

Fungi inhabiting the microbialites of the alkaline lake in Pantelleria island (Italy): biodiversity across a submerged-emerged transect

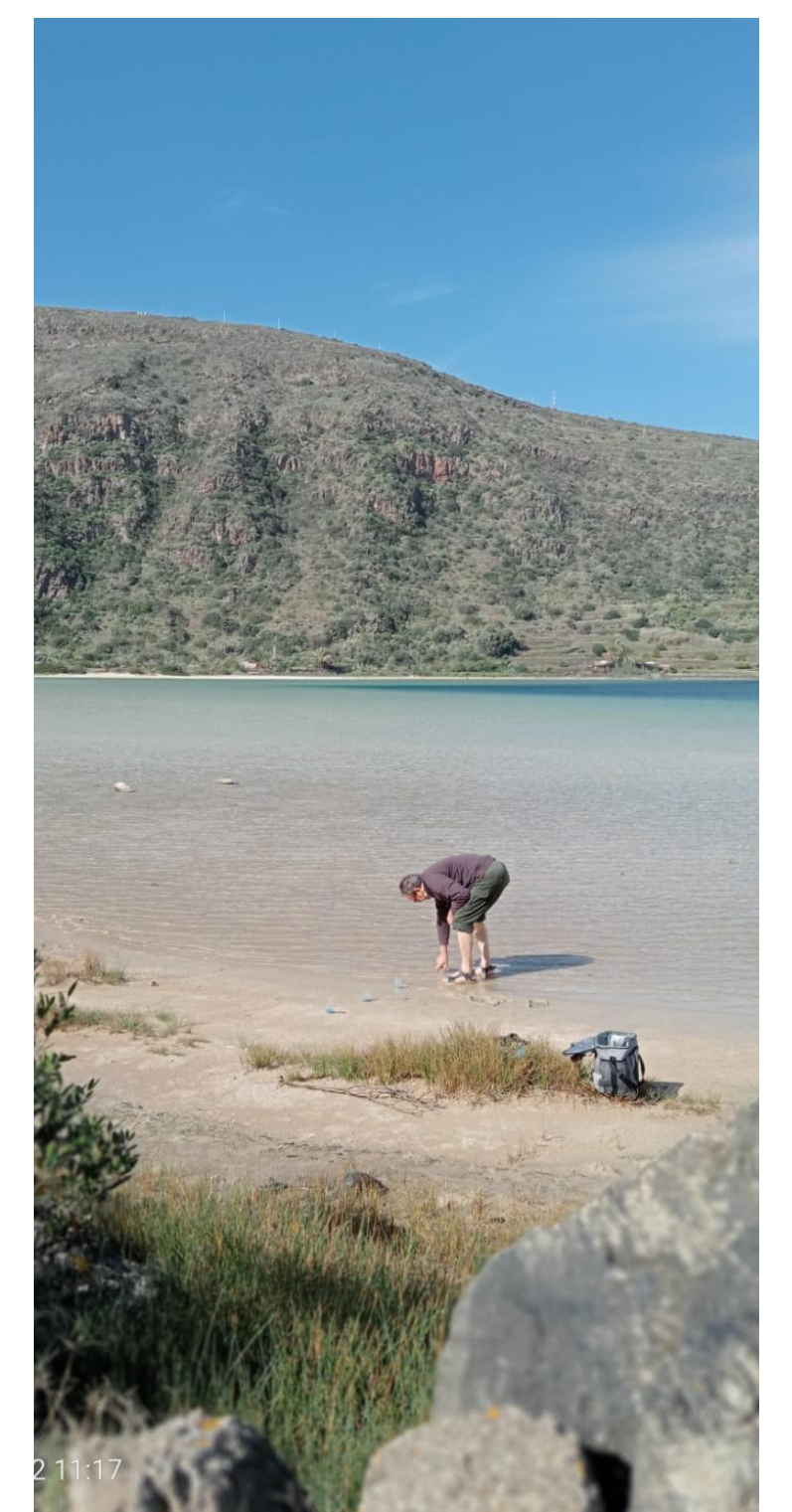
Agnese Piacentini¹, Lorenzo Pin², Stefano Fazi^{3*}, Francesco Latino Chiocci⁴, Mauro Iberite⁵,
Ilaria Mazzini⁶, Cristina Mazzoni¹, Flavia Pinzari^{2*}

