

1. Research activity (max 1.000 words)

Landscape versus climate changes at lake Volvi (Macedonia, Greece) during the Holocene

My research work aims to highlight human responses and resilience to climate changes detected through pollen analyses. I will contribute to reconstruct the interactions between environment and human societies during Holocene in the Mediterranean basin. More specifically, it aims to reconstruct the vegetation of Lake Volvi in central Macedonia (Greece) during the last millennia investigating human-environment relationships in order to understand the response of past societies to climatic changes. The area shows a continuous human occupation in the last millennia and was a key place for many succeeding civilizations. This research intends to investigate this important environmental and cultural area to provide a paleoenvironmental archive describing the climate and vegetation dynamics of the region for the last millennia.

Lake Volvi is the second largest lake of Greece and is protected by the Ramsar convention for its importance as wetland habitat. It formed, with the nearby Lake Koroneia, a single huge lake in the past inside the alluvial plain of Mygdonia. The geological bedrock of the area is mainly constituted by sedimentary (limestone and clay), igneous (granite), and metamorphic (gneiss and marl) rocks (Nimfopoulos et al. 2002 Proc 6th Pan-Hellenic Geographical Conf Hellenic Geographical Society Vol.II 436-444). The lake has been classified as meso-to-eutrophic and its status is mainly influenced by agricultural runoff and farming activities. It is fed by rainfall, surface, ground water and thermal springs. The main outlet, Richeios, flows through the Macedonian Tempi valley, characterized by dense riparian vegetation. The area, inhabited since the Paleolithic, shows a continuous human occupation in the last millennia and is in a key region for biodiversity. The lake is also in a very strategic position for trading routes since the Bronze Age and particularly in Roman time when the road "Via Egnatia", ran the northern shore of the lake. For such reasons, Lake Volvi is a perfect case study for the analysis of the environmental and climatic changes that occurred in the Balkans and to investigate the development of past populations through time. Balkan Peninsula has been recognized as a preeminent area in the paleoenvironmental reconstruction due to its faunal and floristic richness (Willis 1994 Quat Sci Rev 13:769-788, Krystufek 2004 in: Griffiths H.I., Kryštufek B., Reed J.M. Balkan Biodiversity pp.79-108, Sadori et al. 2016 Biogeosciences 13:1423-1437) and is considered one of the main hot-spots of the Mediterranean basin. Despite its historical importance, investigations of Holocene records are quite rare in Macedonia and limited to Lake Dojran (Masi et al. 2018 Clim Past 14:351-367), Tristinika marsh (Panajiotidis et al. 2016 Journ Archaeol Sci Rep 7:138-145) and to a marine core from Mount Athos Basin (Kotthoff et al. 2008 Holocene 18:1019-1032).

My research activity has focused on bibliographic research on the environmental history of the area of Volvi lake and on the parameters of identification of specific pollen grains. During the first and second years I carried out the pollen analysis on sediments extracted from the 705,5 cm long sequence (V8-11) of continuous cores recovered at Lake Volvi during the sampling campaign of June 2019.

I selected three terrestrial plant macro-remains and one bulk sediment from the core V8-11 for the 14C analysis. Samples have been dated at the CIRCE (Center for Isotopic Research on the Cultural and Environmental heritage) laboratory at the University of Campania “Luigi Vanvitelli” with an Accelerated Mass Spectrometer. According to the chronology, a sample resolution of 12-16 cm has been chosen with a total of 47 samples selected with an average resolution of 54 years.

I chemically treated the samples to extract pollen from the sediment and continue with the identification. I identified pollen, non-pollen palynomorphs and microcharcoals under the optical microscope at 400X and 630X magnification. I counted an average of 482 pollen grain for each sample and identified 54 different taxa on average

PRELIMINARY RESULTS: Pollen results reveal a landscape characterized by deciduous, semideciduous and evergreen oaks, together with *Ostrya/ Carpinus orientalis* (hornbeam) and *Fagus* (beech). The first signs of agricultural activities are testified by the contemporary presence of Cerealia followed by *Juglans* (walnut) and *Castanea* (chestnut). The expansion of weed and ruderal taxa, such as *Plantago lanceolata* (ribwort plantain), *Rumex* (dock), *Galium* (bedstraw) and Cichorieae underline the first signs of animal husbandry in the lake area, confirmed by the presence of *Sporormiella*, a coprophilous fungus. Starting from 1200 yr. BP a decrease of the tree plants, especially evergreen oaks and hornbeam and a slight increase in deciduous oaks occurred, with an evident opening of the landscape indicated by xeric taxa such as *Artemisia* (mugwort) and Amaranthaceae that characterize steppe and arid environments. A rather high percentage of Poaceae (grasses) is probably due to the presence of the marsh reed that grow along the shore of the lake and may indicate fluctuations in the water level. The cultivation of cereals and edible plants seems to be very developed during the Roman occupation of the region (2100- 1300 yr BP); human activity is attested throughout the analysed period, although some historical and climatic events seem to have influenced the production system. The increase in plants of dry environments and the simultaneous decrease in tree plants suggests an increase in aridity in the last millennium that characterizes the entire Mediterranean basin. The human impact is also highlighted by the increase in *Pediastrum*, a green alga that indicates both a fluctuation in the level of the lake and a greater state of eutrophication of the water and is probably linked to soil fertilization due to the presence of livestock. Both cultivation and pastoral activities seem to be practiced with the introduction of the cultivation of *Olea* (olive tree) and chestnut in the last centuries.

2. Research products

1. Masci L., Sadori L., New insight into the Roman culture: Archaeopalynological investigation at the Roman site of via de Lollis (Abstract)
2. Masci L., Masi A., Sadori L., Palynological investigation to reconstruct environmental changes and human impact at Lake Volvi (Greece) (Abstract)
3. Masci L., Masi A., 2021, Late – Holocene environmental changes and human impact at Lake Volvi (Greece), in: Florenzano A. & Clò E. (Eds.), Mediterranean Palynology Societies Symposium 2021 Abstracts Book, pp. 77-78, Modena, Italy

4. Masi A., Masci L., Vignola C., Izdebski A., 2021, The Lake Dojran pollen sequence: a bridge between scientific and humanistic approach to the environmental history in the Balkans, in: Florenzano A. & Clò E. (Eds.), Mediterranean Palynology Societies Symposium 2021 Abstracts Book, pp. 91-92, Modena, Italy
5. Masci L., Masi A., Sadori L., 2021, Paleoenvironmental changes and human impact at Lake Volvi (Greece) through pollen analysis during the last three millennia, Young Research in Archaeometry 4th, 24-27 August 2021, pp. 13-14 Evora, Portugal
6. Moricca C., Nigro L., Masci L., Pasta S., Cappella F., Spagnoli F., Sadori L., 2021, Cultural landscape and plant use at the Phoenician site of Motya (Western Sicily, Italy) inferred from a disposal pit, Vegetation History and Archaeobotany 30:6, pp. 815-829