Scenes from the Sapropels: Revealing Orbital Forcings and Climate in the Mediterranean over the last 500 kyr with Image and XRF Analysise and XRF

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The Mediterranean Sea serves as a critical reservoir for uniquely capturing the planet's orbital climate signal due to its geographic location and near-closed basin properties, making it more sensitive to localized climate variations than the open ocean. This study employs time-series analysis of the classic and well-characterized Mediterranean sediment core RC9-181PC (1, 2) as well as ODP site 964 (3, 4) and NESSC core 64PE406E1 (5) to quantitatively explore the relationship between sapropels and the orbital climate cycles that are proposed to have formed them. The time scale by which these cores span is the near present to approximately 500 kyr. This research follows a 3 pronged approach to understanding sapropels as a marker for orbital climate cycles: 1) identify sapropels from grayscale data and composite image of RC9-181PC, 2) determine the chemical signal at those sapropel layers, and 3) interpret how well orbital forcings are recorded from spectral analysis of both grayscale data and chemical proxies. Data include grayscale and reflectance profiles in RC9-181PC and ODP site 964, new XRF chemistry on RC9-181PC and published XRF chemistry on NESSC 64PE406E1, using published age models for each core. Preliminary time-series analysis reveals the expected strong climatic precession- and eccentricity-pacing as well as at least some pacing by obliquity, as has been previously modeled [e.g., (6)]. New XRF chemistry on RC9-181PC also reveals a distinct chemical signature among sapropels also revealing a clear signal of orbital pacing. To our knowledge, this study will provide the first quantitative frequency analysis of the Milankovitch pacing of this classic and important paleoclimatological archive and challenges our understanding of the climate system to local orbital forcing.

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