Perforazione della serie evaporitica Messiniana

C. Bertoni[1], A. Camerlenghi[2]

([1]) Shell Geoscience Laboratory, Earth Sciences Department, Oxford University
([2]) Istituto Nazionale di Oceanografia e di Geofisica Sperimentale OGS

Deep Sea Record of Mediterranean Messinian Events ' DREAM

TIMELINE

DSDP leg 13 1970
DSDP leg 42 1975
ODP leg 107 1986
DSDP leg 160 1995
DSDP leg 161 1995
IODP Expedition 2021 ?

2013: International Ocean Discovery Program

Glomar Challenger

Joides Resolution

2005 Chikyu riser vessel

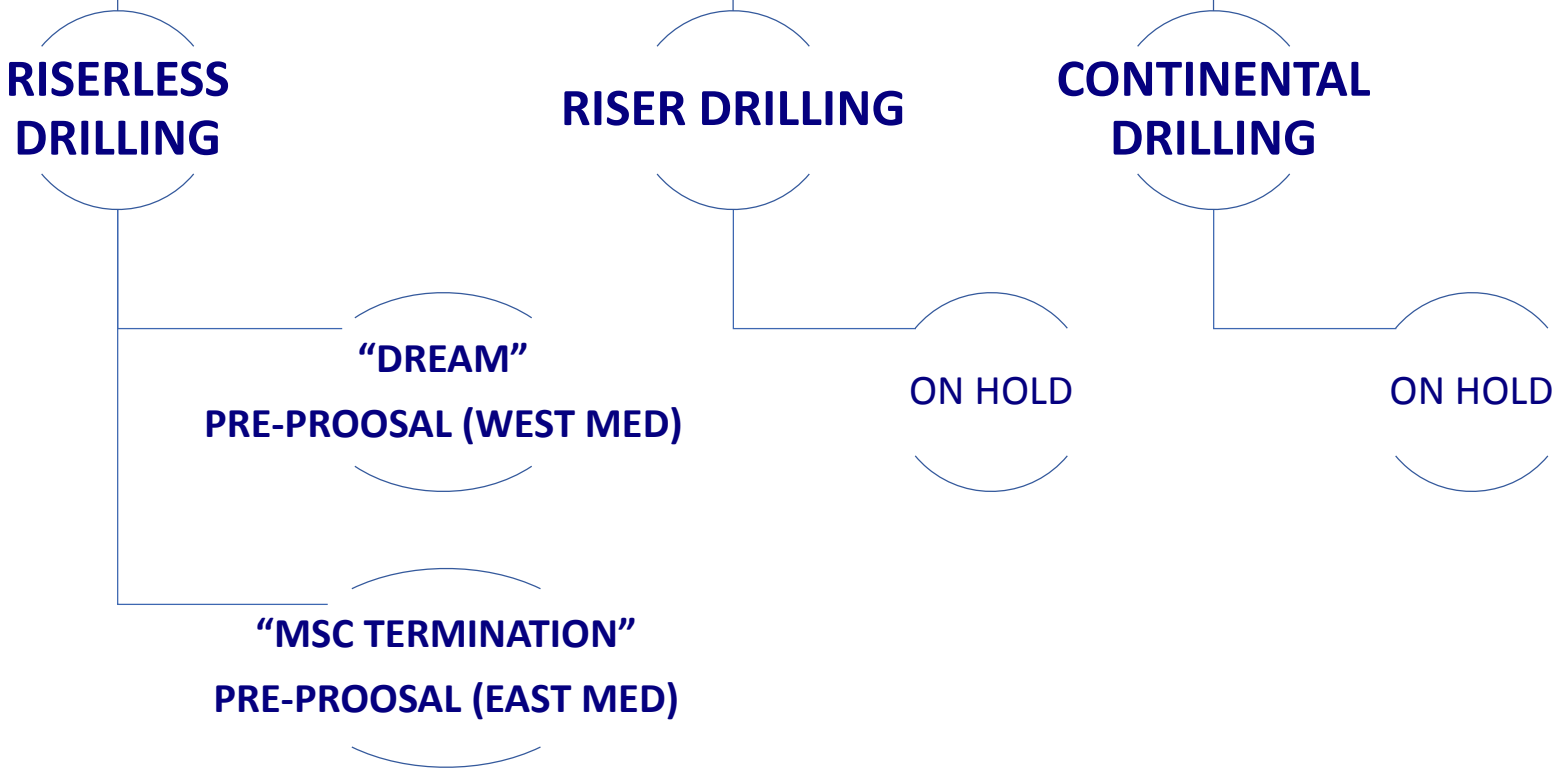
2003 Mission Specific Platforms

2006 2007 2010 2012 2013 2014 2015 2016 2017 2018

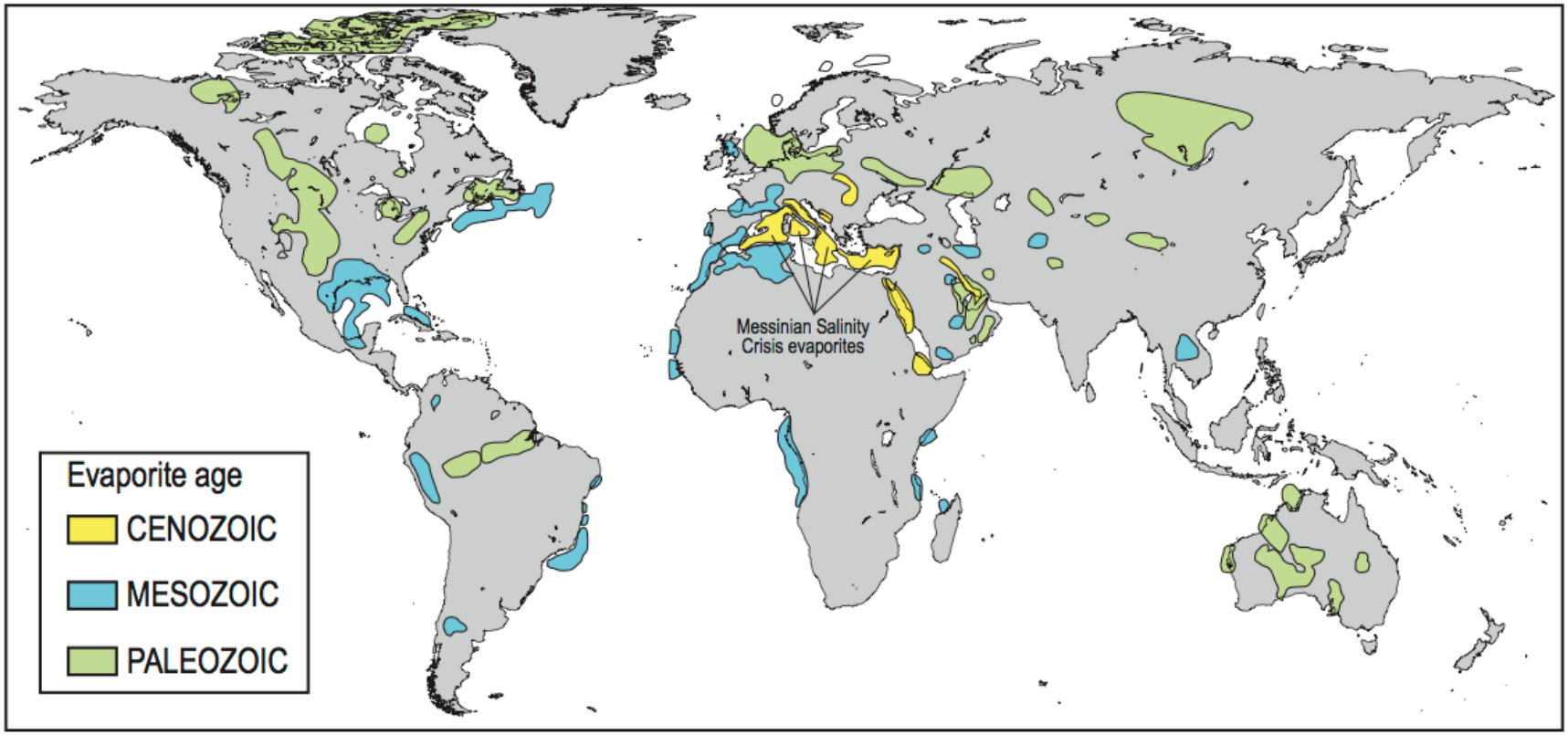
Pre-699, Jolivet et al.
ESF-Magellan, Hübscher et al.
CIESM Workshop, Almeria
ESF-Magellan – GOLD Rabineau et al.
MDP-798 - GOLD, Rabineau et al. - deactivated
ECORD/ICDP Magellan+, Camerlenghi et al.
ECORD/ICDP Magellan+, Paris, Aloisi et al.
MDP-857, Camerlenghi et al., **accepted**
857A-Full - GOLD, Rabineau et al., deactivated
ANR MEDSALT, Aloisi et al., **accepted**
COST ACTION MEDSALT, Camerlenghi et al., **accepted**
MEDSALT 1 - cruise, Camerlenghi et al.
IODP EPSP – DREAM preview, Camerlenghi & Lofi
P857B **DREAM-** PRE-PROPOSAL, Lofi et al. **- accepted**
EAST MED - PRE-PROPOSAL, Bertoni et al. **- submitted**
ETN SALTGIANT, Aloisi et al., **accepted**
IONIAN SEA - cruise, Huebscher et al.
More cruises? Full proposal submission?

