

FLAWS

Minutes of the workshop for an IODP proposal in the Gulf of Cadiz

Barcelona, 15th - 16th February 2018

Assistents:

Rafael Bartolomé, Eulàlia Gràcia (Chair), Marc-André Gutscher, Filomena Loreto, Sara Martínez-Lorient, Luis Pinheiro, César R. Ranero, Valentí Sallarès, Pedro Terrinha and Nevio Zitellini,

Thursday, 15th February

- **Introduction from the IODP Cadiz proposal by Cesar Ranero**

On the IODP plan, the DV Joides Resolution will come to the North-Atlantic and Mediterranean area in 4 to 5 years. We have a complete seismic dataset from new to vintage data. However, we may consider collecting new data, in order to propose testable and competing hypothesis, tested by one possible way: drilling. The science proposed needs to fit on the themes and challenges of the IODP science plan 2013-2023, thematically orient's, not regional. The potential team needs to be multi-disciplinary, and international

- **Presentations of WG members**

Marc-Andre Gutscher (IUEM, Brest, France)

Sara Martínez Lorient (Institute of Marine Sciences, Barcelona, Spain)

Nevio Zitellini (CNR-Institute of marine Sciences (ISMAR), Bologna, Italy)

Eulàlia Gràcia (Institute of Marine Sciences, Barcelona, Spain)

Marc-André Gutscher, Sara Martínez-Lorient, Nevio Zitellini and Eulàlia Gràcia presented different ideas / topics for a potential IODP drilling proposal in the Gulf of Cadiz. Marc-André reminded us about the existing DSDP sites 120 and 135 in the Gulf of Cadiz, the only ones drilled in the external part of the Gulf of Cadiz. However, DSDP Site 135 did not reach the basement. Sara showed us her MCS dataset and the availability of survey data. Also the basement distribution map that illustrates five different crustal / mantle domains, which will be very useful to prepare a strong pre-proposal. Nevio reminded us of the average time to have a proposal approved is about 3-4 years. He showed us the profiles AR9 (parallel to the Gorringe Bank) and AR1 (record of sinrift and postrift oceanic crust). Eulàlia Gràcia presented the IODP science plan (2013-2023), their main themes and challenges. She also proposed potential topics for an IODP proposal in the Gulf of Cadiz, which range from: Active

seismogenic faults and tsunamis, Submarine landslides, Paleoseismology, Fluid flow and deep biosphere, and stratigraphy and crustal structure. We have the SISMAR (M.A. Gutscher), SWIM (E. Gràcia) and NEAREST-SEIS (V. Sallarès) cruises available, in which MCS and wide angle seismic suggests evidence of Jurassic age crust.

- **Working group discussions and potential themes to address**

All participants suggested a variety of different topics and themes to address regarding the Gulf of Cadiz. Some of the initial, broad topics were:

1. Nature of the basement in GC
2. Drilling on Jurassic age oceanic crust, the oldest
3. Understand long term aging of oceanic crust
4. Mesozoic to modern stratigraphy, major extinctions, climatic upheavals
5. Deep biosphere objectives, among the oldest pieces of oceanic crust on earth
6. Recent deformation, material properties (rheology along faults),
7. Mud volcanoes near LS, deep fluid flow, gas hydrates, and deep biosphere
8. Serpentinization, methane, mantle hydration
9. Subduction initiation and deep seismicity (>40 km)

Friday, 16th February

- **Presentations of WG members**

Marc-Andre Gutscher (IUEM, Brest, France)

Pedro Terrinha (IPMA, Lisboa, Portugal)

Eulàlia Gràcia (Institute of Marine Sciences, Barcelona, Spain)

Marc-André Gutscher, Pedro Terrinha and Eulàlia Gràcia continued with the presentations. Marc-André proposed an acronym for a proposal: STORM “Subduction initiation and mantle serpentization at a reactivated Thethyan Oceanic transform offshore SW Iberia“. Regarding some of the topics initially selected for an IODP proposal. Laia presented how the different IODP challenges fit with the potential themes presented above. Selected themes and specific challenges are:

Earth Connections

What are the composition, structure, and dynamics of Earth’s upper mantle?

How are seafloor spreading and mantle melting linked to ocean crustal architecture?

How do subduction zones initiate, cycle volatiles, and generate continental crust?

Earth in Motion

What mechanisms control the occurrence of destructive earthquakes, landslides, and tsunami?

