IODP Proposal Cover Sheet

857C - Pre

DREAM: Lago-Mare deposits

Received for: 2017-10-02

Title	The demise of a salt giant: climatic-environmental transition during the terminal Messinian Salinity Crisis
Proponents	Claudia Bertoni, Giovanni Aloisi, Angelo Camerlenghi, Judith McKenzie, Johanna Lofi, Aaron Micallef, Andrew Madof, Iuliana Vasiliev, Hugh Daigle, Terry McGenity, Jörn Peckmann, Christian Hübscher, Zohar Gvirtzman, Nick Evans, Junichiro Kuroda, Alice Marzocchi, Daniel Garcia-Castellanos, Patrick Grunert, David Hodell
Keywords	Messinian, Lago-Mare, Mediterranean
Area	Eastern Mediterranean

Proponent Information

Proponent	Claudia Bertoni
Affiliation	University of Oxford
Country	United Kingdom

☐ Permission is granted to post the coversheet/site table on www.iodp.org

Abstract

This proposal aims to address fundamental questions related to mechanisms responsible for the dramatic salinity fluctuations experienced by the Mediterranean Basin during the terminal stages of the Messinian Salinity Crisis (MSC) ~6 to 5 million years ago. The processes by which this large water mass underwent a rapid hypersaline-brackish-normal seawater evolution in ca. 600ky are still widely unknown: this refers in particular to the influence of monsoons via large African and Arabian river systems, and of the Paratethys, on the hydrological cycle and its evolution in the MSC.

Just after the emplacement of up to 3-4 km of salt in the deepest part of the Mediterranean basin, short-lived and dramatic environmental perturbations led to the formation of brackish-water Lago-Mare deposits. These environmentally enigmatic accumulations may serve as a record to better understand diagenetic mechanisms responsible for dolomitization. Based on results of previous DSDP drilling (Leg 42, site 374), the Lago-Mare related dolomite deposit could hold the key for understanding the little known processes that lead to microbially-mediated, low-temperature formation of this geologically relevant carbonate mineral.

The central and eastern Mediterranean MSC deposits are ideally located for understanding 1) the hydrological connectivity among all sub-basins and with the Paratethys, 2) the response of major circum-Mediterranean rivers to the demise of the Messinian salt giant and 3) the link between evaporite formation, microbial activity and dolomitization. Therefore, we propose to sample and analyse in these basins the record of the last stages of the MSC, including Lago Mare facies and the upper part of the evaporite/clastic series, which were not fully cored in previous scientific drilling campaigns (DSDP/ODP Legs 13, 42, 160).

We propose to drill four sites, two in the Ionian Basin and two in the Levant Basin, which would penetrate (in descending order): open-marine Pliocene siliciclastic deposits hosting the hypothesized active dolomitization front; lacustrine Lago-Mare sulphate evaporites, carbonates, marls, and siliciclastic accumulations; and Upper Messinian salts. These sequences are accessible to riserless drilling; the depth below mudline ranges from ca. 600m to 1000m and TD is located within the top of the halite, without approaching the base of the main salt unit.

The wider scientific objectives on the mechanisms of the MSC termination and probable biosphere modulated dolomitization processes are in line with the strategy of the 857-MDP2 Umbrella proposal 'Uncovering a Salt Giant', and complementary to the pre-proposal P857B 'Deep Sea Records of the Messinian Salinity Crisis (DREAM).

857C - Pre

Scientific Objectives

SCIENTIFIC OBJECTIVES
The present drilling proposal addresses two overarching scientific objectives:
(1) to unravel the enigmatic controlling factors for the Lago-Mare deposition, and the role of monsoon, circum-Mediterranean river systems and Paratethys connection on the hypersaline-brackish-normal marine transition of the end-MSC;
(2) to understand the development of a microbial deep biosphere in the upper reaches of the MSC and its involvement in the formation of dolomite.

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

857C - Pre

Proposed Sites (Total proposed sites: 4; pri: 4; alt: 0; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
ION-01A (Primary)	35.8478 18.1963	4078	582	0	582	Sampling the dolomitised sediments in the upper Messinian (Lago Mare?) and basal Pliocene oozes. Sampling the distal part of the Eo-Sahabi/Chad fluvial system (upper Messinian). Sampling the Upper Evaporites (gypsum-anhydrite, carbonates, K-Mg salts) and the upper part of the halite unit.
MAL-01A (Primary)	35.3594 16.9549	3696	619	0	619	Sampling the Upper Evaporites (gypsum-anhydrite, carbonates, K-Mg salts) and the upper part of the halite unit. Sampling the distal part of the Eo-Sahabi/Chad fluvial system (upper Messinian).
LEV-01A (Primary)	33.3283 33.3003	1733	648	0	648	Sampling the distal part of the Nahr Menashe fluvial system (upper Messinian). Sampling the Upper Evaporites (gypsum-anhydrite, carbonates) and the upper part of the halite unit.
LEB-01A (Primary)	34.2701 35.1461	2391	605	0	605	Sampling the proximal part of the Nahr Menashe fluvial system (upper Messinian). Sampling the Upper Evaporites (gypsum-anhydrite, carbonates) and the upper part of the halite unit.