UNCOVERING A SALT GIANT

"UMBRELLA" PROPOSAL



Drilling the Mediterranean Salt Giant represents a unique opportunity to understand the genesis, sedimentary and structural evolution, the biosphere and fluid dynamics of a salt giant as a reference for older salt giants.



This is a novel concept for scientific drilling in sedimentary basins and addresses fundamental questions posed in the IODP Initial Science Plan and beyond.

Four overarching questions:

What are the causes, timing and emplacement mechanisms of the MSC salt giant?

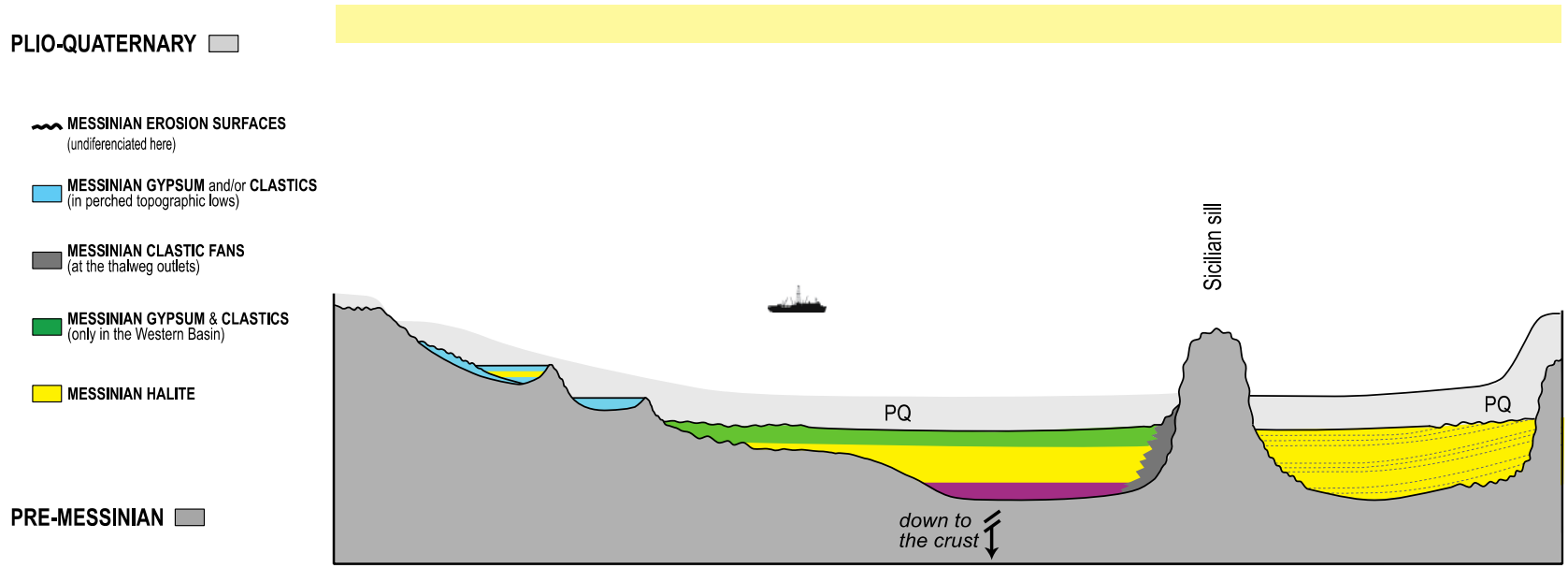
What are the factors responsible for early salt deformation and fluid flow across and out of the halite layer?

