltic area.

The middle Atlantic (ca. 6000-4400 BC) is the period of low and instable lake levels with the calcareous gyttja with shells' deposition. A short-lived water table rise is evidenced for ca. 5500 BC and later ca. 5000-4500 BC. A distinct regression is recorded for the period ca. 4500-4350 BC with detritus-gyttja accumulation. But later a stable rise of lake-level is evidenced. The pollen spectra reflect a relatively cool episode in the middle Atlantic, with the total amount of broad-leaved species (oak, elm and lime) less than 7 % and rapid rise in spruce and pine. Among the plant macrofossils were identified: alder, birch, willow and horsetail. But later, the pollen spectra show the highest content of thermophilous broad-leaved species reaching 34 % resulting from a significant rise of mean temperature in the period between 5000-4500 BC (i.e. in AT3). Results of the pollen analysis evidence, at ca. 4400-2800 BC that mixed coniferous forests were restricted to morainic hills, with pine forests on sandy plains. The climate was humid and warm in the AT5 stage and lake transgressions are observed in the region (Kulkova et al. 2001; Кулькова and Савельева 2003).

The Meso-Neo-Holocene transition was about 2900 BC and the climate became cooler and more humid. During SB1 (2900-1750 BC) gradual decline in humidity and temperature decline is reconstructed, while SB2 (1750-900 BC) was the warm phase (Starkel et al. 2013). After 2750 BC the arid climate and decreasing of precipitation was recorded and as a result, steppes extended and water level in the rivers and lakes fell in the western part of Russian territory. Warming and decreasing of precipitation had begun in the middle Subboreal at 2200 cal. BC (i.e. the transition to the Meghalai or Meghalayan stage of Holocene) and reached their maximum at 1700 cal. BC. Cooling and humidity increasing was recorded for the late Subboreal and first half of Subatlantic period about 1450-600 cal. BC (Aleshinskaya and Spiridonova 2000). The phases of humidity increased, and periods of peat accumulation in Europe were recorded for 2300, 1200 and 600 BC and 400, 1200 AD. The gradual cooling increase in the last 4200 years resulted from global climate change due to the fact of solar activity variations in this period. Climate changes during 4200 and 2800 BP events were affected by a complex set of interactions within the global ocean-atmosphere circulation system and solar activity (Marks 2016). In the Subboreal period, the subsequent lake level fluctuations were recognized with lake-level rise ca. 2500-2100 BC and ca. 1700-1500 BC and lake-level decrease ca. 210-1900 BC in Serteya region (Kulkova et al. 2001). They were the result of climatic (mostly precipitations) fluctuations. In the Subboreal period the spruce became the base forest type - the maximum of spruce pollen (up to 23 %) is registered. The pine-spruce and birch-spruce forest with alder-trees, deciduous trees and hazels were developed. In the pollen spectrums, the deciduous tree pollen concentration decreased sharply: oak – to 2 %, elm – to 3 %, linden – to 4 %. The beech pollen appeared and the herb pollen concentration increased to 18 %. In the period ca. 1900-1400 BC, rapid decrease of spruce and slight increase of pine is observed, followed by a sharp increase of alder (up to 40 %) and further reduction of elm, oak and also hazel (Кулькова and Савельева 2003; Tarasov et al. 2019).

The Subatlantic period began at about 900 BC with cooling and a short rise of humidity. SA1 stage (900 BC-450 AD) was cooler in the beginning and later turned to warmer period. SA2 stage (450-1450 AD) started with short cooling and later began gradual warming. The next cooling is characteristic for the SA3 from ca. 1450 AD (i.e. the Little Ice Age) (Starkel et al. 2013). The maximum of cooling was from 1400 to 1850 AD (Marks 2016). The transition to cold and humid climate takes place in the beginning of the Subatlantic period in the Serteya region based on pollen data. In the beginning of SA2, the spruce pollen concentration decreases to 15 %, pine pollen varies from 15 to 20 %, birch from 10 to 15 %, and alder from 10 to 20 %. The sum of deciduous tree pollen makes up 10% due to increasing of oak pollen concentration. Later, the spruce and pine pollen predominate (up to 25 %). The climate became warmer, precipitation and lake level increased in the beginning of SA2. For the last centuries BC, a lowering of the lake level was recorded. The climate was cold and the humidity decreases (Кулькова and Савельева 2003; Арсланов 2003). During the SA2, the lake basin in the present Serteya River valley with the Serteya II site was finally replaced by a fluvial system with channel and overbank fluvial deposition (Kittel et al. 2018, 2020).

Palaeoenvironmental (above all hydrologic and climatic) fluctuations influenced the development of prehistoric communities on the one hand. Since the Neolithic, human impact on the environment was increasing on the other hand. Therefore, the impact of the climate and of mankind can be very difficult to distinguish, as they have both acted at the same time. The archaeological context suggests presence of short-term episodes of lakes' regression, allowing settlement introduction on post-lake plains in the middle and late Neolithic. A geological and geomorphological research of the area along with a versatile palaeoecological analysis allows to create a detailed palaeoenvironmental reconstruction of the natural environment transformations and the environmental conditions for functioning of the Neolithic settlements. New palaeobotanical, palaeozoological and geochemical high-resolution multidisciplinary analyses for new-collected organic deposits cores (fig. 3, 4) are in progress (Mazurkevich et al. 2017; Kittel et al. 2018, 2020).

In the years 2016-2018, six cores of biogenic deposits for palaeoecological studies have been taken from the Serteya II site area. The ST IIa core with a length of 8 m (fig. 3) was collected from the central part of the site with the pile-dwellings remnants. Its deposits cover the period from the Late Weichselian to the Middle Ages, as confirmed by the results of the earlier recognition (see Kul'kova 2001, Mazurkevich et al. 2012, Tarasov et al. 2019) as well as new <sup>14</sup>C data set. The wetland Serteya II site gives an opportunity to undertake high resolution multi-proxy palaeoecological study based on the core ST M25 collected directly from the archaeological trench wall (fig. 4), that covers the lacustrine deposits with cultural layers. This way, an archive has been obtained both of traces of ancient communities and natural evolution as well as human-environment relationships. The results document the evolution of the natural environment in the period between ca. 4300 and 1600 BC, i.e. during global climate changes ca. 6200, 5900 and 4200 BP. The intense human activity in the lake shore area existed when the water table was relatively high. A hunter-fisher-gatherer communities' impact on the lake environment was recorded. The pile-dwellings constructions existed in the 3<sup>rd</sup> mill. BC during the phase of lake water level decreasing. The period of the 4200 BP cool event is recorded as a phase with temporal lake water level increase.

Our results do not confirm a transition into the productive economy before 1500 BC showed earlier by Mazurkevich (2003), Mazurkevich et al. (2009) or by Tarasov et al. (2019). We suppose that strong landscape geo- and biodiversity of the Serteya region offered a variety of different natural resources suitable for Neolithic hunter-fisher-gatherer way of life (Kittel et al. 2020).

## References

### In English:

- Alley, R.B., Ágústssdóttir, A.M. (2005). The 8k event: cause and consequences of a major Holocene abrupt climate change. *Quaternary Science Reviews* 24, 1123-1149.
- Björck, S., Rundgren, M., Ingolfsson, O., Funder, S. (1997). The Preboreal oscillation around the Nordic Seas: Terrestrial and lacustrine responses. *Journal of Quaternary Science* 12, 455-466.
- Bond, G., Showers, W., Chesby, M., Lotti, R., Almasi, P., deMenocal, P., Priore, P., Cullen, H., Haiada, I., Bonani, G. (1997). A pervasive millennial-scale cycle in north Atlantic Holocene and glacial climates. *Science* 278, 1257-1266.
- Bond, G., Kromer, B., Beer, J., Muscheler, R., Evans, M.N., Showers, W., Hoffmann, S., Lotti-Bond, R., Hajdas, I., Bonani, G. (2001). Persistent solar influence on North Atlantic climate during the Holocene. *Science* 294, 2130-2136.
- Böse, M. (1995). Problems of dead ice and ground ice in the central part of the North European Plain. *Quaternary International* 28, 123-125.
- Brauer, A., Haug, G.H., Dulski, P., Sigman, D.M., Negendank, J.F.M. (2008). An abrupt wind shift in western Europe at the onset of the Younger Dryas period. *Nature Geoscience* 1, 520-522.
- Cohen, K.M., Harper, D.A.T., Gibbard, P.L. (2019, May 15). ICS International Chronostratigraphic Chart. International Commission on Stratigraphy, IUGS. [www.stratigraphy.org](http://www.stratigraphy.org).
- Dergachev, V. and van Geel, B. (2004). *Large Scale Periodicity of Climate Change During the Holocene, Impact of the Environment on Human Migration in Eurasia*: Kluwer Academic Publishers, 159-183.
- Dergachev, V.A., Dmitriev, P.B., Raspopov, O.M., Jungner, H. (2006). Cosmic ray flux variations, modulated by the solar and earth's magnetic fields, and climate changes. 1. Time interval from the present to 10-12 ka ago (the Holocene Epoch). *Geomagnetizm i Aeronomiya* 46(1), 123-134.
- Dolukhanov, P.M., Shukurov, A.M., Arslanov, Kh.A., Mazurkevich, A.N., Savel'eva, L.A., Dzinoridze, E.N., Kulkova, M.A., Zaitseva, G.I. (2004). The Holocene Environment and Transition to Agriculture in Boreal Russia (Serteya Valley Case Study). *Internet Archaeology* 17: <[http://intarch.ac.uk/journal/issue17/dolukhanov\\_toc.html](http://intarch.ac.uk/journal/issue17/dolukhanov_toc.html)>.
- van Geel, B., Raspopov, O.M., Renssen, H., van der Plicht, J., Dergachev, V.A. and Meijer, H.A.J. (1999). The role of solar forcing upon climate change. *Quaternary Science Reviews* 18, 331-338.
- Goździk, J.S. (1995). A permafrost evolution and its impact on some depositional conditions between 20 and 10 ka in Poland. *Biuletyn Peryglacjalny* 34, 53-72.
- von Grafenstein, U., Erlenkeuser, H., Müller, J., Jouzel, J., Johnsen, S. (1998). The cold event 8200 years ago documented in oxygen isotope records of precipitation in Europe and Greenland. *Climate Dynamics* 14, 73-81.
- Heiri, O., Tinner, W., Lotter, A.F. (2004). Evidence for cooler European summers during periods of changing meltwater flux to the North Atlantic. *The Proceedings of the US National Academy of Sciences* 101(43), 15285-15288.
- Isarin, R.F.B. (1997). Permafrost distribution and temperatures in Europe during the Younger Dryas. *Permafrost and Periglacial Processes* 8, 313-333.
- Kalicki, T. (2006). Zapis zmian klimatu oraz działalności człowieka i ich rola w holocenijskiej ewolucji dolin środkowoeuropejskich. *Prace Geograficzne IGiPZ PAN* 204, 1-348.
- Kittel, P., Mazurkevich, A., Dolbunova, E., Kazakov, E., Mroczkowska, A., Pavlovskaja, E., Piech, W., Plóciennik, M., Sikora, J., Teltevskaia, Y., Wieckowska-Lüth, M. (2018). Palaeoenvironmental reconstructions for the Neolithic pile-dwelling Serteya II site case study, Western Russia. *Acta Geographica Lodziensia* 107, 191-213.
- Kittel, P., Mazurkevich, A., Wieckowska-Lüth, M., Pawłowski, D., Dolbunova, E., Gauthier, E., Krapiec, M., Maigrot, Y., Danger, M., Mroczkowska, A., Okupny, D., Plóciennik, M., Szymańda, J., Thiebaut, E., Słowiński, M. (2020) (in press). On the border between land and water: the environmental conditions of the Neolithic occupation from 4.3 until 1.6 ka BC at Serteya, Western Russia. *Geoarchaeology an Interdisciplinary Journal*.

Kofler, W., Krapf, V., Oberhuber, W., Bortenschlager, S. (2005). Vegetation responses to the 8200 cal. BP cold event and to long-term climatic changes in the Eastern Alps: possible influence of solar activity and North Atlantic freshwater pulses. *The Holocene* 15(6), 779-788.

Krajewski, K. (1977). Późnoplejstoceńskie i holocenijskie procesy wydymotwórcze w pradolinie warszawsko-berlińskiej (Late Pleistocene and Holocene dune-forming processes in the Warsaw-Berlin Pradolina). *Acta Geographica Lodziensia* 39, 1-87.

Kulkova, M. (2006). The geochemical indicators of paleoclimate of Holocene and their meaning for reconstruction of prehistory sites in Western Dvina-Lovat' area of North-Western Russia. In: *Proceeding from the 8th Nordic Conference on the Application of Scientific Methods in Archaeology. Archaeology and Environment, Umeå* 21, 93-100.

Kulkova, M.A., Mazurkevich, A.N., Dolukhanov, P.M. (2001). Chronology and palaeoclimate of prehistoric sites in Western Dvina-Lovat area of North-western Russia. *Geochronometria* 20, 87-94.

Kulkova, M.A., Mazurkevich, A., Gerasimov, D. (2015). Stone Age archaeological sites and environmental changes during the Holocene in the NW region of Russia. In: Harff, J., Bailey, G., Lüth, F. (eds.), *Geology and Archaeology: Submerged Landscapes of the Continental Shelf*. Geological Society, London, 27-50.

Notebaert, B., Verstraeten, G. (2010). Sensitivity of West and Central European river systems to environmental changes during the Holocene: A review. *Earth-Science Reviews* 103, 163-182.

Magny, M. (2004). Holocene climate variability as reflected by mid-European lake-level fluctuations and its probable impact on prehistoric human settlements. *Quaternary International* 113, 65-79.

Magny, M., Haas, J.N. (2004). A major widespread climatic change around 5300 cal. yr. BP at the time of the Alpine Iceman. *Journal of Quaternary Science* 19(5), 423-430.

Magny, M., Bégeot, C., Guiot, J., Peyron, O. (2003). Contrasting patterns of hydrological changes in Europe in response to Holocene climate cooling phases. *Quaternary Science Reviews* 22, 1589-1596.

Makhnach, N., Zernitskaya, V., Kolosov, I., Demeneva, O., Simakova, G. (2000).  $\delta^{18}O$  and  $\delta^{13}C$  in calcite of freshwater carbonate deposits as indicators of climate and hydrological changes in the late-Glacial and Holocene in Belarus. *Journal of Geochemical Exploration* 69-70, 435-439.

Marks, L. (2016). Zmiany klimatu w holocenie, *Przegląd Geologiczny* 64(1), 59-65.

Mazurkevich, A.N., Korotkevich, B.N., Dolukhanov, P.M., Shukurov, A.M., Arslanov, Kh.A., Savel'eva, L.A., Dzinoridze, E.N., Kulkova, M.A., Zaitseva, G.I. (2009a). Climate, subsistence and human movements in the Western Dvina - Lovat River Basins. *Quaternary International* 203(1-2), 52-66.

Mazurkevich, A., Dolukhanov, P., Shukurov, A., Zaitseva, G. (2009b). Mesolithic and Neolithic in the Western Dvina-Lovat Area. In: Dolukhanov, P.M., Sarson, G.R., Shukurov, A.M. (eds.). *The East European Plain on the Eve of Agriculture. BAR International Series* 164, 145-153.

Mazurkevich, A., Dolbunova, E., Kittel, P., Fassbender, J., Maigrot, Y., Mroczkowska, A., Płóciennik, M., Sikora, J., Słowiński, M., Sablin, M., Shirobokov, I. (2017b). Multi-disciplinary research on the Neolithic pile-dwelling Serteya II site (Western Russia) and the landscape reconstruction. In: Marciniak-Kajzer, A., Andrzejewski, A., Golański, A., Rzepecki, S. (eds.). *Nie tylko krzemienie. Not only flints*. Instytut Archeologii Uniwersytetu Łódzkiego, Łódzka Fundacja Badań Naukowych, Stowarzyszenie Naukowe Archeologów Polskich Oddział w Łodzi, Łódź, 103-128.

Mayewski, P.A., Rohling, E.E., Stager, J.C., Karlen, W., Maasch, K.A., Meeker, L.D., Meyerson, E.A., Gasse, F., van Kreveld, S., Holmgren, K., Lee-Thorp, J., Rosqvist, G., Rack, F., Staubwasser, M., Schneider, R.R., Steig, E.J. (2004). Holocene climatic variability. *Quaternary Research* 62, 243-255.

Mertens, K.N., Gonzalez, C., Delusin, I., Louwye, S. (2009). 30 000 years of productivity and salinity variations in the late Quaternary Cariaco Basin revealed by dinoflagellate cysts. *Boreas* 38, 647-662.

Morrill, C., Anderson, D. M., Bauer, B. A., Buckner, R., Gille, E. P., Gross, W. S., Hartman, M., Shah, A. (2013). Proxy benchmarks for intercomparison of 8.2 ka simulations. *Climate of the Past* 9, 423-432.

Nowaczyk, B. (1986). *Wiek wydmy, ich cechy granulometryczne i strukturalne a schemat cyrkulacji atmosferycznej w Polsce w późnym Vistulianie i holocenie*. Seria Geogr., Adam Mickiewicz University Press, Poznań 28.

Ralska-Jasiewiczowa, M., Goslar, T., Madeyska, T., Starkel, L. (eds.). 1998. *Lake Gościąg, central Poland. A monographic study. Part 1*. W. Szafer Institute of Botany, Polish Academy of Science, Kraków.



Rasmussen, S.O., Bigler, M., Blockley, S.P., Blunier, T., Buchardt, S.L., Clausen, H.B., Cvijanovic, I., Dahl-Jensen, D., Johnsen, S.J., Fischer, H., Gkinis, V., Guillevic, M., Hoek, V.Z., Lowe, J.J., Pedro, J.B., Popp, T., Seierstad, I.K., Steffensen, J.P., Svensson, A.M., Vallelonga, P., Vinther, B.M., Walker, M.J.C., Wheatley, J.J., Winstrup, M. (2014). A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy. *Quaternary Science Reviews* 106, 14-28.

Schmölcke, U., Endtmann, E., Klooss, S., Meyer, M., Michaelis, B., Rickert, B.-H., Röbber, D. (2006). Changes of sea level, landscape and culture: A review of the south-western Baltic area between 8800 and 4000 BC. *Palaeogeography, Palaeoclimatology, Palaeoecology* 240, 423-438.

Starkel, L. (2002). Changes in the frequency of the extreme events as the indicator of climatic change in the Holocene (in fluvial system). *Quaternary International* 91, 25-32.

Starkel, L., Michczyńska, J. D., Krąpiec, M., Margielewski, W., Nalepka, D., Pazdur, A. (2013). Progress in the Holocene chrono-climatostratigraphy of Polish territory. *Geochronometria* 40, 1-21.

Subetto, D.A., Wohlfarth, B., Davydova, N.N., Sapelko, T.V., Björkman, L., Solovieva, N., Wastegård, S., Possnert, G., Khomutova, V.I. (2002). Climate and environment on the Karelian Isthmus, northwestern Russia, 13000–9000 cal. yrs BP. *Boreas* 31, 1-19.

Tarasov, P.E., Savelieva, L.A., Long, T., Leipe C. (2019). Postglacial vegetation and climate history and traces of early human impact and agriculture in the present-day cool mixed forest zone of European Russia. *Quaternary International* 516, 21-41.

Thomas, E.R., Wolff, E.W., Mulvaney, R., Steffensen, J.P., Johnsen, S.J., Arrowsmith, C., White, J.W.C., Vaughn, B., Popp, T. (2007). The 8.2 kyr event from Greenland ice cores. *Quaternary Science Reviews* 26, 70–81.

#### **In Russian:**

Арсланов, Х.А., Джиноридзе, Е.Н., Максимов, Ф.Е., Савельева, Л.А., Тертычная, Т.В., Чернов (2003). С.Б. Палинологические, диетомовые характеристики и возраст позднеледниковых и голоценовых осадков в верховьях Западной Двины. *Древности Подвинья: исторический аспект*. СПб, 291-299.

Кулькова, М.А. (2005). Геохимическая индикация ландшафтно-палеоклиматических условий в голоцене в регионах Двинско-Ловатского междуречья и Южной Сибири. *Автореферат диссертации*, СПб.

Кулькова, М.А., Савельева, Л.А. (2003). Восстановление палеоклиматических условий голоцена в районе заболоченных озер в долине р. Сертейки в Велижском районе Смоленской обл. по данным сопряженного анализа. *Древности Подвинья: исторический аспект*. СПб, 291-299.

Марков, К.К. (1961) (ed.). Рельеф и стратиграфия четвертичных отложений Северо-Запада Русской равнины: К 6 конгрессу INQUA в Варшаве 1961, 241. Изд-во Академии Наук СССР, Москва.

Мазуркевич, А.Н., Долуханов, П.М., Савельева, Л.А., Арсланов, Х.А., Зайцева, Г.И., Кулькова, М.А. (2003). Динамика заселения долины р. Сертейки (Смоленская обл.) в каменном -железном веке. Чтения, посвящ. 100-летию деятельности В.А.Городцова в Государственном Историческом музее. Тезисы конференции. Часть I. М.

Зайцева, Г.И., Васильев, С.С., Дергачев, В.А., Мазуркевич, А.Н., Семенов, А.А. (2003). Новые исследования памятников бассейна Западной Двины и Ловати: распределение радиоуглеродных дат, корреляция с изменением природных процессов, применение математической статистики. *Древности Подвинья: исторический аспект*. СПб, 140-154.

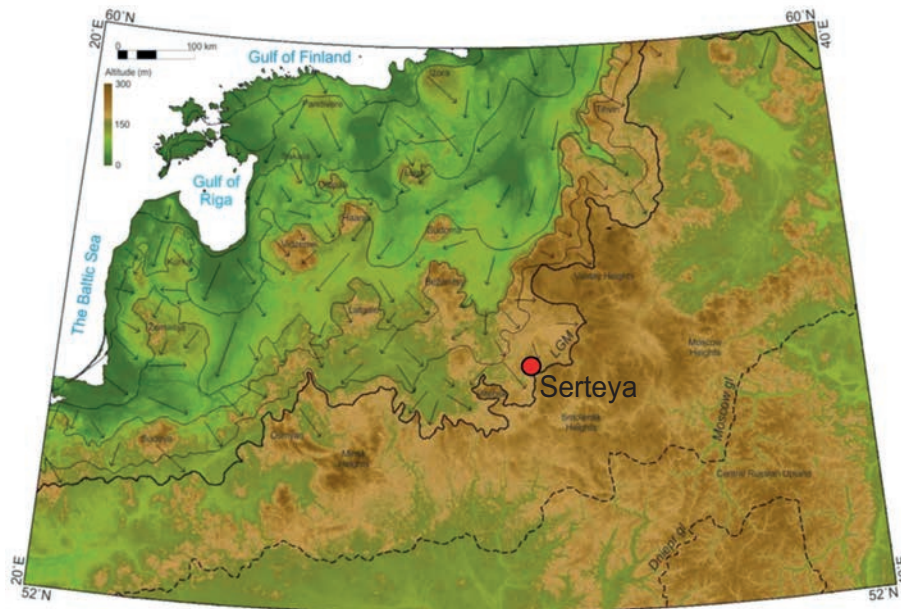


Fig. 1: Research area against the limit of the LGM, after Gorlach et al. (2015)

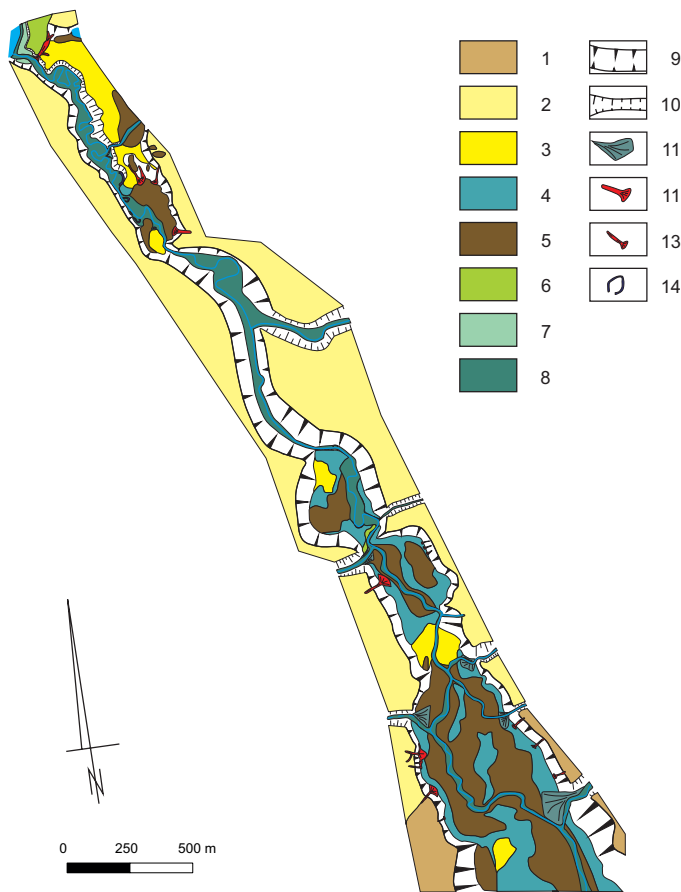


Fig. 2: Geomorphological sketch of the area of the lower Serteyka River: 1 – moraine plateau, 2 – glaciofluvial plain, 3 – eskers and crevasses fills, 4 – kames and kame terraces, 5 – biogenic plains, 6 – alluvial terraces, 7 – upper flood plain, 8 – lower flood plain, 9 – subglacial channel, 10 – valley slopes, 11 – alluvial fans, 12 – denudational valleys and alluvial fans, 13 – gullies and erosional cuts and accumulative fans, 14 – oxbows

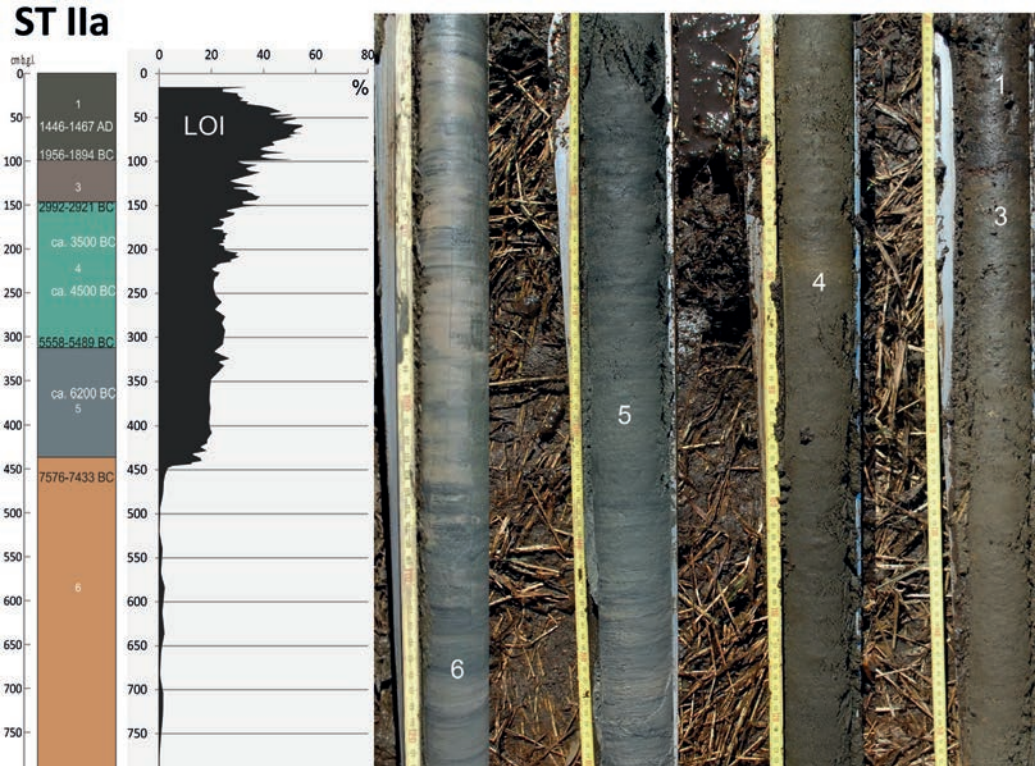


Fig. 3: Core of lacustrine deposits from the palaeolake deep-water zone at the Serteya II-1 site (Photo by P. Kittel, 2016) LOI – Loss-On-Ignition analysis results, 1 – peaty organic mud, 3 – coarse-detritus gyttja, 4 – fine detritus gyttja, 5 – muddy fine detritus gyttja, 6 – clay



# STII M25 core

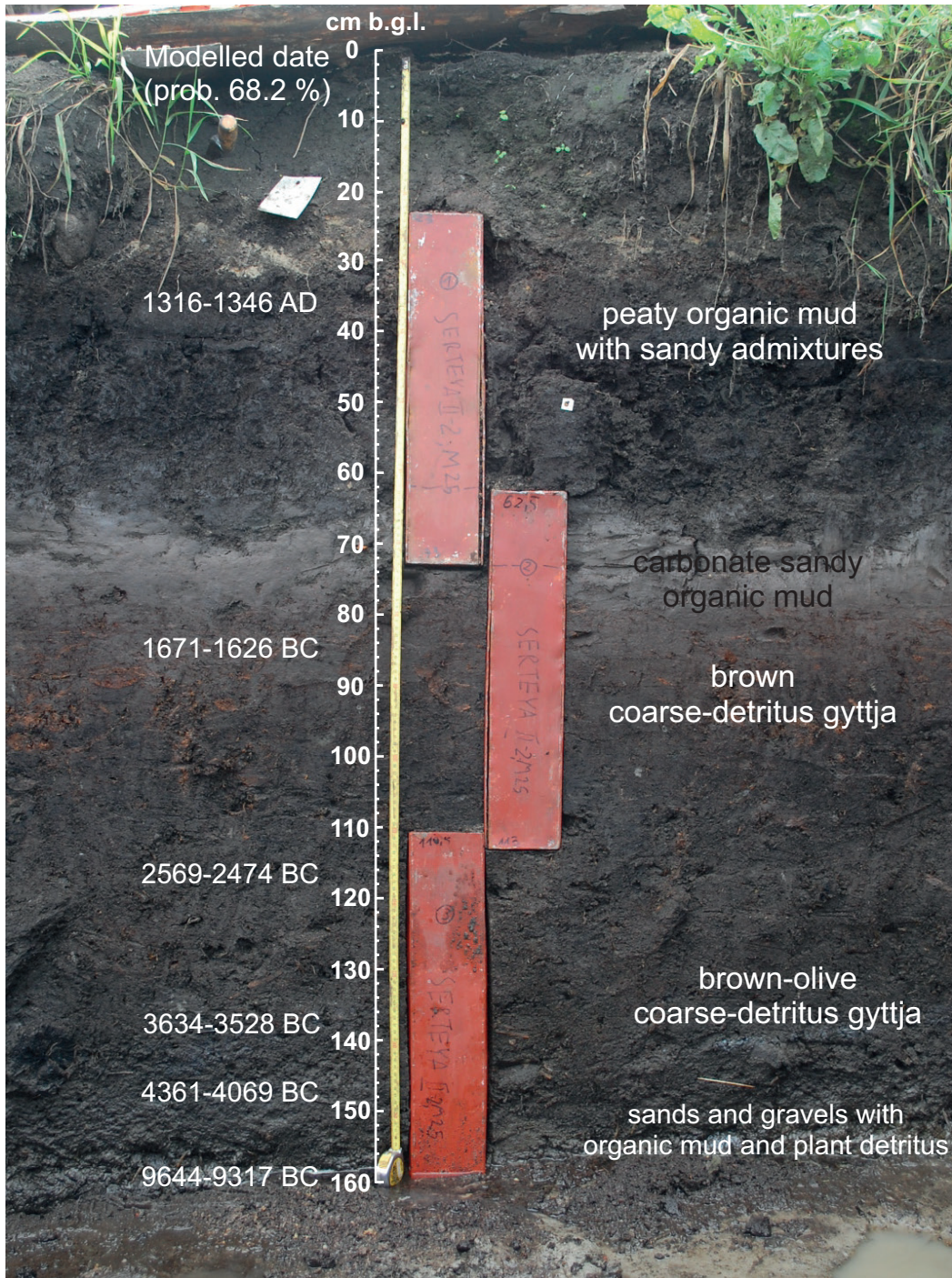


Fig. 4: Core of organic deposits in the wall of the exposure (the M/25 square) in the palaeolake shore zone at the Serteya II-2 site (Photo by P. Kittel, 2016)



## **II.A.4 Bone, Antler and Teeth Items in the Dnepr-Dvina Area (NW Russia) in the Neolithic – Bronze Age (VI–III mill. BC): Technological-Functional Features and Cultural Attribution**

Neolithic sites with well-preserved organic objects are not numerous in the Dnepr-Dvina region. Such items were found in Usvyaty IV, Dubokray I and Dubokray V, Serteya II, Serteya X, Rudnya Serteyskaya, Naumovo, Udvyaty I, Dyazditsa I and II (researches of A.M. Miklyaev, A.N. Mazurkevich and T.I. Bepalova; The State Hermitage Museum, Russia). Bone and antler collections from these sites include more than 300 objects. These sites are attributed to the early to late Neolithic and the beginning of the Bronze age (VI-III mill. BC), based on specific ceramics, flint industry and radiocarbon dates (Мазуркевич et al. 2016).

Bone and antler collections include finished products (utilitarian and non-utilitarian ones), preforms and production wastes. This set of items allows analyzing manufacturing techniques and the function of tools. The preservation conditions of the items' surfaces are quite good, which gives the opportunity to analyze them on a macro- and microlevel (according to use-wear analysis method).

Bones of wild animals (elk, red deer, bear, boar etc.) and birds were used as raw materials. Bones of elk were used more often than bones of boar and bear, both for the production of tools and objects of non-utilitarian character during the whole Neolithic period and at the beginning of the Bronze age. Only bones with the largest durability – leg bones (tibiales and tibias, metapodiums, humeral and radial bones), ribs and antlers were processed. Species diversity of processed bones varied within different archeological cultures of this region (Саблин et al. 2011).

Two stages of raw material processing were distinguished as a result of the technological analysis of bone and antler artefacts. Preforms made for various categories of items and traces of primary treatment related to it are characterized by the following operations: fracture with the help of heavy object, longitudinal or latitudinal knapping using preliminary prepared (in a case with antler raw materials – notched) grooves, knapping using the cracks, transversal fracture by bending or chopping. Different operations could be made on the preform – scraping, drilling, abrasion and polishing. These operations were connected with the secondary treatment of the preform. These traces overlap, usually, traces of the preform making, sometimes partly or entirely destroying them. That is why the existence of not only finished pieces but also items with traces of different stages of modelling is very important in order to reconstruct the whole “chain of operation sequence” (Малютина, Саблин 2014). Treatment was made by flint tools. Only at late stages of the settlement Usviaty IV (layer A, the Bronze age) traces of treatment by a metallic tool can be recorded. In general, care of production differs for the whole assemblage, that does not allow defining in some cases neither raw materials nor the mode of treatment.

Macro- and microtraces analysis allowed determining tools' function. The available material, in general, reflects a typical usage of bone and antler tools for the Neolithic period: treatment of skins (piercing, cutting and scraping), wood treatment (from removal of bark and piercing of birch bark to objects' making), work with wet and dry clay (production of pottery). A wide variety of implements was used in hunting and fishing. A specific place is occupied by ornaments and objects of art. In addition, the analysis of microtraces has allowed to reveal specific, not standard, forms of bone and antler tools whose purpose was not clear.

The early Neolithic settlements Serteya X and Rudnya Serteyskaya revealed various types of arrowheads, which are typologically similar to finds from the Baltic region attributed to the Narva

culture (Мазуркевич, Микляев 1998). A poor toolkit was found here (fig. 1), and its morphological and technological features have no continuation in tradition of bone and antler treatment with the settlements of the middle and late Neolithic. Not numerous tools found on these sites testify specific economic and cultural specialization of these temporary sites and/or the places of hunting.

Settlements of the Usvyaty Middle Neolithic culture (Usvyaty IV, Dubokray V, Dyazditsa I, II, and part of materials of Serteya II) are characterized by a set of various bone and antler tools. Ways of treatment and making items from bone and antler on these sites is similar, as they had a common origin connected to the builders of the pile-dwelling settlements (Мазуркевич 1998). Almost all categories of tools made of bone and antler were found here, they display the complete range of ancient economy (fig. 2, 3, 4). A definite set of the most widespread tools represents specifics of processing and usage of tools made of bone, antler and teeth. *Spatules* for pottery treatment are characteristic for the middle Neolithic settlements (fig. 2: 8, 13; fig. 4: 9), mostly made in the same technique: longitudinal cut-out plate from a tubular bone diaphysis, flat and spongy bone served as a preform. Smoothing of bone sides and spongy tissue was made by scraping and grinding. In certain cases, it is scratched out almost completely, and the plates thickness, in that case, reaches slightly more than 2 mm. There are small items (up to 10 cm) and bigger ones. They are either decorated or not, with a figured handle (fig. 2: 13), one with a carefully made image of the animal head on its extremity (fig. 2: 8; fig. 8), others with a simple handle. One tool has a notched part of the handle (with a *comb*) on one end (fig. 2: 4). It was formed on a thin plate, longitudinally cut out from animal's rib. The plate was broken transversally. Then, one end was worn out by planing and grinding, nine prongs were cut out on another extremity. Edges of the prongs were sharp and irregular. Apparently, this tool was used to put decor pottery. *Spoons* were cut out from flat bones (most likely, scapulas) (fig. 2: 3; fig. 4: 8). The plates were prepared by scraping and grinding. Traces of these operations can be clearly seen on surfaces. Spoon bowls, judging by two entirely preserved objects, could be different – from slightly concave to deep. *Chisels* with direct, slightly convex edge were found on the settlement Usvyaty IV (5 pieces) and Dubokray V (2 pieces) as fragments and complete forms (fig. 2: 6, 14; fig. 4: 3, 10). All of them were made in the same technology. Fragments of elk metapodia, small boars' tibias and other tubular bones served as preforms. They can be divided into several groups – with an epiphysis–handle and without it. Symmetric narrow edge was made out on the opposite end by planing and abrasive grinding of those items, and the bone epiphysis served as a handle. In other cases, the fragment of a tubular bone was worn out additionally by means of transversally chopping of sides, longitudinal planing and grinding of symmetrically pointed narrow edge. The tip of the edges is, as a rule, softly dulled, sometimes was insignificant eroded. Spongy tissue of a bone on the opposite end of the tool is in certain cases strongly hammered. According to the trace wear analysis on the items' working parts, this category of tools was used in work with fresh wood.

Side metapodium of elk served as the main raw materials for production of awls, in lesser quantity – boars' tibiales and other undetermined fragments of tubular bones of medium-sized animals (fig. 2: 5; fig. 4: 5). Processing techniques of awls from side metapodium of an elk was rather simple due to the natural pointed shape of the bone. Small epiphyses of bones served as a handle whereas at the opposite end, a working edge was formed by longitudinal planing. Removal of one epiphysis and a further planing of a working edge was applied in case of boars' tibiales. *Sinkers* made of tubular bone fragments (3 pieces) and *spinner* made of boar's tusk (1 item), that were found only on the settlement Usvyata IV, belong to fishing equipment (fig. 2: 9, 10). Sinkers are made by planing and cutting of small fragments of tubular bones. On both ends of such

products, grooves for rope fastening were cut out. *Fish-spear* and *harpoons* (fig. 2: 7; fig. 4: 11) are attributed to the same category of items (fig. 2: 11).

Various types of arrowheads are also represented in the collection (fig. 2: 12; fig. 4: 6, 7, 12).

The following categories are referred to objects of non-utilitarian character: *flutes* made of birds' tubular bones (fig. 3: 7, 10), *pendants* made of bears' tusk, elk and boars' incisors (fig. 3: 8, 9, 11), *cover plate* made of tubular bones (fig. 3: 2, 3), ornaments — *cover plates* on clothes (fig. 3: 4), a massive *hook* made of the top shoot of elk lower jaw (fig. 3: 5), specific *baton* (fig. 3: 1) with figured image of bird head (crow?) on the one end and possibly *harness* element (for dogs?) (fig. 3: 6) made of an antler prong. An anthropomorphic figure ("*idol*") was found on the site Usvyaty IV (fig. 9). The item is formed from an antler prong. The figure is made with a special attention to the anatomy of the body. Its face was made schematically: deep eyes under expressed eyebrow ridges, a straight nose and opened, "calling" mouth. Traces of production did not survive. The whole surface of the idol was carefully smoothed and polished. It is difficult to identify whether this polishing was connected with special processing of the item or storage and carrying in a leather bag. The item from Dyazditsy II was made in the same stylistics. The artefact represents a fragment of a tubular bone on which human faces were cut out (one of two masks remained partially) (fig. 7). Traces from cutting can be clearly seen on its surface. This item was not finished. It served most likely as a preform for small anthropomorphic figures.

Late Neolithic traditions were also formed on the basis of preceding Middle Neolithic culture (Mazurkevich et al. 2009). Certain categories of implements (*spatules*, for example) were still in use, however, also new forms and new categories appeared (*scrapers* for wood treatment). Collections from the settlements Naumovo, Udvyaty I, Dubokray I and Serteya II are not so numerous, but various and also new items appeared. Awls, knives, spatules, different types of arrowheads with various preforms were found in the settlement Naumovo (fig. 5). *Pressure flaker* was found in the settlement Dubokray I (1 ex.) (fig. 4: 4). This small tool was made of a bear's elbow bone fragment with a handle. In one human burial of the site Udvyaty I (burial 1, bone chamber No. 3), there were pendants made of various wild animal teeth and tubular bones (fig. 6).

Analysis of macro and microtraces on ornaments' surface connected with items' production and use allowed us to divide the items into two groups. Items made of tubular bone belong to the first group (14 items) (fig. 6: 1-10, 12-15). All of them represent small (up to 2 cm in length), trapezium-shaped plates, no more than 5 mm thick, with drilled hole in a narrow part of pendants. Traces of pendants production did not remain. A zone with polishing inside and on the edges of holes in the top part was traced on almost all items attributed to this group. Concentric traces of drilling on these areas were not traced. It might be connected with a possible way of pendants fastening — items were densely sewn to clothes in which the person was buried. Pendants made from various wild animal teeth (24 items) and one pendant-beading made of bird tubular were attributed to the second group (fig. 6: 11, 16-38). Dog (or a badger?) canines, elk incisors, bear molars and tusks were used. Additional treatment of teeth was recorded only on elk incisors. In a root part of six teeth traces of scraping, namely the longitudinal scratches preparing place for hole making, remained. In those cases where holes remained partially or completely, they have concentric traces of drilling by flint drill. Utilitarian wear traces, which might appear as a result of fastening or carrying pendants, were not recorded inside the holes or near them. Traces connected with contact or friction of pendants with each other were neither traced. Thus, it is possible to assume that pendants made of animal teeth were strung on a lace (all together or some sets) shortly before their placement on a body of a buried person.

