



# Prehistoric lakeshore settlements in South-East Europe: archaeological, palaeoecological and bioarchaeological investigations within the EXPLO project.

## Mid-term Conference

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## ABSTRACTS

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## **DENDROCHRONOLOGY: METHODS AND RESULTS**

### **Dendrochronology: Turning Prehistory into History? An outline of the methodological basics of building and dating tree-ring chronologies from wood sampled from wetland sites**

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Recent path-breaking dendro-results confirm the growing possibility of eventually ascribing calendar dating's to floating tree-ring sequences taken from subfossil wooden structural remains that have been collected from EXPLO-related excavation sites situated at or near the Lakes of Kastoria, Ohrid and Prespa. This presentation offers an overview of the tried and tested techniques being utilized in the practical application of EXPLO-dendrochronology. These methods have been gained from over 40-years of experience building robust tree-ring chronologies enabling thousands of subfossil ring-width sequences to be calendar dated, thus allowing the building history of many Neolithic and Bronze Age settlements to be reconstructed. The examples presented are taken from documented pile-fields collected from submerged settlement-sites at Lake Biel/Bienne, Switzerland (ca. 4200-800 BC). These elucidating results offer an unfolding vision of potential for calendar-dating the well replicated ring-width chronologies now emerging from dendro-studies of documented pile-fields from EXPLO-related Lacustrine excavations, situated in the region of the southern Balkans and northern Greece.

### **Prehistoric dendrochronology in the southern Balkans: state-of-the-art and prospects**

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Dendrochronological research in the Eastern Mediterranean started more than half a century ago. From king's tombs, through charcoals to subfossil wood, tree-rings have provided important information on chronology, wood species or long-distance trade. In most cases however, the recovery of archaeological wood remains was more of a by-product rather than one of the research goals. Therefore, the wood samples acquired during the archaeological excavations and systematic dendrochronological sampling within the EXPLO project represent a unique collection. This presentation will give an overview of the state of the dendrochronological research on wetland prehistoric sites from the Lakes of Ohrid, Kastoria and Maliq. Besides precise site dating, tree-ring analyses enable establishing contemporaneity with other sites, diachronic study of wood selection, site occupation, forest species composition or environmental conditions.

## **The dendroarchaeology of the prehistoric waterlogged site Ploča - Mičov Grad, Lake Ohrid, North Macedonia**

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In 2018 and 2019, almost 800 piles were sampled for dendrochronological analysis during underwater excavations. The dendrochronological analysis allowed the construction of several mean curves for oak, juniper, pine, ash and hop hornbeam, which can be dated very precisely by means of wiggle matching of radiocarbon dates. The chronologies cover many centuries in the middle of the 5th millennium as well as in the 2nd millennium BC. They form a unique basis for dating other timbers and sites in the region and make an important contribution to the construction of a long reference chronology for the southern Balkans. Further analyses provide insights into the use of timber at Lake Ohrid in prehistoric times.

## **MATERIAL CULTURE**

### **Phases and architecture of Dispilio: results and challenges**

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The paper presents an overview of Dispilio basic stratigraphic and architecture attributes resulted from the study of the variable dataset of the excavations conducted from 1992-2013, as well as from the recent research tasks in the framework of EXPLO. The reconstruction of the settlement's stratigraphic sequence and the detection of secure excavation contexts (build and open spaces) are the main topics of the presentation.

Moreover, the specification of the settlement's chronological framework with the utilization of the dendrochronological analysis's preliminary results is gradually leading to specific working hypotheses regarding the diachronic development of Dispilio architecture. Their verification, together with the correlation of the pile-field with specific excavation contexts and the detection of house plans are some of the study's upcoming challenges.

### **Site stratigraphy and key stratigraphic markers at the Neolithic wetland settlement of Dispilio. Our progress to date within the project of EXPLO**

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Previous geoarchaeological research at the site of Dispilio has focused on landscape reconstruction and site formation processes (Karkanas et al. 2011, Gkouma 2017). In the context of EXPLO, the emphasis is on the internal anatomy of the settlement, in conjunction with the dendrochronological study that is conducted by the Swiss team.

