



Messinian Salinity Crisis – DREAM (Deep-sea Record of Mediterranean Messinian events) drilling projects

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About 6 My ago the Mediterranean Sea was transformed into a giant saline basin. This event, commonly referred to as the Messinian salinity crisis (MSC), changed the chemistry of the global ocean and had a permanent impact on both the terrestrial and marine ecosystems of a huge area surrounding the Mediterranean area. The first fascinating MSC scenario was proposed following DSDP Leg XIII in 1970 and envisaged an almost desiccated deep Mediterranean basin with a dramatic ~1,500 m drop of sea level, the incision of deep canyons by rivers on the continental margins, and a final catastrophic flooding event when the connections between the Mediterranean Sea and the Atlantic were re-established ~5.33 My ago.

In spite of 40 years of multi-disciplinary research conducted on the MSC, modalities, timing, causes, chronology and consequence at local and planetary scale are still not yet fully understood, and the MSC event remains one of the longest-living controversies in Earth Science.

Key factor for the controversy is the lack of a complete record of the MSC preserved in the deepest Mediterranean basins. Anywhere else, the MSC mostly generated a sedimentary/time lag corresponding to a widespread erosion surface. Correlations with the offshore depositional units are thus complex, preventing the construction of a coherent scenario linking the outcropping MSC evaporites, the erosion on the margins, and the deposition of clastics and evaporites in the abyssal plains.

Recent activity by various research groups in order to identify locations for multiple-site drilling (including riser-drilling) in the Mediterranean Sea that would contribute to solve the open questions still existing about the MSC has culminated in two DREAM Magellan+ Workshops held in 2013 and 2014. A strategy and work plan have been established in order to submit an IODP Multi-phase Drilling Project (“Uncovering A Salt Giant”) including several site-specific drilling proposals addressing different scientific objectives related to the MSC. Among these proposals, one will be fully dedicated to the MSC event.

Improved quality of seismic data has allowed important advances in the recognition and understanding of MSC seismic markers (surfaces and depositional units) and lithological and stratigraphical calibrations are now critical. Therefore, the drilling strategy must include multiple sites covering representative locations of both Western and Eastern Mediterranean basins. A series of critical drilling targets were thus identified as follows:

- A first set of drilling targets, dedicated to shallow water (< 2500 m water depth) MSC markers, includes the Messinian clastic wedges, the erosion surfaces and the MSC deposits (including thin salt bodies) trapped in small topographic lows observed at various water depths between the shoreline and the abyssal plain. Up to 10 sites, presented in this work, could be drilled with the riserless R/V Joides Resolution, provided the safety conditions are met;
- Another critical drilling target is the full recovering of undeformed MSC sequence (including the Tortonian-Messinian and the Messinian-Zanclean boundaries) in the deep water (>2500m) of both the eastern and western Mediterranean basins. This will be possible thanks to R/V Chikyu riser drilling vessel and will be the scope of a second MSC IODP proposal.

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