Results of the technological and functional analysis have provided information about bone and antler raw materials value in the life of ancient hunter-gathering communities in Dnepr-Dvina



interfluve, about methods of its treatment and tools function. This material reflects contacts with the neighboring regions, interferences of cultural traditions and ways of their adaptation according to local resources. Unfortunately, it is only a small part of material culture which survived.

Materials of Neolithic lake-dwelling settlements of Switzerland are represented within a well-preserved archaeological context. Bone and antler implements represent a significant part of utilitarian and non-utilitarian complex of artefacts throughout the whole Neolithic period of this region. Well-established technological methods of bone and antler raw materials processing, functionally formed forms of tools with well-preserved wooden fastening elements (handles, arrowhead shafts and fastening organic materials) are distinctive feature of Neolithic cultures of Circum-Alpine foreland (Schibler 2013). The analysis of context along with utilitarian macrowear on a working part of an item allows defining its function. Thus, bone and antler artefacts of Circum-Alpine foreland Neolithic settlements used as reference material might be of a great importance in the analysis of bone, antler and teeth implements from the Neolithic period and the beginning of the Bronze age on the territory of Dnepr-Dvina interfluve. Comparison of two, at first sight, culturally different ancient communities reveals also some common elements traced through details (for example, ways of boar's tusks treatment for morphologically similar tools processing (scrapers) used for wooden treatment).

Thanks to the participation in NEENAWA project, I got the possibility to see bone, antler and teeth items of Neolithic pile-dwelling settlements from Switzerland and exchange experience of technological and functional analysis with colleagues from the University of Basel (IPNA).

#### **Acknowledgement**

Special thanks go to Prof. Albert Hafner and to the curator of Stone Age collections at the Bern Historical Museum, Sabine Bolliger Schreyer, as well as to Prof. Dr. Jörg Schibler and Manar Kerdy.

#### **References**

- Мазуркевич, А. Н. (1998). О происхождении усвятской культуры среднего неолита. *Проблемы археологии. Вып. 4. СПб.*, 77-85.
- Мазуркевич, А. Н., Микляев, А. М. (1998). О раннем неолите междуречья Ловати и Западной Двины. *АСГЭ. Вып. 33. СПб.*, 7-33.
- Мазуркевич, А. Н., Зайцева, Г. И., Кулькова, М. А., Долбунова, Е. В., Семенцов, А. А., Ришко, С. А. (2016). Абсолютная хронология неолитических древностей Днепро-Двинского междуречья VII-III тыс. до н.э. Радиоуглеродная хронология эпохи неолита Восточной Европы VII-III тыс. до н.э. Смоленск, 317-356.
- Малютина, А. А., Саблин, М. В. (2014). Выбор сырья и первичная обработка костяного и рогового материала торфяниковой неолитической стоянки Усвяты IV. *Записки ИИМК РАН, №9. СПб.*, 21-31.
- Саблин, М. В., Пантелеев, А. В., Сыромятникова, Е. В. (2011). Археозоологический анализ остеологического материала из неолитических свайных поселений Подвинья: хозяйство и экология. *Труды Зоологического института РАН. Том 315, №2. СПб.*, 143-153.
- Mazurkevich, A., Dolukhanov, P., Shukurov, A., Zaitseva, G. (2009). Late Stone – Early Bronze Sites Age in the Western Dvina – Lovat Area. In: Dolukhanov, P., Sarson G. R., Shukurov, A. M. (eds.). *The East European Plain on the Eve of Agriculture. BAR International Series 1964. Oxford*, 145-153.
- Schibler, J. (2013). Bone and antler artefacts in wetland sites. In: Menotti, F. and A. O'Sullivan (eds.). *The Oxford Handbook of Wetland Archaeology. Oxford University Press, Oxford*, 339-355.

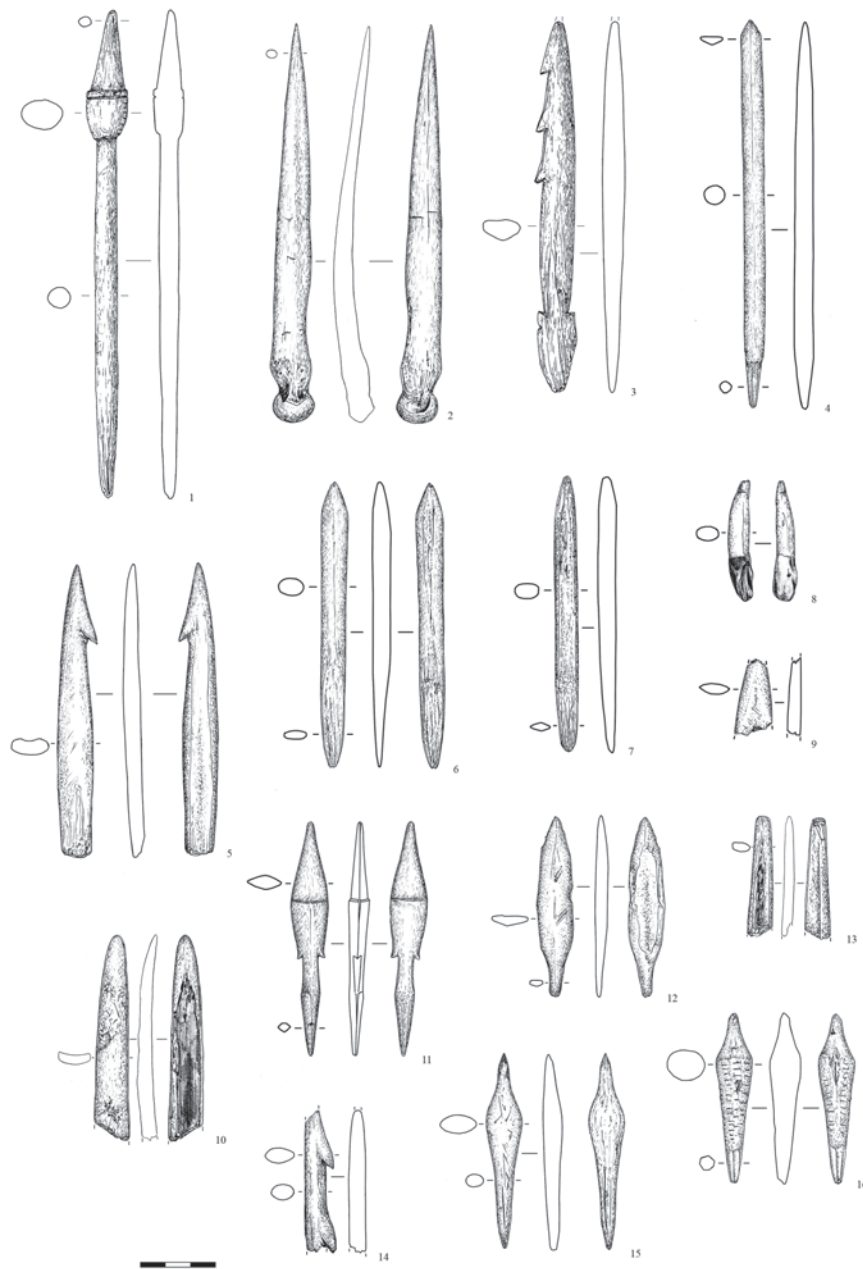


Fig. 1: Bone, antler and teeth items. 1-4, 6, 7, 10, 11, 13 — Rudnya Serteyskaya; 5, 8, 9, 12, 14, 15, 16 — Serteya X. 1, 4, 6, 7, 9, 11, 12, 15, 16 — arrowheads; 2 — awl; 3, 5, 14 — harpoons and spear-head; 8 — pendant; 10, 13 — tools.

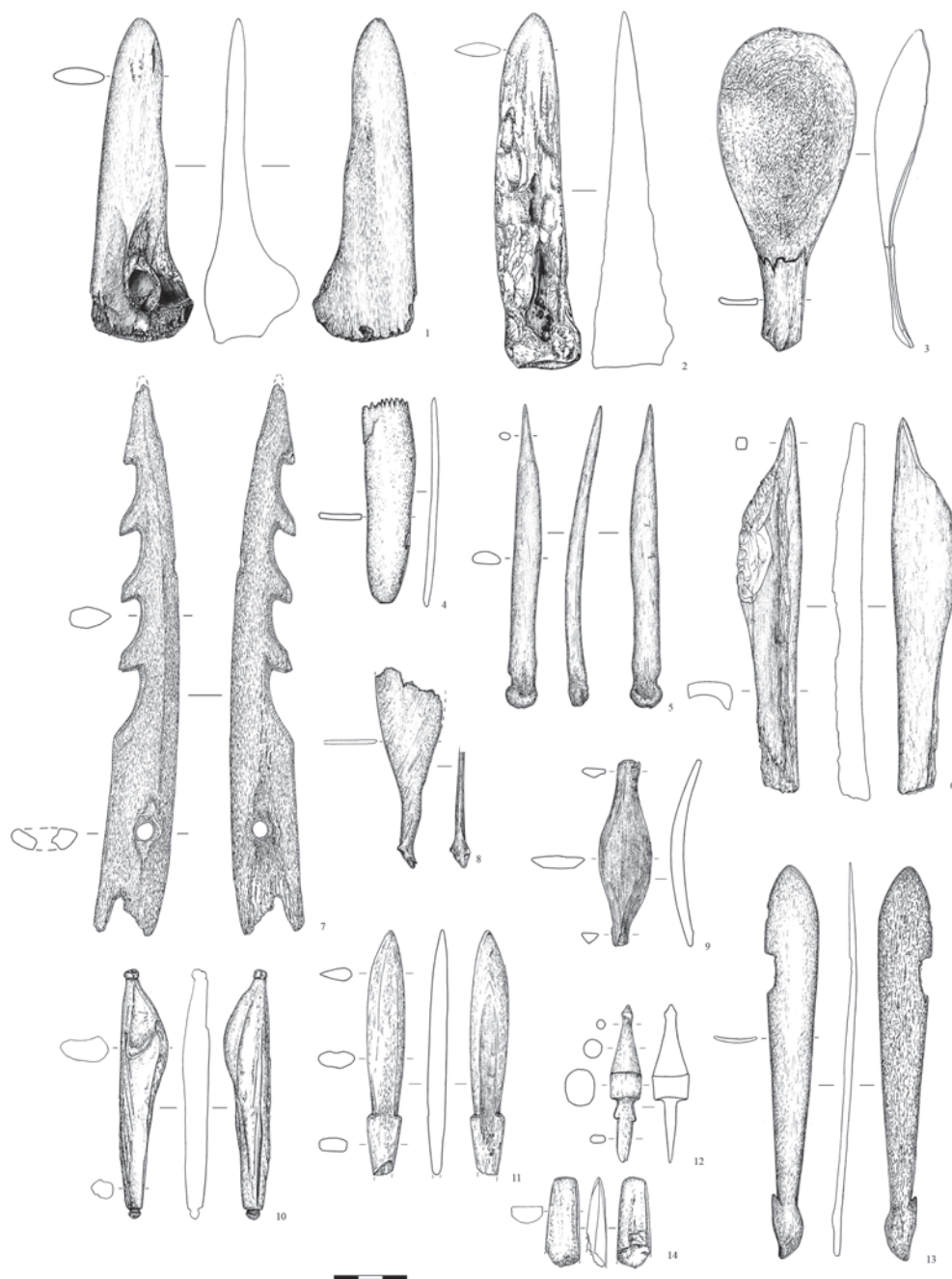


Fig. 2: Bone, antler and teeth items. Usvyaty IV. 1, 2 — daggers; 3 — spoon; 4 — spatula with prongs; 5 — awl; 6, 14 — chisels; 7, 11 — harpoons and spear-heads; 8, 13 — spatules; 9 — spinner; 10 — sinker; 12 — arrowheads.



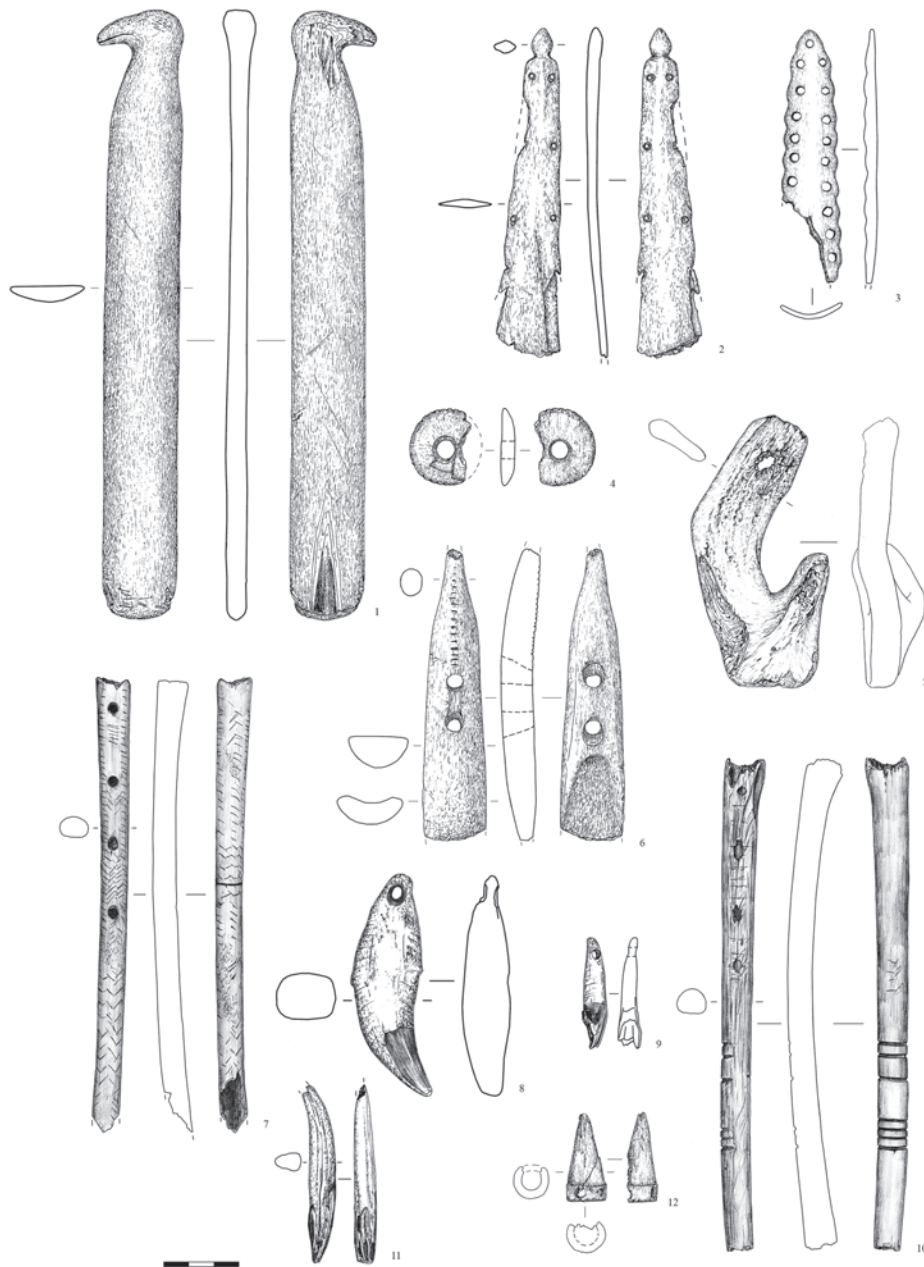


Fig. 3: Bone, antler and teeth items. 1-6, 9, 11, 12 — Usvyati IV; 7, 8, 10 — Dubokrai V. 1 — baton, 2-4 — cover plates; 5 — hook; 6 — element of harness; 7, 10 — “flutes”; 8, 9, 11 — pendants; 12 — fragment of antler item.

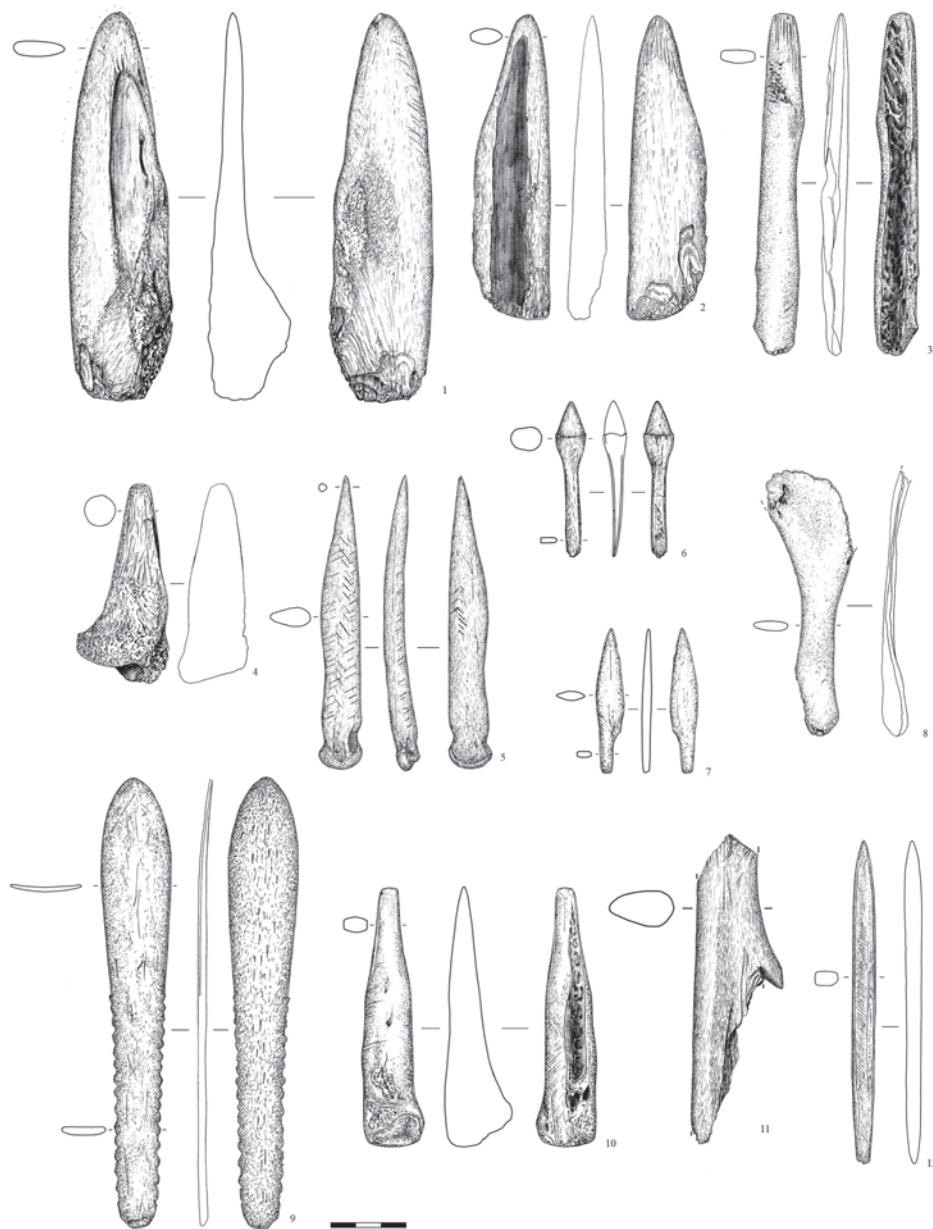


Fig. 4: Bone, antler and teeth items. 4 – Dubokrai I; 1–3, 5–12 – Dubokrai V. 1, 2 – daggers; 3, 10 – chisels; 4 – pressure flakers; 5 – awl; 6, 7, 12 – arrowheads; 8 – fragment of spoon; 9 – spatula; 11 – fragment of harpoon.

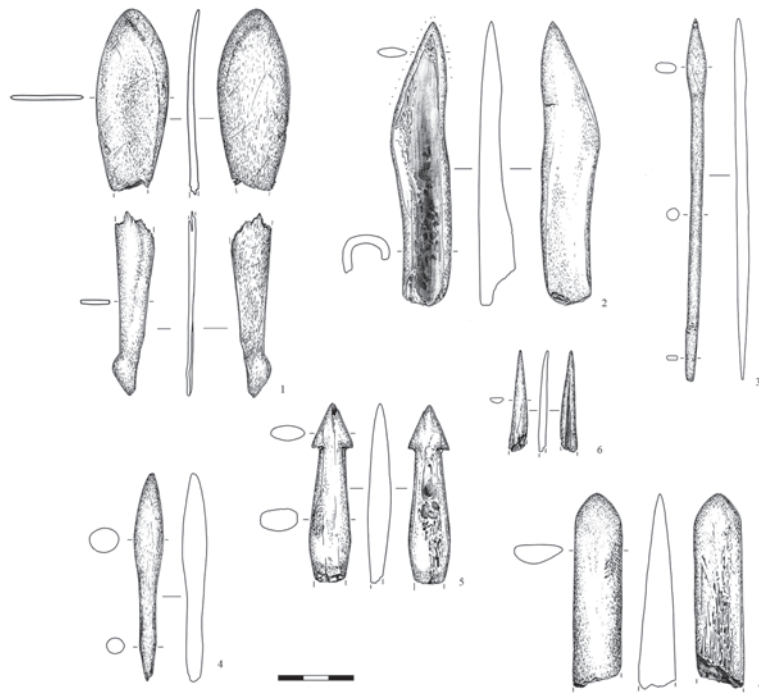


Fig. 5: Bone, antler and teeth items. Naumovo. 1 – spatula; 2 – knife; 3, 4, 5 – arrowheads; 6 – awl; 7 – chisel.

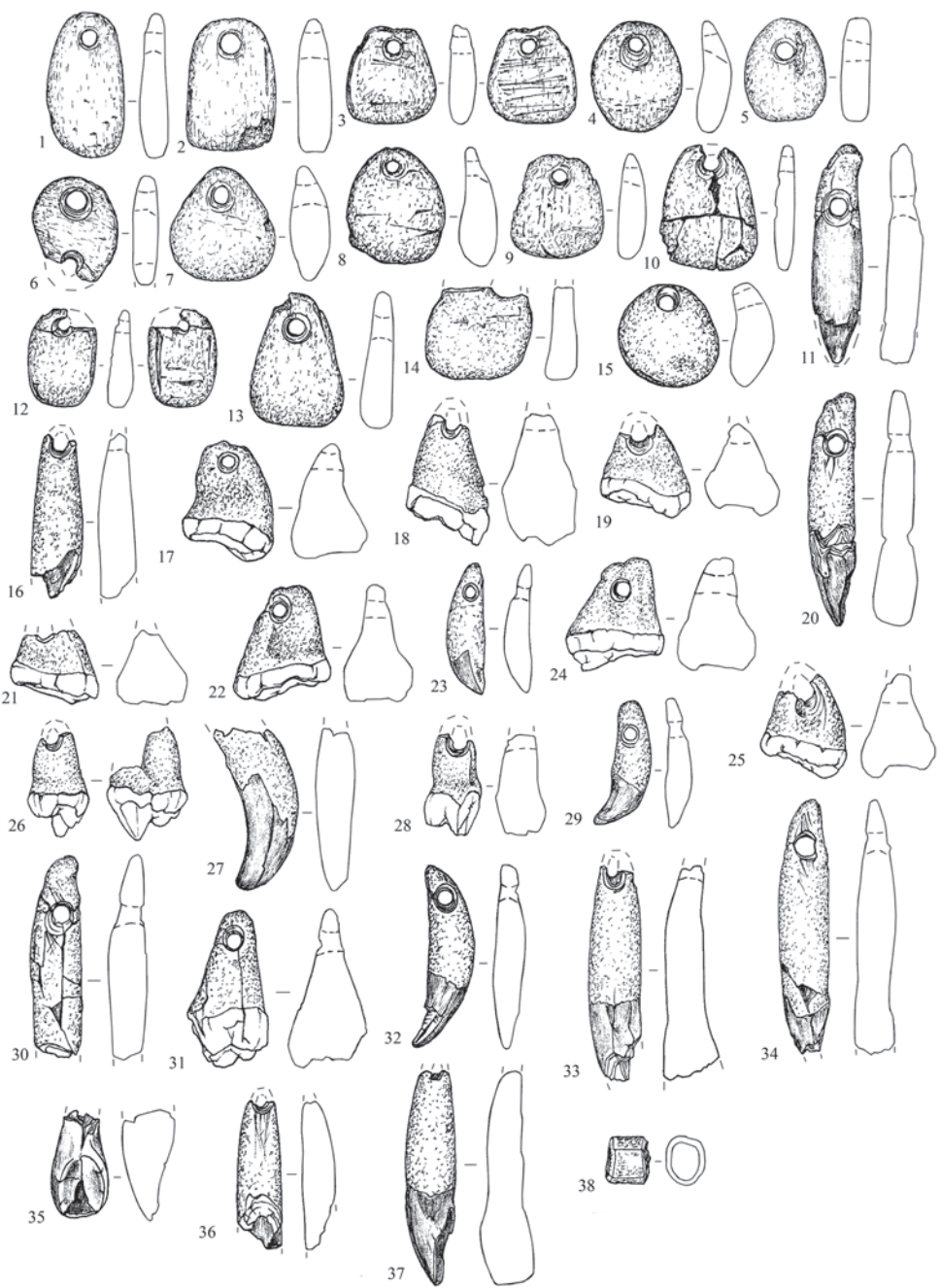


Fig. 6: Udvyaty I. Pendants made of bone, antler and teethes of wild animals.





*Fig. 7: Dyazditsy II. Item made of tubular bone with anthropomorphic faces.*



*Fig. 8: Usvyaty IV. Zoomorphic decoration of spatula handle.*



*Fig. 9: Usvyaty IV. Antler figurine.*

## II.A.5 Field Conservation of Waterlogged Organic Archaeological Finds of the Pile-Dwelling Site Serteya II

Hidden at the bottom of lakes and rivers, pile-dwelling settlements are one of the most unique sources to study the ancient epochs of humanity. In the Neolithic age, natural resources were actively involved in many facets of life, remnants of which are preserved in wet layers. Among them are the remains of constructions, tools, weapons, fishing gear, utensils, objects of worship, clothing items, and ornaments.

Serteya II is one of the pile-dwelling sites situated on the Lovat-Dvina interfluvium. Every year, during new field season, the State Hermitage Museum's collection of ancient objects is replenished with a variety of rare finds, many of which are made of organic materials. Thanks to decades of active and versatile research conducted on the pile settlement Serteya II, this site is exemplary in the field of studying and conserving the cultural heritage of the "pile-dwelling civilization" that existed in the Upper Dvina area from the beginning to the end of the third millennium BC (Miklyayev 1977, 12).

Archeologists are responsible for conserving cultural heritage for future generations. When waterlogged organic materials are found, conservation of archaeological finds becomes an acute problem as measures for the conservation of waterlogged organic matter must be taken immediately at the time of its detection. Even before excavations begin, archaeologists need to consider ways of lifting, temporarily storing, transporting, and ensuring the further restoration and storage of the finds.

An important task is the transfer of knowledge and skills of excavation and conservation to the younger generation of researchers. During field seasons at the site Serteya II, inexperienced archaeologists practice both in the field and in the laboratory. An exchange of experience was conducted with colleagues from other countries involved in the study of pile-dwelling settlements, which included giving lectures on the field conservation of waterlogged organic finds.

Preservation of wood, birch bark, bones, and amber are promoted by local climatic, landscape conditions, and features of formation of cultural layers of the site itself. Findings from the pile settlements of the Lovat-Dvina interfluvium lie in wet dense layers of peat, gyttja or silty sediments (Miklyayev 1969, 22; Miklyayev 1982, 27; Mazurkevich 1995, 81).

The cultural layers of the site Serteya II are compressed and saturated with water. Their microclimate is characterized by several properties: abundance of water, limited access to oxygen and sunlight, and neutral/low-acid soils.

One significant factor affecting conservation of organic matter is the buried soil's acidity level. It is established that acidic soils contribute to the preservation of protein materials, such as leather and wool. Alkaline soil is favorable for cellulose fibers. Soils with a neutral pH preserve both cellulosic and proteinaceous fibrous materials (Higgit et al., 2011, 81; Pedeli, Pulga 2013, 14-15).

The express method for determining the pH level for the layers of the site Serteya I and Serteya II with preserved organic materials (bone, wood, threads from the willow bark) showed grades 6 and 7 (low-acid and neutral). It should be noted that although environmental conditions are quite satisfactory, on none of the investigated pile settlements of the Lovat-Dvina interfluvium residues of leather, fur, or fibers of protein origin were found. The reasons for the lack of proteinaceous fibrous materials should be sought in the specifics of the economic type of the population of pile settlements, in the technological level of processing leather, as well as in the material value of leather and fur products.

Despite the fact that the existing conditions contribute to the preservation of all organic materials, in reality, the objects from bone and amber are better preserved, while the wood, lime bast, and

vegetable fibers are more affected by degradation.

This can be explained by the age of the finds and their large water content. Water is one of the ways to preserve the world's oldest organic materials, and, also, a factor in their decomposition. It first fills the cells of bone, wood, fiber, then gradually diminishes their "adhesion components" (protein or cellulose), and then replaces them and fills all voids. Thus, objects become water-saturated, so that the shapes and sizes of objects already destroyed by physical and chemical properties are preserved (Nikitina 1972, 235; Hoffmann 2013, 25-36).

The specificity of preservation of organic materials saturated with water requires a number of conservation measures, so that ancient finds can continue to exist in museums as exhibits and become an accessible source for research.

The accumulation of experience and knowledge about the conservation of waterlogged organic archaeological finds is accompanied by the expansion of research on pile settlements. Excavations of the Neolithic wet layers have caused the foundation of a direction of conservation of waterlogged archaeological wood, bone, and amber in the State Hermitage Museum.

By the beginning of the study of pile settlements in the Pskov and Smolensk regions, specialists of the State Hermitage Museum already had experience in field conservation of archaeological finds, including the discovery/preservation of waterlogged organic materials. E.A. Rumyantsev made great contributions to the birth and development of both field conservation and restoration of archaeological finds of organic materials in the museum. He was a leading specialist in the field of conservation of archaeological finds for the State Hermitage Museum from 1938 to 1964 (Nikitina 1990). Under his active leadership, wooden, leather and bone objects were conserved in the frozen barrows of Pazyryk, in the wet layers of Novgorod, Staraya Ladoga, and Pskov. E. A. Rumyantsev actively promoted the introduction of synthetic resins (PBMA, PVB, PVS) into conservation practice and developed methods of conservation of archaeological finds (Rumyantsev 1953, 1958a, 1958b, 1959).

In 1962, when the Neolithic expedition, headed by A.M. Miklyaev, of the Pskov archaeological expedition was sent for reconnaissance, the field laboratory (FL), "typical for archaeological expeditions of the State Hermitage Museum", was already formed. It was equipped with "all the means of conservation used in the field" (Miklyaev, Nikitina, Pozdnyak 1985, 7).

In 1964–1967 field conservation of archaeological finds discovered at the site Usvyaty IV was carried out by restorer of the State Hermitage, A.I. Pozdnyak (Miklyaev 1971, 7). To preserve objects made from wood, bone, and antler solutions were used in the field including PVB in alcohol, low viscosity PBMA in acetone and xylene, disinfecting solutions of sodium pentachlorophenolate in water and alcohol. For packaging, gauze and polyethylene film were used: "In the field, bone and wood finds are quickly packed in a gauze soaked in disinfectant and sealed in polyethylene envelopes, which protects the find from mold and drying and allows it to be delivered to the laboratory in an unchanged state" (Miklyaev, Nikitin, Pozdniak 1985, 7-8).

The study of pile settlements in the Pskov region continued. In the 1970s, the Northwest Archaeological Expedition of the State Hermitage Museum (NWAE SH), under the leadership of A. M. Miklyaev, conducted excavations of the Naumovo site, Dubokray I and Dubokray V (Miklyaev 1977, 10; 1982, 6, 18; 1995, 7; Miklyaev, Semenov 1979, 5). The same materials and methods for conservation of waterlogged archaeological objects were used there and for the finds of the pile settlement Usvyaty IV (Miklyaev, Nikitina, Pozdnyak 1985, 8).

In 1972 two more sites dated the middle of the third millennium BC, were discovered - Serteya I and Serteya II. They are located in peat layers and partly on the bottom of the river Serteyka, in the north of the Smolensk region, near the town of Velizh (Miklyaev 1977, 10, 12). In 1980, the study of the pile settlement of Serteya II was conducted using methods of underwater archeology, which allowed the preservation of many of the construction features and rescuing finds "from inevitable destruction" (Miklyaev 1982, 28).

The first underwater find during the study of the pile settlement Serteya II was a fragment of lime bast rope (Miklyaev 1982, 27). The find was comprised of “fragments of a fishing net made from a single string of linden bark, previously screwed on a solid foundation, and before weaving the net once again twisted. The size of the mesh is 4.5 x 4.5 cm” (Древности ... 1995, 13).

Systematic underwater excavations of the site Serteya II, as well as the study of layers located on peat and mineral shores, were conducted in the last decades by the NWAЕ SH under the supervision of A. N. Mazurkevich, General Curator of the Department of Archaeology of Eastern Europe and Siberia. Among the finds are an abundance of bone materials – tools, pendants, many wooden objects; among them, fragments of vessels, fragments of the oar, tools, details of constructions, pendants, floats from the bark, sinker, vegetable threads (and products made of them), and amber ornaments.

The study of the site Serteya I resumed in 2010 (Mazurkevich, Dolbunova 2011, 59). During underwater archaeological work, “were found the remains of two wooden constructions, numerous palings, the remains of a fishing net and a sinker. Also, various treatment wooden objects, fragments of bone tips were found here” (Dolbunova 2014, 243). Such finds of the site of Serteya I, like fragments of the network and fishing construction are labor-intensive objects, both during archaeological research and during the restoration process.

Between the archaeological research of the piles-dwelling sites Usvyaty IV and Serteya II, more than half a century has passed and, of course, the methods and materials of conserving waterlogged archaeological organic finds have changed; somewhat, as a rule, due to the appearance and spread of new packaging materials (various food films, plastic containers), and also the possibility of using special mobile equipment (refrigerated bags, equipment for making vacuum and sealing food products).

The principle of field conservation, which was formulated by E. A. Rumyantsev, remains unchanged: “the main task of conservation in the field is ... in the temporary, instant and reliable safety of finds for excavating them from the earth, safe sending to restoration laboratories - workshops where they should be to cleaning, disinfection and final consolidation” (Rumyantsev 1953, 136). The object must be conserved in its nature and features and it should be brought to the restoration laboratory in a condition not worse than at the time of detection (Field conservation ... 1984, 4; Nikitina, Baranova 1985, 70-71).

Organic materials have high hygroscopicity - they are capable of both absorbing and giving away moisture in order to maintain relative humidity in equilibrium with the environment. When an organic find is removed from the wet archaeological layer, water, which holds the cellular structure of the material, evaporates, thus the object can lose shape and size.

The further conservation of a waterlogged find depends on the first conservation measures taken, because, at the time of discovery and ascent, the archaeological find undergoes a sharp change in physicochemical situation, “which in most cases has a more detrimental effect on the condition of the object than a prolonged stay in the earth” (Field conservation ... 1984, 2-3).

The processes of destruction can be suspended by a number of measures that contribute to the preservation of “relatively stable conditions” (Nikitina, et al. 1985, 73).

The structure of the field laboratory and methods of conducting field conservation largely depend on features of the investigated site itself, the condition of the finds, and the organization and material support of the expedition. So, for work on the waterlogged sites investigated by NWAЕ SH it is possible to determine the following characteristics that affect the organization of field conservation:

Usually, there are excavations on several sectors of Serteya II. Each has its own degree of humidity: underwater excavation, coastal excavation, several peat sites, sieving materials (fig. 1).

The field laboratory (FL) is located at a sufficiently remote distance from the place of excavation, which requires the organization of transportation of finds. The duration of the expedition is 1.5 - 2



months, which means it is necessary to provide temporary storage of the finds.

It is necessary to take into account the saturation of layers with archaeological material and the variety of archaeological material in nature, size and condition, which in turn requires a sufficiently large stock of packaging materials and a large area of FL. Technical support of NVAE SH allows the use of special equipment for primary conservation measures in the field.

Thus, proceeding from the listed features, the field conservation of the finds of the pile settlement Serteya II is divided into several stages.

The first stage follows the discovery of the object. Both under water and in peat layers it is necessary to uncover the boundaries of the find. In order not to damage or miss objects, wet ground excavations are carried out by hands, and the surface is cleaned with a wet natural sponge or a soft, damp cloth (fig. 2). Under water archaeologists do not touch the layer, but just hanging over the area under investigation. With light and smooth sweeping movements of hands, they create a local flow, which clears the layers, while the ground is sucked into the pump (fig. 3). The second stage is the lifting of the find. It is carried out after the necessary documenting: leveling, photographing, and sketching. A small find under water can be picked up by hand and immediately packed in a sealed bag of water, and when lifting to air, move it as quickly as possible into a dark container (fig. 4).

Organic objects, highly saturated with moisture, become very soft. Wet finds of large dimensions, elongated shapes or thin-walled can break down under the weight of water. To lift them, it is necessary to utilize a strong flat substrate (for example, a piece of plexiglass) which, to some extent, ensures the integrity of the object. Good practical results of lifting complex finds show how to create a monolith from a plastic strong substrate (food cutting boards, plastic rulers were used), with which the ground under the object was cut. Then the object should be strengthened to the base with a food film that fits snugly against the object, and packed in dense polyethylene (fig. 5). If the moisture content of the find is small, then for the strengthening of the edges of the monolith it is also possible to use gypsum bandages (fig. 6).

While the detected waterlogged objects from organic materials continue to remain in layers of peat, it is necessary to protect their upper layers from drying. To do this, one should wet them with water or cover with polyethylene. Packaging and transportation to the field laboratory is carried out in the same way. All finds are signed after packing. The best option for field labels are thin plastic waterproof white sheets, the labels are then applied with a pencil.

The third stage is packaging and transportation to the field laboratory. If the find was raised as a monolith, then it is usually packaged and transported in a separate container. If the monolith is large, then it is additionally hermetically wrapped in dense polyethylene and transported in this form. In general, any waterlogged find is tightly packed in polyethylene and placed in a dark plastic container. This is done to maintain stable moisture and avoid sunlight.

Before packing, large soil contaminations are removed from the find. For this, the objects are dipped in a container of clean water. A large number of finds on the pile settlement of Serteya II do not allow for complete removal of contaminants from each object before the first packing. Findings from birch bark, fibers and amber are packed with hydrogel, as it provides a constant moisture, does not wash out fibers, and creates depreciation (fig. 7).

The fourth stage is the conservation of waterlogged archaeological finds in the field. Only in extreme (special) cases waterlogged archaeological finds are processed with the help of conservation materials. Basically, field conservation of waterlogged organic materials involves organizing proper temporary storage and packing of finds. Next is the continuous monitoring of their condition. When packaging waterlogged organic materials, it should be remembered that the object will be in a packed condition for several months until it is finally handed over for restoration in a specialized laboratory. In addition, many finds will be investigated by investigators before

restoration begins; therefore, the use of solvents or synthetic polymers is not desirable. It is also necessary to know what finds will serve for radiocarbon dating and exclude their treatment with an antiseptic.

### **Bone objects**

Bone is the most massive material among organic remains in the layers of pile settlements. This collective term means different types of bone tissue, each of which has a specific structure and composition (Birshtein 1975, 63). Ternary and lamellar bones, antler, teeth of animals, fangs, bones of fish and birds are found on the site Serteya II, and rare human remains have also been discovered. Known as faunal remains, are widely represented in objects of bone tissue: tools, weapons, jewelry (Malyutina, Sablin 2014; Maigrot 2014; Sablin 2014).

As is known, in the composition of bone tissues there are various proportions of protein and mineral components. Due to their chemical and physical properties, bone, as a material, in the process of archeologisation is less prone to damage compared to other organic materials. However, in conditions of high humidity, in an alkaline environment the organic component is lost, while in an acidic environment it is the mineral component (Pedeli, Pulga 2013, 28; O'Connor 1987, 7).

Bone finds of Serteya II are saturated, but strong enough that most of them can be lifted from the layer with hands. They darken when the wet environment changes to air, probably this change is caused by the destruction of collagen (Birshtein 1975, 70; O'Connor 1987, 7). Destructions on objects are more mechanical including loss along the edges, breakage, cracks. On some antler items, the top layer is partially lost (fig. 8). It is rather thin and brittle, and sometimes the bone exfoliates and deforms. For products from teeth and canines, the appearance of microcracks on the surface of the enamel is characteristic, and if the process of slow drying is not observed, it begins to crack and peel off with microparticles (fig. 9).

Prior to the restoration of wet archeological bone finds, a number of studies were carried out, including determining the species of the animal whose bone was used, the technology of making the object, and investigative analysis (Malyutina, Sablin 2014; Maigrot 2014; Sablin 2014). These types of research are better done with finds that have not been treated with solvents and synthetic polymers. In the course of the research, the samples under study are repeatedly subjected to a change in the medium from moist to atmospheric. For this reason, for bone finds from pile settlements, it is more expedient to apply a slow drying of wet bone material, which should be started in the field and monitored during preliminary research and continued in the laboratory.

Slow drying can be completed in several ways. Immediately after lifting, the find must be cleaned from dirt and placed in a sealed plastic bag, then in a plastic sealed container. In under water conditions, bone finds are packed in a bag with water immediately after detection. Depending on the degree of preservation, the findings can be densely wrapped in food film, tightly wrapped with strips of mica or filter paper and placed in a bag with holes, or wrapped in food perforated film. Periodically, it is necessary to check the finds and change the soaked paper strips to dry ones. Finds must be kept in a dark place. Dry sand or refrigerated bags can be used for temporary storage and simultaneous slow drying process in the field (if possible) (fig. 10). In the field, the drying process is monitored organoleptically, and a mobile device for measuring relative humidity and temperature can also be used. The use of control weighing by means of scales as in a specialized laboratory is also used when equipping an expedition. Slow drying can also be carried out in a sealed container with holes in the lid. In this case, bone objects must be tightly wrapped with paper or absorbent cloth, periodically changing it (fig. 11).