1) Sapienza Università di Roma, Dipartimento di Biologia e Biotecnologie Charles Darwin, Rome, Italy; 2) Cnr-Istituto per i Sistemi Biologici, Montelibretti (Rome), Italy; 3) Cnr-Istituto di Ricerca Sulle Acque, Montelibretti (Rome), Italy; 4) Sapienza Università di Roma, Dipartimento di Scienze della Terra, Rome, Italy; 5) Sapienza Università di Roma, Dipartimento di Biologia Ambientale, Rome, Italy; 6) Cnr-Istituto di Geologia Ambientale e Geoingegneria, Montelibretti (Rome), Italy;
*National Biodiversity Future Center—NBFC (flavia.pinzari@cnr.it)

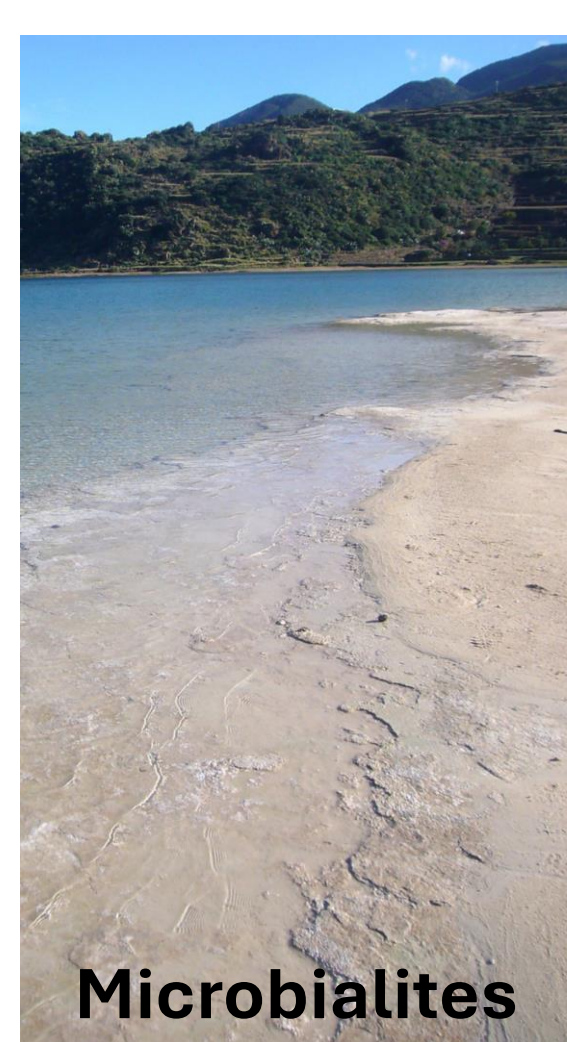
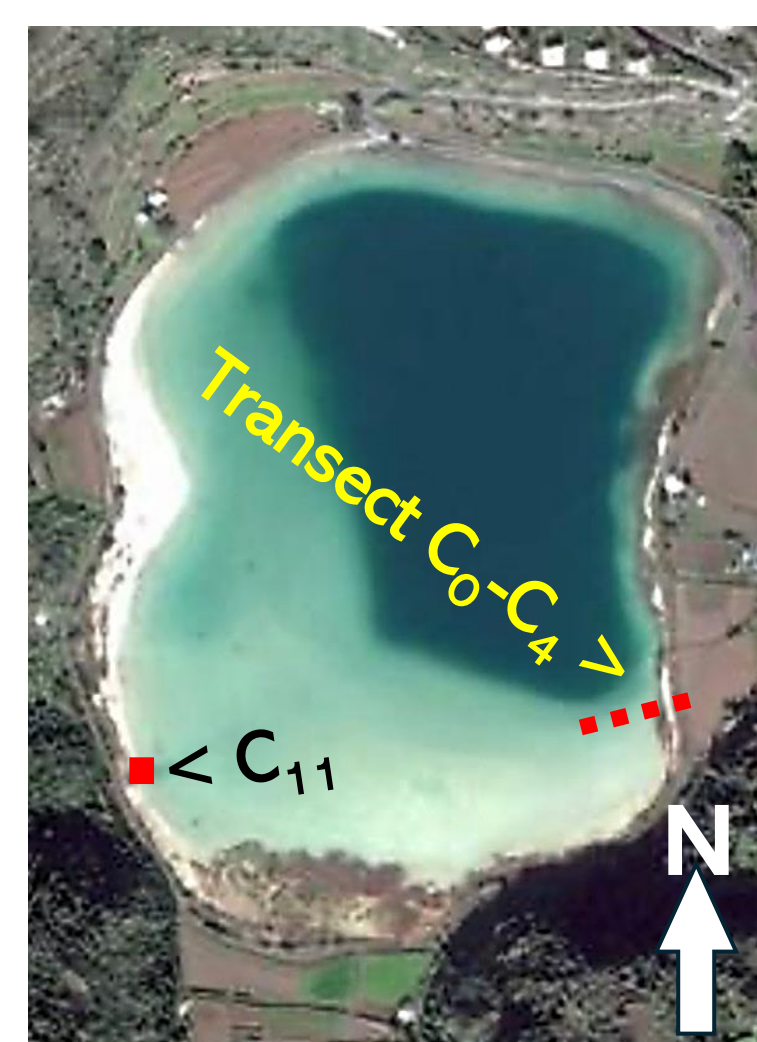
The Bagno dell'Acqua alkaline lake in Pantelleria island, Italy, is **characterized by CO₂ emissions, alkaline waters with a pH of around 9**, and strongly oxidizing conditions. The lake is home to actively growing microbialites rich in calcium carbonates and silica precipitates. The lake's sediments are dominated by Mg-smectite clays associated with K-feldspars and Ca-carbonates, and the presence of volcanic glass and minor phases like pyroxene and hematite has been observed.

