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Annual evaporite deposition at the acme of the Messinian salinity crisis: evidence for solar-lunar climate forcing

Vinicio Manzi (1), Rocco Gennari (1), Stefano Lugli (2), Marco Roveri (1), Nicola Scafetta (3), and B. Charlotte Schreiber (4)

(1) Parma University, Dipartimento di Fisica e Scienze della Terra, Parma, Italy (vinicio.manzi@unipr.it, +39 521 905305), (2) Modena and Reggio Emilia University, Dipartimento di Scienze Chimiche e Geologiche, Modena, Italy, (3) Active Cavity Radiometer Irradiance Monitor (ACRIM) Lab and Duke University, Durham, NC 27708, USA, (4) University of Washington, Department of Earth and Space Sciences, Seattle, WA 98195, USA

We studied two evaporite successions (one halite and the other gypsum) consisting of annual varves in order to reconstruct the paleoclimatic and paleoenvironmental conditions existing during the acme of the Messinian salinity crisis (MSC; ≈5.5 Ma), when huge volumes of evaporites accumulated on the floor of the Mediterranean basin.
The spectral analyses of these varved evaporitic successions reveal significant peaks in periodicity at around 3-5, 9, 11-13, 20-27 and 50-100 yr.
The deposition of varved sedimentary deposits is usually controlled by climate conditions. A comparison with modern precipitation data in the western Mediterranean shows that during the acme of the MSC the climate was not in a permanent evaporitic stage, but in a dynamic state where evaporite deposition was controlled by quasi-periodic climate oscillations similar to modern analogs including Quasi-Biennial Oscillation, El Niño Southern Oscillation, and decadal to secular lunar- and solar-induced cycles.
Particularly, we found a significant quasi-decadal oscillation with a prominent 9-year peak that is also common in modern temperature records and is present in both the contemporary Atlantic Multidecadal Oscillation (AMO) index and Pacific Decadal Oscillation (PDO) index. These cyclical patterns are common to both ancient and modern climate records because they can be associated with solar and solar-lunar tidal cycles.
During the Messinian, the Mediterranean basin as well as the global ocean, were characterized by somewhat different continent distribution, ocean size, geography, hydrological connections, and ice-sheet volume with respect to the modern configuration.
The recognition of modern-style climate oscillations during the Messinian, however, suggests that, although local geographic factors acted as pre-conditioning factors turning the Mediterranean Sea into a giant brine pool, external climate forcing, regulated by solar-lunar cycles and largely independent of those local geographic factors, modulated the deposition of the evaporites.