As noted, the top layers of antler objects can peel off with loss of moisture. To prevent such destruction in the field, you can use water solutions of acrylic emulsions such as Primal WS 24,

Lascaux 4176, Plextol B 500 (Johnson 1994, 227). In this case, the find should retain moisture, but not be very waterlogged. Apply glue to the upper layers with a soft synthetic brush or pipette, then cover the object with a food film.

In the 1980s, aqueous dispersions of copolymers of vinyl acetate with vinyl butyrate or vinyl acetate with dibutyl maleate (Field conservation ... 1984, 14) were used to preserve bone findings. At the same time, in the Laboratory of Scientific Restoration of Objects of Applied Art from Organic Materials (LSROAOM) of the State Hermitage Museum, copolymer dispersion was used to conserve a damp bone that "cannot be dried naturally" (Nikitina et al. 1985, 76).

### **Waterlogged Wood Objects**

In wet conditions, wood absorbs a large amount of water until it becomes saturated; as a result, water slowly dissolves the pulp until it almost completely replaces this component. Water instead of cellulose begins to provide support for the cellular structure, thereby preserving the recognizable shape of the object. In this state, a waterlogged wood can survive for thousands of years, as evidenced by the finds of pile settlements.

"Waterlogged archaeological wood" is not a wood in the usual sense; its chemical composition has changed during its stay in the archaeological layer. It is more correct to say that in archaeological sites we find objects made from the material that was once a tree (Gerasimova, Nikitina 1975, 80; Field conservation ... 1984, 18; Zaitseva et al. 1985, 62; Kolosova 1985, 65). K. F. Nikitina noted that objects from peat bogs and bogs are destroyed specifically due to: "evaporation of water from such wood under conditions of natural drying causes cracking, buckling and volume change, sometimes so significant that the object loses its historical and artistic value" (Nikitina 1972, 235) (fig. 12). The degree of destruction of wet archaeological wood and the water content in it depends on many factors "from the species of the tree, the conditions and the duration of its stay in moist soil" (Gerasimova, Nikitina 1975, 80). Neolithic waterlogged wood can be compared with a "sponge", it is soft to the touch, with a slight tap on the surface of the water. The moisture content of the wood (W) according to the samples of the site Serteya II is about 900-1100 %. Conservation of a waterlogged archaeological wood requires specialist supervision and can last several years. It must be carried out in a specialized laboratory.

The task of field conservation is to properly pick up and pack the find from a waterlogged wood. How to avoid mechanical breakdowns was mentioned above (see the first, second and third stages). There are several ways to prevent biological contamination of the finds of a waterlogged archaeological wood. First, involves treatment with an antiseptic. An antiseptic solution on Neolithic waterlogged wood is best applied with a soft synthetic brush. For the treatment of large objects, spray application can be used. Also, the packaging of a waterlogged object along with cotton wool or a piece of cloth soaked in an antiseptic showed positive results if the object itself was not processed at the same time. It is possible to exclude the use of antiseptics if waterlogged organic materials are stored at constant low temperatures of 5-9°C. In the field, refrigerated bags can be used for this (fig. 13). They need constantly cooled refrigerants, which in turn can be cooled in an automobile refrigerator. Biotransplants have not been observed when storing Serteya II waterlogged wooden finds in open containers with water, as the water was periodically replaced with fresh water. In addition, the evacuated sealing of wet wooden products also gave a positive result but it should be used with caution. It is necessary to control the exhaustion of air from the bags and stop it before the compression of the object itself begins (fig. 14).

### **Waterlogged Archaeological Birch Bark, Bast, and Plant Fibers Objects**

Several of the last field seasons of Serteya II gave archaeologists astonishing finds from plant fibers. Among them are simple fragments of rope, twisted yarns on wooden sticks, and fragments

of wickerwork. Also, several objects and their fragments from birch bark, bark, and lime bast are known. The main part of these finds refer to fishing accessories - floats, sinkers, network fragments, winding of fishing traps, remains of baskets, lob bucks, and other fragments of objects braided from threads have also been found.

In Neolithic sites' wet layers, objects from birch bark and bark are preserved, but unlike medieval birch bark and bast, they are very soft, loose, and thin. In the process of drying, they lose elasticity, delaminate, deform, become brittle, they can crumble, and their shape changes. Therefore, it is very important to properly pick up such products and pack them while keeping their moisture and shape before starting restoration work in the laboratory. When detecting objects from birch bark, bast, fiber, it is best to lift them with a monolith (fig. 15).

Most of the fishing sinkers from the sites Serteya I and Serteya II have pebbles or a dense clod of limestone and silt, on which layers of bast wrap, with or without threads, are partially preserved (fig. 16.) Strips of bast are usually thin, brittle, warped, and often displaced from the original place, but from their form it is possible to determine the location on the basis. When dried, the material breaks and crumbles, and the soil contamination can "cement" on the surface of the bast and ropes so that they become difficult to remove without damaging the material itself. In these cases, pollution is not removed, but canned together with the material. A conservation process of sinkers found on the sites Serteya I and Serteya II, discovered in the last few field seasons, was conducted at a specialised laboratory. The use of water solution of acrylic emulsion for the conservation of these items has shown good results. Restoration was successful with birch bark objects, which at the time of admission to the laboratory retained moisture (fig. 17).

On the sites Serteya I and Serteya II, special attention is given to the most "tender" objects - those that were made from vegetable fiber. They were made from linden bark, willow bark and blueberry roots (Mazurkiewich 2014, 261).

Work with waterlogged archeological objects made from vegetable threads is entitled to be called the most painstaking work in both conservation and field work. Such finds are rather difficult to detect, not only in conditions of poor visibility on the bottom of the Serteyka River, but also in the "mire" of the peat bog. Their detection is a consequence of the utmost care and, of course, the luck of the archaeologist. The rise of these finds should be carried out with extreme caution, since thread products are easily traumatized under the weight of the water they are saturated with. If possible, the lifting must be done with a monolith, which is immediately sealed in order to avoid drying out. Packaging for the items under consideration, if not raised by a monolith, is quite problematic. Undoubtedly, a flat, rigid waterproof base is required to hold the objects. In addition, it is necessary to keep moisture so that the objects do not dry out. This is achieved by wrapping the object in food film, with further placement in a sealed plastic bag or plastic container. However, dense packaging on a flat waterproof basis can create excessive moisture, which will lead to fiber blurring (to the state of "porridge") and, as a consequence, to loss of the object. Accordingly, the humidity of the packaged wet threads, ropes, and objects from them, as well as the above described weights, must be constantly monitored in the field.

Objects made from vegetable fibers from the sites Serteya I and Serteya II were raised in different ways, depending on their condition and the possibility of removal from the layer. They entered the restoration in varying degrees of condition (Vasilyeva 2018; 2014, 232). Accordingly, in the future, a different restoration approach to these objects is required. Thus, some samples of ropes in the field were treated with 10% aqueous solution of PEG-1500, applied by a soft brush. In this way, a temporary "protective" wax casing was created for the findings, which fixed the volume and location of the filaments, and slowed the natural drying of the objects (fig. 18). Other objects were taken with a monolith of muddy soil, which was packaged on a solid substrate and wrapped in several layers of food film (fig. 19). Stones with a fibrous and basted winding were also taken with a monolith (fig. 20). Separate samples of filaments, as well as filaments on



fragments of sticks, were packed together with hydrogel on a plastic substrate, wrapped with several layers of food film, and then placed in plastic containers (fig. 21). All listed methods of field packing of fibers do not allow both drying for the objects under consideration and washing the fiber to the state of “porridge”.

Based on the practice of packaging birch bark, bast and fibrous finds on the site Serteya II, the best result is the packaging of the object by using a solid plastic base, food film and a sealed package. The item is packed together with hydrogel.

### **Amber artefacts**

Amber artefacts of the pile settlement Serteya II are still scarce and are represented by pendants. Discovered amber finds are dense, with varying degrees of transparency, honey-caramel shades, with insignificant losses along the edges. The surface of the objects is usually polished, with minor abrasions.

This material does not dissolve in water; therefore, the condition in wet dense, oxygen-free, dark layers of pile settlements of amber objects is more than satisfactory. However, a change in the environment during the lifting of the find has a negative impact. It is noticed that, when discovered, amber objects have greater transparency than after removal. Archaeological amber raised from a wet environment should be very slowly adapted to normal atmospheric conditions, keeping the conditions of high humidity as long as possible, and protecting it from direct sunlight. When amber objects are preserved in very dry conditions, they become opaque as their surface is covered with craquelure and after that, the amber begins to disintegrate into small prismatic fragments. Such examples are known from burials from the Sakhtysh burial grounds (Ivanovo region) of Konchansky and Repishcha cemeteries dating back to the 4th-3rd millennia BC (Zimina 1999). So, this demonstrates that increased dryness has a more negative effect on the preservation of archaeological amber than a humid environment.

Upon finding, the amber of the settlement Serteya II was placed in a small bag of water or hydrogel, which was then left in a dark container. After semi-annual adaptation to the atmospheric environment, amber suspensions of Serteya II did not lose their transparency nor color (fig. 22). The fifth stage is the organization of temporary storage in the field. The field season on the site Serteya II on average lasts about two months. During this time, a diverse heterogeneous material accumulates in the field laboratory: individual finds, zoological remains, flushing, and geological and dendrochronological samples. To organize storage, individual finds are divided according to the material, size, and degree of condition. Before being placed for temporary storage, packing for transportation to the special laboratory, the find is again examined and visible contaminants are removed, and, if necessary, antiseptic treatment is carried out.

Items made from vegetable fiber, birch bark and bast, as well as amber are packed immediately in the above described ways and stored in separate containers. The bone objects begin to pass through controlled slow drying sand in a container with holes in the lid or in a food perforated film. If they manage to dry out during the field season, the bone finds are packed and stored separately like already dry bone finds. To do this, you can use cardboard boxes and wrapping paper such as mica paper.

Large items of wood should be stored in containers with water with periodic changing. Small objects can be packaged in sealed bags with or without vacuum, and then stored in refrigerator bags. If there is no possibility to use a refrigerator bag, then, in order to avoid biological contamination, it is necessary to provide treatment with an antiseptic. A good method of maintaining the constant humidity of a waterlogged archaeological wood is to place the objects in a container together with wet moss (fig. 23). However, after moss storage, a mushroom smell may persist for a long time on objects. When preparing for transportation, it is not superfluous to lay refrigerants or medical cooling agents to protect against burns between the packaged waterlogged wood.

Wood and bone were the main widely available materials in Neolithic. Artefacts made from wood, bast, threads, bone, antler, and amber found on the sites serve as a source for ancient technologies' reconstruction, palaeolandscape and palaeofauna, economic structure, exchange (trade) relations, and beliefs study. The conservation of the materials of pile-dwelling settlements is an integral part of archaeological research and begins when the find is discovered, with its field conservation.

## References

### In Russian

- Бирштейн, В. Я. (1975). О строении и химическом составе поделочной кости, слоновых бивней и клыков моржей. *Художественное наследие* 1 (31), М., 63-73.
- Васильева, Н. А. (2014). К проблеме сохранения археологических изделий из растительных волокон (по материалам памятника Сертея II). *Археология озерных поселений IV – II тыс. до н.э.* СПб., 23 2-237.
- Герасимова, Н. Г., Никитина, К. Ф. (1975). Консервация мокрого археологического дерева полиэтиленгликолями. *Художественное наследие* 1 (31), М., 80-90.
- Долбунова, Е. В. (2014). Рыболовные конструкции среднего – позднего неолита (памятник Сертея I, Смоленская область). *Труды IV (XX) Всероссийского археологического съезда в Казани. Том I. Казань.*, 243 – 246.
- Древности Северо-Западной России (1995). К 90-летию со дня рождения Г. П. Гроздилова. Каталог выставки.* СПб.
- Зайцева, Г. И., Оболенская, А. В., Леонович, А. А., Кутневич, А. М., Шишко, А. М., Волкович, С. М. (1985). Исследование степени деградации археологической древесины в зависимости от продолжительности и условий залегания. *Краткие тезисы докладов Всесоюзного семинара Новые методы исследования, консервации и реставрации художественных произведений.* Л., 62–63.
- Зимина М.П. (1999). Древнейшие могильники Валдайского Приозерья. IV-III тысячелетия до н.э. *Кончанский могильник (материалы).* М., 264 с.
- Колосова, М. И. (1985). Анатомический анализ мокрой археологической древесины // *Краткие тезисы докладов Всесоюзного семинара Новые методы исследования, консервации и реставрации художественных произведений.* Л.
- Мазуркевич, А. Н. (1995). О раннем неолите Ловатско-Двинского междуречья. *Петербургский археологический вестник* 9. СПб, 77-84.
- Мазуркевич, А. Н. (2014). Свайные поселения Северо - Запада России. *Археология озерных поселений IV – II тыс. до н.э.* СПб., 260-266.
- Мазуркевич А. Н., Долбунова Е. В. (2011). Подводная археология рек и озер в России. *Нептун* 6, 54–62.
- Малютина А. А., Саблин М. В. (2014). Выбор сырья и первичная обработка костяного и рогового материала торфяниковой неолитической стоянки Усвяты IV // *Археология озерных поселений IV – II тыс. до н.э.* СПб, 208-213.
- Микляев, А. М., 1969. Памятники Усвятского микрорайона. Псковская область. АСГЭ, вып. 11, Л., 18-40.
- Микляев, А. М. (1971). Неолитическое свайное поселение на Усвятском озере. АСГЭ, вып. 13, 7-29.
- Микляев, А. М. (1977). О свайных поселениях третьего – второго тысячелетий до нашей эры в бассейне Западной Двины. АСГЭ18, Л., 10-14.
- Микляев, А. М. (1982). О разведках свайных поселений III-II тысячелетий до н.э. в Псковской и Смоленской областях. *Древние памятники ... на территории СССР.* Л., 6-29.
- Микляев, А. М. (1995). Каменный – Железный век в междуречье Западной Двины и Ловати // *Петербургский археологический вестник* 9. СПб, 7-39.

Микляев, А. М., Никитина, К. Ф., Поздняк, А. И. (1985). Организация полевой камеральной лаборатории (на примере Северо-Западной археологической экспедиции ГЭ). Краткие тезисы докладов Всесоюзного семинара Новые методы исследования, консервации и реставрации художественных произведений. Л., 7-8.

Микляев, А. М., Семенов, В. А. (1979). Свайное поселение на Жижицком озере. Стратиграфия и история поселения. ТГЭ, XX, Л., 5-22.

Никитина, К. Ф. (1972). Консервация мокрой археологической древесины. Семинар «Проблемы музейного хранения, консервации и реставрации произведений декоративно-прикладного искусства». М., 234-248.

Никитина, К. Ф. (1990). Реставрация предметов прикладного искусства и археологических находок из органических материалов. Эрмитаж. История и современность 1764 – 1988. М., 325-328.

Никитина, К. Ф., Баранова, Т. А. (1985). Восполнение утрат на археологических находках из органических материалов. Краткие тезисы докладов Всесоюзного семинара Новые методы исследования, консервации и реставрации художественных произведений. Л., 70-71.

Никитина, К. Ф., Баранова, Т. А., Чехова, Е. А., Ильина, М. Е., Крачун, Н. В. (1985). Консервация археологических находок из органических материалов (арсенал методов, критическая оценка, перспективы поисков). Краткие тезисы докладов Всесоюзного семинара Новые методы исследования, консервации и реставрации художественных произведений. Л., 73-76.

Полевая консервация археологических находок в СССР и за рубежом, М., 1984. 32 с (Field conservation of archaeological finds in the UdSSR and abroad, 1984).

Румянцев, Е. А. (1953). Использование синтетических смол при археологических раскопках. КСИИМК, вып. XLIX, 133-138.

Румянцев, Е. А. (1958а). Стабилизация насыщенной влагой древесины, найденной при археологических раскопках. КСИИМК, вып. 72, 96-99.

Румянцев, Е. А. (1958б). Один из способов консервации кожи. КСИИМК, вып. 72, М., 100-102.

Румянцев, Е. А. (1959). Применение синтетических смол для закрепления древних предметов при археологических работах. Труды Исторического музея Армении. Т. 5., 139-200.

Саблин, М. В. (2014). Археозоологический анализ остеологического материала из свайных поселений Подвинья. Археология озерных поселений IV – II тыс. до н.э. СПб., 221-231.

Славошевская Л. В., Светличная В. А., Смоляницкая О. Л. (2005). Опыт применения биоцидов, содержащих четвертичные аммониевые соединения, для защиты музейных коллекций. Художественное наследие 22 (52), 84-86.

#### **In English**

Johnson, J.S. (1994). Consolidation of archaeological bone: a conservation perspective. *Journal of field archaeology* 21(2), 221-233.

Higgitt, C., Harris, S., Cartwright, C., Cruickshank, P. (2011). Assessing the potential of historic archaeological collections: a pilot study of the British Museum's Swiss lake dwelling textiles. *The British Museum Technical Research Bulletin*. London, 81-94.

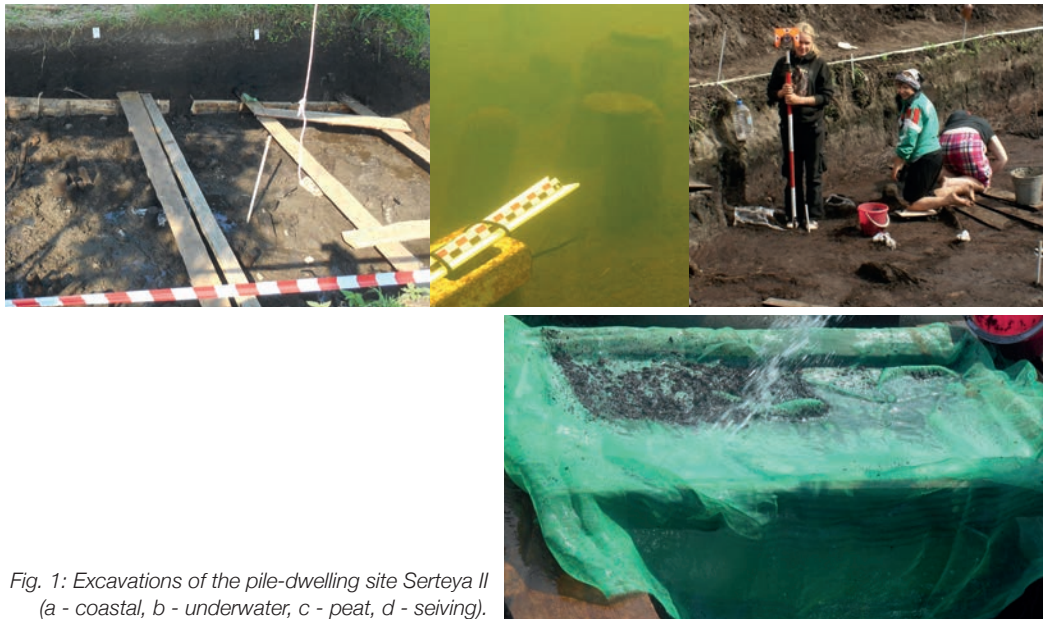
Hoffmann, P. (2013). *Conservation of archaeological ships and boats*. London.

Maigrot, Y. (2014). Bone tools from Neolithic settlement Serteya II (Smolensk region, Russia). *Археология озерных поселений IV – II тыс. до н.э.* СПб., 214-220.

O'Connor, T.P. (1987). On the structure, chemistry and decay of bone, antler and ivory. *Archaeological bone, antler and ivory. Occasional papers No. 5. The proceedings of a conference held by UKIC archaeology section, December 1984. The United Kingdom Institute for Conservation*, 6-8.

Pedeli, C., Pulga, S. (2013). *Conservation practices on archaeological excavations. Principles and methods*. Los Angeles.

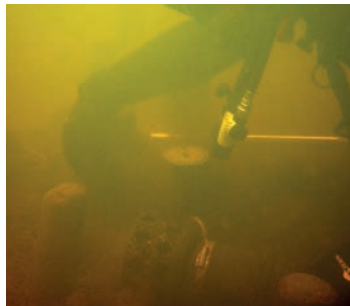
Vasilyeva, N. (2018) Conservation of waterlogged objects made from plant fibers excavated from the pile-dwelling sites Serteya I and Serteya II. In: Williams, E. and Hocker, E. (eds.). *Proceedings of the 13th ICOM-CC Group on Wet Organic Archaeological Materials conference, Florence 2016. Paris*, 108-114.



*Fig. 1: Excavations of the pile-dwelling site Serteya II (a - coastal, b - underwater, c - peat, d - seiving).*



*Fig. 2: Clearing the surface of a waterlogged organic find with a natural sponge soaked in water during the excavation of the pile-dwelling site Serteya II*



*Fig. 3: Underwater archaeological excavations of the pile-dwelling site Serteya II*



*Fig. 4: Bone archaeological find from the pile-dwelling site Serteya II, packed under water*

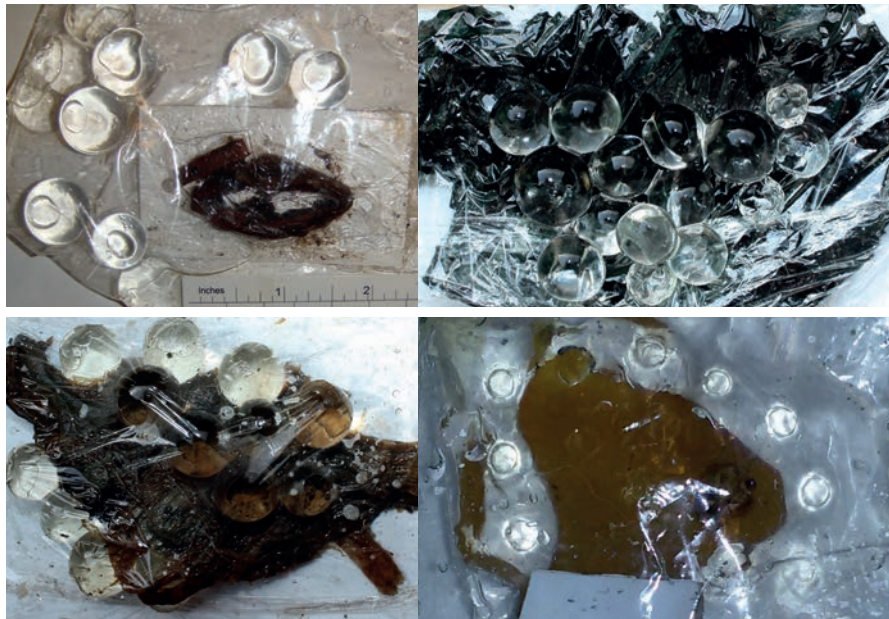




Fig. 5: The lifting of waterlogged archaeological finds from the layers of the pile-dwelling site Serteya II. A plastic solid foundation and food film were used for the lifting (a - fragment of a thin-wall wooden vessel in the excavation, b - covering a waterlogged wooden find with a food film in the layer, c - lifting a fragment of a thin-wall wooden vessel : cutting the soil with a plastic food board wrapped in a food film, d - condition of a monolith before the beginning of restoration, e - a fragment of a wooden vessel after restoration, f - the lifting of waterlogged archeological birch bark, g - the lifting of the monolith with finds from underwater excavation)



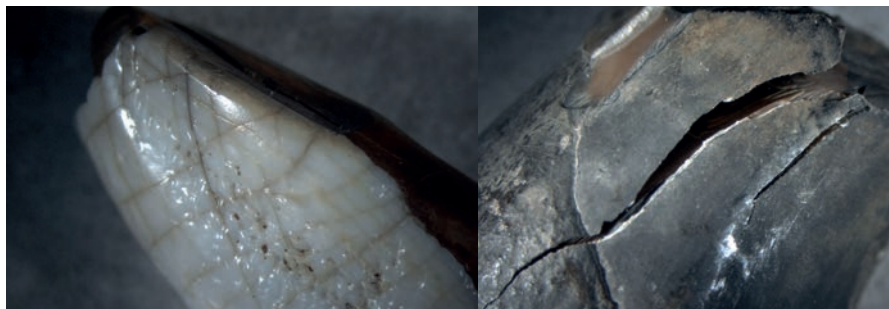
Fig. 6: Lifting of the monolith with human skull. The monolith was made with gypsum bandages, food film and food plastic board



*Fig. 7: The packing of waterlogged organic archaeological finds with hydrogel, plastic base, food film and plastic bags (a - birch bark, b - mushroom tinder, c - vegetable fibers, d - amber)*



*Fig. 8a, b: The loss of upper layers on antler items.*



*Fig. 9a, b: Cracks and losses of enamel on animal teeth items*





Fig. 10: Drying of waterlogged bone archaeological finds with sand in the field



Fig. 11: Drying of wet bone archaeological finds with a plastic box with "ventilation" in the field (a - preparing the object for drying, b - bone finds on the bottom of the plastic box, c - food film with holes instead of the covering on the container)



Fig. 12: The degree of water saturation of waterlogged archaeological wooden samples which were found on the pile-dwelling site Serteya II (a - waterlogged condition of a hardwood sample, b - the condition of the hardwood sample after atmospheric drying, c - waterlogged condition of a conifer sample, d - the condition of the coniferous sample after the atmospheric drying)



*Fig. 13: The temporary storage of waterlogged archaeological wooden finds in a refrigerator bag with refrigerants*



*Fig. 14a, b: Sealed packaging of a waterlogged archaeological wood with a device for vacuum and sealing food*



*Fig. 15: Monolith of waterlogged soil with sinkers, packed in a plastic container*



*Fig. 16: After restoration: three sinkers with fragments of threads, extracted from the monolith*





Fig. 17: A birch-bark sinker, filling is a mixture of sand and clay (a - sinker in the layer, b - sinker before lifting, c - sinker packed with hydrogel, d and e - sinker after restoration, general view from two sides)



Fig. 18: A piece of a thread made from a willow fibers (a – treated with 10% water solution PEG-1500, a condition before restoration, b - after restoration)



Fig. 19: A woven object made from vegetable threads (a - in a monolith of wet soil, before restoration, b - after restoration)



Fig. 20: A stone with basted winding (a - bast strips winding with food tape, b and c - cutting the soil under the stone with a food plastic board wrapped with food film, d -lifting with a monolith, e - the packing of the monolith before transportation of it to a camp, f - a packing of a monolith before the restoration g - in the process of restoration)



Fig. 21: A fragment of a thread made from a vegetable fibers (a - removal of large soil contaminations from a surface of an object in a field laboratory, b - an intermediate packing of a thread with a food film on a hard plastic base, c - the final packing of an object, it is placed in two polyethylene bags with a hydrogel)





Fig. 22: Amber finds (a - amber object in the layer, b - packing of an object before its transportation, c - a condition of an amber object three months later, d - condition of an amber object one year later, e - a packing of other amber object for its transportation, f - the condition of it a year later, g - the condition of the third amber object three months later after digging, h - temporary storage in the hydrogel as a way to adapt to the new environment, i - the condition of the third amber object a year later)



Fig. 23: The temporary storage of a waterlogged archaeological wood in a plastic box with moss.

### Acknowledgements

I would like to express my thanks to colleagues from the National Museum of Denmark, from Archäologischer Dienst des Kantons Bern and Hochschule der Künste Bern, from Osaka City Cultural Properties Association, from the Scientific-restoration laboratory "Ostrov Krym" and all from the Laboratory of Scientific Restoration of Objects of Applied Art from Organic Materials, the State Hermitage Museum for sharing with me some of their considerable field experience. And sincerest gratitude to Andrey N. Mazurkevich from the Department of Archaeology of Eastern Europe and Siberia and to Tatiana A. Baranova from the Department of Scientific Restoration and Conservation, the State Hermitage Museum, for their critical reading of an earlier draft of this paper and for their support, inspiration and the opportunities they provided.

## II.B.1 Wetland Archaeology in Macedonia

Even though excavations in marshy areas started in the 1950s, wetland archaeology is a relatively new discipline in Macedonia. This pioneer research was performed with traditional archaeological methods, without consideration of specific wetland features and the environment. New methods were not incorporated until two decades ago when underwater archaeology was introduced, but also a more scientific approach in the exploration of the landscape and prehistoric settlements (Naumov 2020).

### History of Research

Although some surveys were performed during the 1930s, the first methodological excavation of wetland sites was initiated in Pelagonia in 1954. The excavations in the following decades provided significant information on tell-sites in this swampy valley, but not much on the environment. Nevertheless, numerous excavations and a geological study were performed in the 1970s, indicating an abundance of tell-sites and water basins in the vicinity of Neolithic villages. In the following years the interest for prehistory in this region decreased and for more than 20 years there was a gap in archaeological studies. However, few years ago a new initiative started with the employment of the most recent archaeological methods in research of tell-sites, as well as incorporation of GIS, geomagnetic survey, radiocarbon, zooarchaeological, archaeobotanical, use-wear, isotope and lipid analyses.

The first excavation of pile dwellings was performed in the region of Struga where two prehistoric sites of this kind were excavated in 1956 and 1979. With the gap of several decades such settlements were absent in archaeological research until 2000s when new sites in the regions of Ohrid and Dojran were explored. In the same period underwater archaeology was introduced in Macedonia when dozen of pile-dwelling settlements in Lake Ohrid were discovered and excavated. This enabled an entirely new understanding of lakeside environment and intensified more thorough research of the sites and necessity of the implementation of new methods. In general, eight underwater and three ground pile-dwellings were determined in Lake Ohrid basin, two in Lake Prespa, one on the shore of Lake Dojran, and approximately 140 tell sites in the wetlands of Pelagonia. Majority of prehistoric villages in Pelagonia and regions of Ohrid and Dojran had dynamic mutual network and established contacts with those in neighboring areas in Greece and Albania.

The implementation of NEENAWA project had a significant impact on further and a more thorough research of wetland sites in North Macedonia. The project contributed in establishing the Center for Prehistoric Research and focus of particular group of Macedonian archaeologists in study of pile-dwellings, tell sites and the cultural heritage associated with these settlements. In just three years the large group of Macedonian professionals and students had a chance to get acquainted with new methods and to enlarge their knowledge with a training in wetland archaeology. Many participated in trainings, excavations and workshops of various sites in Switzerland, Russia and Macedonia and were able to learn and implement recent methods and a more scientifically based approach.

NEENAWA project also contributed in involvement of dendrochronology at Macedonian sites, thus a student was sent on specialization at the University of Bern to learn the methods and later to incorporate them in North Macedonia. Moreover, the ESD course performed within this project provided the first Macedonian archaeologists with such a license and also created a group of Macedonian, Swiss, Russian and Ukrainian archaeologists that will continue their research of pile-dwellings of Lake Ohrid. Many Swiss, Ukrainian, Czech and Macedonian students were



introduced to prehistory and wetland archeology of Macedonia and provided new avenues for their future research. The conferences and lectures performed within the project enabled the circulation of recent results and knowledge on wetland archaeology and thus contributed in a more thorough study of pile-dwellings and tell sites in North Macedonia. Consequently, the NEENAWA project made a significant step forward in a better understanding of wetland archaeology in Macedonia and continually contributes in the implementation of latest scientific methods.

### **Pile-dwellings in Lake Ohrid and Lake Dojran**

In 1979/1980, Lake Ohrid and its surrounding were listed as UNESCO World Heritage sites. Besides numerous ancient and medieval cultural monuments, this region also has prehistoric pile-dwellings. They represent a certain phenomenon differing from the other sites in the Balkans, especially for their architectural features and the preservation of organic remains (Naumov 2016). Pile-dwellings have been registered on the shore of Lake Ohrid, but recently also on Lake Dojran. Such settlements have been found in the Albanian part of Lake Ohrid, as well as the Maliq Region in Albania and also in Greece, at the Lake Kastoria and four sites in the Amyndeon region. Even though all these sites are to be found in three different states, they are in an immediate proximity and represent an archaeological whole, different from the remaining cultural heritage in the region.

Considering the identical features of the pile dwellings on the shore of Lake Ohrid, there is a great possibility that they could also be listed as UNESCO World Heritage sites. In case there is a legal norm which could separate these pile-dwellings as a cultural unit (as are the pile-dwellings around the Alps), then such a status of the Ohrid region could significantly contribute for a more certain listing of these sites. Below, the short overview of all so far known pile settlements around Lake Ohrid is listed with a brief description of their basic features.

#### **1. Ploča – Mičov Grad, Peštani**

Discovered in 1997, this site is located in the so-called Bay of Bones. It has been explored in several archaeological campaigns, confirming pile dwellings and a material culture from Chalcolithic, Bronze and Iron Ages. Given its solid exploration and its appeal, the pile-dwelling was reconstructed. Today it is visited by numerous tourists (fig. 1). Unlike some other sites, this one is not endangered, since it is not located in a construction area and its territory is owned by the state.

#### **2. Penelopa, Ohridati**

This site is located in the very heart of the town of Ohrid, near the shore. It was discovered in 2003 during construction and it was briefly explored. Research showed strata, pile-dwellings and a material culture dated as early as the Neolithic up until Iron Age, defining this site as especially complex regarding the cultural stratigraphy. Unfortunately, this site is in a construction zone with numerous public and private buildings built over it, preventing a complete definition of its boundaries.

#### **3. Ustie na Drim, Struga**

The place where Crn Drim River flows off Lake Ohrid is also known as an archaeological site. In 1962 a smaller archaeological research was performed, along with construction activities for diverting the riverbed. Excavations revealed Neolithic and Eneolithic piles and artifacts (fig. 2). This site is also partially in a construction area which makes the definition of its boundaries difficult.

#### **4. Vrbnik, Struga**

This site is located under water, in the vicinity of the town of Struga. It was being researched

since 1998 in several phases, revealing remains of wooden buildings and ceramic finds from the Iron Age. Given the location of this site in lake itself, it is not in jeopardy of construction activities and its boundaries can be determined easily.

#### **5. Crkveni Livadi, Vranishta**

Unlike the other sites, this pile settlement is located further from the lake, in a space that was once marshy and had a small river, i.e. today Shum River. It was researched in 1956, 1979 and 2012, revealing pile dwellings, but also daub houses from the Neolithic, Eneolithic and the Bronze Age. Even though the site is located beneath the village football playground, it is currently not in danger of construction activities, thus its boundaries could be determined.

#### **6. Na Dol, Trpejca**

This site is located on the shore of Lake Ohrid, in the area known as the Goat's Bay. It hasn't been archaeologically excavated. However, during a survey in 1998, wooden piles and Bronze Age finds have been registered. This site is underwater, thus not in danger of future construction and its boundaries can be determined with future survey.

#### **7. Zaliv na Bombite, Peshtani**

This site still lacks an exact name; however, it is located within the Bombs' Bay (Zaliv na Bombite). It was discovered by local peasants, who found wooden piles and ceramic fragments from Bronze and Iron Ages. Given its location on the north shore of the village of Peštani, the archaeological space could be disturbed in the future, therefore its protection is necessary prior to intensifying the construction activities within the village.

#### **8. Bučila, Ljubaništa**

The site is situated near the monastery complex of St Naum. Remains of wooden piles still have not been found; however, Neolithic ceramic fragments were registered. Considering the protected character of this region, the site is not in danger of construction activities, thus a survey could be made in the future in order to determine its boundaries.

#### **9. Mrdaja, Star Dojran**

This site is located on the beach of the military resort known as Mrdaja. The shore research began in 2012, revealing a pile settlement from the end of the Bronze Age and the beginning of the Iron Age. Even though a large portion of this site is situated in an unpopulated space of the shore of Lake Dojran, still the expansion of construction in the future could jeopardize it. Current and future research of this site could reveal its boundaries.

#### **Tells in the wetlands of Pelagonia**

Until recently, Pelagonia was known for its wetlands that were artificially dried more than five decades ago as a result of regional ameliorative processes. Geological research confirmed that even in the Neolithic this valley had an abundance of marshy lakes, which is also demonstrated by the exact measurements of these sites distributed around the wet areas. So far, approximately 150 prehistoric sites have been confirmed (fig. 3), but their number is expected to rise given that many settlements have still been not surveyed and some were completely destroyed by agricultural and construction activities or by coal mining. Due to the large number of tells, there will be only a general review of the Neolithic in Pelagonia (Simoska/Sanev 1976).

As previously stated, for nearly a century prehistory in Pelagonia draws the attention of Macedonian and foreign archaeologists. Among the first researchers who studied this region were Ethi-

enne Patte, Vladimir Fewkes and W.A. Heurtley. The work of the British archaeologist Heurtley is more significant, as while surveying Pelagonia, he detected several prehistoric settlements near the villages of Čepigovo, Optičari and Karamani. He published his insight in his work entitled as '*Prehistoric Macedonia*', thoroughly reviewing his excavations of the large tell in Karamani and its Late Neolithic layers. Several decades later, the information provided by the aforementioned researchers inspired numerous Macedonian archaeologists, especially Dragica Simoska and Blagoja Kitanoski, to survey Pelagonia even more thoroughly and to discover many prehistoric sites, some of which they would excavate.

According to the archaeological material and chemical analyses, these tells were dated in the Early and Middle Neolithic. In rare cases, elements of Late Neolithic have been confirmed. As a result of numerous primary excavations and the processing of the material, two cultural groups have been defined in Pelagonia: (a) Early Neolithic Velušina-Porodin group and (b) Late Neolithic Trn cultural group. Radiocarbon analyses of samples from the tells at Veluška Tumba, Porodin, Optičari, Topolčani and Mogila, provide exact data regarding the chronological determination of Pelagonian tells, even though this information should be considered with certain reservation. According to the chemical analyses, the beginning of the Neolithic in Pelagonia could be dated between 6250 and 6030 BC, i.e. transition between the 7<sup>th</sup> and the 6<sup>th</sup> millennia BC. Several geographical and cultural factors prevented an earlier population of Pelagonia, but also some other regions in Macedonia, foremost the marshy area and the frequent plunge of water by the end of the 7<sup>th</sup> millennium BC, but also the several high mountains and big lakes that did not allow greater mobility.

The most impressive elements of the Pelagonian Neolithic material culture are the painted patterns on the vessels, human body presentations, architectonic ceramic models, stamps and the frequent presents of oval 'projectiles' usually unknown or rare in the other parts of Macedonia. The most specific are the anthropomorphic house models bearing extremely complex symbolical significance and one of the most remarkable shapes of the Neolithic material culture in Europe. They shed a completely new light on the Neolithic house and its role among the first farmers in Pelagonia. In favor of the appearance of Neolithic dwellings are also the house models with clearly depicted plans, apertures and roofs. Excavations of about fifteen Pelagonian tells confirm similar architectural landmarks of these dwellings, but also provide information regarding the everyday life, tools and nutrition.

Latest research of the site of Vrbjanska Čuka is of special importance, led by the Center for Prehistoric Research and encompassing trainings of Macedonian and foreign students that is supported by the NEENAWA project. Located between the villages of Slavej and Vrbjani, Vrbjanska Čuka is a tell typical for the Neolithic in Pelagonia. Fertile crop fields, rivers, swamps, vegetation, birds and animals constituted an ecological environment where this agricultural settlement was established and developed in the Neolithic, i.e. in the 6<sup>th</sup> millennium BC. It resulted from the intense life of a community living in daub houses surrounded by ditches protecting them against floods, wild animals and attacks. This Neolithic community was engaged in agriculture, stock-breeding, fishing, hunting and different crafts such as pottery, manufacture of stone tools, but also of various ritual items.

The massive granary, decorated with a relief typical of the artifacts with symbolical feature, witnesses of the exquisite significance of this settlement. Altars, anthropomorphic house models, figurines and the painted patterns on the vessels are the most remarkable. These features confirm that Vrbjanska Čuka was a significant center in the northern half of Pelagonia, not only regarding agriculture, but also regarding beliefs and rites. After the cessation of life of this Neolithic settlement, the tell was not in use during the next five millennia, up until Late Antiquity and the Middle Ages, periods of activity confirmed by multiple pits and burials.

All these insights were obtained as a result of the intense scientific cooperation of the Center for Prehistoric Research, the Museum in Prilep, the Center for Old Slavic Culture, the BioSense Institute, the University of South Bohemia, the Universities of Bern and Basel, the Spanish National Research Council, the Principat Krakow and the Free University of Berlin. These various types of cooperation involve excavation, geomagnetic scanning and topographic measurements of the site, zooarchaeological, archaeobotanical, anthropological, radiocarbon, isotopic, geological and use-wear analyses, as well as analyses of lipids on vessels. Such a multidisciplinary approach is based on the current trends in archaeology with the aim to study the Neolithic in Pelagonia from numerous points of view, but also the life of the first farmers that inhabited the tells in the wetlands.