The island is located in the Strait of Sicily, Mediterranean Sea, between Sicily and Tunisia. The **National Park of Pantelleria** was established on July 28, 2016, and is the first one in Sicily. It has the UNESCO World Heritage status and is part of the Natura2000 network, recognised as a **Special Protected Area and a Special Area of Conservation** under the European Habitats Directive.

The microbialites from the lake were studied by Ingrassia et al (2023) using X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS). A close association has been demonstrated between **Mg-smectite/carbonate minerals**, which are the primary components of the stratified deposits at the lake margins, and the presence of **exopolymer-producing microorganisms (EPS)**, capable of precipitating carbonates and clay minerals (Mazzoni et al., 2024).



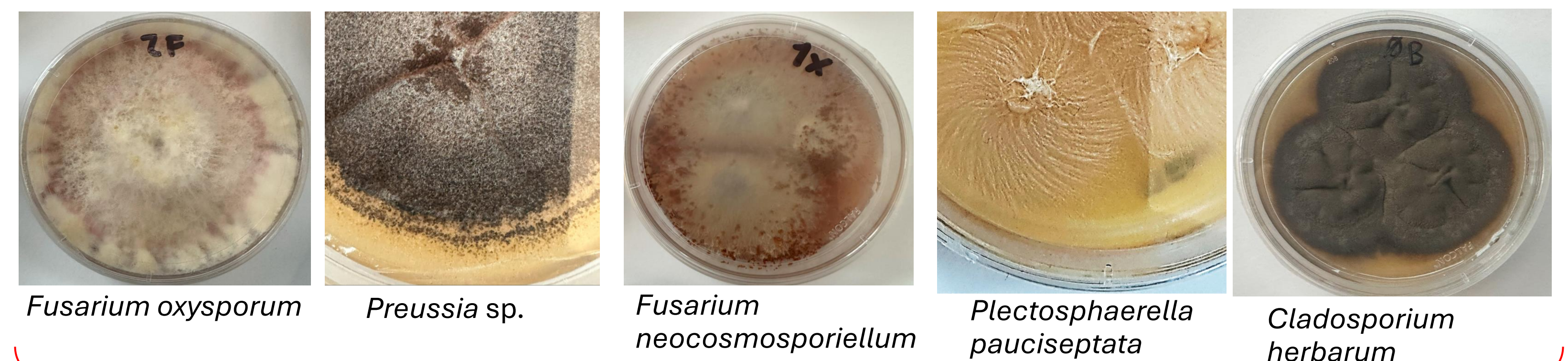
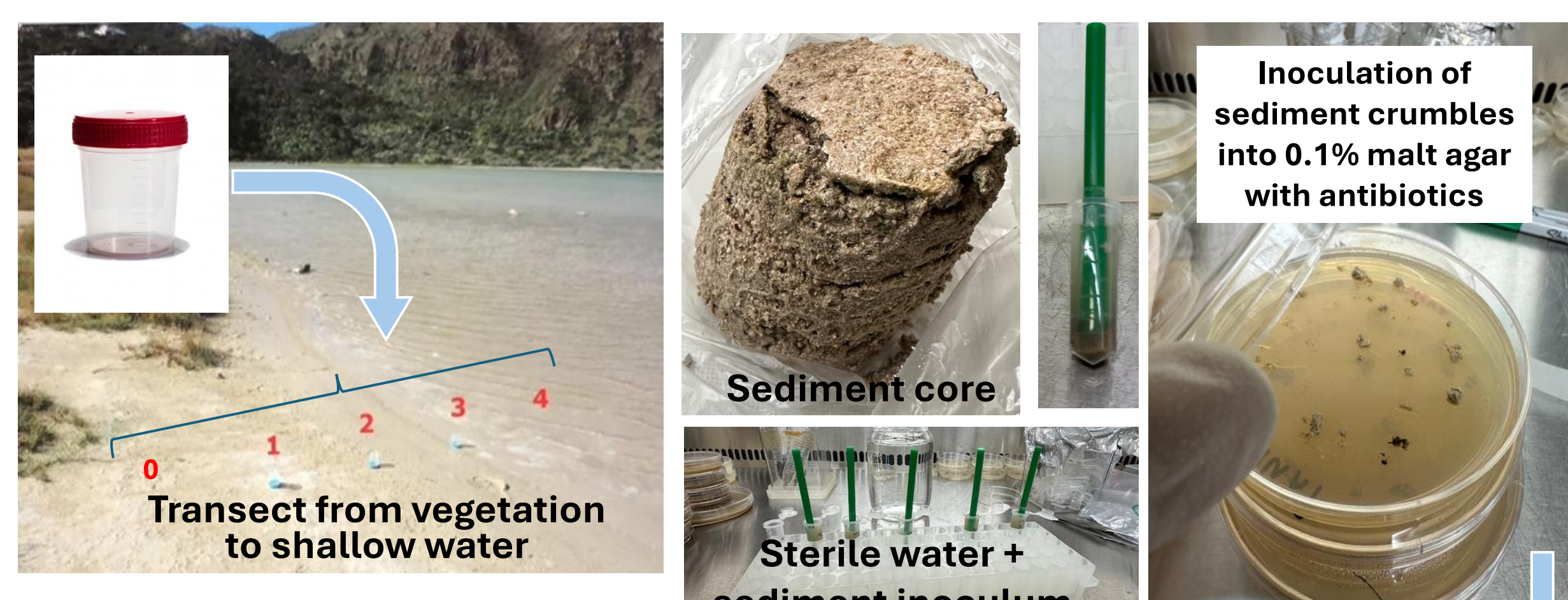
These singular conditions could impact the **fungal diversity** in the sediments and microbialites, offering insights into the adaptation of fungi to high pH values. A **transect** from the lake's margins to the line of vegetation was used as a sampling scheme to evaluate the impact of **alkaline water** on the fungal communities in the first 5 cm of **sediment** depth (C0 only emerged, C1-2 water-front, C3-4 submerged), a further submerged sample (C11) was sampled on the lakeshore opposite the transect.