Do salt giants promote the development of a diverse and exceptionally active deep biosphere?

What are the mechanisms underlying the spectacular vertical motions inside basins and their margins?

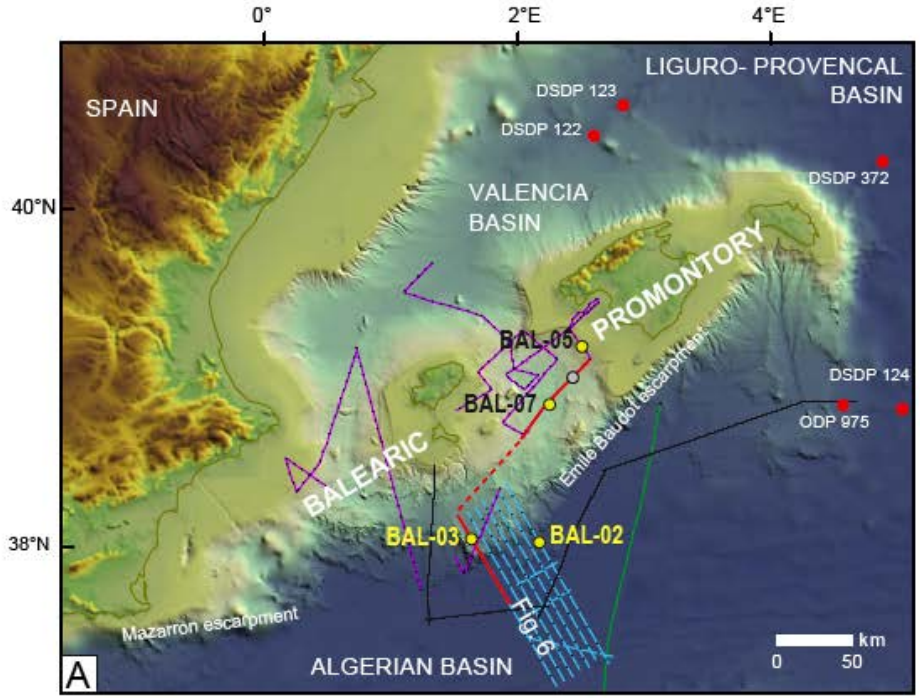
“UNCOVERING A SALT GIANT” DRILLING STRATEGY

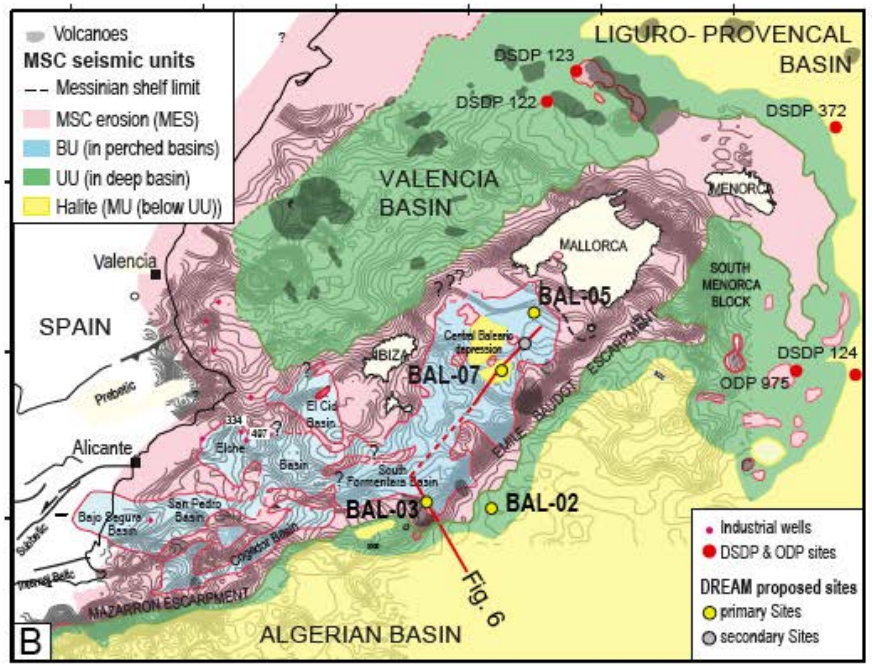
es of a given scientific proposal.



Deep-Sea Records of the Messinian Salinity Crisis

J. Lofi, A. Camerlenghi, G. Aloisi, D. Garcia-Castellanos, C. Huebscher, J. Kuroda, J. Anton, M. Bassetti, D. Birgel, R. Bourillot, A. Caruso, H. Daigle, G. DeLange, F. Dela Pierre, R. Flecker, V. Gaullier, D. Hodell, F. Jimenez-Espejo, W. Krijgsman, L. Lourens, S. Lugli, A. Maillard-Lenoir, V. Manzi, T. McGenity, J. McKenzie, P. Meijer, H. Moreno, A. Moscariello, P. Munch, N. Ohkouchi, J. Peckmann, P. Pezard, J. Poort, M. Roveri, F. Sierro, K. Takai, T. Treude,