#### **References**

*Kuzman, P. (2013). Praistoriski palafitni naselbi vo Makedonija. In: Kuzman, P., Dimitrova, E., and J. Donev (eds.). Makedonija. Mileniumski kulturno-istoriski fakti. Skopje, 297–430.*

*Naumov, G. (2016). Among Wetlands and Lakes: the network of Neolithic communities in Pelagonia and Lake Ohrid, Republic of Macedonia. In: Bacvarov, K. and P. Gleser (eds.). Southeast Europe and Anatolia in prehistory: essays in honor of Vassil Nikolov on his 65th anniversary. Bonn: Verlag Dr. Rudolf Habelt, 175–187.*

*Naumov, G. (2020). Neolithic wetland and lakeside settlements in the Balkans. In: Hafner, A., Dolbunova, E., Mazurkevic, A., Prankenaitė, E. and Hinz, M. (eds.). Settling waterscapes in Europe. The archaeology of Neolithic and Bronze Age pile-dwellings. OPSA 1. Propyläum Heidelberg, Heidelberg, 111-134.*

*Simoska, D. and V. Sanev (1976). Praistorija vo Centralna Pelagonija. Bitola: Narodni Muzej.*





Fig. 1: Drone aerial photography of the Bay of Bones, Lake Ohrid, with the pile-dwelling reconstructions (photo: Gjore Milevski, 2018)



Fig. 2: Photo of Ustie na Drim pile-dwelling during excavations in 1962 (Kuzman 2013, Fig. 8)

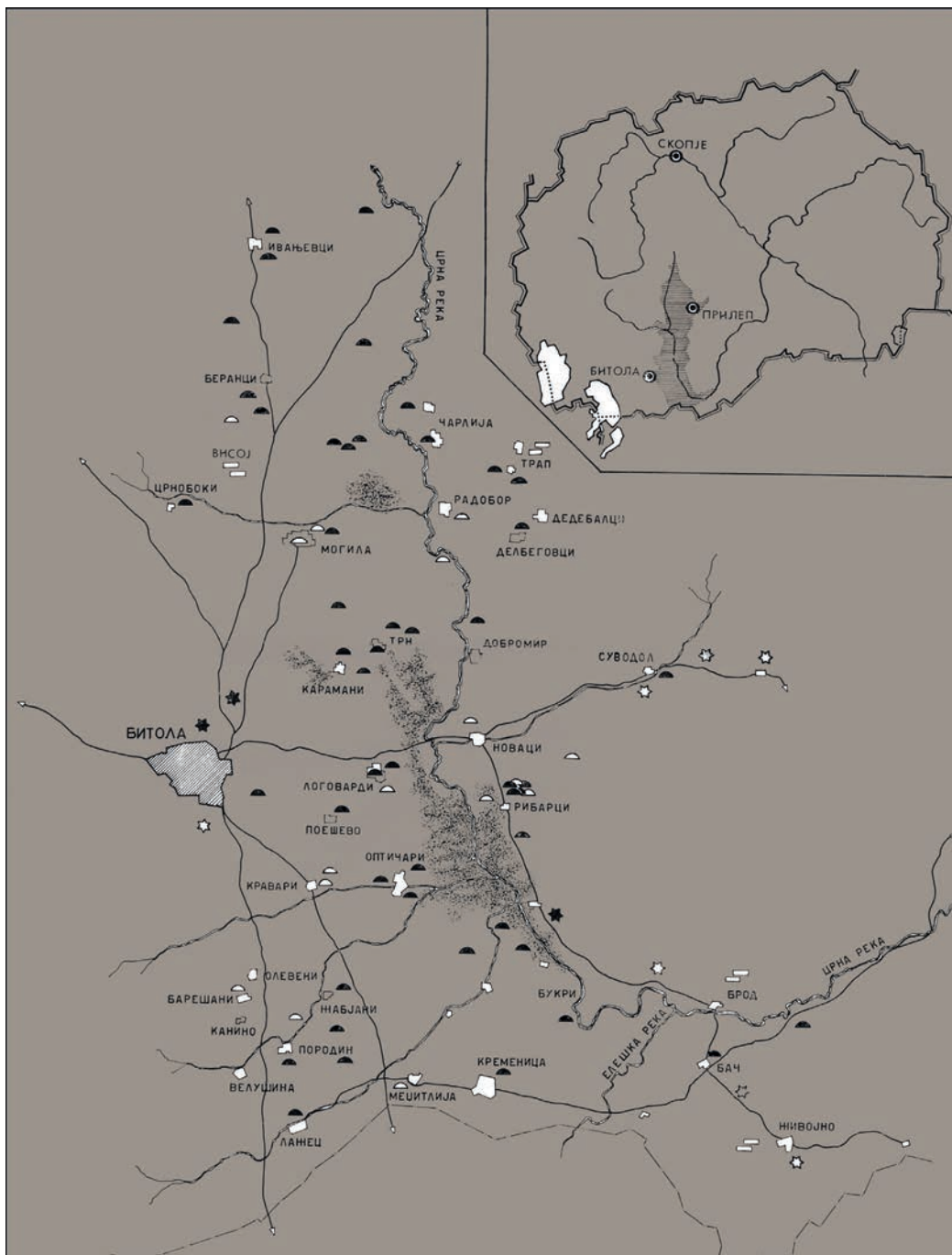


Fig. 3: Map with now dried wetlands in Pelagonia and the disposition of the Neolithic tells around marshy area (Simoska and Sanev 1976, annex).



Goce Naumov, Valentina Todoroska, Center for Prehistoric Research, Skopje,  
Albert Hafner, Institute of Archaeological Sciences, University of Bern

## II.B.2 Report on Activities Skopje and Ohrid

The main event of 2016 was the strategic workshop and scientific meeting in Macedonia, which was renamed “Prehistoric Wetlands and Lakes: bringing forward dendrochronology in archaeology”. It took place as scheduled in Skopje and Ohrid, North Macedonia, from 11 to 17 May 2016. The workshop was organized by the Center for Prehistoric Research (CPR) under the lead of Goce Naumov and Valentina Todoroska.

For the event, a website was set up: [www.neenawameeting.cip-cpr](http://www.neenawameeting.cip-cpr).

The seven-day workshop started at the Skopje City Museum and the Archaeological Museum of Macedonia in Skopje. The transfer from Skopje to Ohrid was organized as an excursion to Neolithic sites of the Pelagonian Plain as well as to the Bitola Museum.

During three days at Ohrid scientific meeting, the latest advances and challenges in wetland archaeology were presented with contributions from more than 40 participants from Switzerland, Russia, Ukraine, France, the Netherlands, Greece, Lithuania, Slovenia and Macedonia. Numerous prehistoric sites from East, Central and Southeast Europe were elaborated with particular focus on the pile dwellings, chronology, networks, agricultural societies, underwater archaeology, wetlands, inland waters, wooden structures, house models, bone tools, and conservation. A special half-day session with in-depth presentations on dendrochronology was performed by five Swiss experts in dendrochronology and underwater archaeology from laboratories in Zurich and Bern. The aim was to thoroughly introduce the benefits of this scientific method and its incorporation within wetland archaeology. As an area with a large number of Neolithic and Bronze Age pile dwellings, Lake Ohrid was a perfect setting for such a workshop and discussions on experiences and challenges with dendrochronology.

Apart from an intensive lecture programme (fig. 1), several excursions to local archaeological places and sites took place (fig. 2). A visit to the Museum and pile-dwelling settlement reconstructions at the so-called Bay of Bones was another part of the programme (fig. 3), which included active diving in the nearby prehistoric site of Ploča Michov Grad, belonging to the Chalcolithic and Bronze Age and the beginning of Iron Age, between 4500 and 700 BC (fig. 4a-c).

The scientific meeting in Ohrid was part of the ‘NEENAWA’ project in partnership with University of Bern (Switzerland), State Hermitage Museum (Russia), Taras Shevchenko National University (Ukraine) and Center for Prehistoric Research (North Macedonia). Therefore, this event was an excellent occasion for the implementation of project aims and a significant contribution in promotion of latest knowledge and practices in wetland archaeology and dating methods.

## 11.05.2016

---

11:00 – Museum of Macedonia

NATALIA VASILYEVA (The State Hermitage Museum)

*Conservation of Wet Wooden Archaeological Finds from The State Hermitage Museum*

14:00 – Skopje City Museum

ANDREY MAZURKEVICH (The State Hermitage Museum)

*Archaeological Collection in The State Hermitage Museum*

19:30 – Archaeological Museum of Macedonia

ALBERT HAFNER (University of Bern)

*Archaeology in Switzerland Between Mountains and Lakes*

## 12.05.2016

---

08:30 – Meeting in front of City Museum and trip to Bitola and Ohrid with bus

12:00 – Visit of the Museum of Bitola

13:00 – Visit of a Neolithic tell at Porodin

14:30 – Lunch at the Neolithic tell in Mogila

15:30 – Trip to Ohrid through Prespa Lake

19:30 – Official opening with speeches and project presentation

20:30 – Guest Lecture

PASKO KUZMAN (Institute for Preservation of Cultural Monuments and Museum of Ohrid)

*Review of the Prehistoric Pile Dwellings in Macedonia: prehistoric settlement at the Bay of Bones on Lake Ohrid as case study*

## 13.05.2016

---

09:00-10:00 – MATTHIAS BOLLIGER (Archaeological Service Canton of Bern)

*The History of Dendrochronology: from the early years to its impact in wetland archaeology* (Dendrochronology Workshop)

*Current Documentation Technique of Woods in the Canton of Bern*

10:00-11:00 – JOHN FRANCUZ (University of Bern, Institute of Archaeological Sciences)

*Lacustrine Dendrochronology in Context of Underwater Pile Dwelling Archaeology at Lake Biemme, Switzerland* (Dendrochronology Workshop)

11:30-12:30 – NILS BLEICHER (City of Zurich, Underwater Archaeology and Dendrochronology)

*Dendroecology-Dendrotypology-Dendroclimatology* (Dendrochronology Workshop)



### 13.05.2016

---

12:30-14:00 – Lunch break

14:00-15:30 – Visit of medieval churches in Ohrid

16:00-17:00 – FELIX WALDER (City of Zurich, Underwater Archaeology and Dendrochronology)

*Procedure in Dendrochronological Work: tools (hardware and software packages) used in dendrochronology (Dendrochronology Workshop)*

17:00-18:00 – ANDREAS MÄDER (City of Zurich, Underwater Archaeology and Dendrochronology)

*Underwater Archaeology in the Lake of Zurich, Switzerland (Dendrochronology Workshop)*

18:00-18:30 – Discussion and summary

18:30-19:30 – Dinner

### 14.05.2016

---

09:00-09:30 – PANICOS CHRYSOSTOMOU (Florina Ephorate of Antiquities)

*The Culture of Four Lakes in Amindeon Florina's Basin (Northern Greece): the lakeside dwellings and their distinct characteristics*

09:30-10:00 – TRYFON GIAGKOULIS (University of Bern)

*At the Edge: preliminary remarks on some wooden structures from the periphery of the habitation space at the prehistoric lakeside settlement Anarghiri IXb (Amindeon, Western Macedonia, Greece)*

10:00-10:30 – ZORAN RUJAK (Institute for Protection of Cultural Monuments and Museum of Strumica)

*Mrdaya: pile dwelling settlement from the Late Bronze Age in Dojran Lake, Republic of Macedonia*

11:00-11:30 – Valentina Todoroska ('Nikola Nezlobinski' Museum of Struga)

*Pile Dwelling Settlements in Northern Part of Lake Ohrid, Republic of Macedonia*

11:30-12:00 – GOCE NAUMOV (Museum of Macedonia)

*Network of Neolithic Communities in the Wetlands of Pelagonia and Lake Ohrid Basin, Republic of Macedonia*

12:00-12:30 – NIKOS CHAUSIDIS (St. Cyril and Methodius University)

*Were the Prehistoric House Models on Trestles Representation of Actual Pile Dwellings?*

12:30-13:30 – Lunch break

13:30-18:30 – Visit of pile dwellings at the Bay of Bones and diving

18:30-19:30 – Dinner

19:30-21:00 – NEENAWA coordinators meeting

## 15.05.2016

---

09:00-09:30 – CHRISTOPHER ARABATZIS (University of Bern)

*Preliminary Data About the Bone, Teeth and Antler Artifacts from the Prehistoric Wetland Settlements of Amindeon, Western Macedonia, Greece*

09:30-10:00 – YOLAINE MAIGROT (CNRS, UMR 8215 – Trajectories)

*Bone, Teeth and Antler Tools Production Systems at Chalain et Clairvaux (4<sup>th</sup> and 3<sup>rd</sup> millennium, Jura, France)*

10:00-10:30 – DAŠA PAVLOVIĆ (National Museum of Slovenia)

*Wooden Traps from Ljubljana Moor*

10:30-11:00 – ANDREY MAZURKEVICH and EKATERINA DOLBUNOVA (The State Hermitage Museum)

*Chronology of Archaeological Cultures of the 7-3<sup>rd</sup> Millennia BC in Northwestern Russia in the Neolithic Context of Eastern Europe*

11:00-11:30 - *Coffee break*

11:30-12:00 – Pavel Shydlovskiy and Ivan Radomskiy (Taras Shevchenko University; Mohyla Academy)

*Early Agricultural Communities of Southwest Ukraine*

12:00-12:30 – Yana Morozova and Sergii Zalenko (Taras Shevchenko University)

*Development and Challenges of Ukrainian Underwater Archaeology*

12:30-13:00 – ELENA PRANCKÉNAITĖ (Klaipeda University)

*Archaeological Survey of Wetlands and Inland Waters: challenges and possible strategies in Lithuania*

13:00-13:30 – JADRANKA VERDONKSCHOT (University of Tübingen)

*The First Lake Settlers: a case study from Egolzwil 3 (Kanton Luzern, Switzerland)*

13:30-14:30 – Lunch

14:30-17:30 – Visit of Classical archaeological sites in Ohrid

18:00-19:00 – SYNERGIA project application meeting

## 16.05.2015

---

09:00 – Meeting in front of Hotel Millennium Palace and trip to Skopje

19:00 – Skopje City Museum

PAVEL SHYDLOVSKYI (Taras Shevchenko University)

*Mezhyrich Upper Palaeolithic Settlement: a model of human/environment interaction in Middle Dnieper area*



*Fig. 1: Evening lecture of Pavlo Shydlovskiy at the Archaeological Museum of Macedonia (photo: Pavlo Shydlovskiy)*



*Fig. 2: Excursion to a church in Ohrid (photo: Pavlo Shydlovskiy)*



*Fig. 3: Excursion to the Bay of Bones, Lake Ohrid (photo: Albert Hafner)*





Fig. 4a-c: Diving at Bay of Bones, Lake Ohrid (photos: Pavlo Shydlovskyy)



### **II.B.3. Dendrochronology: A Vision of Possibilities**

Over the past 50 years, the dendrochronological method has made outstanding progress, decisively shaping European archaeology and, in particular, the study of ancient pile-dwellings. It is still a novelty for archaeological research to determine the year - sometimes even in which season - the trees of well-preserved wood from wetland sites have been felled and utilized. This dating precision allows detailed insights into our past by reconstructing, not only the spatial distribution of buildings, but also the development and span of entire settlements. Similarly, material remains - ceramics, tools, and also food remnants - from settlement or site strata that have been dated to the exact year allows, among other things, the possibility to recognize the onset of technological developments, to investigate similarities and differences between regions and to reconstruct the prehistoric landscape.

Drawing on experiences gained from over 40 years of underwater and wetland archaeology at Lake Biel (Switzerland), this paper summarises some of the methods, application, and experiences gained from dendrochronological studies of tens of thousands of subfossil construction wood excavated from Swiss wetland pile-dwelling settlements (fig. 1). In doing so, it is intended as an example of verified procedures and results that dendrochronology can potentially elucidate when systematically applied to studying the large amounts of well-preserved wood remains now made increasingly available from recently excavated wetland and lacustrine sites such as those of North-western Greece and the southern Balkans (Chrysostomou et al. 2015; Chrysostomou/Giagkoulis 2016; Naumov et al. 2018; Giagkoulis 2019).

#### **Research history: The development of dendrochronology in the Canton of Bern**

The excavation of Twann, Bahnhof 1974-1976 was the first modern, large-scale excavation of a wetland pile-dwelling Settlement in the Canton of Bern and Lake Biel (fig. 2). The excavation area extended over more than 2300 m<sup>2</sup> on the formerly flat Strand Platte of Twann at the northern shore of Lake Biel. The excavation recorded at least 17 settlements extending from the Classic Cortaillod to the Horgen period (3835 - 2976 BC) (Furger 1980; Orsel 1981; Stöckli 2018). The numerous stratified layers and the large quantities of well-preserved timbers and material remains allowed the introduction of modern scientific methods.

Over 10,000 subfossil construction timbers, mostly upright-support-piles of oakwood, were systematically documented and collected for analysis (fig. 3). Such extensive pile-fields and large quantities of wood necessitated a team specializing only in dealing with the wood finds. It also awakened the initiative and laid the foundation for the introduction and development of dendrochronology in the Canton of Bern.

The dendrochronological (short: dendro) laboratory of the Archaeological Service Bern was established in 1978. Since then, over 50'000 construction timbers have been documented and sampled from over 35 erosion endangered, prehistoric wetland and underwater pile-dwelling excavation sites in and around Lake Biel. From these, over 25'000 have been studied for dendrochronology.

The large well-preserved wood assemblages offered by wetland and underwater sites excavated in and near lake Biel allowed development of a general strategy for underwater excavating and curation of large quantities of wooden piles. This has been explained in detail elsewhere (Winiger 1989; Hafner 1992; Hafner/Suter 1999, 2000, 2004, 2005; Hafner/Fischer/Francuz 2010; Suter/Fischer/Francuz 2014; Suter 2017; Francuz 2018), here the focus is more on the documentation, sampling and dendrochronology of extensive, now submerged pile fields.

Unlike the well preserved Twann stratigraphy, the erosion of lake bed sediment of settlement remains in most submerged sites was generally quite advanced, the overlaying cultural layers having been almost completely removed leaving only a stony-detritus surface covering containing various scattered settlement finds sedimented from the now missing layers (fig. 4). Generally, the finds included such items as ceramic-shards, silex objects, antler tools, animal bones and organic remains such as nets, bark-bast string and the occasional horizontally laying wood.

Excavation grids built of secured robust steel-scaffolding pipes that have been precisely geo-located, allow two divers to clear a 10m<sup>2</sup> strip. Afterwards, the cross-bar will be advanced by one metre allowing the exposure and excavation of the next row, and so on.

After the surface sediment had been inspected, removed and archaeological finds collected, the eroded part of the piles are cut to approximately 10 cm above the lowest sedimentation of lake-clay and numbered. A m<sup>2</sup>- size Plexiglas is placed over them and a profile of the transversal section of each post drawn using a wax crayon. A 3-5 cm slice from the exposed post would then be cut and taken to the dendro laboratory for wood species analysis and potential dendro-chronology.

Every documented wood receives a unique, consecutive number. This aids clarity when cross-correlating large assemblages of wood from many different excavation sites by avoiding same-number repetition. The numbers are pre-printed on two separate waterproof plastic coloured labels, one red and one blue. The red numbered label accompanies the drawn and cut slice to the laboratory (fig. 5), the blue-numbered label stays in situ underwater nailed to the remaining post, thus allowing, in cases of uncertainty, verifications or re-checks to be made later.

This proved to be a very effective documentation system for extensive lake-bed documentation. On land the Plexiglas drawings would be redrawn onto graph paper and larger plans constructed. Updated technology now allows the Plexiglas to be directly photographed and digitalised into computer constructed plans.

In the laboratory, the species of each sampled wood was microscopically determined and, in the case of Twann, the number of growth-rings counted. The sampled woods were initially separated into two major categories oak and 'non oaks': The oaks (*Quercus*) were then sorted into age-related groups (50 and more rings, 30-49 rings, 20-29 rings, and less than 20 rings), sealed, with a little water in plastic bags, and stored in closed dry plastic containers in preparation for dendro-chronology. This method has proven an effective 'temporary' storing procedure for periods of up to around 15 years when using plastic bags with minimum thickness of 0.075 mm. More recently vacuum packing has been introduced which may extend this average storage period. For longer term curation more effective methods must be introduced.

From the 'non-oak' categories all ash, elm and silver fir samples (*Fraxinus*, *Ulm*, *Abies alba*) were later separated for dendrochronology. In Lake Biel excavations, oak wood piles made up on average over 65 %, often 80-90 %, of the documented timbers. Of the remaining species, only those were studied if dendrochronology could help solve a specific archaeological question. For example, to determine if parallel rows of palisade posts made up of hazel- and/or poplar wood (*Corylus* or *Populus*) all belonged to contemporaneous or different settlement periods being studied.

#### **Methodology: problems and solutions**

The basis of dendrochronology is the accurate visual cross-matching of similar ring-width growth patterns (fig. 6a, b). Although statistics help us to localize probable synchronizations between sample growth, it is the visual check that validates and determines the correctness of the cross-match. Two correlation programs have been routinely used to aid in locating possible synchronization positions between two curves:

The percent agreement (Gleichläufigkeit) test (Eckstein/Bauch 1969): this compares the yearly agreements between two ring series and plots it as a percentage. The Students 't' correlation coefficient value (Baillie/Pilcher 1973) compares the long-term growth agreements between two series and plots it as a number. In both cases, and taking into account the number of rings of overlap, the higher the correlation value, the more significant the result. It should be emphasized that it is the visual comparisons between series that finally determined if two ring series actually cross-match and synchronize and not the statically value. The optical cross-correlation work is eased by plotting annual ring values onto a semilogarithmic scale (cf. fig. 6b). The resulting curve slightly de-emphasizes the anomalous wider rings and emphasizes narrower rings.

The minimum number of rings required for an accurate reliable cross-match is still under discussion. In the 1970s, wood-samples with less than 50 rings were still considered by many unsuitable for dendrochronology. Less rings offer a higher risk of chance, incorrect cross-matching and so, generally, were not evaluated. Although there is truth in this argument, experience with large assemblages of subfossil material from Lake Biel and other similar sites (fig. 7), mostly of oak wood, proved that accurate cross-matching of younger samples was indeed possible. Age statistics from 7279 measured oak samples collected from the excavations Twann Bahnhof 1974, Sutz-Lattrigen (V) Rütte 1985, Vinelz (XVII) 1985, Lüscherz 1987, Sutz-Lattrigen Riedstation 1988 showed that over 81 % of the Lake Biel documented wood contained less than 50 rings, leaving these samples unchecked and unutilized would result in also losing over 81 % of our potential archaeo-dendrochronological information. This would have been unacceptable (fig. 8).

As the dendro-work progressed, observations began to show that younger oak samples, with fewer rings, could also be accurately cross-matched. In response, appropriate methods were developed enabling successively smaller, age-related, series to be utilized. It should be reminded that the following describes dendrochronological methods based on experience with large assemblages of subfossil woods collected from prehistoric pile-dwelling settlements. These methods may not necessarily be appropriate for the dendrochronology of smaller projects with few timbers originating from unknown and possibly varied source locations. After completing correlation work with woods of 50 or more rings and establishing site-reference chronologies, work could begin on cross-matching smaller ring groups. Starting with the 40-49 ring series, then 30-39, 20-29, 16-19, 12-15, and finally less than 12 rings. Within each age-related group, clear cross-matching series were synchronized and ring values averaged into mean-curves. Initially, each mean-curve containing between five and seven samples. Thus, allowing a visual overview of the variety and range of dendro-typological growth-patterns within each age-related grouping. Dendro-typological groupings are defined as samples showing similar growth-patterns, ring counts and fell-dates. This has been extensively described elsewhere (Billamboz 1996, 2011; Suter/Francuz 2010; Bolliger 2013; Suter 2017). With this established, each group was then cross-checked. Any cross-matching ring-patterns synchronized and averaged into larger replicated groups: the smaller with the larger and eventually cross-synchronized and dated with the Site-Reference-Chronology (fig. 9). This method proved most effective. It should be emphasized that cross-synchronizing samples with under 30 rings needs special care. Most samples in this category, especially with less than 20 rings, were only able to be reliably detected and cross-correlated by matching-up the still intact terminal ring, i.e. bark boundary/Waldkante, and synchronizing with the Waldkante, of other well replicated groups of trees that had also been harvested that same year. From the under 16-ring grouping, which were mostly thin round posts used as small structural supports, only few relative inter-post cross-matches have been successful but none, as yet, have been reliably cross-dated in calendar time.

### **Dating security: using a correlation category system**

When wood samples were later processed from the lakeshore excavation of Twann in 1978, a system for categorizing dating quality was developed (Francuz 1980). If and how a ranking or classification of possible dates should be made is still a topic of discussion between various tree-ring laboratories. Ideally, only wood specimens that show a high degree of conformity between growth patterns and are thus dendrochronologically “certain” cross-matches should be considered for further investigations. The term “possible dating” is not meaningful from a dendrochronological standpoint and ideally should not be used. However, the dendrochronological investigations of tens of thousands of woods from the shores of Lake Biel showed that very different situations can occur: on the one hand, not all growth curves with more than 50-year rings could be synchronized well with each other or matched with reference chronologies. On the other hand, there are always test series with 40 and fewer annual rings, which can be matched and dated beyond doubt to one or more reference curves. Also, samples with less than 30 years and sometimes even groups with less than 20-year-ring series show good coincidence and clear cross-matching patterns. Frequently, these synchronized datings could be later confirmed by comparisons with the archaeological context, in which clear structures could be identified on the pile plans. In this regard, it is important that the dendrochronological analysis is initially independent of the findings so that the archaeological context can then be used to verify the data.

Generally, three cases can be distinguished when comparing growth signatures of woods: secure datings: a good unambiguous visual cross-match between growth series indicates a secure synchronization and reliable dating, which is usually underlined by corresponding high statistical correlation values (see below).

For other samples, the curves do not visually cross-match so obvious, but the trend remains good, statistical correlation values significant and only one strong possibility for cross-dating indicated.

Then again, other samples can be visually matched ‘well’ at several points on the reference curve, so multiple dates are possible, but obviously only one of them can be correct.

Therefore, to clearly illustrate the reliability of the dendrochronological dating of each sample a classification system was introduced. The following correlation category system was developed using woods from Twann and, with minor variations is still in use today. However, it should be noted that various laboratories differ in their classification criteria.

**Category “Standard”:** This category consists of wood samples that have more than 50 year-rings that can be synchronized beyond doubt to other ring series and show reliable supporting statistical correlation values. The mean-curves produced from averaging the measuring values of these correlated woods are used to build and cross-date reference chronologies. In some cases, robust and easily reproducible mean-curves from averaged wood samples with 40-49 rings are also integrated into the Standard category mean-curves for building reference chronologies.

**Category “A”:** Dated with certainty. Samples of this category can be uniquely synchronized and dated with the reference chronology, regardless of the number of growth rings a sample has.

**Category “B”:** Uncertainly dated. These samples show a visually good, but still uncertain dating at one position only on the reference curve.

**Category “C”:** Very uncertainly dated. Samples of this category can be correlated to the reference curve at several places. The uncertain dates of this category should not be published as results (since of the possible dates only one is correct) and should remain as only ‘in-house’ information for future review using new data sets.

This classification of the dendro-data into different categories proved very useful to rapidly distinguish between reliable and unreliable data during the evaluation process.



### **Results: Building reference chronologies and dating in calendar time**

Reference chronologies are built from averaging the synchronized ring-width values of individual samples of the 'standard' category (see above). Ideally, the site reference integrates values taken from individual curves containing neither growth anomalies, nor measuring uncertainties. They have at least fifty or more consecutive annual growth rings that visually clearly cross-match to other chronologies. Optimally, the reference standard integrates settlement woods that have been cut from trees covering the whole spectrum of a settlement's occupation thus serving as a correlation basis for cross-matching younger trees from throughout the entire settlement period. Further, the site standard serves as the reliable robust basis for cross-dating with other settlement site reference chronologies elsewhere in the region. Thus, a mosaic of individual site standard reference chronologies is constructed that, when cross-synchronized and averaged together, forms the robust basis of a master regional chronology (fig. 10). The regional master chronology works not only as an anchor for archaeological calendar dating with other dated master chronologies, but also serves as a year exact reference for a whole range of environmental and climatological studies that connect and reflect tree rings, environment and human mobility.

### **Sample replication: meaning and importance**

The phenomenon that ring width patterns from different trees, from different sites, can be cross matched shows that they reflect a common growth signal that can be cross-correlated (Baillie 1995). The more samples that show matching replicated patterns (signals) within a specific time frame, the greater the reliability that the cross-matches are accurate.

A good replicated site reference chronology is an essential tool. Replicated ring-patterns confirm the correctness of the measuring and cross matching procedures. Averaging synchronized annual ring-width measurements between series removes the 'noise' associated with individual samples and emphasizes the collective signal within all trees from the growing site. Experience has shown that the more replicated individual curves incorporated into a site chronology, the easier it becomes to find cross-matches to chronologies, constructed by independent laboratories, at further locations. Thus, this will help at verifying and confirming the results from each laboratory.

### **Reference chronologies Lake Biel**

After more than 36 years (until 2014) of intensive archaeological campaigns around Lake Biel, the prehistoric epochs of this region, for this period are dendrochronologically well covered. In total, more than 100 reference chronologies from almost 3000 woods of around 35 settlements-sites have been created. Figure 10 presents an overview of the cross-synchronized oak site-reference chronologies (blue) used in making up the Regional master Chronologies (red) which extends with gaps over two thousand years of tree-ring referencing between 4092 and 2626 BC. Site chronologies of the spices, silver fir, ash and hazel, not shown in this figure, have also been synchronized and cross-dated with the presented oak reference chronologies. Fig. 11 shows the fell datings summarized from dated samples excavated from the Lake Biel prehistoric sites. The Lake Biel regional oak master chronologies have been synchronized and dated in absolute calendar time by synchronized cross-matching with the Southern German and Swiss Oak chronology (Becker et al. 1985).

### **Conclusion**

As more ring-width chronologies are produced and synchronized, growth signals reflecting wider environmental and climatic influences become more pronounced allowing closer climatological and environmental studies. A data base containing a regional mosaic of growth ring measurements and robust tree-ring chronologies will form the necessary basis for unfolding these poten-

tial research possibilities. Besides, it also offers a valuable contribution to the increasing network of archaeo-dendrochronological data that expands our understanding of local environmental dynamics that influence and trigger cultural change and movement throughout this region and beyond.

There are many unresearched wetland prehistoric settlements, including those in the geographical locality of what is today the Southern Balkans and North-western Greece, containing large quantities of well-preserved construction wood. As the Lake Biel and similar studies are increasingly demonstrating, dendrochronologically dated sub fossilized timbers collected from peat bog, wetland and lacustrine sites offer a wealth of valuable information and research possibilities well beyond that of archaeological dating. It should not be forgotten that such well-preserved construction timbers also offer a unique biological archive, an annual record of environmental and climatological influences and changes that have been enigmatically encoded within tree growth. The more we are able to decipher from this code the better we'll be able to understand the motivation, movement and destiny of human beings. This unique heritage should be preserved and secured, for novel research methods that will inevitably appear in which these curated woods could prove an invaluable resource in helping us unravel and understand even more about the environmental forces that influence not only tree-growth but also shapes the destiny of human movement, technology and behaviour.

#### **References**

Baillie, M.G.L. and J.R. Pilcher (1973). A simple crossdating program for tree-ring research. *Tree-Ring Bulletin* 33, 7-14.

Baillie, M.G.L. (1995). *A Slice through time. Dendrochronology and precision dating*. B.T. Batsford Ltd., London.

Becker, B., Billamboz, A., Egger, H., Gassmann, P., Orcel, A., Orcel A. and Ruoff, U. (1985). *Dendrochronologie in der Ur- und Frühgeschichte. Die absolute Datierung von Pfahlbausiedlungen nördlich der Alpen im Jahrringkalender Mitteleuropas. Antiqua 11*. Verlag Schweizerische Gesellschaft für Ur- und Frühgeschichte, Basel.

Billamboz, A. (1996). *Tree Rings and Pile-Dwellings in Southwestern Germany: Following in the footsteps of Bruno Huber*. In: Dean, J.S., Meko, D.M., Swetnam, T.W. (eds.). *Tree Rings, Environment and Humanity. Proceedings of the International Conference, Tuscon, Arizona, 17-21 May 1994*. Radiocarbon, University of Arizona, 471-483.

Billamboz, A. (2011). *Applying dendro-typology to large timber series*. In: Friture, P. (ed.). *Tree Rings, Art, Archaeology, Proceedings of an International Conference*. Royal Institute for Cultural Heritage. Scientia Artis 7. Brepols, Brussels, 177-190.

Bolliger, M. (2013). *Wenn's taut, wird gebaut! Schnurkeramische Besiedlungsdynamik an Zürichsee*. Master thesis in Prehistory and Archaeological Science, University of Basel.

Chrysostomou, P., Giagkoulis, T. and A. Mäder (2015). *The "Culture of Four Lakes". Prehistoric lakeside settlements (6th-2nd mil. BC) in the Amineon Basin, Western Macedonia, Greece*. *Archäologie Schweiz* 38(3), 24-32.

Chrysostomou, P. and T. Giagkoulis (2016). *Land und Seeufersiedlungen der „Kultur der Vier Seen“, Griechenland. Neue archäologische Einblicke in den prähistorischen Siedlungen im Amineon-Becken*. *Plattform*, 23/24, 4-9.

Eckstein, D. and J. Bauch (1969). *Beitrag zur Rationalisierung eines dendrochronologischen Verfahrens und zur Analyse seiner Aussagesicherheit*. *Forstwissenschaftliches Centralblatt* 88, 230-250.

Francuz, J. (1980). *Dendrochronologie*. In: Furger, A. R. (ed.). *Die neolithischen Ufersiedlungen von Twann 7. Die Siedlungsreste der Horgener Kultur*. Staatlicher Lehrmittelverlag, Bern, 197-210.

Francuz, J. (2018). *Zur Entwicklung der Dendrochronologie am Bielersee 1978-2014*. *Archäologie Bern 2018*, 242-267.

Furger, A. R. (1980). *Die neolithischen Ufersiedlungen von Twann 7. Die Siedlungsreste der Horgener Kultur*. Staatlicher Lehrmittelverlag, Bern.

Giagkoulis, T. (2019). *The pile-field and the wooden structures of the Neolithic lakeside settlement Anarghiri IXb Western Macedonia, Greece*. Bern: Dissertation, Faculty of Humanities of the University of Bern.

Hafner, A. (1992). *Latrigen VI-Riedstation. Siedlungsplan und Baugeschichte. Ufersiedlungen am Bielersee 4*. Staatlicher Lehrmittelverlag, Bern.

Hafner, A., Fischer, J. and J. Francuz (2010). *Sutz-Latrigen, Abschluss der Rettungsgrabungen Neue Station und kommende Aufgaben*. *Archäologie Bern* 2010, 132-135.

Hafner, A., Stapfer, R. and J. Francuz (2016). *Die Bucht von Sutz-Latrigen*. In: *Archäologisches Landesmuseum /Landesamt für Denkmalpflege Baden-Württemberg (eds.). 4000 Jahre Pfahlbauten. Begleitband zur Grossen Landesausstellung Baden-Württemberg*. Jan Thorbecke Verlag, Stuttgart, 116-118.

Hafner, A. and P. J. Suter (1999). *Ein neues Chronologie-Schema zum Neolithikum des Schweizerischen Mittellandes: das Zeit-/Raum-Modell*. *Archäologie im Kanton Bern* 4b, 30-40.

Hafner, A. and P. J. Suter (2000). *-3400. Die Entwicklung der Bauerngesellschaften im 4. Jahrtausend v. Chr. am Bielersee aufgrund der Rettungsgrabungen von Nidau und Sutz-Latrigen*. *Ufersiedlungen am Bielersee* 6. Verlag Paul Haupt, Bern.

Hafner, A. and P. J. Suter (2004). *Aufgetaucht. 1984-2004*. *Archäologischer Dienst des Kantons Bern*, Bern.

Naumov, G., Hafner, A., Taneski, B., Reich, R., Hostettler, M., Todoroska, V., Emmenegger, L., Stäheli, C., Szidat, S., Papadopoulou, S., Francuz, J. and M. Bolliger (2018). *Research in 2018 at PLOČA-MIČOV GRAD Site on the Lake Ohrid*. *Patrimonium.mk*, year 11, br. 16/2018 UDC: 902.2 (497.771) „2018“.

Orcel, A. (1981). *Les vestiges des villages Cortaillod. Die neolithischen Ufersiedlungen von Twann 12*. Staatlicher Lehrmittelverlag, Bern.

Suter, P. J., Fischer, J. and J. Francuz (2014). *Sutz-Latrigen Rütte. Erste Ergebnisse der Tauchuntersuchungen 2011-2013*. *Archäologie Bern* 2014, 184-193.

Suter, P. J. (2017). *Um -2700 v. Chr. Wandel und Kontinuität in den Ufersiedlungen am Bielersee*. *Ufersiedlungen am Bielersee* 8. Rub Media Verlag, Bern.

Stöckli, W. E. (2018). *Schlussbericht über die Ausgrabungen (1974-1976) und Auswertungen (1976-1982) von Twann. Mit einem Kommentar von 2017. Die neolithischen Ufersiedlungen von Twann 21; Hefte zur Archäologie im Kanton Bern* 3. *Archäologischer Dienst des Kantons Bern*, Bern.

Winiger, J. (1989). *Bestandesaufnahme der Bielerseestationen als Grundlage demographischer Theoriebildung. Ufersiedlungen am Bielersee 1*. Staatlicher Lehrmittelverlag, Bern.

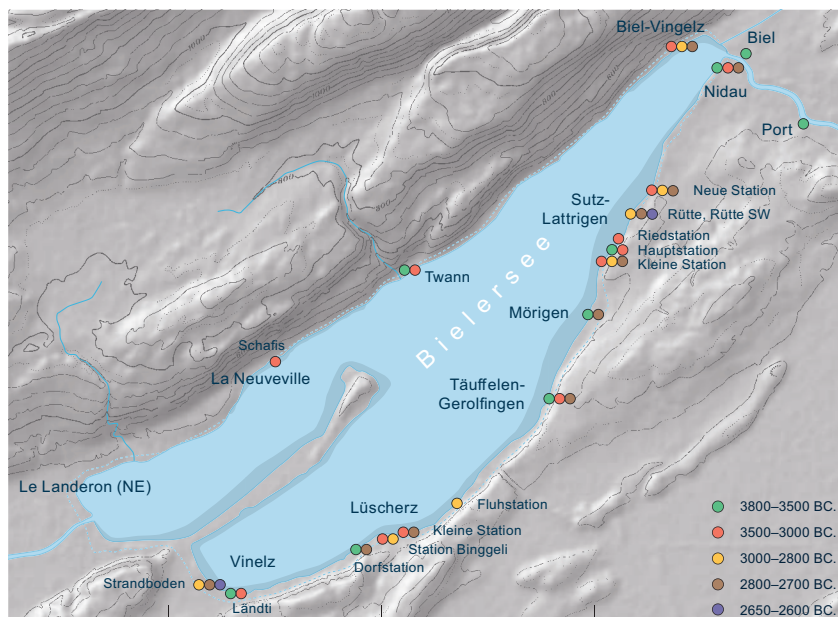


Fig. 1: Lake Biel: Overview of excavated pile-dwelling settlements between 1974 and 2017 and associated dendrochronological dating spectrum (© Archäologischer Dienst Bern (ADB), Andreas Zwahlen; topographic map: Swiss Federal Office of Topography)





Fig. 2: Twann Bahnhof: View of sections 6 & 7, two of the 16 sections excavated between 1974 and 1976, discovered during a national highway construction project of an underpass extending through the village of Twann at Lake Biel (© ADB, François Roulet).



Fig. 3: Work at Twann Bahnhof excavation site (1975). Large quantities of wood, mostly oak piles, were documented and sampled for further evaluation and eventually dendrochronology (© ADB, Ruth Jud).





Fig. 4: View underwater of excavation field showing method of extensive pile-field documentation (© ADB, drawing: Max Stöckli).



Fig. 5: Oak samples cut and prepared for dendrochronology. An approximately 3 cm slice is taken using a band saw. This equipment leaves the wood with a flat smooth-surface greatly aiding speed in sample preparation and saving razor blade costs (photo: John Francuz).

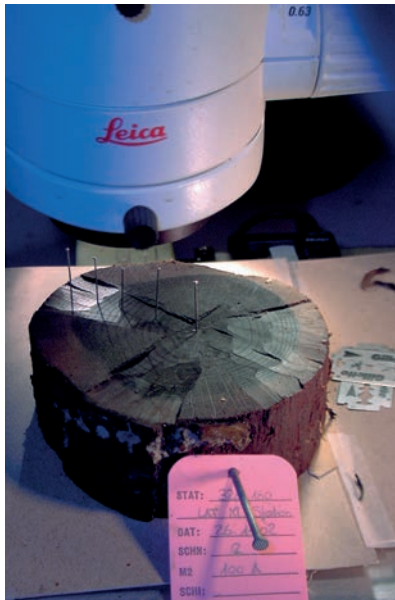


Fig. 6a: Oak sample with growth rings prepared for measuring. To ensure accuracy each radius will be measured at least twice along different radii (photo: John Francuz).

Fig. 6b: Wood sample with pith, cambium, and bark and containing 61 growth rings (above). The measured ring-width values, when plotted onto a graph, produces a curve (below). Arrows on curve point to the widest (5) and narrowest (19) ring-width measurements (© ADB, Max Stöckli, John Francuz).

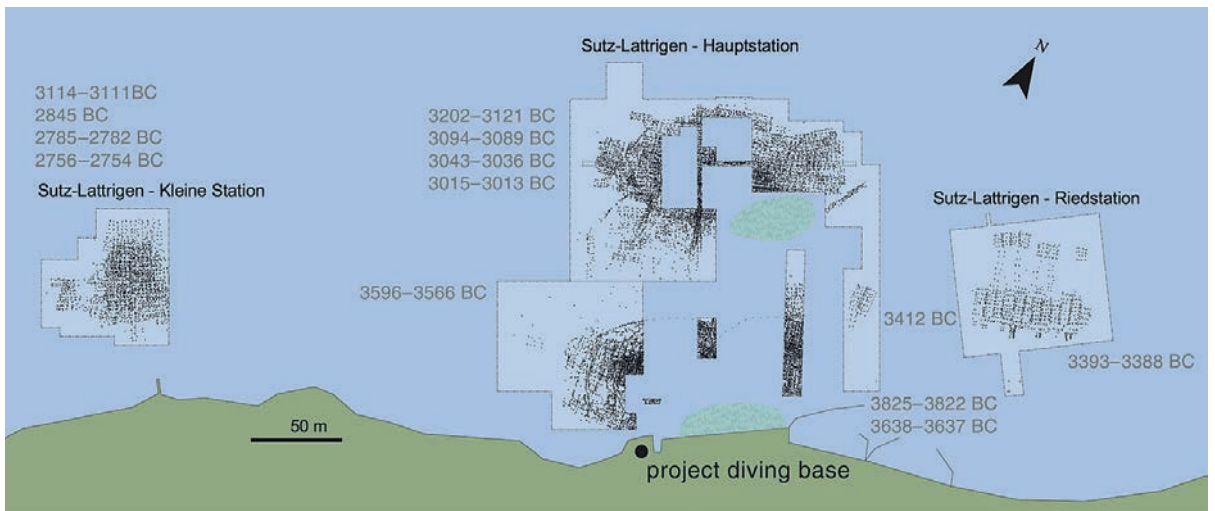
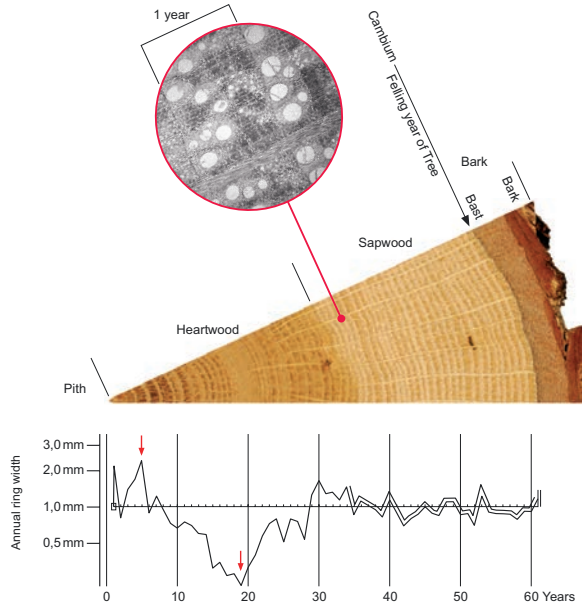


Fig. 7: Pile-plan Sutz-Lattrigen, Lake Biel: Between 1988 and 2003 extensive rescue excavations were carried out. The dendrochronology of the pile-plan shows that during the period 3825-2754 BC, with interruptions, numerous settlements existed, slightly shifting horizontally, each containing large quantities of piles (© ADB).