In this paper, we present the results of the field microstratigraphic study that we designed and implemented parallel to the dendrochronological sampling in 2019-2021. Twelve major sections were examined in the Eastern Sector of the site, in an area >600m<sup>2</sup>, and one running, continuous section in the Western Sector. Deep section cleaning was combined with micro-grid excavation and micromorphological sampling, for analysis in large-format resin-impregnated thin sections, to enhance the level of resolution at the micro-scale. A new trench was set out and excavated next to the examined sections to observe the field contexts, and their content, at separate levels. Key layers that comprise, for example, from base up, shells, sands, traces of hearths, midden-like deposits, and cemented ashes, were identified and are briefly presented, alongside their significance for the nature of the occupation on-site through time, the life history of the settlement, and its end-life.

Gkouma, M. 2017. Paleolandscape reconstruction at the lake-dwelling site of Dispilio, Northwestern Greece: A geoarchaeological approach. PhD Thesis, Vrije Universiteit Amsterdam.

Karkanas, P., Pavlopoulos, K., Kouli, K., Ntinou, M., Tsartsidou, G., Facorellis, Y. and Tsourou, T. 2011. Palaeoenvironments and site formation processes at the Neolithic lakeside settlement of Dispilio, Kastoria, Northern Greece. *Geoarchaeology* 26(1): 83-117.

### **Reassembling continuity and change in Neolithic Dispilio pottery**

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In the ERC Explo Project, we have studied so far over 125.000 sherds and 1610 whole pots and profiles from Dispilio. The microscopic petrographic analysis of 390 samples supplements the macroscopic dataset. In this contribution, we discuss our effort to combine the quantitative with the qualitative data of this large ceramic assemblage. The detailed morpho-technological study and its combination with the stratigraphic analysis allowed us to distinguish multiple phases in the long ceramic sequence and identify breaks, continuities, and changes in the pottery production and consumption. We also try to investigate the ceramic horizontal distribution hoping to correlate our remarks with those of other materials and shed light on the spatial organization in the Dispilio installation.

## **Dispilio pottery in its regional context: affinities and potential contacts**

Marina Sofronidou<sup>1</sup>, Evangelia Voulgari<sup>2</sup>, Anastasia Dimoula<sup>2</sup>, Niki Saridaki<sup>2</sup> and Kostas Kotsakis<sup>2</sup>

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The Neolithic has been a period of communication and interactions as demonstrated by material evidence. Specifically, pottery wares appear to have been distributed over large areas, with recent research establishing the circulation of vessels and/or the dissemination of techniques and styles.

Neolithic Dispilio, located among a lake system, apparently participated in a wide contact network, with pottery wares sharing common stylistic and technical characteristics with ceramic assemblages from adjacent or remote areas. Still, the systematic and analytical study of pottery suggests that its production is largely local with only a very small number of vessels representing potential imports.

In this context, this presentation aims to explore the ceramic affinities of the Dispilio pottery with other sites and regions in order to detect their potential contacts. Therefore, a series of pottery wares, characteristic of the Dispilio chronological phases, were selected and correlated with contemporary comparable ceramic material from excavated and published sites in the broader regions of central and northern Greece and southern Albania. The results of this combined material and bibliographical research confirm that Dispilio participated in an extended ceramic network with the above areas, which scale and form varied throughout the site's lifespan.

## **The stone and bone industries from Neolithic Dispilio: preliminary typological and technological observations**

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The Middle-Late Neolithic lake-site of Dispilio, among other portable finds, brought to light rich assemblages of stone and bone artefacts that show high typological variability and an impressive state of preservation. More than 13.000 macrolithics, chipped stone, bone and antler implements, but also objects, raw materials, and related by-products, comprise exceptionally rich datasets, ideal for exploring various aspects of the stone and bone technology and use, such as production, curation, consumption, and discard practices, and also for investigating the varied meaning of these industries within the context of the neolithic community of Dispilio.

