Mapping the abyssal Mediterranean's Messinian Evaporite Giant: Salt volumetrics from all deep basins

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The thick saline series deposited in the deep Mediterranean during the latest Messinian (between 5.97 and 5.3 Ma) is among the youngest of salt giants in Earth history. During this Messinian Salinity Crisis (MSC) voluminous evaporites precipitated in the abyssal basins when the main inflow of saline water from the Atlantic through the Gibraltar Straits was severely restricted. Considerable volumes of sediments were also interbedded with evaporites, eroded from the shelves or mass-transported downslope during the oceanic drawdowns and thus this event was also a major erosional crisis. Geochronologic advances and better understanding of the geodynamic history of various basins have led to insights about the timing of the salinity crisis and the tectonics and role of Gibraltar passage and other western narrows from the Atlantic to the Mediterranean. However, much of the new understanding comes from the Mediterranean's shallow peripheral basins whereas knowledge of the nature of evaporites from the deep basins remains sketchy due to lack of deep drilling through the salt, and many controversies remain unresolved. An invaluable collaboration between academia and industry permitted access to most of the available seismic and core data from the Mediterranean allowing the total amount of salt (thicknesses and volumes) and associated interbedded sediment from all abyssal basins to be calculated. These new estimates are based on seismic facies analysis, which reveal that there is between 821 ± 50 and 927 ± 50 thousand cubic km of late Messinian salt, and a total of up to 1.2 ± 0.1 million cubic km of salt plus associated sediment tied up in the deep Mediterranean basins. First isochron maps of the MSC deposits (evaporites + sediment) in all the basins have been produced. These volumetrics suggests that after the initial restriction, the Mediterranean had to be either continuously supplied with brine, or partially to completely refilled several times to produce the total salt edifice. The amount of Atlantic saline water needed to amass this evaporite giant is between 7 and 8 times the modern-day Mediterranean's equivalent of saline water. The volumetric data have implications for the MSC sequestration and desiccation scenarios and should lead to more meaningful geodynamic models and provide constraints for many of the controversies that still surround this major event in geological history. Maps of salt distribution in various basins also have important implications for sub-salt exploration geoscience.

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