#### Percentage of Age-Groups of Oak Samples



Fig. 8: Comparison of age groupings of oak samples excavated from seven major submerged Neolithic settlements in Lake Biel (© John Francuz; graphics: Cornelia Schlupp).

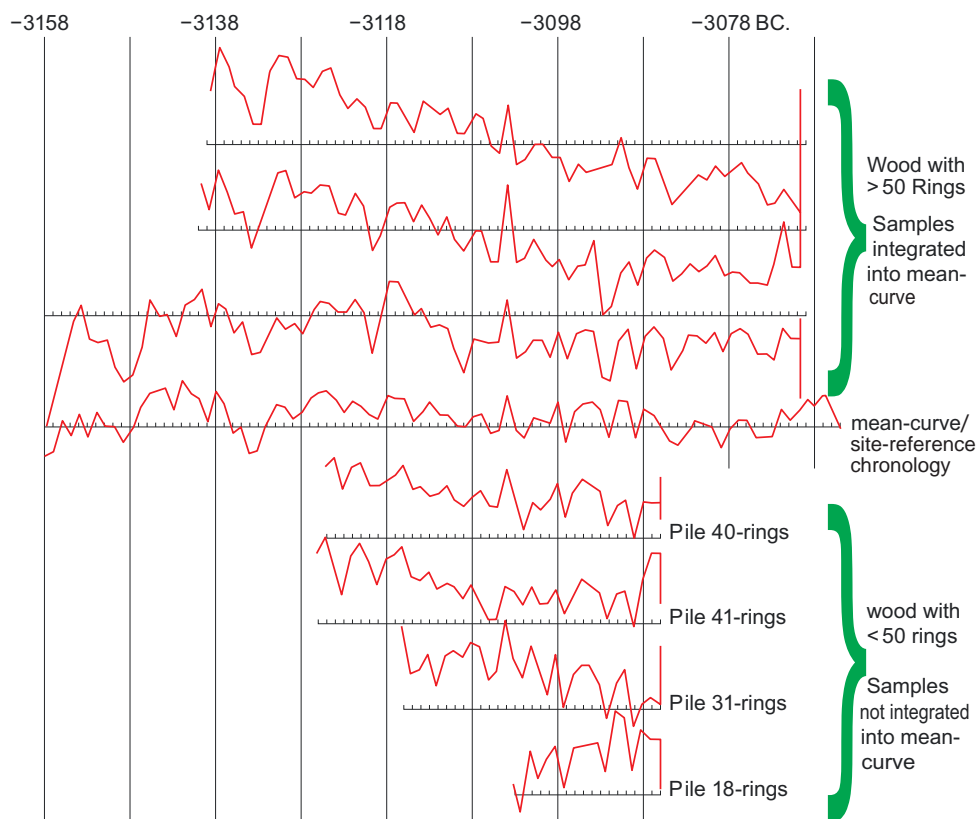


Fig. 9: Example of synchronizing annual ring-width curves. Wood samples with more than 50 tree rings are cross-matched, synchronized and averaged into a reference mean-curve/chronology. On this basis, samples with less tree rings can be synchronized with and eventually cross-dated to the site-reference mean-curve but are not integrated into it (© ADB, John Francuz; graphics: Margaret Voss and Cornelia Schlupp).

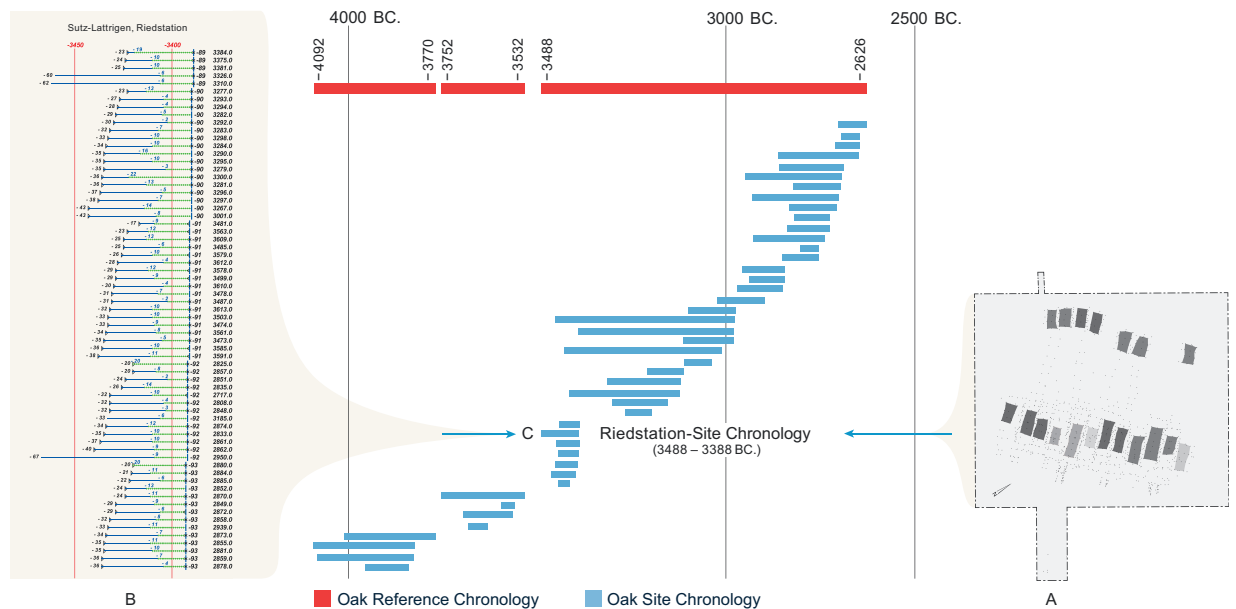


Fig. 10: Building site and regional reference chronologies: From the ring width measurements of c. 900 posts collected from the settlement Sutz-Lattrigen Riedstation (A), the oldest measured samples are synchronized (B) and their ring-width values averaged to produce the site reference chronology (C) dated between 3488-3388 BC. C is one of the 44 site-chronologies (blue) that produce the Lake Biel regional chronologies (red) (© ADB, John Francuz; graphics: Cornelia Schlupp).







## **II.B.4 SUISS Hydra – a GPS-based Surveying Device Used by the Zurich Underwater Archaeology Section**

The Zurich Underwater Archaeology Section maintains cultural monuments located under water, most of which are prehistoric settlement sites. These monuments are under acute threat from both human intrusion and the natural environment; in Canton Zurich alone, 250,000 m<sup>2</sup> of archaeological layers, pile fields, base plates and finds from 86 sites known today lie exposed on the lakebeds or slope edges under water. Protection measures such as gravel deposits and the insertion of caisson walls to support and protect profiles are being put in place in order to counteract the ongoing loss of substance.

Since the 1960s, the Zurich Underwater Archaeology Section's archaeological and conservational remit has been carried out by means of numerous survey dives, documentations as well as test and rescue excavations, thereby gradually adding to the inventory, assessing the sites and, based on this, developing concepts for their protection.

As with dryland archaeology, surveying and precise mapping of all finds and features are a crucial component of the documentation work.

Usually, the work is carried out using an analogue local survey grid, which is set up under water using yardsticks and surveyor's tape. This allows us to divide the area under examination into square metres, which have distinct coordinates. The local coordinates of the piles and finds and also of the layer boundaries are measured and noted by square metre and the depths are recorded in relation to the known lake level using yardsticks. The local square grid is then georeferenced by conventional surveying methods using a theodolite (fig. 1). Following the underwater surveying, the data recorded have to be transferred manually to a database, checked and then plotted using a geographic information system.

### **Aims**

Against this background one might ask whether some of the steps in this labour-intensive and time-consuming method could perhaps be simplified and the recorded data processed more efficiently. The main priority would be to map specific points as precisely as possible by directly targeting them with an input device under water and electronically measuring their three-dimensional coordinates. This would apply first and foremost to piles, finds, layer boundaries, auger coordinates and survey points. Besides a small input unit which could be operated under water strapped to a diver's arm, it was imperative that the measuring device would be easy to manage and operate. It should be possible to easily transfer the recorded data to a GIS system via an interface and to automatically generate maps of particular categories.

These were the requirements drawn up by the Zurich Underwater Archaeology Section in 2011 and used by the company SMT Swiss Mains in Würenlos to carry out a feasibility study to assess the system components necessary to achieve a survey accuracy of 5 cm for three-dimensional point determination under water.

### **Technology**

The systems that currently exist which allow for under-water positioning are not sufficiently precise and are too inflexible for use in archaeological examinations in shallow-water zones; one such device is the ACSA Underwater GPS (GIB-LITE), which is comprised of four buoys fitted with GPS systems, an underwater hydrophone linked by a cable and an ultrasonic transmitter whose position can be determined under water. A prototype developed in western Switzerland

by archéo développement offers precise positioning but its underwater components are unwieldy and do not meet the specific requirements of the Zurich Underwater Archaeology Section with regard to its operation and handling – quite apart from the fact that it is not commercially available. Inertial systems (gyrocompasses) combined with a GPS system as used mainly in aviation, were also excluded from the range of potentially suitable technologies.

A satellite receiver fitted into a floating buoy in combination with a telescopic arm was ultimately revealed to offer both the operational flexibility and the measurement accuracy required.

### **System components**

The Swiss Underwater Integrated Survey System (SUISS) “Hydra” was developed in close consultation between SMT Swiss Mains in Würenlos as the contractor and the Zurich Underwater Archaeology Section as the customer. The aim was to fulfil certain general criteria. The desired measuring accuracy should be achievable in wind speeds of up to 15 kn and wave heights of up to 20 cm, measurements should be possible to a depth of 3.5 m for a period of at least 6 hours without an external electricity supply and the data recorded should be transferable from the input unit to a geographic information system (figs. 2; 3).

The underwater survey device basically consists of a floating, hydro and wind-dynamically optimised fibreglass composite buoy and a telescopic arm made of rigid fibreglass piping fixed to the base of the buoy (fig. 4). The buoy contains an RTK-GNSS satellite receiver (Trimble SPS985 GNSS Smart Antenna) and sensors that can precisely pinpoint its position. A magnetic field sensor and an acceleration sensor determine the orientation and direction of the gravity acceleration (slope) and thus the exact position of the buoy. Another sensor measures the cable pull within the telescopic arm. The electronic system in the buoy offsets the GPS measurements against the sensor values and calculates the precise position of the measuring point at the time of measurement. This enables the device to take measurements with a tilt of the telescopic arm of up to 30 degrees from the vertical. The total measuring error resulting from the accumulation of the measuring errors of all individual components is less than 5 cm for all three coordinate axes. In order to attain the accuracy required, correction of the GNSS data is achieved by accessing the local positioning service (e.g. swipos, sapos, apos) via a SIM card with a data plan; if the service is unavailable for some reason, a local base station can be used.

The system is controlled using an operating unit strapped to the diver’s arm; measurements can be defined as points, lines or areas and the individual values can be associated with categories and subcategories (fig. 5). Menu navigation is carried out with a magnetic stylus, as are entries via the numerical keys. Measurements can also be taken by pressing a button on the stylus with one’s thumb, much like on a biro (fig. 6).

The data transfer between the input device and the buoy occurs via a radio transmitter with a range of up to 5 m. However, radio communication via the antenna that is integrated in the protective frame only works in fresh water; the range is substantially limited in salt water. Data quality is constantly monitored by the system and signalled to the diver. If this function is not required and is dispensed with, measurements can be taken even if the radio link is temporarily interrupted. This will not result in an outage of the measuring system because the buoy and the input unit are synchronised with regard to time so that the data recorded by both devices can be brought back together retrospectively once the radio link has been re-established. Measurements can even be linked with a monitoring unit on a boat if required (live-tracking).

An additional function that is very useful in an underwater archaeological context is direct navigation to certain coordinates, which can be displayed on the operating unit and pinpointed under water with centimetre accuracy.

## **Poseidon**

The data recorded under water are saved in the internal storage of the operating unit; the raw data from the satellite measurements recorded in the buoy are transferred via Bluetooth to the operating unit. Both datasets are interconnected and can be transferred via a USB interface using “Poseidon”, a software package specifically developed for the purpose. Poseidon then creates a data file that can be exported to the geographic information system. The package offers software updates for Hydra and can also be used to configure the operating unit and to define and manage various categories and subcategories for different areas of application.

## **Measuring depth**

If a diver is required to stand up in shallow water or carry out measurements on dry land, the RTK-GNSS satellite receiver can be removed from the unit in a few simple steps and fitted on a conventional tripod. Preliminary tests carried out under water have shown that Hydra, with its telescopic arm fully extended, can be used at depths of between 0.9 and 3.5 m (fig. 7). It only takes one diver to comfortably and efficiently operate the device. The centre of gravity and the buoyancy of the telescopic arm are synchronised in such a way that the measuring point is in a balanced position floating alongside the diver.

There is an option to attach an extension to the telescopic arm instead of the measuring point, so that the measuring depth can be extended to 4-5 m. However, this results in a loss of mechanical stability in the arm and thus reduces the accuracy.

## **Outlook**

It must be stressed that Hydra is not a drawing device and therefore does not replace sketches and drawings made on an excavation. Its accuracy allows us to efficiently record piles, boundaries of pile fields and layers, finds and entire areas with sufficient precision (fig. 8). It is also possible to digitally record lakebed topography. In order to carry out measurements at greater depths, for instance to survey shipwrecks, a plumb line (a plummet suspended from a piece of string) of specific length could perhaps be attached to the tip of the telescopic arm.

Besides underwater archaeology, Hydra could also potentially be used by other disciplines such as underwater biology, hydraulic construction or by the police in underwater investigations.

As a potential further development, a live-tracking function could be added, which would allow us to track the diver's position on screen from a boat and communicate instructions via radio link, for instance when searching for a particular location or swimming along a particular line.

Having comprehensively tested the different components of the system and solved certain initial teething problems, Hydra has now been in use by the Zurich Underwater Archaeology Section for several years. We have found that it allows us to carry out surveying, from qualified recording of data under water to mapping the data by means of a geographic information system, in a precise and timely manner.

## **Summary**

As with dryland archaeology, the surveying of excavation grid coordinates and the precise positioning of individual finds, samples or features, is also a crucial documentary component of underwater archaeology. The newly developed GNSS-based underwater survey device Swiss Underwater Integrated Survey System (SUISS) “Hydra”, allows a diver to comfortably and efficiently record points, lines and areas and subsequently map these data by means of a geographic information system. The system consists of a floating buoy that is fitted with an RTK-GNSS satellite receiver and sensors (a magnetic field sensor and an acceleration sensor) to precisely measure the orientation of the buoy as well as a telescopic arm with a sensor that measures its cable pull. The satellite coordinates are offset against the sensor values in order to localise the position of

the measuring point under water. Measurements can be taken with a tilt of the telescopic arm of up to 30 degrees from the vertical and to a depth of 3.5 m. The maximum measuring error for all three coordinate axes combined is less than 5 cm. The system is controlled using a small operating unit strapped to the diver's arm; menu navigation and entries are carried out using a magnetic stylus which is also used to trigger the measurements. The data transfer between the input device and the buoy is maintained via an antenna installed in the protective frame of the buoy. Hydra also allows a diver to directly navigate to certain locations under water and predetermined coordinates can be pinpointed exactly.



*Fig. 1: Wädenswil Vorder Au 1997. Divers surveying the piles located within a particular square metre. The measurements recorded are transferred to a square metre grid (photo: Zurich Underwater Archaeology Section, Department of Urban Development).*



*Fig. 2: The transport crate for Hydra fits into the luggage compartment of an estate car (photo: Zurich Underwater Archaeology Section, Department of Urban Development).*





**Swiss Underwater Integrated Survey System (SUISS) "Hydra":**

Buoy dimensions: 0.73 m x 0.42 m  
 Height (telescopic arm retracted): 1.22 m  
 Weight: 19 kg  
 Measuring accuracy: 5 cm

Areas of application: the underwater measuring device is generally for use in water. The buoy with the GPS floats on the surface, the telescopic arm is extended under water. The GPS can be removed and used for surveying on dry land.

Fig. 3: Open transport case with Hydra and a case with accessory equipment (photo: Zurich Underwater Archaeology Section, Department of Urban Development).

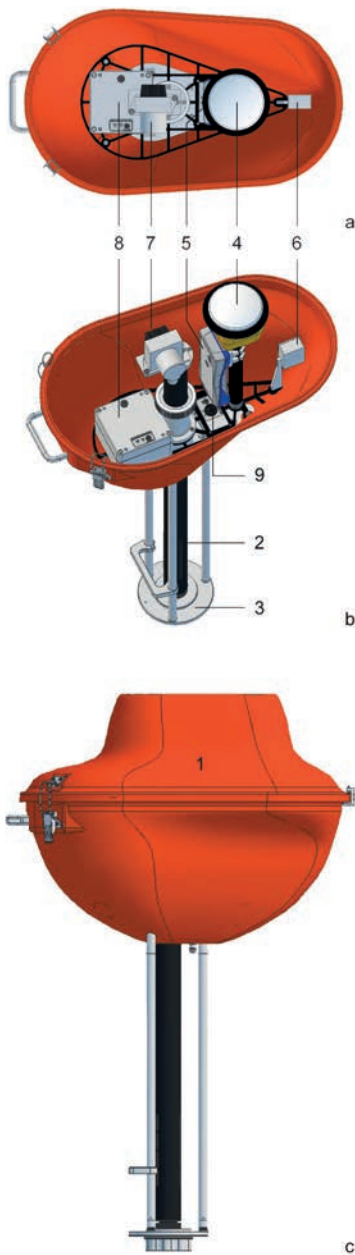


Fig. 4: Construction plan of Hydra with the main system components (a view from above with its protective housing open, b oblique view, c side view with its housing closed).

- 1 Buoy made of a fibreglass compound
- 2 Three-part telescopic arm made of fibreglass
- 3 Protective frame for the telescopic arm
- 4 RTK-GNSS satellite receiver
- 5 Control unit
- 6 Magnetic field sensor and acceleration sensor
- 7 Cable pull sensor
- 8 Battery
- 9 Main switch

(Illustration by SMT Swiss Mains and Zurich Underwater Archaeology Section, Department of Urban Development).



Fig. 5: The input unit is strapped to the diver's arm; the magnetic stylus allows the diver to operate the device and trigger measurements (photo: Zurich Underwater Archaeology Section, Department of Urban Development).

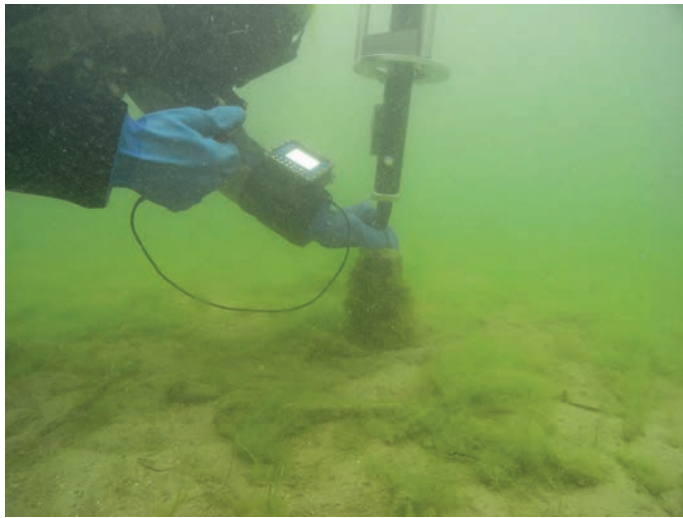


Fig. 6: The telescopic point is placed on top of a pile, the position is checked on the display and the measurement triggered (photo: Zurich Underwater Archaeology Section, Department of Urban Development).



Fig. 7: Hydra in use in shallow water (photo: Zurich Underwater Archaeology Section, Department of Urban Development).

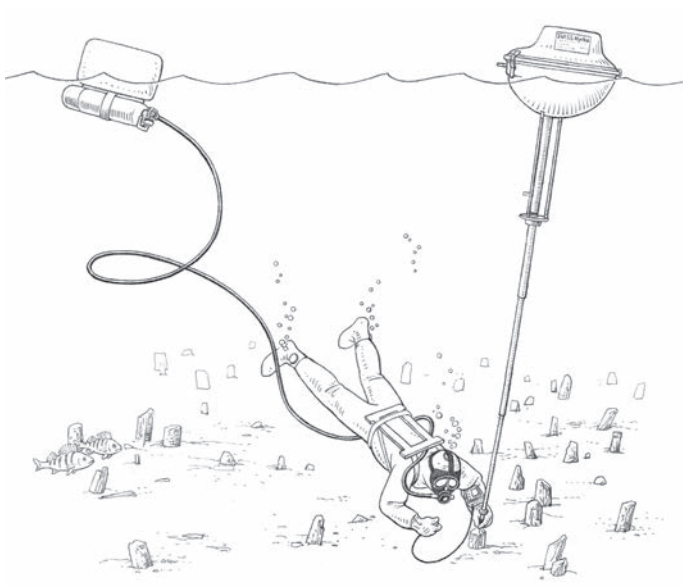


Fig. 8: Precise surveying of a pile field using the underwater survey device Hydra (drawing by bunterhund, Atelier für Illustration, D. Pelagatti).

Johannes Reich, Lea Emmenegger, Marco Hostettler, Corinne Stäheli, Institute of Archaeological Sciences, University of Bern, Switzerland

Martin Mainberger, Teraqua Training Company for Scientific Divers, Staufen i. Br., Germany

## **II.C.1 Lake Ohrid 2017, Course “European Scientific Diver”**

### **Introduction**

An important part of the NEENAWA project was the training of eight divers to achieve the license as “European Scientific Diver”. Spread over more than half a year, they were trained in various disciplines as scientific divers. The training was carried out by “Teraqua Training Company for Scientific Divers” under the direction of Dr. Martin Mainberger. The course consisted of a four-day block course in Bern in January 2017, followed by a half-year online theory seminar and a three-week final training course at Lake Ohrid, Macedonia in August/September 2017.

### **What is the “European Scientific Diver”?**

The idea behind the “European Scientific Diver” (ESD) is to simplify intra-European mobility for scientific divers. Professional training for scientific divers remains organized at the national level. Each country issues its own professional license. With the establishment of the “European Scientific Diving Panel” (ESDP), minimum standards for scientific diving within Europe were defined, which are accepted by the respective member states as an equivalent to their own professional training. Scientific divers trained in a member state can apply to the ESDP for recognition of their training as ESD. This means that they can be legally employed in all member countries affiliated to the ESDP and carry out their profession. The “European Scientific Diver” is therefore not an education, but the recognition of national professional training at the European level. In our case, we completed the training under German law to become a “Certified Scientific Diver”.

### **Course schedule and content**

In the four-day block course in January 2017, the participants were shown the course goals; at the same time a thorough diving medical check was carried out by the diving doctors Dr. J. Wendling, Biel CH, and Dr. P. Katschker, Konstanz DE. The aim was to find out whether the participants met the high physical and mental requirements for the training. This part of the course was divided into half-day indoor pool exercises, such as diving with a full face mask, freediving and lifesaving. These exercises in water were supplemented by first theoretical lessons in diving physics, diving medicine and labor law. During these lessons, the participants gave lectures on the country-specific labor law foundations for scientific diving in Macedonia, Ukraine, Russia and Switzerland. In the subsequent six-months online seminar, the theory of diving physics, diving medicine, diving technique, equipment and labor law was developed independently with extensive learning modules. The goal was to understand how the body and equipment work and how they behave under changing pressure. This should serve to plan a dive and be able to carry it out safely. The final training took place in August/September 2017 for three weeks. This course block was organized in Macedonia and was conducted under German law. Diving and training took place in the “Bay of Bones”. In this bay there is the “Ploča, Mičov Grad” pile-dwelling site (fig. 1), which was previously dated from the late Bronze Age to the early Iron Age using ceramic typologies. The site and its open-air museum with pile-dwelling reconstructions had already been visited once during the 2016 NEENAWA workshop. Ultimately, scientific diving is about being able to carry out scientific work under water safely, effectively, but also legally.

An important part of the practical training was working under German regulations. All legally stipulated requirements had to be observed. The focus was on accident prevention and diving

safety. In practice, this was done in a team of at least three people - consisting of a diving supervisor / signal person, diver and standby diver. All three people performed certain functions that were practiced during training. This includes dive planning and accident prevention. When diving, the most important thing was to ensure communication between diving supervisor and divers. Reacting to accidents was trained using rescue exercises and first aid. In addition, freediving, swimming (fig. 2), as well as the deepening of diving theory and labor law were essential components of this course block.

### **Survey**

The location of the final training directly at an archaeological site made special and unique learning conditions possible. We were able to carry out an underwater archaeological surface survey of 25 square meters during our practical training. This does not interfere with the solid, stratigraphically intact sediment, only the covering layer of aquatic plants and mobile sands was removed (fig. 3). A cultural layer could be uncovered underneath. The visible piles were measured and samples taken for a more precise determination of the wood species. These were mainly oaks and conifers that were well preserved and almost completely covered by the sediment. A large number of stray finds were found in the sandy cover layer (ceramics, bone and stone artifacts) (fig. 4). The examination took place on two days at the end of the three-week final training. On the first day, the practical part of the examination was taken by the examination commission, which had flown in from Germany (Martin Voigt / examination chair, Prof. Dr. Philipp Fischer and Dr. Klaus Müller). Due to a thunderstorm, part of the exam had to be postponed to the next day. For this reason, a further practical exam was carried out on day two in addition to the oral exams planned. All eight participants, Ekaterina Dolbunova, Lea Emmenegger, Marco Hostettler, Yan Krotov, Johannes Reich, Corinne Stäheli, Mariia Timoschenko and Valentina Todoroska, passed the exam successfully (fig. 5), despite all odds.

Building on this, a one-month project was carried out in summer 2018 with the aim of generating the first dendrochronological data for this unique site and to provide initial insights into its chronology, architecture and dynamics. To achieve this aim, the team from the University of Bern, the Center for Prehistoric Research (Skopje) and the Museum of Ohrid collected pile samples using underwater archaeological methods. Documentation was done using multi-image photogrammetry. After being sawn and taken out of the water, the growth rings of all piles were measured in order to perform dendrochronological analysis. The combination of dendrochronological data and radiocarbon dating by means of wiggle-matching has yielded highly accurate absolute chronological dates. The results comprised the first absolute dating of the site as well as the first reliable dendrochronological curves for the region and indications of the settlements structure and phases of the site.

### **Participants:**

Ekaterina Dolbunova, Lea Emmenegger, Marco Hostettler, Yan Krotov, Johannes Reich, Corinne Stäheli, Mariia Timoschenko, Valentina Todoroska





*Fig. 1: Diving in the Bay of Bones, Lake Ohrid, with the pile-dwelling reconstructions in the background. The diver is setting up the excavation grid (photo: Marco Hostettler, 2018)*



*Fig. 2: Swim practice under supervision of Mariia Timoschenko (photo: Martin Mainberger, 2017)*



*Fig. 3: Divers during surface cleaning (photo: Ekaterina Dolbunova, 2017)*



*Fig. 4: A diver during surface documentation. In the foreground an obsidian blade (photo: Yan Krotov, 2017)*



*Fig. 5: Successful newly licensed European scientific divers with supervisors (photo: Marco Hostettler, 2017).*

## II.D.1 Regional Introduction: Neolithic of Ukraine

The study of the Eastern European Neolithic is impossible without the involvement of data on the territory of Ukraine, since Ukraine occupies a large part of the European continent. Due to a number of famous scientists of the twentieth century, it became possible to discover and study Ukrainian Neolithic sites. M. O. Makarenko, M. Ya. Rudynskiy, V. M. Danylenko and D. Ya. Telegin should be mentioned among many others who laid the groundwork for the modern periodization scheme of the development of culture in the early Holocene and gave a volumetric analysis of the outstanding complexes of the Neolithic period in Eastern Europe.

But a major flaw of the Soviet archaeological science was isolated from European research, often because of ignorance of the material from surrounding territories which caused biased approach to the origin and development of concrete archaeological communities. It was argued that all Neolithic communities in the southern and central parts of Ukraine had local roots and practiced reproductive forms of economy. Stadial approach has led to some absolutization of such terms as Neolithic and Chalcolithic that corresponds to the last stage of savagery and the first stage of barbarism by the scheme of Morgan - Engels, without considering environmental, migration specifics of the formation of cultures. For evidence of gradual, evolutionary development of culture in a particular area often used morphological similarity of artifacts, which indicates the transformation of a shape for a long time. Thus, the idea of the continuity of such early Holocene phenomena was developed, for example: "Osokorivka culture" (Final Palaeolithic) – Hrebnyky culture (Mesolithic) – Bug-Dniester culture (Neolithic) – Tripolie A – Tripolie B (Chalcolithic).

At the present state of research, the development of Neo-Chalcolithic cultures of southwestern Ukraine and Moldova is somewhat different. The complexity of this process is evidenced by the various concepts and ideas offered by the researchers. Through the development of technological approaches in the analysis of material cultural remains, along with the experimental and traceology methods for the interpretation of artifacts and their functions, a significant contribution was made to the understanding of neolithization process in Eastern Europe. The comprehensive application of absolute and relative dating methods became a great impulse to create cultural and chronological schemes of the development of the Neolithic within the territory of Ukraine. Radiocarbon dating is still the most important method among others, both for archaeology and for the application of related disciplines such as paleobotany and archaeozoology. The application of geomagnetic survey methods allowed to understand the patterns of settlement structures that belonged to ancient farmers. The possibility of access to information from neighboring regions also has great value.

In recent years, a number of sites which belong to different agricultural communities of Neo-Chalcolithic times have been investigated in the south-western part of Ukraine and in Moldova. They all are located in the basins of the Prut, Dniester, Southern Bug and Dnieper rivers and demonstrate different variants of economic and cultural development in a particular region. Neolithic settlements include Sakarovka I in Moldova, Yosypivka I (the Upper Dniester), Dobrianka I-III, Pugach and Gard (Southern Bug), Romankiv, Pohreby (the Middle Dnieper), etc. Important conclusions were drawn from the studies of Trypillya settlements of Taliyanky, Maidanets'ke, Bernashivka I, Ozheve-Ostriv, etc. The peculiarity of studying these sites is the high methodological level of research, resulting in considerable series of various categories of material culture, including pottery, lithic, bone and antler products. This makes it possible to conduct a comparative analysis of the assemblages from the mentioned and other sites and to trace similar and distinctive features



in the processing technology for pottery and lithics. Studying Neolithic sites using up-to-date techniques has largely shed light on the features of each specific cultural phenomenon and raised questions about the polyvariant development of the Early Holocene communities, and about the necessity of taking into account environmental, economic, social, migration and ideological factors in the development of cultural complexes. Most of the modern research of Neo-Chalcolithic sites is the result of international cooperation between Ukrainian and European scientists. However, despite advances in methods of excavation and significant expansion of sources for research, understanding the processes of prehistoric cultures development mostly remains within the unilinear evolutionary approach, where one phenomenon has to “logically” grow in from another with the absence of abrupt change in between. But detailed analysis of the elements of material culture suggests no single-line development of each archaeological community.

The process of interaction between nature and society has a long history and is characterized by the multiplicity of adaptation strategies of human communities to the changing landscape and climatic conditions. However, the general vector of human culture development is gradually overcoming the natural and geographical determination, which is manifested in mastering of different natural niches and in broad inclusion of the external resources to the sphere of its own activity, gradually enhancing of anthropogenic interference in the ecological systems.

One of the most important issues in the study of ecological systems is to determine the nature of the changes that occurred during the transition from the Late Pleistocene to the Holocene. Prolonged existence of hunters in periglacial area in a relatively soft period of Late Pleistocene, around 18–13 k years BP, caused a high adaptation level of Upper Palaeolithic population to natural conditions. At this time there was flourishing of a culture of prehistoric societies, which was manifested in the spread of certain economic systems based on the availability of faunal resources and specific forms of architecture and original art. But significant landscape changes that occurred on the border of the Pleistocene - Holocene forced people to find new ways of managing and acquire new resources, which is reflected in the nature of material culture.

The process of neolithization that in some regions of the Oecumene took the character of a “Neolithic revolution” was one of the global processes that influenced the development of all mankind. The Neolithic era should be considered as a significant increase in the capacity to conduct various forms of societies’ life-sustaining activity as a result of the liberation from natural determinism in behavior after the fundamental changes in the natural environment at the end of the Pleistocene. If the formation of human society and culture took place in the conditions of the last Würm glaciation which stipulated strict dependence on the ways of husbandry of the environment, then a significant climate mitigation in the northern hemisphere, almost immediately led to development fanning out in all sectors of life. A vital point in the transformation of human culture, resulting in the formation of modern industrial relations and the active involvement of humanity in the transformational processes of the geosphere and biosphere of the planet, is the transition to productive forms of economy. The “triggers” to the explosive changes in human life, however, were catastrophic events in the environment at the end of the last glacial period.

With the disappearance of the mammoth faunal assemblage, transformations in the material culture of hunting groups occurred. Within the late Epigravettian groups a new method of hunting spread, which found its expression in the emergence of “early geometric microliths”; and a small number of sites with such traits in Eastern Europe suggest the demographic crisis among the population during the transition time. The upper limit of mammoth-hunters culture falls on the 13–12 k years BP (Semenivka III, Dobranychivka, Bugorok) and is associated primarily with the disappearance of the main object of hunting. The sharp decrease of sites on the territory of Dnieper Region in the Final Palaeolithic is recorded with the presence of only a few sites dated in frames 12–11 k years BP.



On the other hand, during the Early Preboreal Eastern Europe underwent complicated migration processes. Northern territories became an area of settling the cultures, associated with Final Palaeolithic - Mesolithic communities of Northern Europe – Swiderian, Kudlayivka, later – Janislawice cultures. Active settling of Dnieper area occurred during Mesolithic-Neolithic period. For Mesolithic times, the combining of material culture elements of Northern European (Kudlayivka, PISOCHNYI Riv type) and forest-steppe origin (Tatsenky, Zymivnyky) should be noted, which resulted in features of lithic industry of Mesolithic assemblages.

The Neolithic is an important archaeological period, belonging to the final stages of the Stone Age. It is a transitional epoch from the early and middle Stone Age with exclusively appropriating forms of subsistence compared to the era of early metals. The metal ages are characterized by widespread productive forms of farming, the appearance of craft, the formation of structurally complex societies, and in the most ancient centers of origin of agriculture and cattle breeding - the appearance of the first civilizations. The process of Neolithization is understood as the spreading of innovations in the economic, technological and cultural spheres, among which the domestication of plants and animals play a prominent role. This process is also characterized by early forms of farming and cattle breeding, the hereto linked transition to relative sedentism of prehistoric collectives, the emergence of stationary housing construction, various stone and flint processing techniques, and the spread of pottery. A specificity of life activity was reflected in complex world-view ideas and perceptions, which were materialized in vivid art objects and ornamentations.

During the Preboreal and Boreal, southern regions of Eastern Europe experienced a strong influence from the Near East, Balkanian and Central Asian centers of Neolithic cultures. If in the Near East and the Balkans abrupt changes in the natural conditions quickly caused a reorientation to productive economy and technology inventions related to it, then on the vast plain territories of Eastern Europe, the process of neolithization had a wave character of diffusion of innovations in a particular sequence.

The first wave is associated with proto-Neolithic groups with progressive pressure lithic processing technology, which allows obtaining a series of standardized blades that served as preforms for other tools and hunting weaponry. In the hunter-gatherer societies in Eastern Europe, this technology is actively used to provide primarily the hunting sector – the production of standardized microliths that served as elements of hunting weapons. This culture complex includes Hrebennyky, Kukrek and Donetsk archaeological unities, and technological equivalents which are also known in sites of the Near and Middle East. If the Hrebennyky community (8000-7200 BP) had direct analogies with the Balkan pre-ceramic complexes of the Initial Neolithic (Argissa, Ahilleon, Sesklo, Franhti), then the origins of the Kukrek (9700-8000 BP) culture in recent years were found in the pre-ceramic complexes of the Caucasus and Central Asia.

The second wave of neolithization associated with the penetration from the Balkans in Eastern Europe included the first skills of farming and domestication of animals, along with the tradition of ceramic production. The earliest assemblages in Eastern Europe that represent the culture of ancient farmers belong to the Krish culture of Moldova. The skills of agriculture correspond with the emergence of distinct series of tools related to harvesting operations. Among such are a series of attachments to sickles on the pressure regular blades, antler sickles and stone and antler elements of the hoes. Within the territories of the Dniester and Bug region, the synthesis of Neolithic Balkan traditions with the local Hrebennyky-Kukrek complex occurred, which resulted in the emergence of Bug-Dniester culture (7400-6000 BP) (fig. 1). In recent years, the assumption of agricultural skills in the bearers of this culture has been questioned. Given the topography of the sites, the absence of lithic inventory connected with agriculture and the analysis of plant remains from the BDK sites, it is possible to come to a conclusion about hunting-fishing orientation of representatives of this community.

The next wave associated with the penetration from the northern Carpathian Mountains to Ukraine representatives of the Linear Pottery Culture (6600–5800 BP), which has fully characterized the agricultural oriented farming, which found expression in the stationary architecture, flat-bottom thin-walled pottery and in a specific lithic assemblage. The lithic processing technology characterized by obtaining wide blades with using forced pressure, as the most suitable pre-forms for making sickle insets and knives (fig. 2). The appearance of the earliest Trypillia culture sites (5900–5600 BP) completes the formation process of a Neolithic farming package in the southwest of Eastern Europe.

These cultural unities are associated with a complete reorientation of the population on extensive agriculture that results in the spread of permanent settlements with clay architecture. In terms of lithic technology, a complete shift to agriculture in the economy is reflected in trying to get the regular blades as blanks for the sickle insets – dissemination of the technology of forced pressure with using simple mechanisms – levers. With the advent of agricultural communities in Eastern Europe, there are evidences of complex social relations and formation of network connections within cultural groups. Among such evidences is the transportation of high-quality raw materials at long distances to ensure the flint processing industry, which shows wide exchange links.

The literature has repeatedly expressed the idea of the genetic affinity of LBK, Tripolie A and Tripolie B, and therefore the similarity of their flint inventory. But detailed analysis of the elements of material culture suggests no single-line development of each archaeological community. Every culture develops its own technological tradition that is more pronounced in lithic inventory than in ceramic assemblages. If ceramic systems are often quite colorful phenomena, lithic assemblages demonstrate a high degree of unification, making it important for the cultural identification of the sites. The peculiarity of every cultural phenomenon seen in technology, which is characterized by a focus on a particular type of blank and design of tools primarily associated with the procuring of food resources – arrowheads and attachments for sickles. Comparative analysis of assemblages proves that there are no intermediate transition traditions between the technological vectors of LBK, Trypillya A1 and Trypillya B1 (fig. 3). We can indicate two main technology types – microlithic and macrolithic which are associated with two directions of Neolithic economy – a complex economy with large part of appropriating forms (the Bug-Dniester culture, Trypillya A1) and economy definitely focused on agriculture (LBK, Trypillya B1).

The Mesolithic sites of Middle Dnieper region are represented by several localities with a poor inventory consisting only of lithic artifacts, while fully populating of the landscapes of Middle Dnieper took place only in the Neolithic epoch. Here we can see “an explosion” in spreading of the sites of Kyiv-Cherkasska unity with different stages of development. Neolithic localities of Middle Dnieper have the “bush” disposition – by the concentrations of several sites on dune heights in the vast river valley. One of these concentrations is located at the opposite of the mouth of Pripet’ river, in the territory between Dnieper and Desna rivers: Pustynka 5 (Mnievo Lis), Novosilky on Dnieper, Oshytky, etc. The next concentration is connected with the mouth part of Desna River: Zazymie-Stanky I–III, Zazymie-Osynky, Pohreby-Keliiky, Pohreby-Musieva Dolyna, Pohreby-Lan, Vyhurivschyna, Troieschyna, Mykilska Slobidka I–IV etc. Another concentration is situated to the South of the previously mentioned on the right bank of Dnieper – Khodosivka-Zaplava, Romankiv, Vita-Poshtova. The fourth concentration can be seen to the south by the Dnieper flow – Protsiv, Vyshenky 1–14 etc.

The neolithization of Middle Dnieper region took place through the territory of Southern Polissia, the evidence of which we can see in early complexes Lazarivka, Khodosivka-Zaplava, Roslavske and Krushnyky with Kukrek lithic industry and Bug-Dniester ceramic. We can connect the Kukrek tradition in Middle Dnieper region with the earliest complexes of Kyiv-Cherkassy tradition which dates by <sup>14</sup>C to 6900–6300 B.P.

The second group of ceramic is analogous to the materials from Romankiv I – “ceramic of Romankiv type”. The dating of this site by  $^{14}\text{C}$  is  $6130 \pm 150$  BP. This type of ceramic we can see at Zazymie-Stanky I–III, Pohreby-Keliiky, Pohreby-Musieva Dolyna, Pohreby-Lan, Vyshenky. The highest cultural development marked by the concentration of later sites of Kyiv-Cherkassy community in Middle Dnieper area, which is particularly associated with dune arrays and the first terrace above the floodplain of the Dnieper, Desna, Trubizh, Supii, and Ros rivers (fig. 4). The contacts of Kyiv-Cherkassy communities with a population of Chernihiv Polissia are marked by the presence of Pit-comb Ware culture in the region. On the last stages of development of Kiev-Cherkassy culture one can see the considerable influence of Late Trypillia population, which displayed syncretism in morphology and ornamentation of ceramic features. Difficult ethnic processes were taking place in the Neolithic-Chalcolithic era in the Dnieper basin, as demonstrated by anthropological materials which originate from the cemeteries of Mariupol type in Azov-Dnieper area (fig. 5).