In the present contribution, we discuss our preliminary results on the study of the stone and bone industries of Neolithic Dispilio, undertaken within the ERC EXPLO Project, over the past

three years. Since the study of all three material categories -the macrolithics, the chipped stones, and the bone implements- is still in progress this presentation focuses on a selective array of technological and typological attributes, aiming to form an introductory, yet detailed picture of how these technologies and their associated practices were materialized in the lake-site of Neolithic Dispilio.

### **Archaeological Fieldwork at Lake Ohrid**

Johannes Reich<sup>1</sup>

<sup>1</sup>Institute of Archaeological Sciences, University of Bern, Bern, Switzerland

The presentation gives an overview of the fieldwork carried out since 2019 under the direction of the Institute of Archaeological Sciences of the University of Bern. This involved underwater archaeological excavations and core drillings, with which new archaeological finds as well as numerous samples for dendrochronological and archaeobotanical analysis could be obtained. The absolute dates so far, both from the construction timbers and the archaeological layers, together with the recorded stratigraphies, allow a preliminary presentation of absolutely dated ceramic find complexes from Ploča, Mičov Grad (North Macedonia) and Lin 3 (Albania).

### **Farmers of the Bronze Age – Exploring land use dynamics and agricultural practices using legacy data and land-use modelling**

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The site of Kastanas, a small tell located at the Axios river near the shore of the ancient Thracian Gulf, is used as a case study to assess land use dynamics and agricultural practice through analysis of botanical legacy data and land-use modelling. With a stratigraphy spanning from the Early Bronze to the Iron Age and hundreds of botanical samples from different contexts (first published in 1983), it offers a unique possibility to reconstruct a sequence of probable agricultural practices. This allows insights into the subsistence economy of this specific microregion in the Bronze and Iron Ages, as the tell is one of a group of similar sites located closely to each other. This case study is part of a supra-regional analysis to diachronically evaluate past land-use activities and to connect them to environmental dynamics. The results will contribute to understand the resilience and vulnerabilities of the respective agrarian societies of the Bronze Age in Northern Greece and the Southern Balkans.

## **PALAEOECOLOGY AND BIOARCHAEOLOGY**

### **Reconstructing Holocene climate dynamics in Northern Greece using biomarker proxies in lake sediments**

Antoine Thévenaz<sup>1,2</sup>, César Morales-Molino<sup>1,2</sup>, Erika Gobet<sup>1,2</sup>, Céline Martin<sup>3</sup>, Cindy De Jonge<sup>4</sup>, Oliver Rach<sup>5</sup>, Dirk Sachse<sup>5</sup> and Willy Tinner<sup>1,2</sup>

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It has been hypothesized that the 8.2 ka cooling event fostered the Neolithic transition in Northern Greece, although agriculture had likely been introduced some centuries before. In Northern Greece this event may have enhanced seasonality, with unclear consequences for agriculture. We will reconstruct past climate in that area to investigate whether this event influenced the Neolithic social and technological revolution in Northern Greece. We will use biomarker proxies, GDGT and n-alkane  $\delta D$ , for paleoclimatic reconstructions from lake sediments in Northern Greece. After a first calibration phase dedicated to pollen and vegetation, our second calibration phase is devoted to climate proxies.

