Image improvement of Late Miocene (Messinian) to Plio-Quaternary units in the Algero-Balearic basin

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This study intends to contribute to the understanding of the Mediterranean Salt Giant in the Western Mediterranean, formed about 6 Ma ago during the Messinian Salinity Crisis. It provides reprocessed multichannel seismic reflection data that aim at improving our knowledge of the stratigraphy in the Algero-Balearic deepwater basin and its continental margins, in the absence of lithological information from wells.

We investigate the seismic expression of the Messinian salinity crisis from the south-east of the Balearic promontory to the central Algero-Balearic abyssal basin and the salt tectonic processes associated to these facies. Here the segmentation of salt structures has been previously described using shallow chirp sonar data, low-resolution vintage multichannel seismic data and high-resolution multi-channel seismic data post-stack migrated with a constant velocity field. The structure of the northern Algero-Balearic basin is controlled by two abrupt fault scarps oriented SW–NE (mainly the Emile Baudot Escarpment transform fault) and WSW–ENE (mainly the Mazarron Escarpment transform fault) emplaced during the basin extension, and later intruded by steep and narrow volcanic ridges of Pleistocene age. It is a good analogue to early stage salt tectonic for older and more complex salt giants in the North Sea or the Gulf of Mexico.

We reprocessed 2D Kirchhoff PSTM multichannel seismic data acquired by the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS (SBALDEEP Cruise of 2005 and SALTFLU cruise of 2012; the latter within a Eurofleets cruise) spanning the South-East continental margin of the Balearic islands and the Algero-Balearic basin. The reprocessing was designed for improving the continuity of the reflectors by applying Kirchhoff PSTM using a detailed velocity model, while preserving amplitude information. The objectives are to better apprehend the structural complexity of the area and to retrieve the amplitude variation within the Messinian units, in an attempt to derive the composition of the salt and the pressure regime.

We present preliminary results where we delineate four different domains based on i) the seismic facies, ii) the amount of salt deformation, iii) the thickness of the overburden and iv) the pre-salt configuration. We attempt to reassess the presence of the Messinian trilogy in the south-eastern continental slope. We attempt to reconstitute the paleo-depositionnal environment of the various depositional units, and the effect of crustal structures and salt tectonic gravity spreading and
gliding on their syn to post-depositional evolution. Finally, we search for evidence of fluid circulation within the Messinian and the Plio-Quaternary deposits over the study area.