Signature of sapropel S1 and exceptional preservation of fine laminations to decipher climatic variations and land-ocean interactions in the Ionian Sea

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Résumé

The sediment core FX2-CS14, located in the western Ionian Sea, offers an unprecedented opportunity to explore Mediterranean environmental changes during the Sapropel S1 period (10–6.3 ka BP). Unlike typical S1 records, which are only a few centimeters thick, this core reveals an exceptional 15-meter-thick unit, corresponding to the S1-equivalent interval. This unit is preserved within a fault-graben, acting as a sediment trap, at 2050 m water depth.
High-resolution sedimentological, geochemical, and geochronological analyses reveal that the S1-equivalent unit is finely laminated. It is characterized by the absence of bioturbation and benthic fauna, indicative of persistent seafloor anoxia. Within this laminated interval, numerous micro-turbidites and sub-facies, at the scale of mm in thickness, are preserved. The significant accumulation of detrital material, with over 600 gravity-driven deposits, dilutes the sapropelic signal, and organic carbon content remains low (0.2–1.2%). Organic geochemical analyses indicate a mixed marine-terrestrial origin, with depleted $\delta^{13}C$ values indicating continental inputs, and traces of kerogen-derived compounds suggesting enhanced continental erosion and subsequent transfer to the marine environment. The finely laminated structure, combined with the abundance of turbidites that dilute the sapropelic signature, suggests high-frequency, climate-driven events, such as torrential rainfall triggering hyperpycnal flows. This hypothesis is consistent with known regional climatic conditions around Sicily, where increased precipitation occurred during this period.
This 15-meter-thick archive reveals the record of increased precipitation left a high-resolution sedimentary signature in the upper Calabrian wedge. It contrasts with the eastern Mediterranean, where African monsoon dynamics shaped the sapropel deposition. Yet, despite these distinct climatic influences and sedimentary processes, common patterns emerge in the sedimentary and geochemical features of both regions. Beyond local controls, environmental changes seem to be synchronized across the entire Mediterranean during the Sapropel S1 period. The remarkable thickness and preservation of this core thus provide a rare opportunity to shed new light on the complexity and spatial heterogeneity of Sapropel S1 at pluriannual resolution.

Mots-Clés: Sapropel S1, Climate, Turbidites, Organic geochemistry, Ionian Sea

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