### **From sea to summit: the impact of climate and land-use change on vegetation at different altitudes and along two Neolithisation routes**

Kathrin Ganz<sup>1,2</sup>, César Morales-Molino<sup>1,2</sup>, Erika Gobet<sup>1,2</sup>, Luc Hächler<sup>2,3</sup>, Dmytro Kiosak<sup>4</sup>, Nadezhda Kotova<sup>5</sup>, Jacqueline van Leeuwen<sup>1,2</sup>, Sergey Makhortykh<sup>6</sup>, Sarah Ogi<sup>1,2</sup>, Emmanuel Schaad<sup>1,2</sup>, Christoph Schwörer<sup>1,2</sup>, Paul Zander<sup>2,3</sup>, Martin Grosjean<sup>2,3</sup> and Willy Tinner<sup>1,2</sup>

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Farming, and thus the earliest production economy, was introduced more than 8000 years ago in Europe. Agricultural innovations, laying the foundations for modern societies, spread from the Near East over Greece, the Balkans and other Mediterranean routes. Besides this well-established routes into Europe, there is also evidence for an early, possibly coeval spread of domesticates into the steppes of Ukraine. We will present preliminary results of sediment analyses from Lake Volvi in Northern Greece and Kardashynskyi Swamp in southern Ukraine. Both sites are located on early Neolithisation routes and thus have the potential to disclose novel insights into earliest farming activities and their linkages to environmental conditions.

## **Insights into the impacts of climate and land use on the vegetation of the Four Lakes region in Northern Greece**

Lieveke van Vugt<sup>1,2</sup>, César Morales-Molino<sup>1,2</sup>, Erika Gobet<sup>1,2</sup>, Martin Grosjean<sup>2,3</sup>, Antonietta Knetge<sup>1</sup>, Jaqueline F.N. van Leeuwen<sup>1,2</sup>, André F. Lotter<sup>1,2</sup>, Hendrik Vogel<sup>2,4</sup>, Albert Hafner<sup>2,5</sup> and Willy Tinner<sup>1,2</sup>

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We reconstructed the Holocene vegetation, fire and land-use history at two lakes in Northern Greece. Limni Vegoritida provides a general vegetation overview, whereas Limni Zazari is a high-resolution and continuous record from the Mesolithic to the Iron Age. Both records show similar patterns, with *Quercus* and *Pinus* dominated forest during the early Holocene and a significant forest opening at ~8500–8000 cal yr BP. The overlap of this opening with the 8.2 ka BP cooling event suggests climatic impacts. However, the finding of cultural pollen and the establishment of the first Neolithic villages in the area call for further scrutiny.

## **First results on 50,000 years of vegetation history at Limni Orestías Kastorias**

Lieveke van Vugt<sup>1,2</sup>, Erika Gobet<sup>1,2</sup>, Kathrin Ganz<sup>1,2</sup>, Gian-Luca Grünenfelder<sup>1</sup>, Hendrik Vogel<sup>2,3</sup> and Willy Tinner<sup>1,2</sup>

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We present a first preliminary overview of the vegetation and fire history of Limni Orestías Kastorias. First radiocarbon dates suggest this overview spans roughly 50,000 years. The oldest section most likely corresponds to MIS3 and shows that the area around Limni Orestías was covered by an open mixed deciduous forest, consisting of taxa like oak (*Quercus*), beech (*Fagus*) and hornbeam (*Carpinus*). The Holocene section shows great potential, with vegetation dynamics comparable to Limni Zazari. The presence of cultural indicator taxa during the early Holocene and small forest openings could correspond to activities at Dispilio.

## **The zooarchaeology of Dispilio, Lake Orestias, Kastorias**

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The management of domestic livestock and exploitation of wild fauna are fundamental aspects of land use, as these practices are closely related to the scale of anthropogenic impact on the



environment. For the Greek Neolithic, a fairly uniform pattern of small-scale plant and animal husbandry practices has been proposed (and recently supported by plant and faunal isotopic evidence) for the lowlands and coastal regions. The excavation of the Neolithic site at Dispilio on the shore of Lake Orestias invites the question of whether lake-side settlements in the raised basins of the northwest of the country conform to this apparent pattern or exhibit a distinctive adaptation (with potentially interesting, wider socio-economic implications). In this research context, we discuss preliminary results from the new macroscopic analysis of mammalian faunal remains and freshwater molluscs from Dispilio, undertaken since autumn 2021 in the context of the EXPLO project, and from ethnographic interviews targeting traditional agropastoral and fishing practices undertaken in June 2022.