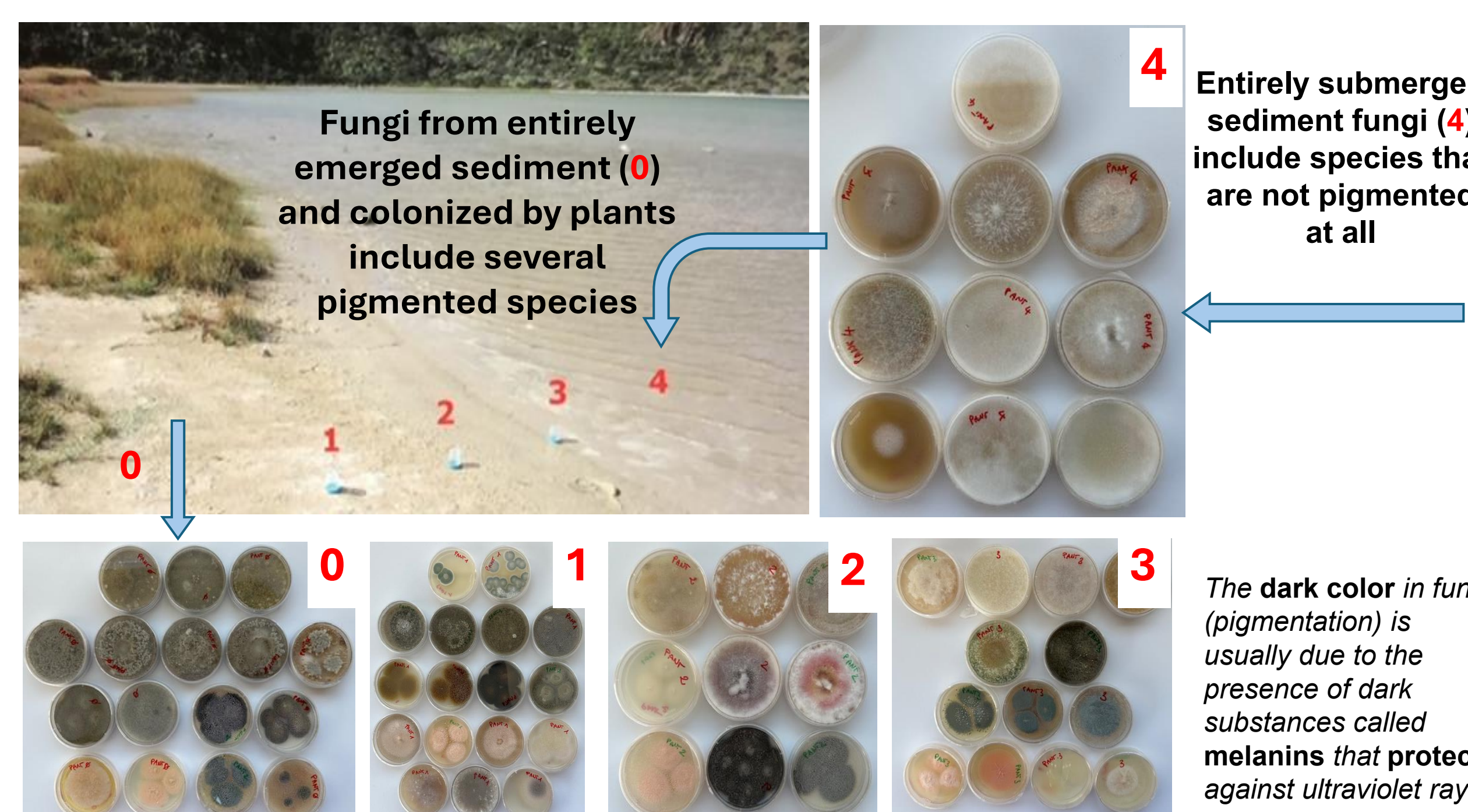
High-throughput sequencing of the **fungal internal transcribed spacer 2 (ITS2) molecular marker region**, performed with the Illumina NovaSeq PE250, was applied to compare the alpha and beta biodiversity of the microbialites' samples.

Fungi were also isolated using **classic culturing** methods, with the lake sediment serving as the culture medium. Identification was based on Sanger sequencing of molecular markers (ITS1-4) and morphology.

The strains isolated from the submerged sediments are different from those obtained from the microbialites that were exposed to air at the time of sampling, suggesting an overlap of two distinct fungal communities: those that colonise the surface material (airborne species) and those that seem to inhabit the submerged plant material. The latter appeared poorly pigmented compared to the species isolated from the vegetation line.



Some of the most recurring fungal isolates identified with morphology and ITS1-4 barcoding



Gradient with respect to emersion from water

- References
- Ingrassia M. et al. (2024) *Minerals*. 14(10):1013
- Mazzoni C. et al. (2024) *Front Microbiol.* May 22;15:1391968.

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