Hypotheses to be tested by DREAM: The Messinian Salinity Crisis

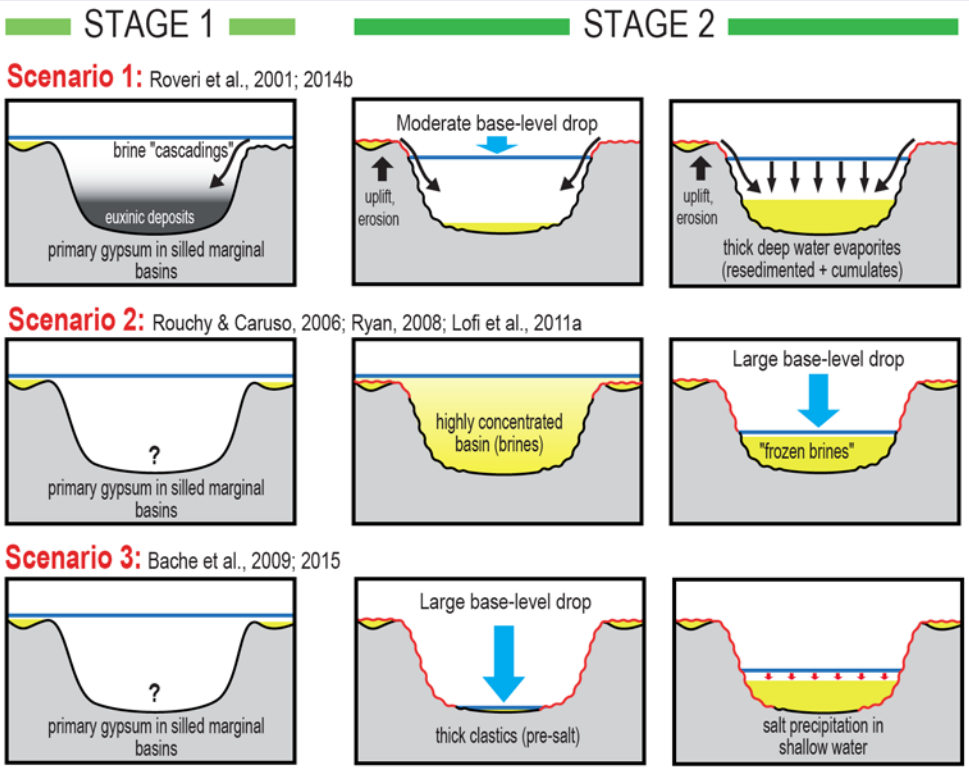
the base-level fell dramatically during the Messinian

the salt was deposited during the base-level fall

the deposition of the salt was synchronous across the Western Mediterranean continental margins and basins

the Western Mediterranean basin was invaded by fresh-waters from the eastern gateways (incursion of Paratethyan waters)

the MSC ended with an extremely rapid re-flooding of the Mediterranean from the Atlantic gateway



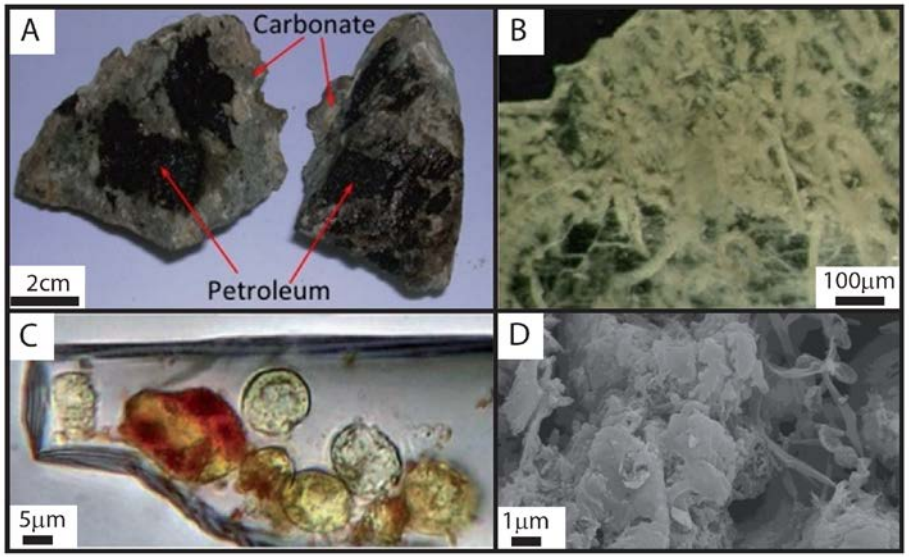
Hypotheses to be tested by DREAM: the deep biosphere

the huge amount of sulphate minerals buried in the Mediterranean sedimentary sequence fuel an exceptionally active and discrete deep biosphere

in a pore-water environment chemically influenced by evaporites, sulphate reducing bacteria are the catalyst that triggers widespread (and possibly on-going) dolomite formation at the Miocene-Pliocene boundary

the interacting effects and gradients of pressure, temperature and salinity, together with a highly variable chemical environment produce a diverse deep biosphere and virosphere

the surviving microbes and the biomarkers trapped within brine inclusions allow the reconstruction of the depth, photic and oxic conditions of ancient hyper-saline depositional environments



