IODP Proposal Cover Sheet

DREAM: Mediterranean Salt Giant

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Title	Uncovering a Salt Giant: Umbrella proposal of the multi-phase drilling project (MDP)		
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Abstract

About 6 million years ago the Mediterranean Sea became an enormous saline basin where more than one million cubic kilometres of salt accumulated, locally exceeding a thickness of 3 km in the deep basins. This extreme, but geologically brief event (640 ka; the so-called 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. Drilling the MSC salt giant represents a unique opportunity to understand the sedimentary history, stratigraphy, biosphere and fluid dynamics of a salt giant in a state close to its original depositional configuration, and to understand the responsiveness of a land-locked oceanic basin to planetary dynamics.

The MDP proposal "Uncovering a Salt Giant" originates from a series of workshops and international initiatives carried out since 2006, when riser-drilling technology was introduced in IODP in 2004.

Four site-specific drilling proposals are conceived under this umbrella:

- DREAM: Deep-Sea Records of the MSC;
- Deformation and fluid flow in the MSC salt giant;
- Probing the Salt Giant for its Deep Biosphere secrets;
- Probing deep Earth and surface connections;

addressing four overarching questions:

- What are the causes, timing and emplacement mechanisms of the MSC salt giant?
- What are the factors responsible for early salt deformation and fluid flow across and out of the halite layer?
- Do salt giants promote the development of a phylogenetically diverse and exceptionally active deep biosphere?
- What are the mechanisms underlying the spectacular vertical motions inside basins and their margins?

The pre-proposal "Probing deep Earth and surface connections" (857A-Pre, Rabineau et al.) has already been submitted within this MD proposal, while the remaining three pre-proposals will be submitted following the response of SEP.

Two deep basin sites will be proposed for riser drilling, one each in the Western and Eastern Mediterranean basin (West-to-East transect), aiming at the recovery of the complete Messinian sequence. One of these, in the Western Basin, will be extended down to basement. Four intermediate basins sites are located at shallower water depths and target the recovery of MSC records to reconstruct a shallow-to-deep transect.

The planning of complementary continental drilling within ICDP is in progress.

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Scientific Objectives

What are the causes, timing and emplacement mechanisms of the MSC salt giant?
- establish the chronology of the MSC
- test existing hypotheses for Mediterranean evaporite formation
- develop unifying models for the MSC salt giant
- reconstruct paleoclimate conditions during the MSC and investigate the impact on global climate

What are the factors responsible for early salt deformation and fluid flow across and out of the halite layer?
- understand syn-sedimentary salt tectonics and halite creep
- constrain post-depositional salt deformation and its consequences on sedimentary mass wasting
- to understand the physical and mineralogical conditions that allow fluids to migrate in and through thick tabular salt sequences

Do salt giants promote the development of a diverse and exceptionally active deep biosphere?
- determine whether evaporitic sulfate minerals are fuelling the Mediterraneanʼs deep biosphere
- establish whether the interaction between limiting factors and a highly variable chemical environment has produced a novel deep biosphere community
- use the biomarkers and surviving microbes trapped within brine inclusions to reconstruct the depth, photic and oxic conditions of ancient, hypersaline depositional environments

What are the mechanisms underlying the spectacular vertical motions inside basins and their margins?
- quantify the consequences of base-level change on river behaviour, sediment erosion, supply, transport, karstification and

Non-standard measurements technology needed to achieve the proposed scientific objectives.

Riser drilling, sidewall coring, LWD

Proposed Sites

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	

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