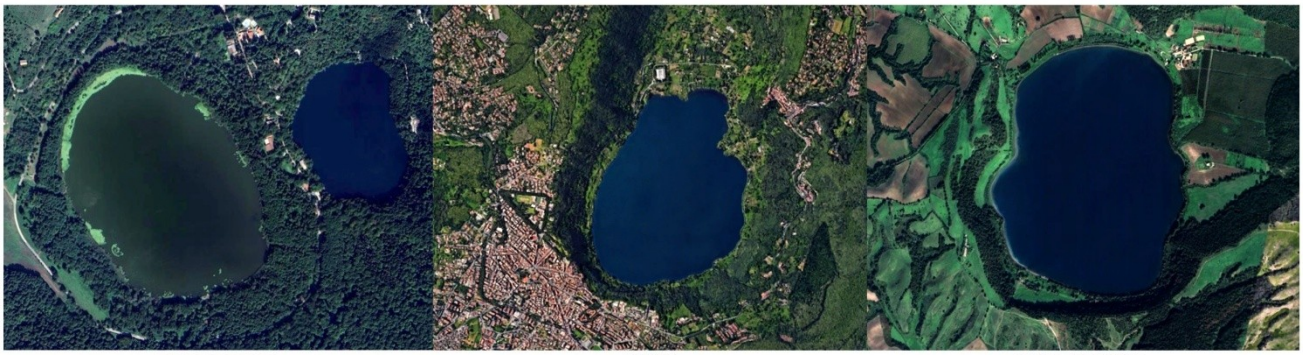
Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani
UNIVERSITA' DEGLI STUDI DELLA BASILICATA

MUR PRIN 2022 – "VOLARE" Research Program

USING ANCIENT ENVIRONMENTAL DNA TO ASSESS VOLCANIC LAKES REFERENCE CONDITION, BIODIVERSITY AND LONG TERM ECOLOGICAL RESPONSE TO CLIMATE VARIABILITY AND ANTHROPIC PRESSURE

Following the European Directive 2000/60/EC (Water Framework Directive; WFD), the ecological quality of lakes is routinely evaluated using numerical indices based on sampling and analysis of four biological quality elements (BQEs): phytoplankton, macrophytes/phytobenthos, macrozoobenthos, fish fauna. WFD-compliant methods use biomass, composition, and community parameters of selected BQE, which require well-trained personnel for taxonomic identification and specific sampling strategy.
Molecular analysis of environmental DNA (eDNA: the entire DNA fraction isolated from an environmental matrix) isolated from sediments, is an alternative tool to assess the ecological quality of lakes, reducing taxonomic work and sampling efforts, but so far it has been used to target a limited number of taxa.
Traditional paleolimnological methods can be used to study the effect of human pressures and climatic variability on time scales ranging from a few decades to the whole Holocene. These studies are limited to organisms that leave durable body parts (diatoms, cladocera, chironomids) or resistant biochemical compounds (algal and cyanobacterial pigments). However, they can be combined with eDNA analyses to assess local presence of rare taxa or taxa no longer present.
As such, eDNA studies of lake sediments, in combination with traditional paleolimnological methods and ecological surveys, have the potential to revise and complement our understanding of past ecosystem conditions before pollution started and therefore to efficiently reconstruct the reference conditions of volcanic lakes before the onset of human impact, representing a major technological improvement in the methodologies for the evaluation of the ecological quality of water bodies.
The overall objective of this project is to reconstruct for the first time lakes reference conditions before human impact using eDNA extracted from the sediments of volcanic lakes in Central and Southern Italy (Nemi, Martignano and Grande of Monticchio), in combination with traditional paleolimnological methods, floristic and vegetational data resulting from bibliographic and field surveys.



MONTICCHIO NEMI MARTIGNANO

This project will allow major technological advancement in the use of molecular techniques to investigate eDNA from lake sediments and produce for the first time high taxonomic resolution DNA data sets from volcanic lake sediments in Italy. A better match of eDNA information with traditional paleolimnological data and ecological surveys allows a better assessment of the ecological quality of these lakes; we will therefore provide relevant steps in the development of DNA-based assessment

method for detecting stressor impacts on lake biota and pave the way for the construction of DNA-based indices for biological monitoring and assessment.

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