### **The archaeobotany of Dispilio, Lake Orestias, Kastorias**

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Dispilio on the southern shore of Lake Orestias, Kastorias is one of the earliest lakeshore settlements in southern Europe (established in the mid-6th millennium BC), and offers important evidence for the adaptation of agricultural practices and plant use strategies in western Macedonia. Ongoing archaeobotanical research at Dispilio combines different lines of evidence: uncharred and charred waterlogged plant assemblages recovered by wash-over from the earlier part of the occupation sequence, and a predominantly charred assemblage recovered by flotation. In this talk we present preliminary results derived from sampling and excavation in the south-west corner of the Eastern Sector as part of the EXPLO project, with a focus on the results of wash-over to recover uncharred and charred remains, and in adjacent Trench 482. These results pertain to 'early' Dispilio (I/II). In addition to discussing emerging results on plant-related activities and diet, we consider macrobotanical implications for site formation processes and the microenvironment during the earlier part of the occupation sequence. We also reflect on the results of wood charcoal analysis from flotation in the older, pre-EXPLO excavations.

### **Vegetation dynamics and land-use change at the Neolithic lakeshore settlement site of Ploča Mičov Grad, Lake Ohrid**

Erika Gobet<sup>1,2</sup>, Sarah Brechbühl<sup>1</sup>, Lieveke van Vugt<sup>1,2</sup>, César Morales-Molino<sup>1,2</sup>, Joseph Volery<sup>1</sup>, André F. Lotter<sup>1,2</sup>, Ariane Ballmer<sup>2,3</sup>, Sandra O. Brugger<sup>1,2</sup>, Albert Hafner<sup>2,3</sup> and Willy Tinner<sup>1,2</sup>

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We present results from Lake Ohrid at Ploča Mičov Grad in North Macedonia with a particular focus on the vegetation dynamics during the Mesolithic-Neolithic transitions and Neolithic settlement phases. Quasinatural forests persisted until 7,500 cal B.P. (5,550 B.C.), when deforestation started as a result of Neolithic land use, which precedes the clearly

archaeologically evidenced occupation (6,450 cal B.P., 4,500 B.C.) at Ploča Mičov Grad by almost 1000 years. Our data suggest two phases of human land use between 7,500 and 6,300 cal B.P. (5,550–4,350 B.C.), when high values of Cerealia type pollen and other cultural indicators denote intense arable and pastoral farming activities.

### **The archaeobotany of Progradec, Lin 3, Lake Ohrid**

Rachel Ballantyne<sup>1</sup>, Michael Charles<sup>1</sup> and Amy Bogaard<sup>1</sup>

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Submerged organic deposits at the pile-dwelling settlement of Lin 3, Lake Ohrid, are linked to a Middle Neolithic settlement (late 6th to early 5th millennium BCE, based upon initial radiocarbon dates). These preliminary archaeobotanical results come from a grid of samples across a thick layer of likely settlement detritus including refuse and faecal matter, excavated in an underwater sondage. A broad-spectrum plant economy is revealed, with many crops and gathered fruits/nuts. The plant remains have excellent potential for reconstructing diets, on-site activities, and subsistence practices in the wider landscape. Temporal change is being addressed by the equivalent organic deposits in a series of vertical cores along the lakeshore.

### **The archaeobotany of Ploča Mičov Grad, Lake Ohrid**

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We present results from the analysis of waterlogged plant remains from the Late Neolithic (mid-5th millennium BCE) pile-dwelling site of Ploča Mičov Grad, Lake Ohrid. An organic cultural layer up to 1.7 m thick, rich in botanical remains, was sampled in sediment cores taken along transects across the pile field. Bulk sediment samples were also taken during excavation of an underwater sondage. Inhabitants of the site made use of a wide range of plant foods including cereals and pulses, oil-seed crops and gathered fruits and nuts. Variability between samples from the cores is considered to explore temporal change and intra-site spatial variation.