Hypotheses to be tested by DREAM: Deep-to-surface connections

the MSC salt giant triggered exceptional vertical motions of the Mediterranean margins and basins

the Messinian topography/bathymetry was controlled primarily by the short-term isostatic response to loading and unloading of the basin and its margins

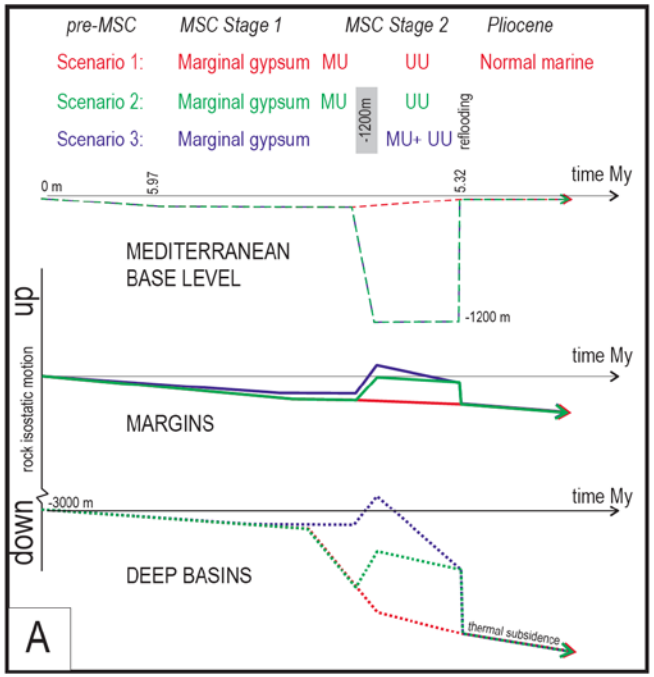
Hypotheses to be tested by DREAM: Salt tectonics and fluids

salt tectonics initiate during salt precipitation

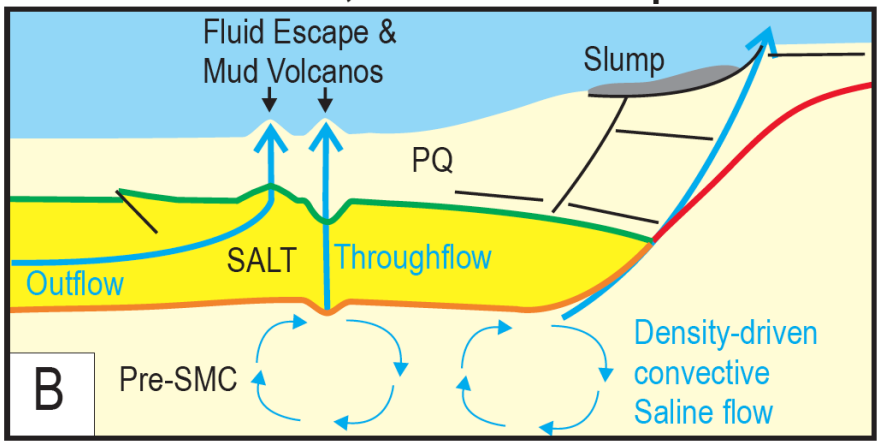
fluids flow out of the growing salt deposit