The Chalcolithic period in the western part of Ukraine begins with inhabitation of Cucuteni-Trypillia population from the Dniester region which characteristic features were: domination of hoe-type agriculture, the emergence of copper artifacts with the domination of stone tools, clay architecture, distribution of female figurines and painted ceramics. The area of this culture in 4000 BC occupied the vast territory from Romania to West Volynia region on North-West and Chernihiv region on North-East (fig. 6). The earliest Trypillian settlements appeared in Middle Dnieper in 4300 BC. They are synchronous with Dnieper-Donets Neolithic culture settlements of middle stage. For some period of time Neolithic and Chalcolithic population coexisted on the Middle Dnieper territory. It is proved by syncretism of ceramics, especially on the late stage of Dnieper-Donets culture.

With the arrival of Trypillian population natural resources of Middle Dnieper area began to be used much wider. At the stages B II – C I, which continued from 4200–3500 BC, the culture shows the greatest development and demographic growth of population. It is connected with appropriate climate condition of Holocene middle stage - Atlantic period when prevailed climatic optimum. The Cucuteni-Trypillian community began to populate the Left Bank of the Dnieper about 3600–3500 cal. BC, near the modern Pereiaslav. Gradually they settled up the valley of Trubizh River, forming sites of Lukashivska group: Tsybli-Uzviz, Krutukha-Zholob, Lukashi and Svitylnia, and reached the Desna basin. Spatial organization of late Trypillian population of Left Bank region obviously shows the use of different parts of the Dnieper valley by separate territorial communities. In terms of topography, this population possessed high loess terraces along the right bank of the Dnieper and upland terraces on the left bank of the Desna. The existence of Trypillian seasonal settlements in floodplain is important fact. The growth of their amount shows the increasing role of fishing, hunting and distant-pasture cattle in the stage of C II.

At the end of Atlanticum and the beginning of Subboreal in the second half of 4th millennia BC the degradation features are seen and then Trypillia culture finally disappears at the beginning of 3rd millennia BC. The changes in culture and composition of population are connected with cooling and draining of climate at the beginning of Subboreal.

The livelihood of prehistoric societies was largely determined by the natural factors, due to the low level of productive forces. But through the process of the historical development, society gradually expanded its resource base, involving more and more natural resources and mastering different landscape levels to ensure and improve living conditions. The environment gave the possibility to practice different forms of economy within a certain region that directly affected on the location of Eastern European sites of the Stone Age.

The main results on the topic of neolithization of the territory of Ukraine are presented in a number of collections of scientific papers and abstracts, which were published with the assistance of the project:

Shydlovskiy, P.S., Lyenko, S.D., Kyrylenko, O.S., Sorokun, A.A., Pichkur, Ye.V. (2016). *Prehistoric Archaeology of the Lower Desna Region*. Kyiv (in Ukrainian). <http://vitaantiqua.org.ua/en/archives/432#more-432>

Shydlovskiy, P.S. (ed.) (2016). *International Scientific Conference "HUMAN & LANDSCAPE : Geographical approach in the Prehistoric Archaeology"* (February 3 - 5, 2016, Kyiv, Ukraine) : Abstracts. Kyiv : Vita Antiqua Library, 94 p. <http://vitaantiqua.org.ua/en/archives/200>

Morozova, Y., Shydlovskiy, P. (eds.) (2017). *Wetland Archaeology and Prehistoric Networks in Europe / NEENAWA International Scientific Conference, September 15th-18th, 2017*. Kyiv – Kaniv: Vita Antiqua Library, 78 p. <http://vitaantiqua.org.ua/en/archives/960>

Terpylovskiy, R.V., Shydlovskiy, P.S. (eds.) (2017). *VITA ANTIQUA, 9. Human & Landscape : Prehistoric Archaeology of Eastern Europe*. Collection of scientific works. Kyiv: Center for Paleoethnological Research. <https://doi.org/10.37098/VA-2017-9>

Shydlovskiy, P.S. (ed.) (2018). *VITA ANTIQUA, 10. Prehistoric Networks in Southern and Eastern Europe*. Collection of scientific works. Kyiv: Center for Paleoethnological Research, 2018 – 212 p. <https://doi.org/10.37098/2519-4542-2018-1-10>

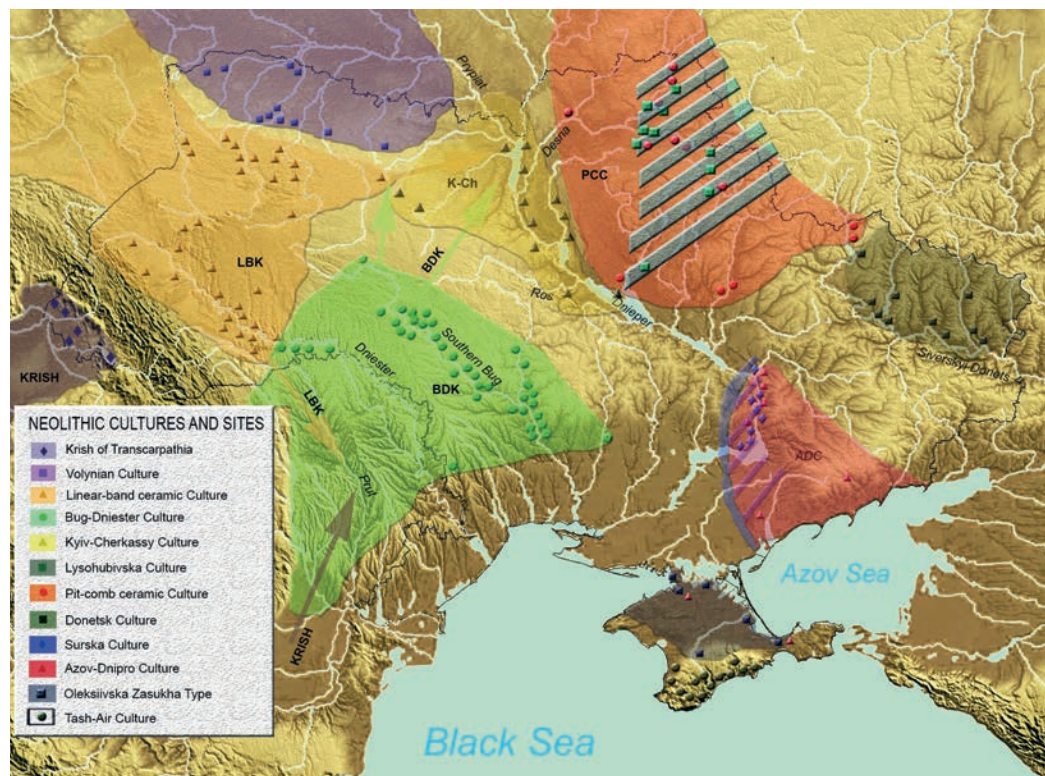


Fig. 1: Map of Neolithic cultures of Ukraine



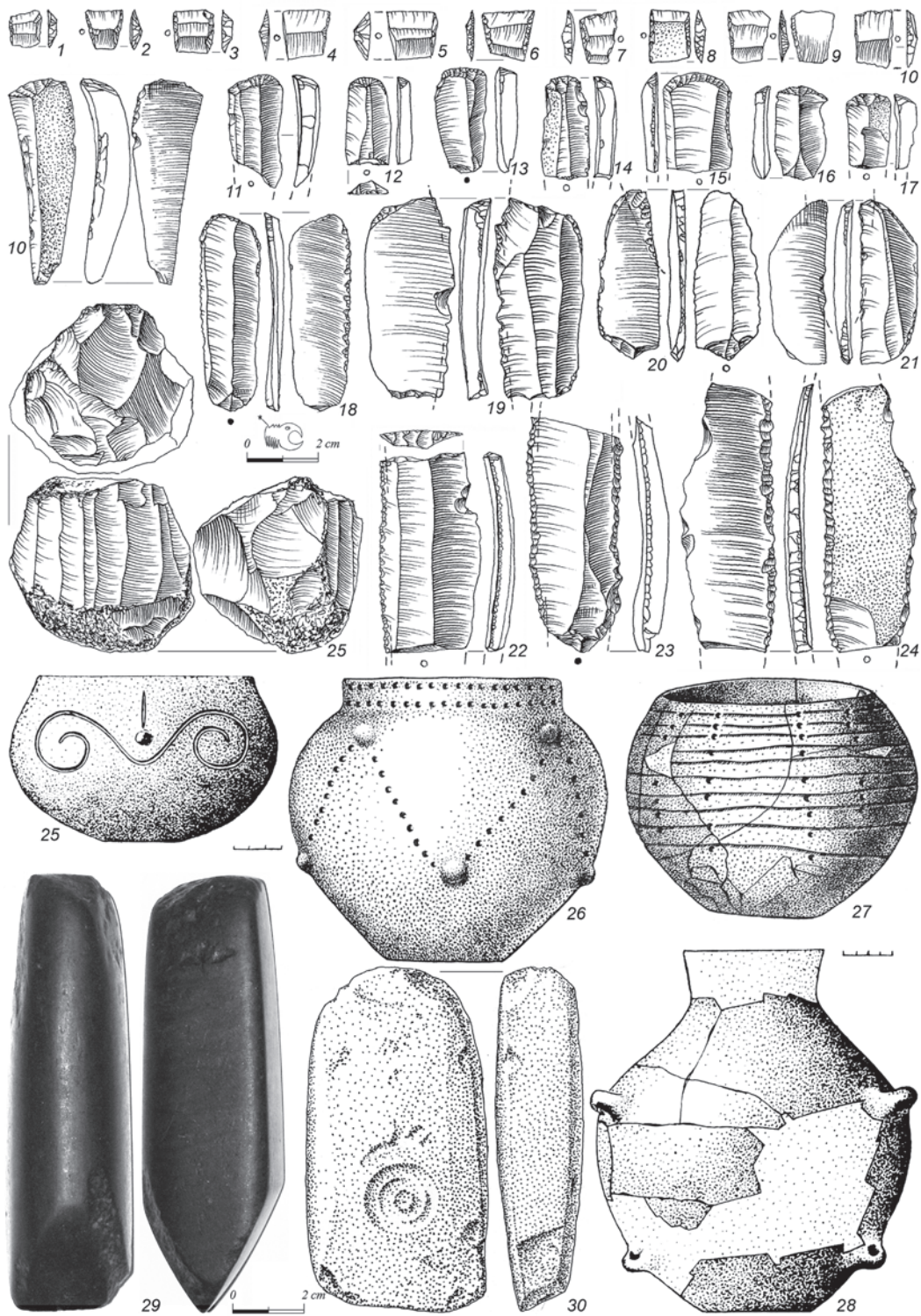


Fig. 2: Materials of LBK culture of Volyn and Middle Dniester area: 1-24 – lithic assemblage; 25–28 – pottery; 29-30 – stone tools.  
 1-24, 30 – Yosypivka I, 25, 28 – Rivne (after: Pyasetsky, Okhrimenko 1990; Chernovol et al. 2009; Shydlovskiy 2018)



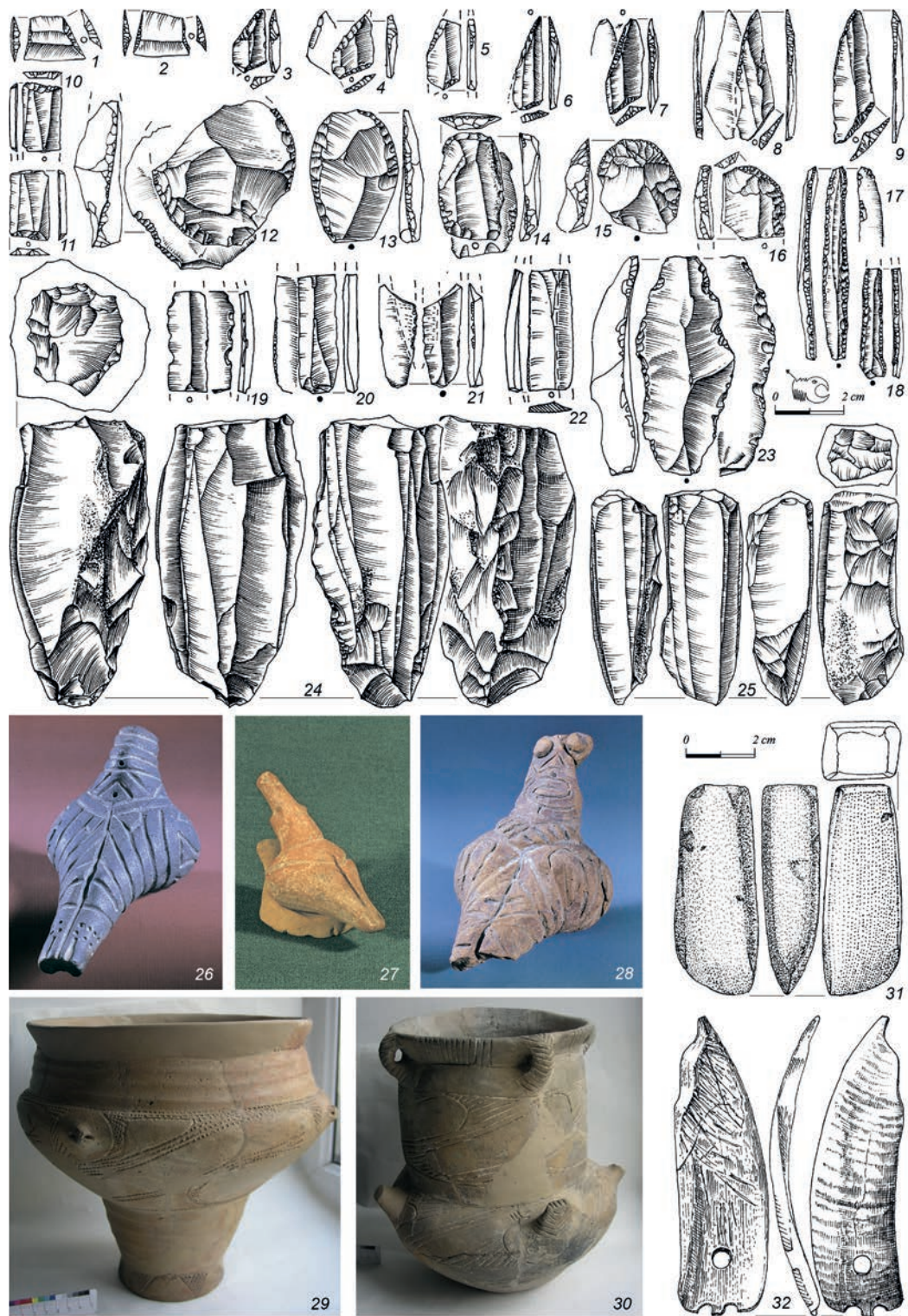


Fig. 3: Materials of Tripolie A culture of Middle Dniester area: 1-25 – lithic assemblage; 26-28 – female figurines; 29-30 – pottery; 31 – polished stone axe; 32 – a knife of the boar canine.  
 1-25, 31-32 – Bernashivka I; 26 – Oleksandrivka; 27-30 – Sabatynivka (Archaeological Museum of The Institute of Archaeology, NAS of Ukraine)

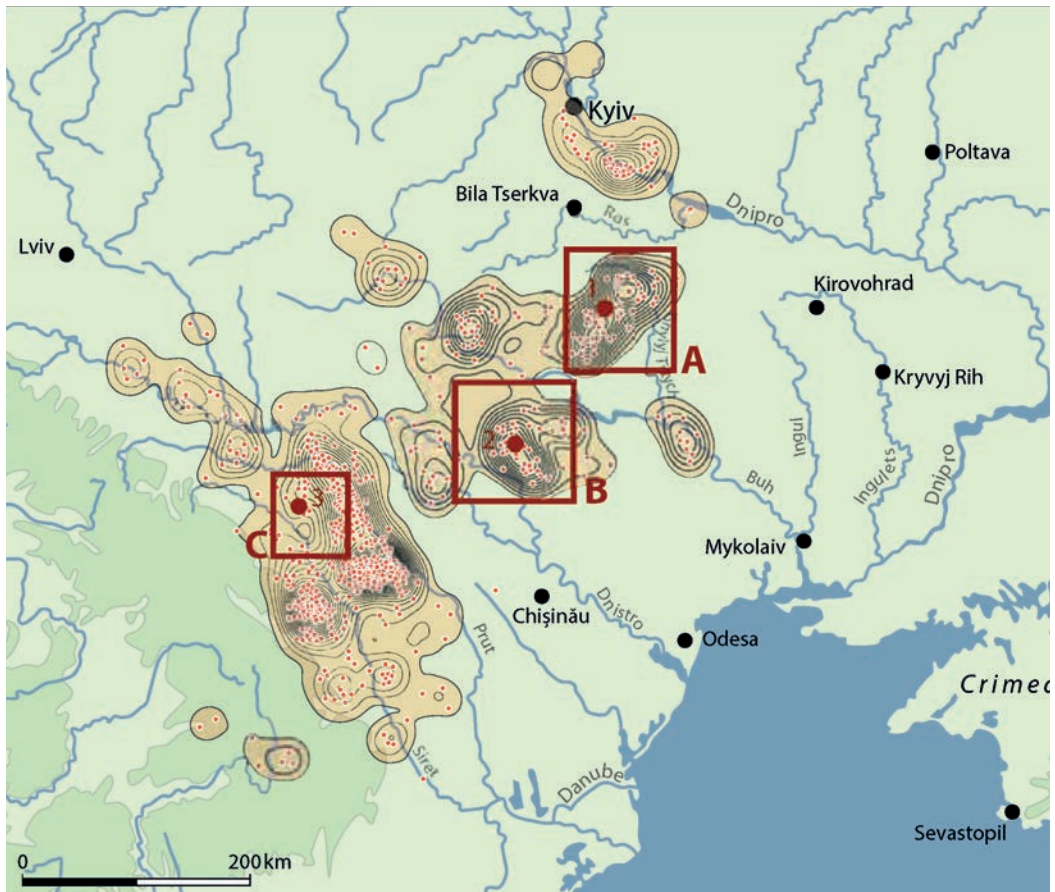


Fig. 4: The distribution of Trypillia C1 sites (kernel density; KDE radius 30 km): A) Southern Bug-Dnieper interfluve; B) Dniester-Southern Bug interfluve; C) Middle Dniester Region (after: Hofmann et al. 2018)



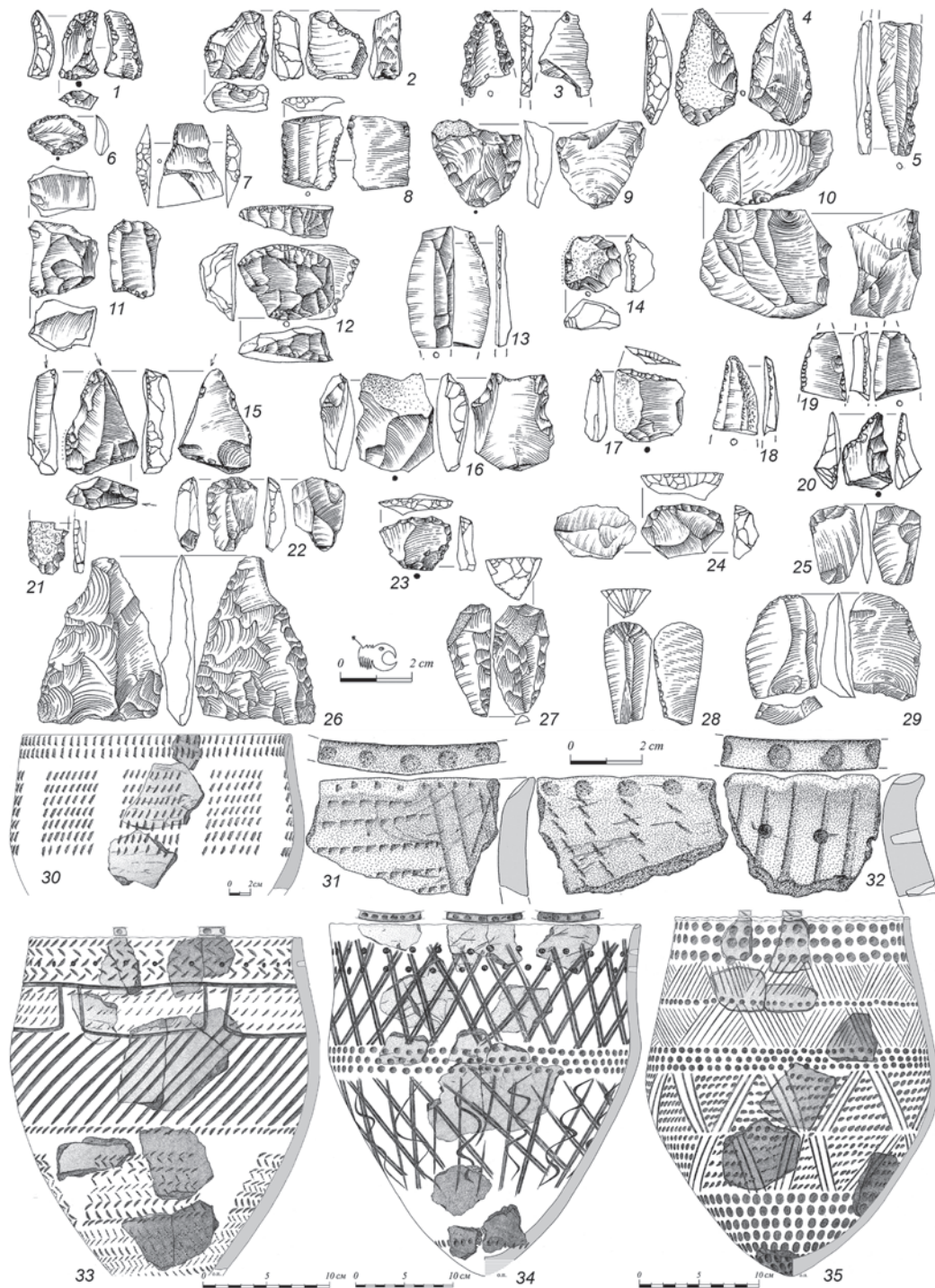


Fig. 5: Materials of Kyiv-Cherkassy Neolithic sites: 1-29 – lithic inventory; 30-35 – pottery.  
 1-5 – Khodosivka-Roslavske, 6-9 – Bodenky, 10 – Suvyd, 11-14 – Litky, 15-17 – Rozhny, 18-20 – Sobolivka, 21-32 – Pohreby-Lan, 33-35 – Mykilska Slobidka II (after: Sorokun, Shydlovskiy 2013; Shydlovskiy et al., 2016)



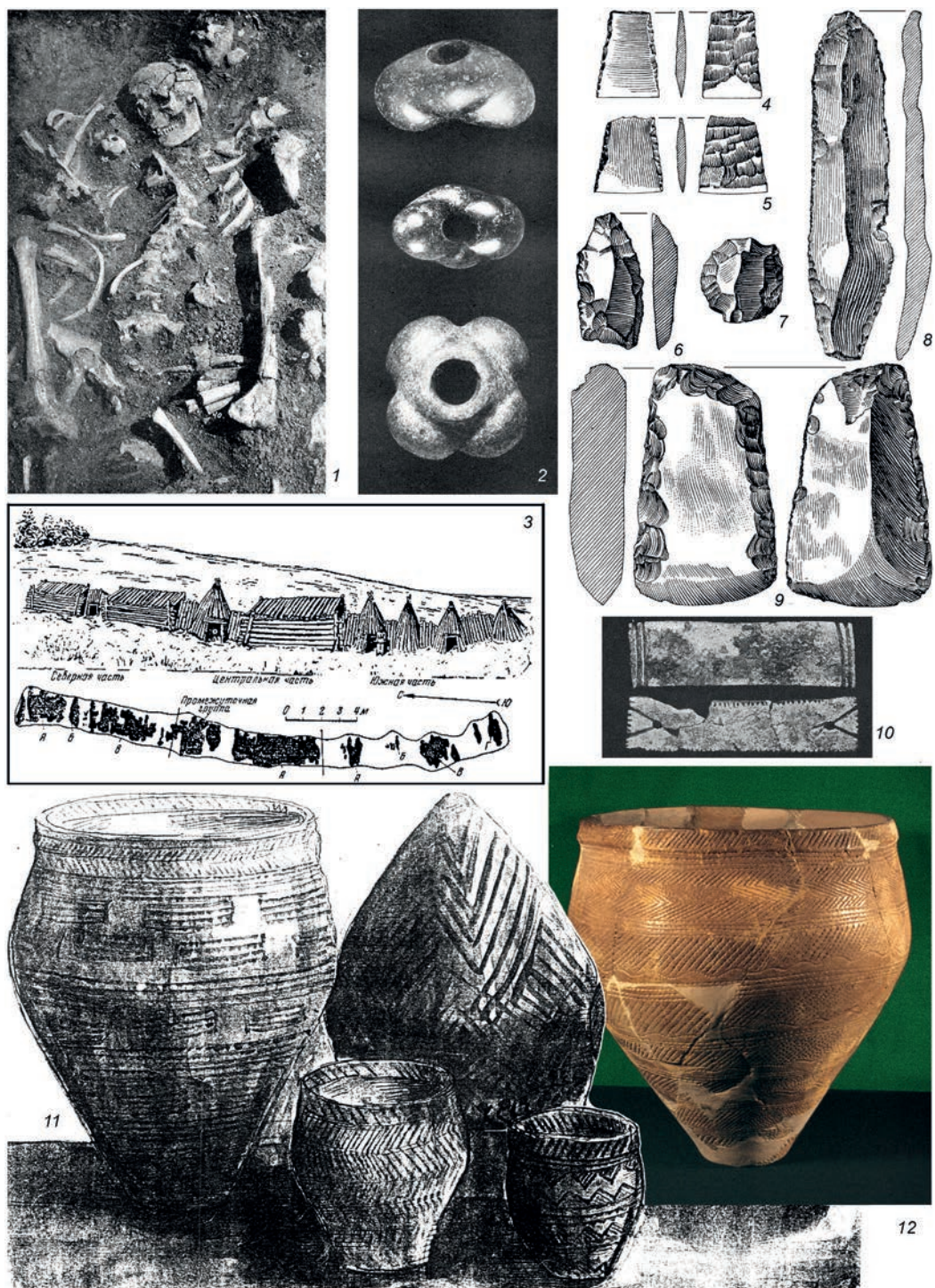


Fig. 6: Materials of the cemeteries of Mariupil type in Azov-Dnieper area: 1 – burial; 2 – stone maces from burials; 3 – reconstruction of Mariupil cemetery; 4-9 – lithic inventory; 10 – plates of the boar canines; 11-12 – pottery. 1-10 – Mariupil cemetery (excavations 1930-19320); 11-12 – Mykilsky cemetery (excavations 1959) (after: Makarenko, 1933; Archive of Department of Archaeology and Museum Studies KNU, exposition of The Archaeological Museum of The Institute of Archaeology, NASU)

### References for Figures

Chernovol, D.K., Pichkur, Ye.V., Shydlovskiy, P.S., Diachenko, A.V. (2009). *Noviy arheologicheskiy kompleks kulturi lineyno-lentochnoy keramiki v Verhnem Podnestrovie*. In: Vasiliev, S.A., Kulakovska, L.V. (eds.) *Sergey N. Bibikov and Prehistoric Archaeology*, SP-b.: RAN, 254-268 (in Russian).

Hofmann, R., Shatilo, M., Ohlrau R., Dal Corso, M., Dreibrodt, S., Videiko, M., Rassmann, K., Kirleis, W., Müller, J. (2018). *Tripolye – Strategy and Results of an ongoing Ukrainian-European Project*. *VITA ANTIQUA*, 10, 146-154.

Makarenko, M. (1933). *Mariupilsky mohylnyk (The Mariupil burial-place)*. Kyiv (in Ukrainian).

Pyasetsky, V.K., Okhrimenko, G.V. (1990). *Studies of Linear-Band Ceramic relics in the Volyn area*. *Arkheologia*, 1990 (4), 69-82 (in Ukrainian).

Shydlovskiy, P.S. (2018). *Lithic Assemblages of Early Agricultural Communities in Middle Dniester: comparative study*. *VITA ANTIQUA*, 10, 61-91.

Shydlovskiy, P.S., Lysenko, S.D., Kyrylenko, O.S., Sorokun, A.A., Pichkur, Ye.V. (2016). *Prehistoric Archaeology of the Lower Desna Region*. Kyiv (in Ukrainian).

Sorokun, A.A., Shydlovskiy, P.S. (2013). *Issledovaniya neolita Nizhniego Podsesenya*. In: Demidenko, O.M. (ed.). *Arheologicheskiye issledovaniya v Yevroregione "Dniepr" v 2012 godu*. Gomel: GGU im. Skoriny, 188-195 (in Russian).



## II.D.2 Report on Activities in Kyiv 2016-2017

One of the first steps towards the creation of an East European network for the study of pre-historic societies and processes of neolithization was the holding of the international scientific conference “Human and landscape: geographical approach in prehistoric archaeology” at Taras Shevchenko National University of Kyiv from 3 to 5 February 2016, which took place within the framework of the SCOPES programme NEENAWA and was supported by the Swiss and French embassies in Ukraine.

Due to the initiative of Department of Archaeology and Museology of the Faculty of History of the Kyiv National University and the Center for Paleoethnological Research the Organizing committee of the conference was created which included teachers and staff of the Department, among them Prof. R. Terpylovskiy, the Head of the Department, and Associate Prof. P. Shydlovskiy, as well as the head of Archaeological Museum of Taras Shevchenko National University of Kyiv L. Samoilenko. It was the first international conference to bring together archaeologists from Ukraine and experts on natural sciences researching interaction between nature and humanity in a wide spatial and time context. Specialists from university institutions in France, Belgium, Switzerland, Poland, Belarus and Georgia were invited following the aim of the conference to integrate Ukrainian research into the European space.

Topics which were highlighted on the conference cover issues of interaction between the environment and societies during prehistory: climate and landscape, natural resources, flora and fauna as factors for the development of human culture on the territory of Europe. Chronologically speaking, the presentations covered the period from the Paleolithic up to the Bronze Age. Speeches and presentations at the conference were divided into three sections, namely:

Section 1: History, theory, and methods of spatial archeology

Section 2: The interaction between nature and society in Pleistocene

Section 3. Cultural adaptation to natural conditions in the Early Holocene

The conference was accompanied by an exhibition of archaeological materials from the collections of the Department of Archeology and Museology at the Archaeological Museum of the University.

From 15 to 18 September 2017, the International Scientific Conference on “Wetland Archaeology and Prehistoric Networks in Europe” was held in Kyiv and Kanev, Ukraine. The Conference was jointly organized by the Taras Shevchenko University of Kyiv, the Center for Underwater Archaeology, and the Th. Voyk Center for Paleoethnological Research. The conference was the final event of the Institutional Partnership in the framework of the NEENAWA project.

The opening of the conference and the plenary meeting took place on 15 September 2017 in the Main Building of Taras Shevchenko National University of Kyiv (fig. 1), on which the vice-rectors of the University Petro Bech and Viktor Martyniuk, as well as the representative of the Swiss Embassy in Ukraine and Moldova, Holger Tausch, gave their greetings to the participants (fig. 2). The Dean of the Faculty of History Prof. Ivan Patrylak, associate professor Pavlo Shydlovskiy and head of the University Laboratory “Centre for Underwater Archaeology, Archaeological and Ethnological Research” Yana Morozova indicated the importance for the University and Ukrainian science of holding such events and the need for international cooperation in the field of archaeological research.

The NEENAWA-representatives also gave their welcoming words to the audience (fig. 3) before the official scientific programme started.



Within the framework of the conference, the opening of the exhibition “The first farmers and pastoralists on the territory of Ukraine” was held at the Archaeological Museum of Taras Shevchenko National University of Kyiv, accompanied by the presentation of two edited books:

*Human & Landscape: Prehistoric Archaeology of Eastern Europe. - VITA ANTIQUA, 9. Collection of scientific works. Kyiv: 2017.*

*Wetland Archaeology and Prehistoric Networks in Europe. NEENAWA International Scientific Conference, 15-18 September, 2017. Eds. Y. Morozova, P. Shydlovskiy. Kyiv, Kaniv, 2017.*

The next day, a trip to the Kaniv Nature Reserve took place, where the main part of the conference was planned (fig. 4). The scientific part consisted of presentations describing the current state of the study of neolithization processes in Europe and the achievements of prehistoric archeology in recent years. The conference brought researchers together working in Holocene European prehistoric archaeology, covering the time periods from the Mesolithic to the Bronze Age. Naturally, the focus of the conference was wetland and underwater archaeology as well as dendrochronology but material studies on pottery and bone tools were also presented. Two workshops on dendrochronology (fig. 5a, 5b) and underwater exploration (fig. 6) were conducted during the meeting.

The scientific programme was accompanied by excursions to archaeological museums (e.g. The Museum of Historical Treasures of Ukraine; Kyiv Regional Archeological Museum in Trypillia) so that the participants could personally experience the unique archaeological exhibits from Ukrainian prehistory to the Middle Ages. Besides, the participants could visit and experience the Ukrainian “wetlands” of Kaniv Nature Reserve on their own (fig. 7).

About 50 participants took part in the event. The majority of these came from the NEENAWA partner institutions. In addition, participants from other Eastern and Western European countries were invited. The conference itself was an exceptional opportunity to create a system of information and experience exchange in research about European prehistoric sites, to introduce up-to-date methodologies of documentation and analysis of archaeological material and to promote Ukrainian archaeological heritage in the European system of research. An important value was the participation of Macedonian, Russian, Swiss and Ukrainian students in this event that will help to develop their knowledge about current theoretical and practical European scientific research and promote their international mobility during their academic experience. In terms of public benefit, the conference will help to represent the Ukrainian cultural and natural heritage at a European level.

The organizers are convinced that during the conferences, young scientists, using acquired skills and knowledge, broadened their circle of professional contacts, put their creative ideas into practice for developing a liberal society, and became thus the most valuable resource for positive changes in the contemporary world.

#### **References**

Morozova, Y., Shydlovskiy, P. (2018). *STEP AHEAD: NEENAWA 2017 International Scientific Conference report. VITA ANTIQUA 10, Prehistoric Networks in Southern and Eastern Europe, 192-207.*  
DOI:10.37098/2519-4542-2018-1-10-192-207





Fig. 1: Lecture Hall at the main building of Taras Shevchenko National University of Kyiv (photo: Pavlo Shydlovskiy)



Fig. 2: At Rector's office in Kyiv, from left: Prof. R.V. Terpylovskiy, head of the Department of Archaeology and Museum Studies; Dr. P.S. Shydlovskiy, Associate Professor of the Department of Archaeology and Museum Studies; Prof. I.K. Patryliak – head of Faculty of History; Prof. L.V. Hubersky, rector of Taras Shevchenko University of Kyiv; Prof. A. Hafner, head of Department of Prehistoric Archaeology of the Institute of Archaeological Sciences, Bern University, Switzerland; Prof. P.O. Bekh, pro-rector (International Relations) of Taras Shevchenko University of Kyiv (photo: Pavlo Shydlovskiy)



Fig. 3: Representatives of the NEENAWA project during their welcome speeches. a. Yana Morozova, b. Andrey Mazurkevich, c. Goce Naumov, d. Valentina Todoroska, e. Pavlo Shydlovskyi, f. Albert Hafner (photo: Pavlo Shydlovskiy)



Fig. 4: Lecture room at Kaniv Nature reserve (photo: Marco Hostettler)



Fig. 5: Dendrochronological workshop by and with John Francuz and wood samples (photo: Pavlo Shydlovskyy)



Fig. 6: Workshop on underwater exploration with Ekaterina Dolbunova, Johannes Reich and Sergii Zelenko (photo: Pavlo Shydlovskyy)



Fig. 7: Conference participants at floodplains in Kaniv Nature Reserve (photo: Liga Palma)



### II.D.3 Kyiv Conference – The Organiser's Experience

In autumn 2016, Prof. Pavlo Shydlovskiy and Yana Morozova offered me to become one of the organisers of the future concluding conference of the NEEANAWA project. Of course, I agreed. In that moment, I already had organising experience. I helped in preparing the conference “Human and Landscape” in February 2016; earlier I also had been involved as a volunteer in the organising team of festivals and study courses. It was a good opportunity for me to gain experience as being one of the main organisers.

We started preparations in January 2017. First, we made a good schedule and shared responsibilities. My main task was communication with the participants and informing them about the conference progress. Besides that, I worked with our programmer to create the website. Despite my previous experience in event management, I faced many tasks that I had not been done yet. In addition, it was the first time when I had so much responsibility.

During the first months, I wrote many letters as coordinator of the organising team: invitations to the conference, letters with conference announcements, personal answers. After the abstract submission deadline, a new step of our preparation started: we could start planning the conference program. The next task was to find a publishing house that would print all conference products: abstract book, posters etc. We decided to create special archaeological cards with the university logo as a present for the participants.

My tasks also included the financial budgeting of the conference costs, including equipment, print products, transportation and catering. This included obtaining and comparing offers and negotiation with different providers.

The hottest time was in August, and not only because of the weather. We had to finish all preparations before September in order to be sure that everything was going well. We made a journey to Kaniv reserve to have a meeting with the director. We discussed questions about the participants' stay during the conference, meals, using of conference room etc.

Most thrilling was the week before the conference when already a lot of preparations had been done but you cannot say for sure if all would work out. Spoiler, of course no. For me, an extremely special moment was when I met our first guests from Macedonia. When I drove to the Airport, I thought “Now the conference started”.

Our conference had four days: the first day in Kyiv and three days in the Kaniv Nature Reserve. The first day was the most serious: we finally could see how our conference started and we met all colleagues that had arrived to the conference. At the first day, we had opening speeches, keynote presentations and after lunch, we prepared an excursion. The last event of this day was a Welcome reception at the Archaeological Museum of the University. This day was running smoothly. Therefore, we were very happy and excited. When you became an event organiser, you get another level of responsibility: in every moment when you have too much time resting you start checking if everything is going well.

At the next day, we moved to Kaniv. On the way, it was planned to stop for an excursion to Kyiv Regional Archaeological Museum Tripillia village. Also, we made a stop for having a snack.

When we arrived to the Kaniv reserve, I had to manage everyone to pass check-in and divided guests into rooms. That was not easy for me, but with humour, we dealt with that, and everyone was satisfied. After late lunch break, we started presentations (fig. 1). Again, I faced a new role, for the first time I was a moderator. During my work at the conference, I understood that the most important skill that you need as a moderator is fast problem-solving.

On the third day, we had two presentations and an amazing workshop about dendrochronology.

Up to this day, everything had been working out and finally, it was time to enjoy that the conference worked.

One of the aspects of my work was managing the students from our University (fig. 2) since they had to organise all coffee breaks and clean up when coffee breaks had finished. After the lunch, we organized an excursion to the National Historical and Ethnographic Preserve “Pereyaslav”. On the last day, we had all day-long presentations. At the last evening, we made a closing dinner (fig. 3) during which we gave special presents to all participants.

We are proud of that fact that our conference was exactly on schedule. We were able to make a cozy atmosphere in which everyone felt comfortable. It was amazing to be in company of great scientists, who also started discussions in the evening after the official conference part.

For me, my work for NEENAWA conference was very exciting and inspirational. First of all, I was in the small organising team that implemented the project. I saw how we planned the future conference, how we prepared it, and the main result – a successful conference. And for me that means a lot. During nine months of organisation work, I grew as a leader and scientist.

This conference did not only inspire me to continue working hard as a scientist, but also gave an unbelievable opportunity for my future career. Prof. Albert Hafner offered me to apply for the Swiss Government Excellence Scholarship and to write my PhD at the University of Bern.

For me, the NEENAWA Conference “Wetland Archaeology and Prehistoric Networks in Europe” Kyiv – Kaniv, 2017, became a personal achievement and inspiration to further development as an archaeologist. In the end I want to express my gratitude to Prof. Albert Hafner, Prof. Pavlo Shydlovskiy, and Yana Morozova who have always believed in me and supported my archaeological career.

### **Epilogue**

*In 2017, I applied for the Swiss Government Excellence Scholarships for Foreign Scholars in order to conduct my PhD at the Institute of Archaeological Sciences of the University of Bern. Thankfully, I was granted a scholarship for the years 2018-2021 (fig. 4)!*



*Fig. 1: Presentation of Ukrainian Neolithic pottery for practical exercise alongside scientific presentation (photo: Liga Palma)*





Fig. 2: Organiser and student helpers at the dendrochronological workshop (photo:Liga Palma)



Fig. 3: Closing dinner at the final day of the conference (photo: Liga Palma)





*Fig. 4: Pottery as new research subject (photo: Alyssa Semenova)*

## II.D.4 Student Participation in a Conference in Kiev/Kaniv, Ukraine

The process of shaping the next generation of scientists and researchers has never been much more exciting as today. This is especially true for archaeology – a discipline where methodologies and techniques for gaining better insight in the human prehistory constantly emerge from various branches of the scientific enterprise. By exploring networks in the past, solid collaborative networks between institutions and universities are made in the present. One such network that grew over a continuum of events was recently finalized as a four-day long scientific meeting in Kyiv and Kaniv, in north-central Ukraine.

After a warm welcome by the NEENAWA team, the conference officially opened on 15 September 2017 with two keynote sessions at 'Taras Shevchenko National University' in Kyiv. Talks started in a relaxed manner, and this continued at the next venue – the Nature Reserve of Kaniv where the majority of sessions were held. In addition to the presentations, the schedule included excursions to the Museum of Historical Treasures of Ukraine, the Kyiv Regional Archaeological Museum in Trypillia and the National Kyiv-Pechersk Historical and Cultural Preserve.