How do fluids link subseafloor tectonic, thermal, and biogeochemical processes?

Biosphere Frontiers

What are the origin, composition, and global significance of subseafloor communities?

- **Working group discussions**

Discussion continued, highlighting specific aspects, such as:

- 1) The Gorringer Bank is the largest gravity anomaly in the world, with exhumed peridotites at the surface (> 5000 m of relief).

- 2) We can find the oldest oceanic lithosphere in the world (Jurassic – 200 Ma).
- 3) Widespread moderate magnitude seismicity (10-50 km depth) indicating ongoing deformation in the crust and lithospheric mantle
- 4) Process of subduction initiation

Regarding the fluid flow, long cores tell us about fault properties, permeability, porosity, and geochemistry. Monitoring the fluid expelled along the fault zone, in association to observatories, could be set during an IODP cruise to monitor active processes (i.e. rock properties, time series, seismicity). We need to present testable hypothesis for each of the challenges presented above. During the meeting, two main topics raised for a potential pre-proposal: drilling into Jurassic crust and understanding subduction Initiation.

Specific questions raised, for instance:

1. How serpentinization works in function of depth?
2. What is the process of mantle exhumation (e.g. Ormonde smt)?
3. What is the nature of the oldest oceanic crust generated in slow spreading ridges in comparison to recent oceanic crust?
4. What is the link between deep MV, serpentinization, deep EQs and fluid flow?

The CSIC team will have 3 cruises this year (May, July and September 2018) in the Gulf of Cadiz. The data obtained will be very valuable as site surveys and the accurately define the potential drilling sites. Valentí also proposed a title for a proposal “The Role of Lithospheric Inheritance on subduction initiation” (RELICT). After different options and suggestions, we proposed three potential drill sites. They are the following:

Site LS: North flank of Coral Patch Ridge, close to profile SW7
Water depth: 4500 m / Sediment: 700 m aprox. / Crust: 300 m aprox.

Site GB-1: NE part of the Gorringer Bank, on AR-9A
Water depth: 1700 m / Sediment: 650 m aprox. / Crust: 300 m aprox.

Site GB-2: SW part of the Gorringer Bank, on IAM-GB2
Water depth: 4050 m Sediment: 1000 m de penetración aprox. / Crust: 300 m aprox

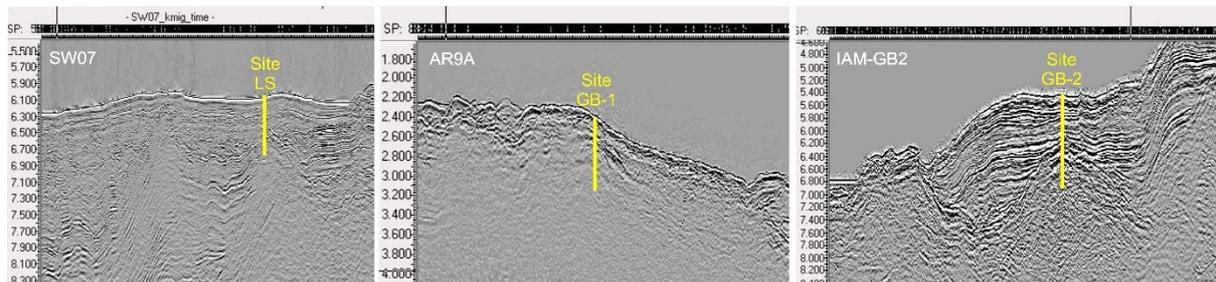


Fig. 1. Potential drilled sites proposed during the IODP-Cadiz workshop

- **Concluding review and distribution of tasks**

The meeting has been intense, very productive with interesting discussions regarding the different topics and with frequent checks to our available dataset. Potential drilling sites, based on our bathymetric, MCS and WAS dataset have been

proposed as presented above. However, new data acquired during this year will be very valuable to prepare a pre-proposal. Doing a pre-proposal by the end of March is not plausible; we aim for September 2018, when all cruises will reach to an end.

We also aim to request for a MagellanPlus Workshop, which deadline for submission will be 15th January 2019. All participants in the IODP pre-proposal as well as the MagellanPlus Workshop will be required to contribute in the writing of both tasks, developing viable and attractive proposals. Finally, the team will need to be enlarged with European and international specialists of different specialties, such as geochemistry, structural geology, logging, sedimentologists, microbiology, etc. reaching to a minimum team of 12-15 people.