post-depositional salt deformation induces sedimentary mass wasting

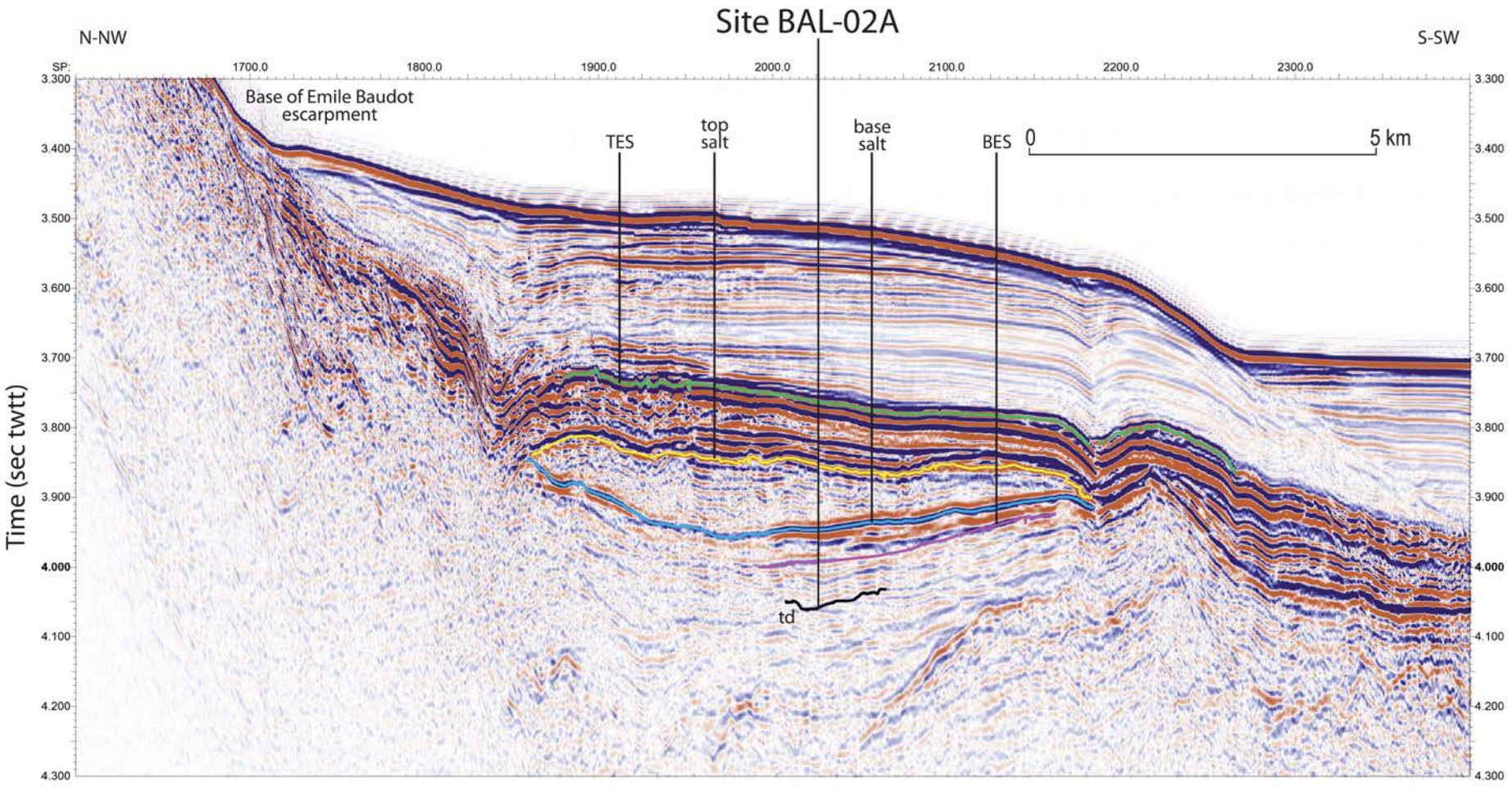
Effects of the MSC Salt Giant on vertical isostatic motions



Effects of the MSC Salt Giant on basinal fluid flow, and associated processes



Lat N	38°02.39857'
Lon E	02°13.69792'
MCS Line SALTFLU SF-03	S.P. 2027.5
Water Depth: 2636.25 mbsl	TD: 773 mbsf



Lat N 39°10.42654'
Lon E 02°08.61825'
Line SIMBAD Ba08 CDP 1600
Water Depth: 804 mbsl TD: 1219 mbsf

Central Balearic Depression

Site BAL-04A