Presentations implemented both theory and discussions about up-to-date practical methodologies that are allowing researchers to ask more complex questions regarding the Neolithic period. A special mention deserves the workshops on day three which encapsulated a diverse set of methods for underwater exploration of peat-bog sites and measuring, dating and chronology building by using dendrochronological analyses of oak samples. After a session of live QGIS scripting, participants had the opportunity to get involved in the forthcoming workshop by preparing and engaging with oak samples directly. Proper attention was given also to the student posters and the photo exhibition on the topic of airborne surveying and ancient landscapes in Central Ukraine.

Overall, the NEENAWA meeting was a great success – it was very well-attended and there were a lot of challenging presentations and talks given by experts and professionals in Neolithic and wetland archaeology. Locations for the events were very well chosen and managed to give attendees the best of big city atmosphere and vast flatlands of the Ukrainian country side (fig. 1). The organizers had done an excellent job in allowing opportunities for professional development and networking between researchers and students.



Fig. 1: Excursion during the conference (photo: Liga Palma)





*Visit of the permanent exhibition at the National Museum of Natural History in Kyiv during Kyiv conference (photo: Marco Hostettler; University of Bern, 2017)*



# Part III: KNOWLEDGE TRANSFER, SCIENTIFIC EXCHANGE 2015–2018



### **III.1 Internship at the Laboratory for Dendrochronology at the City of Zurich**

One of the aims of the SCOPES Institutional partnership NEENAWA project was to set up a frame for cooperation and knowledge transfer for students and professionals to specialize in areas of archaeological research that are still emerging in their home countries. As part of it, I had the opportunity to do an internship at the Dendrochronological Laboratory of the City of Zurich, from July to September 2017. The aim of the internship was to allow for a specialized primary training in the methodology of work in dendrochronology.

Dendrochronological tree-ring measurements are scarce in Macedonia and the wider Southern Balkans region, particularly in the case of archaeological and historical dating. While, on the other hand, the underwater archaeology and dendrochronological research have a long history in Switzerland and the Dendrochronological Laboratory in Zurich is the oldest such institution there (founded in 1969). Its main archeological focus are the prehistoric pile-dwellings on the lakes in the region, but also the dating of historical buildings and artifacts plays an important role in the activities of the Lab.

Dendrochronology is the method of combining (cross-dating) tree-ring series from different periods and from a variety of types of samples (beams from historical buildings, naturally preserved and fossilized wood, foundation piles from prehistoric settlements etc.). This is done in order to construct tree-ring master chronologies, which then serve as references for dating consecutive archaeological finds and calibrating radiocarbon-obtained absolute dates. This is indispensable for understanding Holocene communities, the way they exploited the available resources, as well as the human impact on the environment, and thus the origin and development of man-made landscape

During my internship I worked under the mentorship of Dr Niels Bleicher and Felix Walder from the Dendrochronological Laboratory of the City of Zurich. It was a great personal experience to study in this highly professional, yet friendly atmosphere (fig. 1a). I was introduced to the work on fossilized, archaeological and historical wood (fig. 1b). Firstly, this was done by getting familiarized with measuring tree-ring widths on a measuring table (fig. 2), which were then automatically recorded by specialized software (PAST5 and DD+, a software developed in the Zurich Lab). Afterwards, the obtained tree-ring series would be statistically and visually checked and cross-dated (fig. 3). It was an exciting experience to be able to directly work with material from prehistoric buildings and relatively quickly see the fruit of our labour. Wood anatomy and dendroecology also formed an important part of the internship.

As dendrochronology is a necessary tool in the research on the pile-dwellings phenomenon in Europe, it was the main focus of the underwater excavations that took place on lake Ohrid in 2018. Thanks to my Zurich internship, I could join the dendro team and be part of this important project. The research in Lake Ohrid continued in 2019 and its objectives will be expanded on a couple of other Balkan lakes, with one of the aims being the recovery of wood samples from wetland archaeological sites. As part of my PhD project at the University of Bern, I will take part in the dendrochronological measurement and analysis of these wood samples from the Balkans, which will undoubtedly represent the largest prehistoric dendrochronological database for the region.





Fig. 1a: Working place at the Dendrochronological Laboratory, Zurich



Fig. 1b: Wood sample dating to the Bronze Age from Lake Zurich (photos: Andrej Machkovski)



Fig. 2: Measuring a sample (photo: Andrej Machkovski)

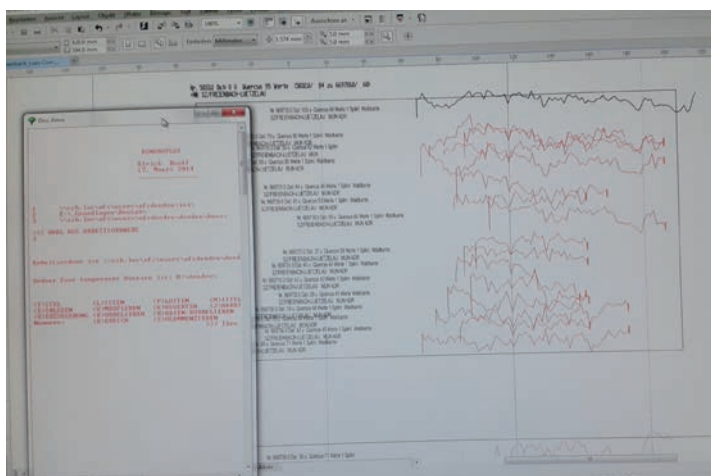


Fig. 3: Cross-dating in progress (photo: Andrej Machkovski)

### **III.2 Participation in the Excavation of the Archaeological Site at Burgäschi, Switzerland**

During the summer of 2016, two students from the Department of Archaeology at the 'Ss. Cyril and Methodius' University of Skopje, Macedonia, had the opportunity to participate in a five-week training period at the archaeological site Burgäschi, Switzerland (fig. 1). This site is part of a large group of Neolithic and Bronze Age lake-side settlements that were established between 4300 and 800 BC, mostly positioned around glacially formed lakes in Switzerland. Because of this, they remain a unique source for generating high quality information regarding the anthropogenic impact on the lakes they've been positioned by.

The site of Burgäschi has long sparked the interest of archaeologists; this could be traced back to the end of the 19th and the early 20th century. The training, which started in the early days of August 2016 was part of the last research project that tries to redefine Burgäschi's chronology. Because of this, for five weeks, eight different locations around the Burgäschi lake were in the primary focus (fig. 2, 3). The objective was to finalize what was considered a successful three-year long campaign at the site in terms of excavating oak piles for dendrochronological analyses. Compared to other species, oak has more steady rings which are ideal for tracing climatic changes in the past and chronologically positioning sites in a time sequence. The samples were carefully collected, documented and stored until their transportation to the laboratory for dendrochronology at the lake Biel. This visit emphasized even more the importance of a carefully collected organic material at field excavations, but also introduced us to a key scientific method – dendrochronology – and its role in the process of coming with solid archaeological conclusions.

Considering the locations where the excavation took place, clustered near the main trim road that surrounds the lake, another important aspect of the training took place. This meant that, besides the excavation, various presentations of the work being done, found artifacts and methods used were available for anyone who had further interest in the project. Towards the end, one big presentation took place at the archaeological site. This event was the annual meeting which is a part of the open-day for this project, when students and professors from different Swiss universities and departments visited the working team at the site.

Two things are worth mentioning as a summary of our student stay in Switzerland: (a) technical skill set acquired during the stay, including properly documenting excavated piles and their storage until further processing; (b) presentation aspect of the archaeological process and the importance of exchanging information with the general public. Last but not least, we would like to thank Prof. Dr. Albert Hafner, the excavation manager; Dr. Othmar Wey and the colleagues from the University of Bern who made the student stay possible and much more engaging.





Fig. 1: Location of Lake Burgäschi in Switzerland and Europe



Fig. 2: Excavation at Burgäschi-Südwest, Schnitt 1, with students Gjore Milevski and Aleksandar Murgoski



Fig. 3: Excavation at Burgäschi-Nordwest, Schnitt 1, with Macedonian and Swiss students





Goce Naumov, Goce Delcev University, Stip

### III.3 22<sup>nd</sup> Neolithic Seminar at the University of Ljubljana, Slovenia

The Neolithic seminar is an international event, organized continuously by the Department of Archaeology at the Faculty of Arts, University of Ljubljana. It is one of the most significant archaeological meetings in Europe particularly focused on the Neolithic that gathers specialists from various countries to present their results and discuss a number of issues concerning the Neolithic. The 2015 edition of the Neolithic Seminar was dedicated to 'Modelling the Processes of Neolithisation', focusing on the Neolithisation process, dating, genetics and climate changes effecting the significant steps for the transposition of so called 'Neolithic package'. It took place at 6 and 7 november 2015 and marked the start of the NEENAWA project. The meeting was very successful with more than 20 papers presented and approximately 100 attendees at the venue.

Goce Naumov presented a paper entitled 'Tell Communities and Wetlands in the Neolithic Pelagonia, Republic of Macedonia' that integrated the recent knowledge of first farming communities in Pelagonia and their marshy environment, establishment of tells, daub architecture, pottery, human representations, economy and identity. Besides, also the NEENAWA project and SNFS foundation were presented. It was asserted that this project will largely contribute to the training of Macedonian archaeologists and further provide new knowledge on the Neolithic of Pelagonia and its networks with Lake Ohrid. The presentation gained particular interest and such multinational project initiative was applauded as a necessary step toward improvement of archaeological methods and knowledge in Macedonia and the Balkans in general.

The paper was consequently published in *Documenta Praehistorica*, an archaeological journal with impact factor that has a high reputation among scholars and students focused on prehistory:

*Naumov, G. (2016). Tell communities and wetlands in Neolithic Pelagonia, Republic of Macedonia. Documenta Praehistorica 43, 327-342.*

### III.4 Journée Thématique: Wetland Settlements during Neolithic and Bronze Age in Europe

A special research day on wetland archaeology was organised on 11 december 2015 by Yolaine Maigrot from the French National Center for Scientific Research, which took place at the University of Nanterre, Paris, France. The connection to the NEENAWA partners was made through the long-lasting professional relationship and scientific cooperation of the organiser with colleagues from Saint Petersburg, Russia. This cooperation included both fieldwork (e.g. in Serteya) and laboratory analyses.

NEENAWA partners Albert Hafner (Bern), Andrey Mazurkevich (Saint Petersburg) and Ekaterina Dolbunova (Saint Petersburg) gave lectures on their respective research fields.



#### Ordre du jour de la réunion du vendredi 11 décembre 2015

**MAE, salle 1 (RDJ) - (10h-12h30/14h-16h30)**

**Dates des prochaines réunions 2015-2016** (le vendredi, salle 1 RDJ, 10h00-12h30 / 14h00-16h30)

- 15 janvier
- 11 mars
- 8 avril
- 10 juin

#### Séminaire scientifique

- ★ Manuel Rojo Guerra (professeur Université de Valladolid) : *la Néolithisation du Nord de la péninsule ibérique*

#### Journée thématique : *Wetland settlements during Neolithic and Bronze Age in Europe*

- ★ Andrey Mazurkevich (Musée de l'Ermitage, Saint Petersburg), Yolaine Maigrot (UMR 8215 Trajectoires) Ekaterina Dolbunova (Musée de l'Ermitage, Saint Petersburg), Piotr Kittel (Université de Lodz), Mikhail Sablin (Institut zoologique de l'Académie des Sciences de Russie), Ivan Shirobokov (Peter The Great Museum of anthropology and ethnography RAS) : *New results of research on the wetland settlement Serteya II*

- ★ Albert Hafner (Université de Bern) : *Neolithic wetland settlements of the Alpine foreland (Switzerland, Germany): evolution, chronology, patterns*

- ★ Elena Pranckenaite (Université de Vilnius) : *The potential of archaeological data from wetland sites in the southeastern Baltic region: Bronze age environmental and cultural context of the lake settlements*

- ★ Henny Piezonka (DAI, Eurasia Department), Nadezhda Nedomolkina (Vologda State Museum), Sebastian Lorenz (Ernst-Moritz-Arndt-Universität Greifswald), Wiebke Kirleis (Christian-Albrechts-Universität zu Kiel) : *Hunters, potters, pile dwellers? New Russian-German research at the multi-layered site of Veksa, Northern Russia*

**Le buffet sera offert par l'UMR pour fêter la fin d'année**



### III.5 Workshop “Formation and Taphonomy of Archaeological Wetland Deposits”

In the framework of the SNSF-funded project “Formation and taphonomy of archaeological wetland deposits: two transdisciplinary case studies and their impact on lakeshore archaeology” of the University of Basel, the workshop “Formation and Taphonomy of Archaeological Wetland Deposits” was organised between 28 and 29 January 2016 at the premises of the Cantonal Heritage service of Zug, Switzerland. Approximately 30 participants attended the workshop. The workshop was devoted to the questions of waterlogged deposits on archaeological sites, including their formation and taphonomy. The formation processes of such waterlogged deposits and the associated dwelling activities in amphibian areas have been the subject of debates from the time of their discovery until today. All the more surprising is the lack of conclusive facts on the composition, formation and secondary transformation of waterlogged dwelling deposits. In order to better understand formation processes and taphonomy of waterlogged organic deposits it is important to leave previously applied explanatory models and to develop new multiperspective ways of comparison based on permanent discussion and cooperation between different lines of research, especially between natural sciences and humanities. The enormous complexity of preserved features and materials and their underlying formative and taphonomical processes do not allow simplistic, static and self-contained models, which are based on only one single scheme.

The workshop included several subjects for discussion:

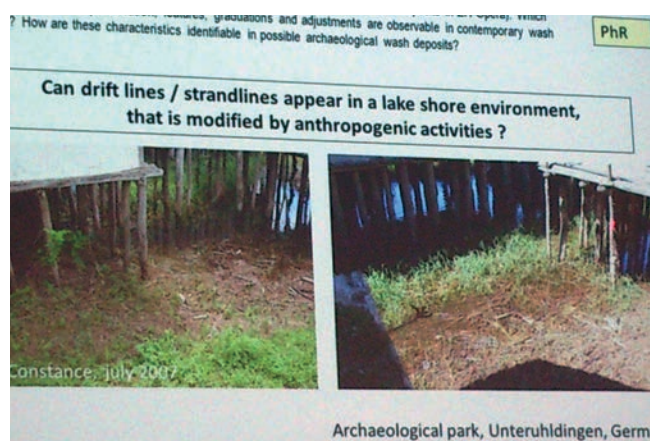
Comparing contemporary and archaeological organic deposits;

Accumulation;

Reduction and Transformation;

Methodological Aspects, Experiments and Future Perspectives.

The workshop followed in his structure a questionnaire (fig. 1) but also provided sufficient time for a mutual sharing of information and experience. The discussion during the workshop left certain questions open, and to some of which there may be several possible interpretations that might even contradict one another as there is, at least presently, no indisputable basis for one comprehensive explanatory model. This openness for possible interpretations is essential for future re-evaluations with new evidence and methods.



For this workshop, our team presented some results of analysis of layers' formation on Neolithic wetland sites in NW Russia, including pile-dwellings. The workshop allowed us to get lots of new information concerning the understanding of cultural layers formations and markers of taphonomical processes, that could be successfully applied already for new excavations held in 2016.

Fig. 1: Discussion of a question dedicated to the accumulation of deposits (photo: Ekaterina Dolbunova)



Ekaterina Dolbunova, Andrey Mazurkevich, The State Hermitage Museum, Saint Petersburg, Albert Hafner, Institute of Archaeological Sciences, University of Bern

### **III.6 Session “Settling Waterscapes in Europe: the Archaeology of Neolithic and Bronze Age Pile-dwellings” in EAA Conference in Vilnius**

Albert Hafner (Chair, University of Bern), Ekaterina Dolbunova, Andrey Mazurkevich (State Hermitage Museum, Saint Petersburg, Russia) and Elena Pranckėnaitė (Lithuanian Institute of History, Vilnius University, Lithuania) organized the Scientific Session TH6-11 “Settling waterscapes in Europe: the archaeology of Neolithic and Bronze Age pile-dwellings” during the 22<sup>nd</sup> Annual Meeting of the European Association of Archaeologists (EAA) in Vilnius/Lithuania (Saturday, 3 September 2016). A total of 25 oral presentations and four poster presentations were given by partners of the NEENAWA SCOPES Institutional Partnership project, researchers who participated before in the events organized by NEENAWA team but also researchers from outside. The one-day-session was one of the largest sessions of the Annual Meeting 2016 (in total more than 1600 delegates) and attracted more than 100 listeners. The goal of this session was to bring together researchers who are involved in investigations of pile-dwellings within largely expanded boundaries in Europe. Originally pile-dwelling phenomena were supposed to be strictly limited to the Alpine region; however, it seems to be a much more complex appearance – wider in its chronological and territorial boundaries, very complicated in its economic and cultural aspect, and very heterogeneous in different regions. The session included an overview of pile-dwellings located not only in the circum-Alpine zone, but also in the Baltic area, North-Western Russia, and Southern Europe. Several subjects were dealt with during the presentations – human-environment interactions, origin and (dis)continuity of European pile-dwellings, regional methodological distinctions, possibilities and limits of interpreting cultural remains of the pile-dwellings from multidisciplinary perspectives. The number of multidisciplinary research of recent years has provided new data about anthropogenic influence on the landscapes of Neolithic-Bronze Age pile-dwellings, which allows characterizing the lifestyle of inhabitants, peculiarities of the ecological niche and human and environment interaction in more detailed ways.

Investigations of the milieu of unique conditions of pile-dwellings’ preservation led to the formation of new methods of excavation and analysis. In huge area, where pile-dwellings have been explored for decades, different ways, methods, even schools of underwater and peat-bog excavation techniques as well as data analysis has been formed under influence of different traditions of practice in various countries.

The proceedings of the session have been prepared for publication in the Open Series in Prehistoric Archaeology (OSPA).

## SETTLING WATERSCAPES IN EUROPE: the archaeology of Neolithic and Bronze Age pile-dwellings

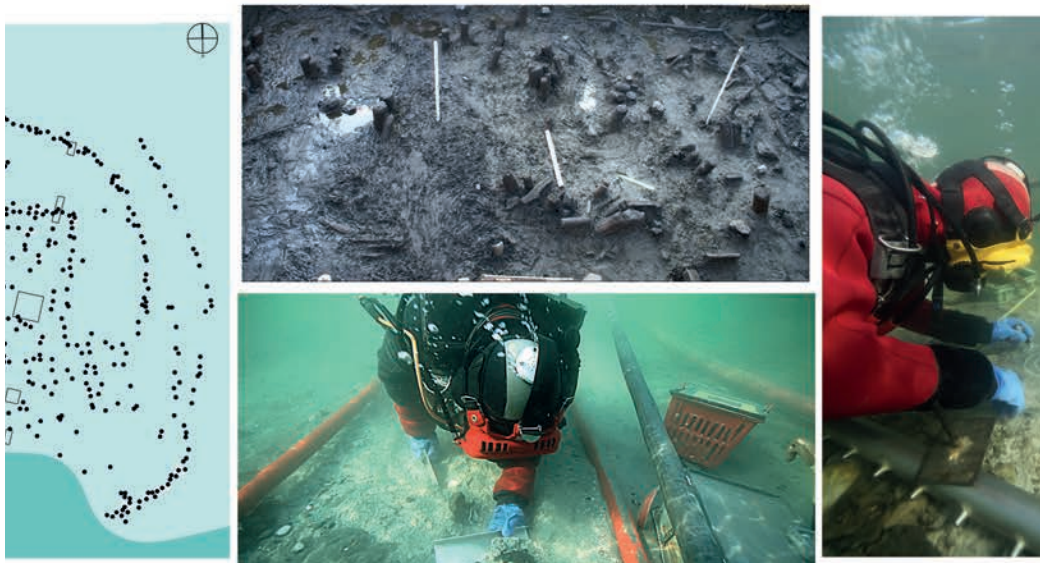
Organizers : Hafner Albert, Pranckėnaitė Elena, Mazurkevich Andrey and Dolbunova Ekaterina

The workshop will bring together scientists who are involved in the research of pile-dwellings within largely expanded boundaries in Europe. The organizers invite contributions with a focus on human-environment interactions, origin and (dis)continuity of European pile dwellings, regional methodological distinctions and regional peculiarities of pile-dwellings sites. This workshop will also examine possibilities and limits of interpreting cultural remains of the pile dwellings from multidisciplinary perspectives.

The number of multidisciplinary research of recent years has provided new data about anthropogenic influence on the landscapes of Neolithic-Bronze Age pile-dwellings, which allows to characterize the lifestyle of inhabitants, peculiarities of the ecological niche and human and environment interaction in more detailed ways.

The widely discussed phenomenon of European pile-settlements suggests such approaches on their origin and evolution as a reaction on natural changes or new symbols of changing societies, as well as underlines existence of specific architectural forms and other evidences in culture (art, weaponry, adornments, utilities etc.). In the huge area where pile dwellings have been explored for decades, different ways, methods, even schools of underwater and peat-bog excavation techniques as well as data analysis has been formed under the influence of different traditions of practice in separate countries. These and other factors can create limits of our understanding the past, but on the other hand may suggest wider possibilities for interpretations.

Submissions via : <http://eaavilnius2016.lt/the-call-for-papers-and-posters/>



TH6-11

## SETTLING WATERSCAPES IN EUROPE: THE ARCHAEOLOGY OF NEOLITHIC AND BRONZE AGE PILE-DWELLINGS

### Faculty of History, Room SP1

**Chair:** Hafner, Albert (University of Bern, Institute of Archaeological Sciences, Bern, Switzerland)

**Organisers:** Dolbunova, Ekaterina (The State Hermitage Museum, Saint-Petersburg, Russia); Mazurkevich, Andrey (The State Hermitage Museum, Saint-Petersburg, Russia); Pranckėnaitė, Elena (The Lithuanian Institute of History, Vilnius, Lithuania)

- 
- 9:00-9:15**      **Introduction**
- 9:15-9:30**      **Settlement history of the wetland site Luokesa 1 (Lithuania): an interdisciplinary approach.**  
Dr. Pranckėnaitė, Elena (Lithuanian institute of History, Lithuania)
- 9:30-9:45**      **Archaeological excavations from the past with new interpretations.** Roio, Maili (Estonian National Heritage Board, Estonia)
- 9:45-10:00**    **The settlements of Kryvina peat-bog region in the context of cultural changes of 3-2 millenium BC.** Charniauski, Maxim (Institute of History NAS of Belarus, Belarus)
- 10:00-10:15**   **Landscape and natural resources use in the 3rd mill BC by pile-settlements' dwellers in NW Russia.** Dolbunova, Ekaterina (The State Hermitage Museum, Russia)
- 10:15-10:30**   **Pile dwellers in the Sukhona basin? New Russian-German research at Veksa, Northern Russia.** Dr. Piezonka, Henny (German Archaeological Institute, Germany)
- 10:30-10:45**   **The Neolithic and Early Metal Age wooden construction of site Okhta 1 in St.Petersburg (Russia).** Dr. Gusentsova, Tatiana (Scientific and Research Institute for Cultural and Natural Heritage, Russia)
- 10:45-11:00**   **Characterization of activity areas in the early Neolithic site of La Draga (Spain).** Dr. Piqué, Raquel (Universitat Autònoma de Barcelona, Spain)

Saturday

3 September



## Coffee Break

- 11:30-11:45** **Wood architecture in the Early Neolithic (5300-5000 cal BC) site of La Draga (NE of Iberia).** Dr. Oriol, López-Bultó (Universitat Autònoma de Barcelona, Spain)
- 11:45-12:00** **Dry land and lakeside settlements in the region of Four Lakes at Amindeon Basin (Greece).** Dr. Chrysostomou, Panikos (Greek Ministry of Culture and Sports, Florina Ephorate of Antiquities, Greece)
- 12:00-12:15** **Ups and downs. Studying structural wood from the prehistoric lakeside dwelling Anarghiri IXb (Greece).** PhD Candidate Giagkoulis, Tryfon (University of Bern, Greece)
- 12:15-12:30** **Wet, Wet, Wet: Neolithic wetland and lakeside settlements in the Balkans.** Dr. Naumov, Goce (Museum of Macedonia, Macedonia)
- 12:30-12:45** **Live and survive in prehistory on northern shore of Ohrid lake.** Todoroska, Valentina (NU. Museum Nikola Nežlobinski Struga, Macedonia)
- 12:45-13:00** **Discussion**

## Lunch Break

- 14:00-14:15** **Neolithic environment and subsistence in the Western Allgäu – first results of the BELAVI project.** Dr. Wick, Lucia (Landesamt für Denkmalpflege, RP Stuttgart, Germany)
- 14:15-14:30** **The Neolithic Landscape of Westallgäu Region – first results of BELAVI in Southern Germany.** Dr. Mainberger, Martin (Landesamt f. Denkmalpflege Baden-Württemberg, Germany)
- 14:30-14:45** **Beyond Lake Villages in the Neolithic of Austria.** Kerstin, Kowarik (University of Vienna, Austria)
- 14:45-15:00** **Beyond lake villages. Archaeological and palaeoecological research at Lake Burgäschli/Switzerland.** Prof. Dr. Hafner, Albert (University of Bern, Switzerland)
- 15:00-15:15** **Above the lakes – Organic finds from Bronze Age mines in the Alps.** Reschreiter, Hans (Naturhistorisches Museum Wien, Austria)
- 15:15-15:30** **News from prehistoric lakeside settlements in Austria.** M.A. Pohl, Henrik (Kuratorium Pfahlbauten, Austria)
- 15:30-15:45** **Wet worlds in context–The Bronze Age pile dwelling of Must Farm in the East Anglian Fens (UK).** Huisman, Floor (Durham University, Great Britain)
- 15:45-16:00** **Sailing the lakes of the Alps. Notes on the prehistoric navigation and boats.** Tiboni, Francesco (Université Aix-Marseille 1, Italy)

#### Coffee Break

- 16:30-16:45** **Pots, pans and dishes to understand food in a pile-dwelling Neolithic society.** Drieu, Léa (CEPAM UMR 7264, France)
- 16:45-17:00** **Micro-economic and socio-cultural networks in lakeside settlements.** M.A. Spring, Markus (Zurich University, Switzerland)
- 17:00-17:15** **A new look to late Neolithic plant economy from the site of Parkhaus Opéra (Zürich, Switzerland).** Steiner, Bigna; Antolín, Ferran (Integrative Prehistoric and Archaeological Science, Switzerland)
- 17:15-17:30** **Settlement dynamics and mobility in Late Neolithic Southwest Germany.** Kaiser, Mirjam (University Freiburg, Germany)
- 17:30-17:45** **Bronze Age pile dwellings in Northern Italy: chronology, environment and architectural features.** Dott, Baioni, Marco (Museo Archeologico della Valle Sabbia, Italy); Mangani, Claudia (Museo archeologico G. Rambotti, Italy)
- 17:45-18:30** **Discussion**

Saturday

3 September

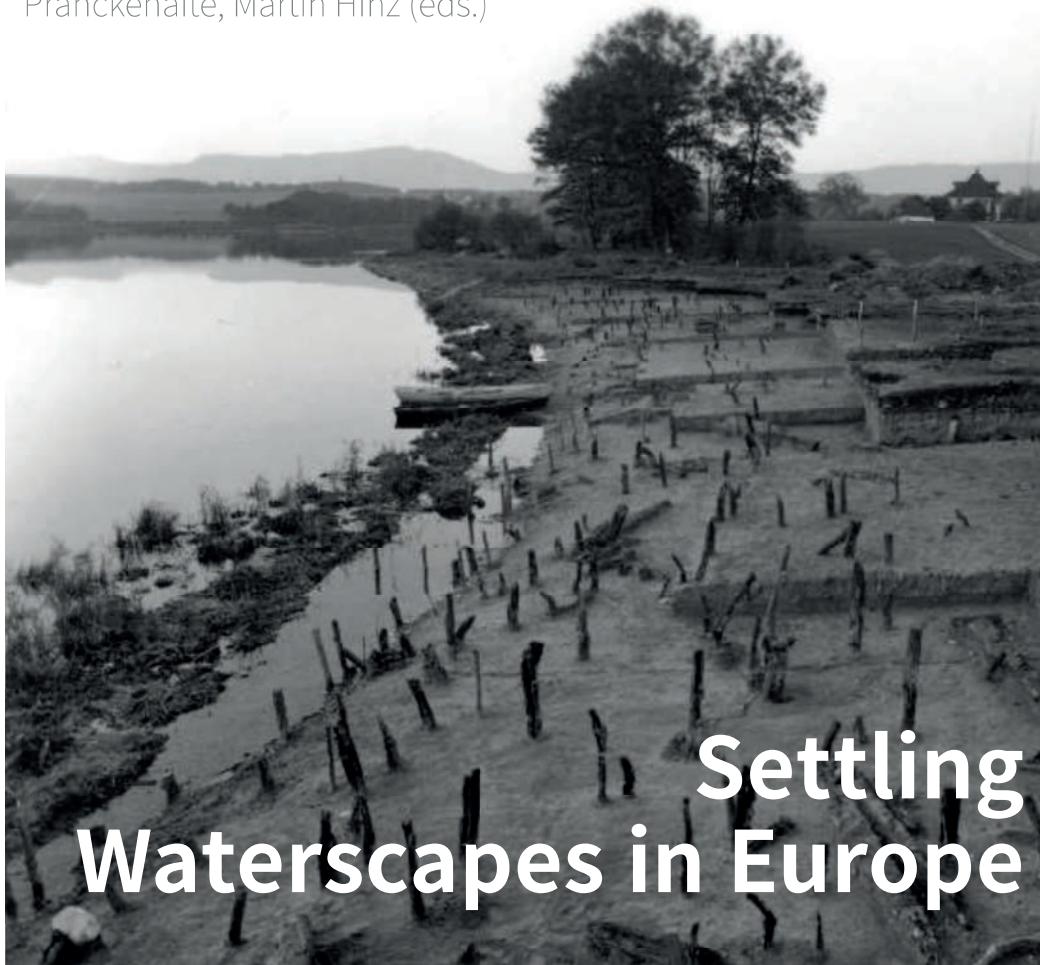
#### Posters

- **Osseous artifacts from the prehistoric lakeside settlements of Amindeon, Western Macedonia, Greece.** Ph.D. Candidate Arabatzis, Christopher (University of Bern, Greece)
- **Cultural layer formation, production and dwelling areas on pile-settlements of Upper Dvina region.** Dolbunova, Ekaterina (The State Hermitage Museum, Russia)
- **Geophysical prospection of submerged Neolithic settlements in Lake Sennitca (Pskov Obl., NW Russia).** Dr. Lorenz, Sebastian (University of Greifswald, Germany)
- **Planigraphy and design features of the Neolithic from the North region of Lake Baikal.** PhD Emelianova, Yuliana (Irkutsk National Research Technical University, Russia)





Albert Hafner, Ekaterina Dolbunova, Andrey Mazurkevich, Elena Pranckenaite, Martin Hinz (eds.)



# Settling Waterscapes in Europe

The Archaeology of Neolithic & Bronze Age  
Pile-Dwellings

1



**OSPA**  
Open Series in  
Prehistoric Archaeology

Pavlo Shydlovskiy, Taras Shevchenko National University of Kyiv,  
Ekaterina Dolbunova, The State Hermitage Museum, Saint Petersburg

### III.7 International Open Workshop: Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes V

Participants of NEENAWA project took part in the International Open Workshop “Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes V”, organised by the Graduate School “Human Development in Landscapes” at Kiel University, between 20 and 24 March 2017. They were particularly engaged in the session “Lakescapes and Seascapes of Neolithic and Bronze Age societies” (Session 18). The session was devoted to investigations into the development of lakeside and seaside sites that played a significant part in the subsistence economy, as well as in the communication/interaction and social developments of prehistoric people. Beside the traditional known wetland sites, especially the last decade brought to attention new discoveries of lake and sea sites. The comprehension of their relevance to European prehistory, and their occurrence in other European areas than those known before, is changing our entire view of prehistoric settlement patterns. To comprehend this development and the importance of waterscapes as active compounds in sustaining livelihoods, as well as the relevance of seaside and lakeside sites in the European prehistory, various matters need to be tackled. This session aimed at bringing together contributors from different fields to put side by side and discuss evidence from various regions in Europe and comparable situations from other continents. Among the points to be brought into discussion, are the diverse methods and techniques proposed for exploring the lakeside and seaside sites.

Albert Hafner was invited as a keynote lecturer in the above mentioned session. In addition, two papers were represented by Russian team of the NEENAWA project entitled:

A. Mazurkevich, E. Dolbunova, P. Kittel, E. Kazalov: Lacustrine pile-dwellings of the 4th-3rd mill BC: particularities of landscape, economy and culture (NW Russia).

E. Dolbunova, A. Mazurkevich, A. Tsybrii, V. Tsybrii, M. Sablin: Using waterscapes in Early Neolithic: new investigations in the southern Russia (site Rakushechny Yar).

More information, abstract submission & registration  
[www.workshop-gshdl.uni-kiel.de](http://www.workshop-gshdl.uni-kiel.de)  
Deadline for submitting abstracts: November 30, 2016  
Deadline for registering: February 2, 2017  
Contact / inquiries: [workshop@gshdl.uni-kiel.de](mailto:workshop@gshdl.uni-kiel.de)

International Open Workshop  
**SOCIO-ENVIRONMENTAL DYNAMICS OVER THE LAST 12,000 YEARS:  
THE CREATION OF LANDSCAPES V**  
Kiel University  
March 20-24, 2017

GRADUATE SCHOOL AT KIEL UNIVERSITY  
human development in landscapes

GRADUATE SCHOOL AT KIEL UNIVERSITY  
human development in landscapes

© Jutta Kieseel

Goce Naumov, Goce Delcev University, Stip,  
Pavlo Shydlovskiy, Taras Shevchenko National University of Kyiv

### **III.8 Neolithic Seminar at the University of Bern**

A significant component of NEENAWA project was the sharing of knowledge among mutually unfamiliar academic environments. As part of this process realized on various occasions during the project, also a Neolithic Seminar was initiated that intended to introduce Swiss students to the prehistory of an area that is not regularly included in their curriculum. The Seminar took place from 23 to 30 May 2017 at the Institute of Archaeological Sciences of the University of Bern and was focused on the Neolithic of East and Southeast Europe (i.e. the Balkans) where representatives of Taras Shevchenko University (fig. 1) and the Center for Prehistoric Research (fig. 2) gave lectures and assisted students in their work. The working language was English.

The Macedonian project partner (fig. 2) guided the students in their research of the Neolithic Balkans and chronology, pottery, identity, burials and human representations in particular. Prior to their final presentations in May consultation and preparation of their seminar works took place (fig. 3, 4). Students were focused on the Early Neolithic chronology of the Balkans and calibration of available dates, pottery production and their relationship with identity, as well as on research on intramural burials, anthropomorphic figurines and house models in Macedonia. For that purpose, a bibliography was provided for them which they used with particular interest in detail.

The second part of the seminar was devoted to the topic "Cucuteni-Trypillia settlements: material culture, chronology and space". The introductory lecture was given by the assistant professor of the Department of Archeology and Museology, Pavlo Shydlovskiy (fig. 5), followed by lectures from both Ukrainian as well as Swiss students. At the end of each lecture and especially after the seminar, there were lively discussions between lecturers (fig. 6) and students which resulted in valuable input for each side.

Students were dedicated in their work and demonstrated meticulous curiosity in exploring a new area of archaeological research and a new region. In matter of few months they prepared their written work with thorough text and images consisted of graphs as well. This confirms their analytical approach and willingness to understand systematically the Neolithic of the Eastern Europe and the subject areas they have chosen. Their seminar work was finalized with presentations in front of students and professors. During their presentations they clearly elaborated the results, self-confidently demonstrating the knowledge they obtained. In general, the seminar work was very successful and proved that Swiss students are talented and dedicated individuals that profoundly entered into a new sphere of archaeological research i.e. the Neolithic of Eastern Europe.

In addition, the Macedonian and Ukrainian project partners had the opportunity to use the well-equipped library of the Institute of Archaeological Sciences (fig. 7) and to visit museums in the cities of Bern and Geneva.





Fig. 1: Ukrainian researchers Ivan Radomskiy, Alyona Tron-Radomskaya and Pavlo Shydlovskiy in front of the Institute of Archaeological Sciences at the University of Bern (photo: Pavlo Shydlovskiy)



Fig. 2: Goce Naumov during his lecture on the Neolithic Balkans (photo: Pavlo Shydlovskiy)



Fig. 3: Swiss student Corina Gottardi giving a lecture on "Human Representations and Burials of the First Farmers" (photo: Goce Naumov)

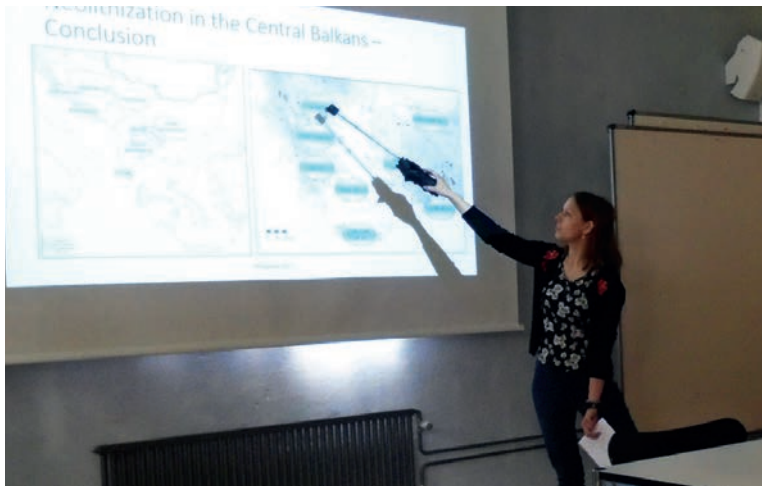


Fig. 4: Swiss student Lea Emmenegger giving a lecture on "The Process of the Neolithization in the Balkans" (photo: Goce Naumov)



Fig. 5: Pavlo Shydlovskiy during his lecture on Cucuteni-Trypillia settlements (photo: Pavlo Shydlovskiy)

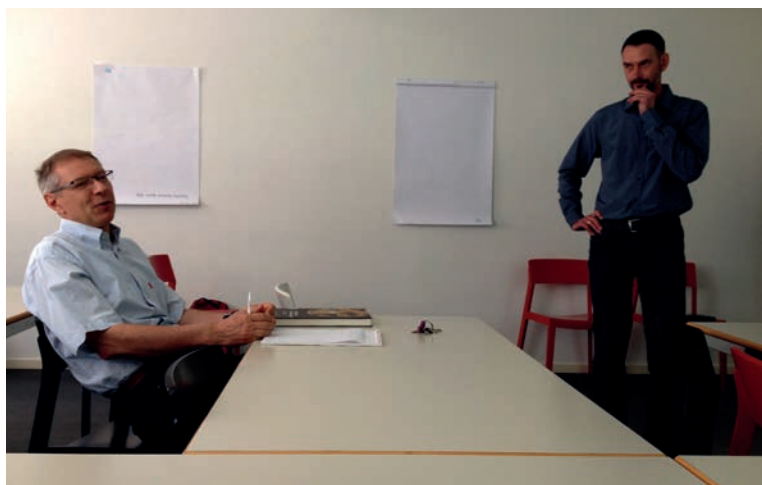


Fig. 6: Discussion between Albert Hafner and Pavlo Shydlovskiy (photo: Pavlo Shydlovskiy)



*Fig. 7: Ivan Radomsky in the library of the Institute of Archaeological Sciences (photo: Pavlo Shydlovskiy)*



### III.9 Research Stays at the University of Bern

The opportunity to upgrade the knowledge on wetland archaeology with literature unavailable in Macedonia is just one of the many components of NEENAWA project. This considered a research stay at the Institute of Archaeological Sciences (fig. 1), University of Bern that has an exceptional contribution in terms of wetland archaeology and has one of the most prosperous libraries in this research area. It was a perfect setting for **Goce Naumov** to work in excellent academic environment with a library and facilities that provided a fruitful research.

The purpose of this month-long research stay in May 2017 was to enrich the data in regard to wetland archaeology and pile-dwellings and tell-sites in Europe and Near East in particular. The research stay was related to preparation of a paper presented at the European Association of Archaeologists session organized by NEENAWA participants in 2016 and that is published in the OSPA series. The paper 'Neolithic Wetlands and Lakeside Settlements in the Balkans' intends to spotlight this almost underestimated branch of archaeology and research of wetland sites in the Balkan Peninsula that are not well known in Western academia. For that purpose, a consideration of numerous publications was necessary in order to make this paper more consistent. The library of the Institute of Archaeological Sciences at University of Bern (fig. 2) has a variety of monographs, edited books and journals related to this topic and especially a large collection of old publications related to Neolithic tell-sites and pile-dwellings in the Balkans that are nowadays very hard to find in Macedonian libraries.

Due to an excellently organized library and amazingly kind and helpful librarian many of these publications were available for research. They significantly contributed to the quality of the paper that has been delivered for publication after the research stay. Within the research stay, a seminar on Balkan Neolithic was held for the students at the University of Bern (fig. 3), elaborated in detail in another chapter of this book. Besides research at this institute, also libraries of other institutions in Bern were considered, having an impact on paper's outcome. At the end of the research stay a guest lecture was given at the Department of Underwater Archaeology and Dendrochronology in the City of Zurich, and also a thorough introduction to the work of this department and pile-dwellings in Zurich was provided.

The research stay of a Macedonian archaeologist in Bern will have a significant impact in future work and have an effect on the knowledge of wetland sites. On one hand, these experiences and research results are shared in Macedonia and motivate other researchers, and also contribute in the improvement of current knowledge on wetland archaeology in the country. The paper written at the University of Bern will be published in an edited book that addresses huge group of readers and will make the Balkan wetland site closer to Western researchers. In general, the research stay has multitude of benefits and enables a better understanding of different academic traditions, data and methods employed in South-Eastern, Central and Western Europe.

**Ekaterina Dolbunova** (The State Hermitage Museum, Saint Petersburg) undertook a study week at the Institute of Archaeological Sciences, University of Bern between 15 October and 14 November 2016. The main activities of her stay included work in the library of the Institute of Archaeological Sciences at the University of Bern. This allowed her to get acquainted with literature concerning Neolithic archaeology, dating methods and underwater archaeology. During her stay, she was also able to attend lectures by Albert Hafner, devoted to Neolithic archaeology of Switzerland. Ekaterina Dolbunova visited a variety of other lectures and courses organized by the University of Bern and a variety of archaeological exhibitions.

**Andrey Mazurkevich** (The State Hermitage Museum, Saint Petersburg), who also undertook a study week at the Institute of Archaeological Sciences, University of Bern between 15 October and 5 November 2016, accompanied her (fig. 4). His main activities also included work in the library. This allowed him to get acquainted with literature concerning Neolithic archaeology, dating methods and underwater archaeology. During this stay, Andrey Mazurkevich was working on his book:

*RADIOCARBON NEOLITHIC CHRONOLOGY OF EASTERN EUROPE IN THE VII-III MILLENNIUM BC* (ed. Mazurkevich A., Kulkova M., Dolbunova E. Smolensk, 2016. 456 p.).

**Anna Malyutina** (Institute for the History of Material Culture, Saint Petersburg) undertook a study week at the Institute of Archaeological Sciences, University of Bern and the IPNA, University of Basel between 27 February and 10 March 2017. In the IPNA, it was possible for her to get an insight to its different departments and methods applied in different subjects (including archaeozoology, anthropology, archaeobotanical analysis, stone age archaeology). During this stay, she studied the collection of Neolithic bone- and antler-artifacts (with aid by Prof. Dr. Jörg Schibler). Particular attention was put on the study of the artefacts of the site Sutz-Lattrigen (Lake of Biel). This material appeared to be typologically and technologically similar to the materials found in northwest Russia, where Anna Malyutina works with The State Hermitage Museum's team. Her stay at the Institute of Archaeological Sciences, University of Bern allowed working with archaeological literature in the library. It was also possible for her to visit the ancient bone and antler collections of the Bern Historical Museum, where Anna Malutina was able to talk with Sabine Bolliger Schreyer (curator of the Archaeological collection). The results of her stay, the studied literature in the library of the Institute of Archaeological Sciences and the bone collections investigated, will be included in her PhD-thesis and further used in her scientific investigations.



Fig. 1: Institute of Archaeological Sciences at the University of Bern, Muesmattstrasse 27, 3012 Bern (photo: Goce Naumov)



Fig. 2: Library of the Institute (photo: Goce Naumov)



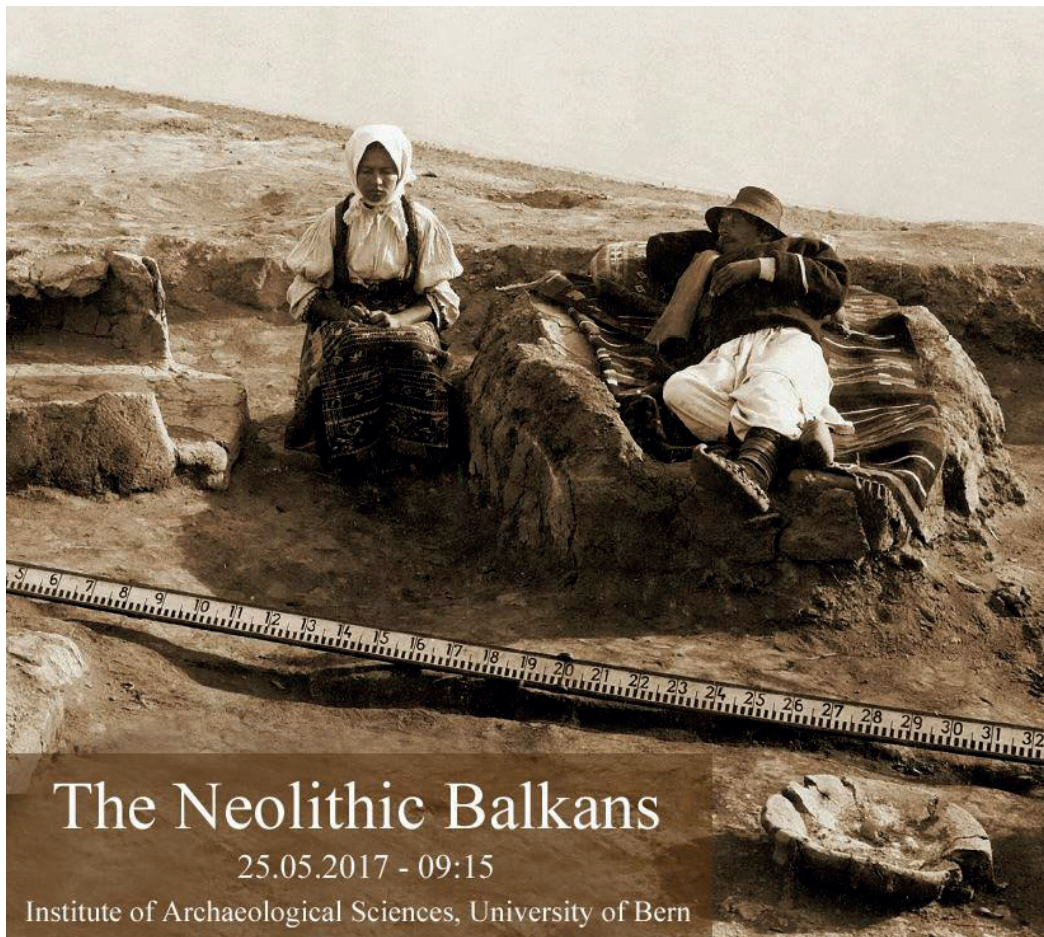


Fig. 3: Lecture announcement (photo: Goce Naumov)



Fig. 4: Andrey Mazurkevich at the Gurten (photo: Ekaterina Dolbunova)



### III.10 International Summer School in Pelagonia

The exchange of knowledge was a fundamental part of NEENAWA project and therefore the summer school in Pelagonia (North Macedonia) was being organized each year in order to introduce students to new insights and develop their academic knowledge. Wetland archaeology is a not well-known discipline in Macedonia which was the initial motive to initiate the summer school where students could work along with professionals at a site that was established in the Neolithic wetlands. The site of Vrbjanska Čuka in Pelagonia was a focal point (fig. 1) where each July students were engaged in excavation of the settlement, prospection of surrounding wetland sites, archaeobotanical study that involved flotation, as well as in geoarchaeological survey, geomagnetic scanning, sampling for radiocarbon, isotope and lipid analyses, GIS research, digital topography, 3D modeling, documentation of material etc. All these segments of research were oriented towards a better understanding of community and its environment in the 6th millennium BC.

The target group consisted of Macedonian and Czech students that were trained by professionals (professors and custodians) from the Center for Prehistoric Research, the Museum of Prilep, the University of South Bohemia and the Biosense Institute (fig. 2). In terms of wetland archaeology, students were engaged in bioarchaeology that gives the most adequate data in determination of vegetation and animals related to marshes. Consequently, they were involved in flotation and processing of organic remains that were later processed along with experienced archaeobotanists and zooarchaeologists. They were also involved in preparation of samples for isotope and lipid analyses that provide further information on the Neolithic environment.

In regard to a better understanding of the community that established a tell site in the Pelagonian wetland, an excavation was performed focused on daub buildings of which some were used for living and others as workshops for processing of cereals. Students were trained in methods of excavation by using the Harris Matrix (not a common tool in Macedonia) that helps in a more detailed documentation of site and better understanding of archaeological contexts. In order to have a precise dating of the settlement they were introduced to modes of sampling for radiocarbon analysis.

In order to understand the spatial patterns of this site and its relationship with others in the wetland area prospection and GIS surveys were performed so that the students were able to learn different approaches for understanding the landscape better and the disposition of settlements in regard to wetlands. Also, the site was geomagnetically scanned, still not a common practice in the Macedonian archaeological research. This was a rare occasion for students to learn the method and processing of data obtained by the scanning and to interpret the information on magnetic maps. Consequently, they could see the spatial organization of the settlements and their architectonic features. As part of the summer school the archaeological material was documented as well, especially the shard that was used in training of students associated with the selection of proper finds for the sampling necessary in lipid analysis. The results of lipid analysis also gave information on food and the environment where the settlement was established.

The essential outcome of the summer school was the introduction and experience in the current and not common knowledge in Macedonia that gave a different perspective to an archaeological site compared to the traditional approach. As a result, students developed their skills in a more scientific study of sites and their landscapes. Due to their dedicated involvement and hard work, it could be elaborated that Vrbjanska Čuka is one of the largest tells in the Northern part of Pelagonia, information provided by their engagement in GIS, digital topography and prospection. Their employment in archaeobotanical and zooarchaeological research indicate that there

were vegetation and animals/birds related to wetland setting. The introduction to geomagnetic scanning helped them understand that the settlement consisted of approximately 25 buildings enclosed by a ditch that had a main entrance in the south-east part. With the excavation of five buildings they determined that one of them is quite large (currently the largest in Macedonia) and consisted of many bins, an oven and a platform. Inside this building more than 30 grinding stones were recorded, suggesting a large focus on processing cereals in it. The engagement of students in sampling for radiocarbon, lipid and isotope analyses soon will give information on the exact dating, diet and environment as the samples are already sent to laboratories. Therefore, it can be resumed that this summer school was a significant experience for a large number of Macedonian and Czech students involved in a scientifically oriented training, the first and only of this kind in Macedonia.



*Fig. 1: Excavating Neolithic buildings at Vrbjanska Chuka (photo: Goce Naumov)*



*Fig. 2: International team of archaeologists and students at Vrbjanska Chuka (photo: Ales Ogorelec)*



### III.11 Students Experience Reports

Johannes Reich

For me, the NEENAWA project started in April 2015 with the application for participation in the field week in Serteya, the workshop in Ohrid and the conference in Kiev (fig. 1a). I was particularly impressed by the opportunity to take part in a field week in the Russian wilderness. The acceptance of my participation as a student came quickly. Even before leaving for Russia, there was also the opportunity to participate in scientific diving training through the project. I had never had any diving experience before, but the element of water has long fascinated me as a skipper and active in pontooning. Participation in the field campaign in Russia and the workshops in Ohrid and Kiev enabled - in addition to getting to know new countries and cultures - an exchange with students and archaeologists from various countries. I was able to learn new things at various levels and deepen the familiar:

Starting with communicating in English in an international environment, be it during a discussion, working in the field or giving a lecture.

The insight into implementation of a field campaign far away from the next larger settlement.

Insights into other views, working methods and perspectives on and for archeology.

And for me in particular the entry into scientific diving and thus the opening up of a completely new field of work.

In order to gain the necessary experience for the training in just a little over a year, we started our first diving course in Gozo, Malta in February 2016. When the water in Switzerland was warm enough, we continued our training in Switzerland. In January 2017 we had a first short block of scientific diving training in the indoor pool. This showed that we still had a lot to learn and to practice. My exchange in the summer semester 2017 was due to the ideal training conditions in Kiel on the Baltic Sea. My personal highlight of the project was the three-week training and examination as a scientific diver at Lake Ohrid in summer 2017 (fig. 1b). Immediately afterwards we traveled to Kiev, where Ekaterina Dolbunova and I organized a small workshop contribution on the perspectives and problems of researching underwater and wetland sites. The Swiss participants in scientific diving training saw a promising perspective in the implementation of a scientific diving project on Lake Ohrid, which could be successfully completed in summer 2018.



Fig. 1: Swiss student Johannes Reich, a: with NEENAWA cup; b: during diving and setting up an excavation grid at Lake Ohrid, North Macedonia



Corinne Stäheli

My name is Corinne Stäheli and I have recently completed my bachelor's degree in archaeology. I majored in pre- and protohistory and the Archeology of the Roman provinces. I have completed my minor in art and architectural history and monument conservation. As a student, I attended the NEENAWA workshops in Ohrid/Skopje, Macedonia and in Kiev/Kaniv. I also took part in the field campaign in Serteya, Russia. Furthermore, I did an apprenticeship as a scientific diver in summer 2017 as part of the project (fig. 2). For me personally, this training as a scientific diver was the reason of my participation. In this course I learned a lot about diving safety, working underwater, planning a research dive and related tasks, device technology, physics and legislation. This training gives me access to a new field of work, underwater archeology (fig. 3). It also led to a joint project of Lea Emmenegger, Marco Hostettler, Johannes Reich and me. As a group of bachelor and master students, we were able to set up our "own" project in the Bay of Bones, Macedonia for underwater archeology and dendrochronology. In the workshops I learned a lot about the methods and working approaches of archaeologists from the partner countries. The lectures gave an exciting insight into the archeology of Ukraine, Macedonia and Russia. I became particularly aware of the phenomenon of the Corded Ware pottery and its spread. What I personally found very exciting was the exchange and the trip to countries that one might not consider as a travel destination (be it Russia, where it is not easy or cheap to get a visa or Ukraine with the current political situation). Traveling through these countries (esp. field week in Serteya, Russia) was very impressive (fig. 4) and the landscape was of course very beautiful. Also interesting were the partially existing „cultural“ differences in gender issues, such as working women on an excavation. I found NEENAWA to be a very instructive project. It was a very good opportunity to get to know colleagues and fellow students from other countries, to exchange ideas and to benefit from them.



*Fig. 2: Swiss student Corinne Stäheli during diving at Lake Ohrid, North Macedonia*



*Fig. 3: Corinne Stäheli and Lea Emmenegger during diving preparations at Amfora Dive Center in Ohrid, Ploča.*

Lea Emmenegger

My name is Lea Emmenegger and during the NEENAWA project I was a master student at the University of Bern. I majored in pre- and protohistory and minored in geology. During my bachelor's degree, I also had Archeology of the Roman provinces as a major. I attended the NEENAWA workshops in Ohrid /Skopje, Macedonia and Kiev/Kaniv, Ukraine as a student or listener. I also participated in the field campaign in Serteya, Russia. In the spring semester 2017 I attended the NEENAWA seminar at the University of Bern. As part of this seminar, I dealt in detail with the neolithization of the Balkans. In summer 2017 I took part in the training as a scientific diver, which I successfully completed together with other NEENAWA participants (fig. 5). Training as a scientific diver laid the foundations for a project of the students of the University of Bern in the field of underwater archeology and dendrochronology at Lake Ohrid in Macedonia. In general, the scientific diver training enables entry into the field of underwater archeology. The workshops, conferences, field weeks and the diving course provided information on current archaeological topics in Russia, Macedonia and Ukraine. An exciting aspect was also the insight into the methods and working techniques used by the NEENAWA partner countries. In addition to the content and methodological knowledge gained, the NEENAWA events were a good opportunity to make new contacts with international colleagues. As part of the NEENAWA project, I had the opportunity to get to know three very interesting countries. I benefited largely from these experiences because the stays in this form would not have been possible as a private person.

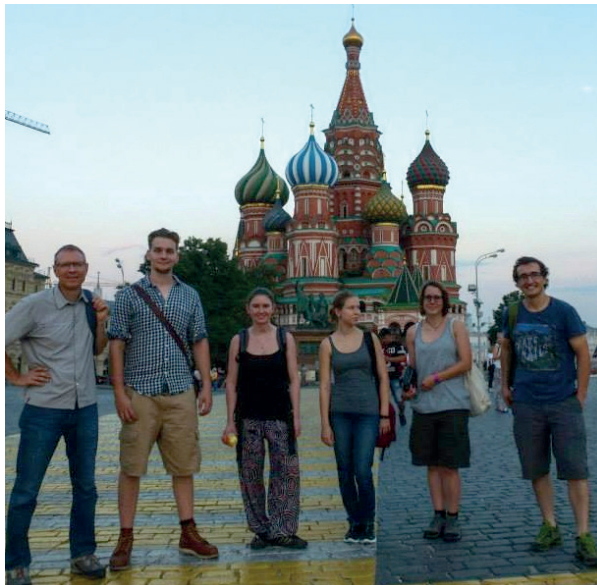


Fig. 4: Prof. Albert Hafner and Swiss students in Moscow, Russia



Fig. 5: Swiss students Lea Emmenegger during dive signalisation at Lake Ohrid, North Macedonia (photo: Corinne Stäheli)

Marco Hostettler

My motivation to participate at the NEENAWA-project was to have the possibility of taking part in the scientific diving course and to get into dialogue with people from other countries.

During the NEENAWA project, I was studying prehistoric archeology and medieval history at the University of Bern in the master curriculum. I had a bachelor's degree in prehistoric archeology, medieval archeology and history from the Universities of Bern and Zurich. For me, the NEENAWA events were both personally and scientifically extremely enriching. My first NEENAWA event was the workshop in Macedonia in 2016 and it gave me insights into the richness of the for me then unknown archaeological heritage of Eastern Europe. The possibility to meet and interact with students and researchers from different countries was especially enriching for me. Communication was not always easy, but we were usually able to overcome the language barriers. The scientific contributions to the workshops provided exciting insights into ongoing research on wetland archeology in Eastern Europe and Switzerland. They gave me the opportunity to think outside the box and to reflect on various questions and methodologies.

The education for the scientific diver started in January 2017, when I still was in the last months of my exchange studentship at the Free University of Berlin. As especially the diving hours needed time, for me as a father of two small children this was not always easy. But with the great support of my partner, I was nevertheless able to accomplish the preparatory training and the three-week intense course (and successfully finish the exam) (fig. 6 & 7). The training as a scientific diver trained me in safely working, teamwork and mental and physical resilience.

Immediately after the diving course at lake Ohrid we travelled to Kiev and Kaniv. I was deeply impressed by the city of Kiev and the landscape around Kaniv. The intense but short workshop was a lasting experience for me.

Together with Lea Emmenegger, Corinne Stäheli and Johannes Reich and in cooperation with Prof. Hafner and our colleagues from Macedonia we met during NEENAWA, we started working on a new underwater archaeological project on Lake Ohrid directly after the concluding workshop in Kaniv (Ukraine). We realised the project in summer 2018.

The project enabled me to expand my research interests into underwater archeology. Thanks to NEENAWA, I met different inspiring people, and some of us still have contact to each other. I hope to meet my colleagues from NEENAWA again in the future, to work with them and, at best, to realise joint projects.



Fig. 6: Taking out the boat after the scientific diving course at Lake Ohrid, North Macedonia



Fig. 7: Swiss student Marco Hostettler diving at Lake Ohrid



Helena Wehren

I hold a master degree in geology and am currently doing my bachelor in archaeology. I am an undergraduate student member of the NEENAWA project. I took part in the trips to Serteya (Russia) in 2015, to Skopje and Ohrid (Macedonia) in 2016 and to Kiev and Kaniv (Ukraine) in 2017. Till spring 2017 I was part of the European Scientific Diver course. Shortly before the final part in Macedonia, health issues forced me to abandon the course.

I met interesting people and had many good discussions about the presented topics and other subjects. I learnt much about wetland archaeology in general and its challenges and application in the partaking countries. It was interesting to see differences in organisation due to different cultural background. And great to see that even between countries with huge political differences it is possible for scientists to work together (fig. 8).

For me personally it was good to meet colleagues which are not part of the Swiss or German community. They are therefore having other approaches. The trips were very interesting. We were able to see and get a feeling how archaeology works in other countries. The fieldtrip to Serteya impressed me most. As geologist silicites are my main interest. Talks in Kaniv were sometimes a bit challenging to follow but interesting to me.

Out of a discussion with a presenting Ukrainian archaeologist in Kaniv a small project evolved. In the scope of the SNF Project „Responses of Vegetation and Prehistorical Society to Climatic Changes in Ukraine“ we can determine the flints from an archaeological site. I will investigate the silicites provenience by determination of the microfacies and geologic age. We investigate the contact webs of the village. A key question is if changes over time in the material culture do mirror in the silicites. In Ukraine some work is already done by macroscopic determination but reliable sourcing of silicite material is uncharted territory. The NEENAWA project opened an opportunity for me to progress further in my career.



Fig. 8: Swiss student Helena Wehren at Samuel's Fortress in Ohrid

Noah Steuri

I hold a master degree in prehistoric archaeology and economics. In the NEENAWA project I was mainly involved as a project employee with a level of employment of 10 %. In this role, I had many different tasks; I was responsible for the communication with the project partners, helped with the preparation of the scientific and financial reports, organized the trips of the Swiss team, etc. In addition, I was also involved as a “regular” student at the University of Bern in all the main events of the project. As a student and project employee, I took part in all of NEENAWA’s larger events: the field week in Serteya (Russia), the workshop in Ohrid (Macedonia) and the final conference in Ukraine (fig. 9). Unfortunately for medical reasons it was not possible for me to complete the scientific diving training (ESD). Archaeologically speaking, I was only able to contribute to NEENAWA from a technical point of view, since the archeology of Eastern Europe was mostly completely new to me. As a project member, I was able to support the project in a variety of matters; for example the coordination of financial reports or the organization of visas. So I was able to help NEENAWA with my knowledge of accounting and management. However, I have had a great interest in the past of Eastern Europe since my history lessons in high school. So it was enormously enriching for me to be able to travel to these countries and to experience the archaeological practice on site. Therefore, I was always personally very open and curious and hopefully able to contribute to the success of the project.

NEENAWA has taught me a lot; in terms of content, I was able to get an insight into the archeology of Eastern Europe (including the organization of archeology in these countries and which excavation techniques are used). In my function and mentioned activities as a project employee, I was also able to gain a lot of organizational experience. As a learning module, I find the project a very successful idea; other than just reading books from prehistoric cultures in distant countries, being able to travel there yourself, lending a hand and learning more from local archaeologists. In general, it was extremely interesting for me to travel to countries like Russia or Ukraine and learn more about local archeology. The field week in Serteya will always remain in my memory; camping in the forest and exchanging ideas, working and laughing with students from four very different countries. But since my studies were relatively advanced at the start of the project, NEENAWA had only a limited direct influence on it.



Fig. 9: Swiss student Noah Steuri and colleague Caroline Heitz during workshop at Kaniv Nature Reserve



Dmytro Zhelaha

Joining the NEENAWA project helped me understanding global processes in archaeology. The first episode of the project started for me as a visit to Macedonia. I always wanted to come to the Balkan region, because my scientific interest is Cucuteni-Trypillian culture. The culture has Balkan roots. Visiting Macedonian museums helped me to imagine cultural processes in Neolithic communities on the territory of Macedonia. Neolithic communities there and the Cucuteni-Trypillian culture have so much material similarities, despite them having huge distances between. Scientific events were conducted in Skopje and Ohrid. Material analyses by local researchers complemented my own knowledge about the cultural processes and transformations in this region. It was appealing to learn about investigations on the Balkans.

Researchers from Switzerland shared new information about contemporary investigations of dendrochronology. Good specialists, equipment, and workplaces are a precondition for archaeological research without deficiencies. Presentations showed the complete process of dendrochronological research: sampling wooden artifacts, analysis, results. Taking wooden samples is the result of wetland, lake and river investigations. Most of the presentations at the scientific events in Ohrid and Skopje were about underwater methods of researching. It was planned for the students to dive at Lake Ohrid but severe weather stopped us, thus only professional divers and underwater archaeologists with great diving experience could dive into the rough waters. I was really impressed by the nature in Macedonia. The views over Ohrid and Prespa lakes and the mountains are still sticking in my memory like museums exhibitions and the reconstructed settlement Bay of Bones with pile-dwellings (fig. 10).

Our team had much time for communication with our colleagues - students and scientists. It is sad that I've not seen everybody again during the next episode in Ukraine. Here, scientific events took place in Kyiv and Kaniv. Additionally, participants joined the journey to the regional museums in Trypillya and Pereyaslav and Kaniv nature reserve. Ukrainian students and scientists were invited to these events. Participants could listen and discuss about new investigations in Eastern and Western Europe. Considering the conditions of soil activity in Ukraine, mostly we do not have wooden, leather or woven artefacts. So, it was interesting to see presentations about excavations and analyses of those remains from Switzerland, Macedonia, Greece, Belarus and Russia.

The conference in Ukraine included many different sectors and lines of archaeological research. The dendrochronology workshop was very interesting for many participants. Researchers from Switzerland showed how to sample wooden pieces from underwater excavations and what to do with that after all. The most useful was the practical part. Participants could sample wooden artifacts and do primary analysis of these samples. The workshop showed just a part why archeologists investigate wetlands, rivers and lakes and what results and experience scientists in Ukraine

would get, if they would work more in that areas. Posters were good and illustrative material for unplanned discussions or informal conversations.



Big thanks go to everyone who has participated in the organization of the NEENAWA project – of local sessions, journeys and international coordination of the process. Events like this are an important step to archaeological science development, sharing knowledge about future methods and technologies, communication between scientists and students of the world. I am happy to have been involved in this project.

Fig. 10: Ukrainian student Dmytro Zhelaha



Ivan Radomskyi

The NEENAWA project gave me a series of new knowledge and skills in the field of research methodology and laboratory works (fig. 11).

The problem of pile-dwelling settlements has become for me a new landmark in the understanding of ancient societies. The experience gained during the project while working with monuments of this type proved to be very valuable and unforgettable. The questions connected with pile-dwelling settlements gave the opportunity to a new and fresh look to the problem of house-building in the Trypillya-Cucuteni culture. Essence of the question is that even in the second half of the twentieth century, the assumption was made that two-story buildings should be built. The problems discussed at the workshops and scientific meetings made it possible to look with a different point of view on the Trypillya-Cucuteni house-buildings. Of course, these are different types of monuments, but the possibility of building a type of pile-dwelling may well exist. The questions how the walls of the first floor looked like and if they even existed (since it is very difficult to identify them) are often discussed in archaeology. So, if we make the correct calculations, take into account the experience obtained by the researchers of the pile-dwelling settlements, we received the corresponding result.

Dendrochronological method demonstrated at seminars first of all made it possible to understand how this method of dating works, and the illustrative examples that were demonstrated in Kaniv became very interesting and unforgettable.

Discussing the problem of the Ukrainian Neolithic-Chalcolithic transition at numerous meetings gave a new turn to my own development. Valuable comments were made in relation to our work. This knowledge has been used to further scientific work on my dissertation. The work in the library of the Bern Institute greatly simplified my task in the search for foreign literature, which, unfortunately, we actually lack in Ukraine.

Participation in the project made it possible to see how colleagues work abroad, not only with respect to archaeological research, but also in relation to museums, teaching activities, organization of seminars, workshops etc.



Fig. 11: Ukrainian student Ivan Radomskyi during excavation



*Underwater excavation at Lake Ohrid,  
Ploča Michov Grad, North Macedonia (photo: Marco Hostettler;  
EXPLO, University of Bern, 2019)*



# Part IV: EPILOGUE 2018-2020





## IV.1 A Keen Look into the Past: the Archaeology of Lakes and Bogs in Russia and Switzerland

Funded by the State Secretariat for Education, Research and Innovation (SERI), a joint project between the Institute of Archaeological Sciences, University of Bern, and the State Hermitage Museum in Saint Petersburg was conducted between October 2018 and December 2019. It was dealing with the archaeology of lakes and bogs in Russia and Switzerland.

In the **Alpine Space**, the UNESCO World Heritage Sites „Prehistoric Lake Dwellings around the Alps“ include a selection of 111 of the almost 1000 known archaeological lake-dwellings in six countries around the Alps, including Switzerland. These are the remains of prehistoric pile-dwelling settlements dating from 5000 to 500 BC. Due to the extremely precise dating of wood remains and wooden architectural elements (dendrochronology or tree-ring dating), complete prehistoric villages and their spatial development can be traced over a very long period of time. In **Russia**, in numerous lakes and bogs in the north-western part of the country, comparable prehistoric settlement remains have also been preserved in large numbers. In terms of conservation conditions, they can be compared very well with the sites found in the Alpine Space. However, while the southern sites were mainly inhabited by agricultural communities, in the north-western regions they were societies that practised a combination of hunting, fishing and cultivation. The project aimed to communicate the great scientific potential of archaeological sites in lakes and bogs to students from Russia and Switzerland. Courses were intended to introduce methodological principles and practical skills. Above all, however, an exchange across language borders was intended to overcome the boundaries of previous research traditions. Archaeological research in the Alps and north-western Europe, which has so far been largely isolated from each other, was to be enriched by the involvement of students and experienced researchers. During the project, four funded activities took place:

**First part:** Archaeological fieldwork at Serteya, NW Russia, from 24.7.- 9.8.2019 and subsequently an excursion to archaeological excavations at Novgorod, from 9-13.8.2019. This part was focused on fieldwork and archaeological excavations.

Eight Swiss students under the supervision of senior research assistant Dr. Martin Hinz participated in the ‘Archaeology of Northwestern-European peat-bog sites Summer school’ near the archaeological sites of Serteya. The programme included active participation in the excavations of the Neolithic peat-bog site, attendance at lectures on excavations in peat-bogs, lakes and rivers and about geological aspects as well as excursions to different archaeological areas and museums in the regions of Smolensk and Pskov. The fieldwork at Serteya was followed by an excursion to Novgorod (famous excavations of the medieval city with extremely well preservation for organic material).

**Second part:** Excursion to Moscow and St. Petersburg, from 12-16.10.2019 and organisation of a joint scientific conference at St. Petersburg, from 17-18.10.2019. This part was focused on the visit of museum collections, institutions and exchange of knowledge.

The second part of the project took place in Moscow and Saint Petersburg. In Moscow, the Historic Museum and its large collection of archaeological finds from whole Russia was visited. Further, a meeting with the director of the Archaeological branch of the National Academy of Science (Prof. Makarov) took place. The aim was to get in contact and to discuss possibilities for joint projects in alpine environments of Russia, namely the Caucasus mountains.

In Saint Petersburg, different collections of The State Hermitage Museum were visited and guided tours to conservation facilities were offered. On 17 and 18 October 2019, the jointly organized international conference 'The formation of archaeological layers in stone Age wetland sites: understanding complex site structures' took place. The project could build on the NEENAWA project of the years 2015-2018, to promote cooperation with Eastern Europe.

Students and post-docs from Switzerland and staff from the two participating institutions were involved in the project. The different activities contributed largely to the strengthening of the relationship between the participating institutions in Switzerland and Russia. Both are interested in wetland archaeology and future partnerships are most welcome. In addition, contacts were established with the National Academy of Sciences, and a new joint field of research was opened in Alpine archaeology of the Caucasus region. Joint research in this area would be highly desirable. All in all, the project of 2018/2019 allowed to deepen already existing relations.



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,  
Education and Research EAER  
**State Secretariat for Education,  
Research and Innovation SERI**



Fig. 1: Swiss and Russian students in the trench of the excavation at the Serteya II site (photo: Adrian Scherrer)





Fig. 2: Swiss and Russian students at work and wet sieving of the excavated soil from the Serteya II excavation (photo: Adrian Scherrer).



Fig. 3: The Russian partners showing the Neolithic ceramic material from the Serteya excavations in the Restoration facilities of the State Hermitage Museum at Saint Petersburg (photo: Martin Hinz).



## **IV.2 PhD Project: The Neolithic Ceramic from the Mariupol Type Cemeteries at the Middle and Lower Dnieper**

In April 2018 I have received the letter from the Federal Commission for Scholarships for Foreign Students (FCS) commission that I had been chosen as a candidate for the Swiss Government Excellence Scholarship. And I would say, from that moment started my transfer to Switzerland. I had one summer to prepare myself for a move to my new home in Bern for the next three years. The biggest part of the preparation was preparation on how I can work with Neolithic pottery collections, which are stored in Archive of the Institute Archaeology NAS Ukraine, from abroad. My PhD project is on Neolithic ceramics (7th-5th mill. BC) from the Mariupol type cemeteries at the Middle and Lower Dnieper, Ukraine. The main aim of my study is to establish specific types of vessels depending on the shape/form, the composition of clay and the characteristic ornamentation, and to create a detailed typology and chronology based on it. In addition, I hope to find evidence for migration and social contacts through comparison of the ceramics from the cemeteries with ceramics from settlements.

### **I expect the following results of my PhD project:**

1. Identification of main evolution trends that are characteristic for ceramics from each burial site.
2. A reliable typological classification of Neolithic ceramics of the Lower and Middle Dnieper basin.
3. Identification of ceramic traditions that formed the basis of ceramic production.
4. Identification of ways of migration of populations and identification of networks of communication in the Lower and Middle Dnieper basin.

### **For me, this scholarship is a big step in my personal development:**

- as an academic: the possibility to study and write my doctoral thesis under supervision Prof. Dr. Albert Hafner at the Institute for Archaeological Sciences and Dr. Pavlo Shydlovskiy from Taras Schevchenko National University of Kyiv;
- as a person: soft skills development, adaptation to a new country, culture, society, and of course languages.

The first year of my doctoral studies was full of scientific interaction at our institute. It started with a perfect and inspiring “dive in” in the new international archaeological community of Swiss PhD and master students, post-doctoral Researchers and professors. It is hard to count the amount of visited open lectures about different topics in archaeology or related to archaeology. Organized colloquiums from the Prehistoric Archaeology and Near Eastern Archaeology departments have always inspired me with new knowledge about archaeological insights and new research methods. I could dive in an atmosphere fascinated by archaeological science and research. That was what I have dreamed about in Ukraine!

To achieve my goals, I have also applied to the Graduate School of Humanities, in the programme “Global Studies”. The programme unites young PhD students and helps them to grow as a scientist, providing them interesting lectures and courses in interdisciplinary areas.

In the Institute of the Archaeological Sciences, I had an opportunity to learn more about Digital Archaeology and started to use statistics with “R” for my research. With Dr. Caroline Heitz, I started to learn how to use the p-XRF analyser and now, we will work with the pottery fragments from Lysa Hora Neolithic cemetery. Also, for the first time, I have visited a radiocarbon (<sup>14</sup>C)

laboratory and learned more about technical aspects in material dating. With the big inspiration, I am waiting for new  $^{14}\text{C}$  data for the Neolithic cemeteries of Lysa Hora and Mykilske.

Another inspiring point for me is the access to the archaeological library at the institute with a huge collection of books from world-famous researchers and publishers, and in all fields of archaeology: from theoretical to digital archaeology, archaeometry, world site descriptions, etc.

During summer 2019, I had a unique chance to join the EXPLO project on Lake Ohrid in Macedonia. For one month, I worked in an international Swiss-Macedonian underwater archaeological team. It was a fascinating experience: I worked with Neolithic and Bronze Age ceramics by cleaning findings and drawing them (fig. 1). Besides, I have assisted our dendrochronologists to prepare all wooden samples for transportation to Switzerland. The fascination about diversity in the archaeological sciences pushed me as well to take diving courses, and now I am on my way to become an Advanced Open Water Diver.

Also, during my study at the Institute of Archaeological Sciences, I have the perfect chance to participate in archaeological conferences. That is a thrilling and important experience for me as a young scientist. And now, I am for the first time organizing a session at the EAA 2020 Virtual Annual Meeting with my colleagues Olha Demchenko and Dr. Martin Hinz. Its topic is: "The Climate Impact on European Neolithic Societies during the 8.2-ky BP Events near River Basins and Lakes Shores".

In addition, I am improving my language skills every day. I have taken the Academic English course to improve my writing skills and German classes became a part of my everyday routine.

Now I am in the middle of my way to complete my PhD, and I believe that all-new experience, my colleagues, and friends will push me to successfully complete it. I am happy that Prof. Dr. Albert Hafner believed in me and gave me this awesome chance! I hope the next year will bring even more experience and knowledge!



Fig. 1: Marta Andriiovych during work at Mezhirich Upper Paleolithic Site

### **IV.3 Postdoc Project: From the Mediterranean to the Black Sea. Exchange and networks in early Agrarian Societies of Europe**

In the framework of a Postdoc scholarship of the Federal Commission for Scholarships (FCS) for Foreign scholars, the author spends a research stay of one year at the Institute of Archaeological Sciences of the University of Bern. The funded project started in September 2019.

The project is focused on the study of socio-economic changes, as well as the identification of exchange and networks in early agrarian societies between the Northern Pontic region and the Balkans, Southeast Europe and the Aegean Sea region in the late 7th and early 6th mill. BC. The neolithization process of the Northern Pontic region has been the topic of discussions among Ukrainian researchers over the decades. The established paradigm is that certain Neolithic innovations were perceived by the local population and transformed their material culture to a certain extent. The stable presence of a strong local components in the Neolithic communities during 7th and 6th mill. BC excluded any possibility of large-scale migration processes (human groups that could conserve their identity) until the period of the emergence of LBK and Cucuteni-Trypillia societies in Ukraine (5400-5300 cal. BC).

In 2019, the author of the project continued excavations the single-layer site Chapayevka (5950-5850 cal. BC) in the Azov Sea region (under the leadership of O. Demchenko and N. Kotova). The results of excavations confirmed the emergence of a completely different population in the region in the late 7th-early 6th mill. BC, which is radically different from the local Late Mesolithic and Early Neolithic societies. Similar materials were also found on the Crimean peninsula. These sites do not fit into the paradigm of neolithization of Ukraine, which prevails in the scientific literature. The main difference between these complexes is the relative macrolithization of the technocomplex, almost complete absence of geometric microliths, the presence of evidence of primitive agricultural economy and the appearance of flat-bottomed monochrome pottery with impressed and comb-ornamentation. The similarity of these materials to the monochrome horizon in Bul-



*Fig. 1: Olha Demchenko at excavation*

garia, Greece and Macedonia raises the question of the existence of the Ukrainian vector of social changes that took place in the Aegean Sea region, in the Balkans and in South-Eastern Europe in the late 7th and early 6th mill. BC.

This will allow to revise the set of contemporary outdated explanations of the Neolithization of the Northern Pontic region. The results of this project will enable to explain the migration routes and the ways of spreading Neolithic innovations. This will contribute to the popularization, integration and development of East European (Ukrainian) archeology in a pan-European context. Methodological skills gained in the process of work in the Swiss research group, as well as the results of the project will be an important impetus for the continuation of the author's fieldwork in Ukraine after return (fig. 1).



## **IV.4 ERC-Synergy Project EXPLO: ‘Exploring the Dynamics and Causes of Prehistoric Land use Change in the Cradle of European Farming’**

After several years of expanding the community network in Eastern Europe and the Southern Balkans in the context of NEENAWA, the time had come for setting up a scientific project with a major focus on research.

As had been revealed by sediment test coring and archaeological surveys between 2016 and 2018, the lakes of the southern Balkans offer an incredibly rich archive of outstandingly well-preserved archaeological findings as well as of paleoenvironmental data. The wetland environments of the southern Balkans hence provide an excellent opportunity to investigate the archaeological remains of the first prehistoric settlers, their subsistence economy and the environmental conditions they were exposed to. More than 8,000 years ago, technological and social breakthroughs allowed the introduction of farming from western Asia to Greece and thus for the first time to Europe. However, so far, there is no high-resolution picture of how this revolutionary innovation was related to the environment, including its long-term consequences.

The project EXPLO (short for ‘*Exploring the dynamics and causes of prehistoric land use change in the cradle of European farming*’) builds on this state of the art. Initiated by Albert Hafner, Professor of prehistoric archeology, and Willy Tinner, Professor of paleoecology, both from the University of Bern, the international and multidisciplinary project axis is complemented by the two professors Amy Bogaard and Kostas Kotsakis, from the Universities of Oxford and Thessaloniki respectively. EXPLO is one of 27 European projects that has been awarded a *Synergy Grant* by the European Research Council (ERC) in 2018. This grant is the highest level of the Excellence Funding scheme of the European Research Council.

In the scope of the five-year endeavor (2019–2024) the four principal investigators and their teams will conduct interdisciplinary research in the lakes-region between Northern Greece, Albania and North Macedonia. The project promises to break new ground by combining underwater archeology with methods applied by ecologists, biologists and climate scientists for the very first time. New underwater archaeological research will allow the construction of highly precise settlement chronologies on the basis of dendrochronology, radiocarbon dating and Bayesian modelling. On-site information from archaeological sites will be combined with off-site palaeoenvironmental data. Dynamic computer models integrating archaeological contexts and palaeoenvironmental data will open up the opportunity to investigate vulnerability, resilience, tipping points and thresholds of ancient agrarian economies over the last 10,000 years, with implications for future food systems under a rapidly changing climate.

By summer 2020, eight PhD candidates, five postdoctoral researches and further scientific and technical staff members could be hired in the framework of the project. More will join in the upcoming months.

Further information: <https://exploproject.eu/>



Fig. 1: Sediment coring by Willy Tinner's team at Lake Ohrid, Ploča Michovgrad, Gradište, North Macedonia (EXPLO, University of Bern, 2019).



Fig. 2: Impression of an archaeological underwater excavation at the shore zone of Lake Ohrid, Ploča Michovgrad, Gradište (EXPLO, University of Bern, 2019).



Fig. 3: Albert Hafner and Kostas Kotsakis at the Neolithic site of Dispilio, Kastoria, Greece (EXPLO, University of Bern, 2019).

The Bern Working Papers on Prehistoric Archaeology (ISSN 2297- 8607) is an online series dedicated to innovative research ideas and research findings on prehistoric societies. Focussing on inter- and transdisciplinary methodologies, the series is seeking to enrich discussion and collaboration between scholars of different disciplines and institutions in countries around Europe. The working papers form part of research groups based at the division of Prehistory, Institute of Archaeological Sciences (University of Bern). Papers in English or German language from other research groups are also welcome.

Submission of proposals to  
albert.hafner@iaw.unibe.ch

Die Berner Arbeitspapiere zur Prähistorischen Archäologie (ISSN 2297- 8607) sind eine Online-Schriftenreihe, die innovativen Forschungsansätzen zu prähistorischen Gesellschaften gewidmet ist. Im Fokus stehen inter- und transdisziplinäre methodologische Ansätze. Die Serie soll Austausch und Zusammenarbeit von Forschenden aus unterschiedlichen Disziplinen und Institutionen fördern, die in verschiedenen Ländern tätig sind. Die Arbeitspapiere sind Teil der Forschungsgruppen, welche bei der Abteilung für Prähistorische Archäologie am Institut für Archäologische Wissenschaften (Universität Bern) angesiedelt sind. Beiträge in deutscher oder englischer Sprache von anderen Forschungsgruppen sind ebenfalls willkommen.

Einreichung von Beitragsvorschlägen bei  
albert.hafner@iaw.unibe.ch





The “Network in Eastern European Neolithic and Wetland Archaeology for the improvement of field techniques and dating methods” (NEENAWA) was an Institutional Partnership between archaeological institutions in North Macedonia, Russia, Ukraine and Switzerland, funded by the Swiss National Science Foundation (SNSF). The project focused on the enhancement of scientific infrastructure and training of students and professionals dealing with Neolithic settlements near lakes, rivers and marshes.



The aim of this book is to document the activities performed during and arising from this project between 2015 and 2020. Activity and experience reports as well as scientific case studies keep record of the various actions and events that took place in the partner countries. They also witness to the scientific and structural development of wetland and underwater archaeology in Eastern Europe.

