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High-resolution 3D-seismic imaging of twin mud volcanoes on the Calabrian Arc: results from the HERMES-HYDRAMED IONIO 2005 campaign

D. Praeg (1), S. Ceramicola (1), N. Wardell (1), V. Unnithan (2)

(1) Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Trieste, Italy, (2) International University Bremen (IUB), Germany (dpraeg@ogs.trieste.it / Tel: +39 040 214 0340)

A 3D-seismic experiment was conducted on a pair of mud volcanoes in the northern Ionian Sea, part of a new province of cold seep features discovered in summer 2005 during the HERMES-HYDRAMED IONIO campaign (see accompanying poster by Ceramicola et al.). The objective of the experiment was to test the utility of a logistically simple method of short-offset seismic acquisition to obtain high-resolution 3D-imagery of the geometry and rooting structures of cold seep features.

The target mud volcanoes form part of the Explora mounds, which lie on the internal Calabrian Arc, in the Spartivento Basin, in water depths of 1900-2200. Multibeam data and seismic reflection profiles show the Explora mounds to comprise three circular extrusive features that lie within an elongate fault-controlled seabed depression up to 10 km long and 3 km wide. Two of the extrusive features are a pair of cones, referred to as the Gemelli, each up to c. 1.5 km wide and 200 m high, that lie within a Plio-Quaternary sedimentary succession up to 300 m thick. Gravity cores proved mud breccias to lie at or near seabed near the crests of both Gemelli, suggesting active mud volcanism.

One week was dedicated to a 3D-seismic survey of an area of about 2.8 x 4.5 km encompassing the Gemelli. A total of 109 closely-spaced (25 m) lines were acquired using two GI guns and a 600 m multichannel (48 trace) streamer, yielding a nominal in-line (2D) data coverage of 16 fold. Frequencies up to 250 Hz were recorded over a record length of 3.5 seconds, which guaranteed at least 1.0 second of section beneath the water bottom. Although there was some overlap between adjacent lines due to

variations in the ship's route, the bin size was maintained at 25 m to avoid empty bins in the volume cube. Reasonable velocity control was available from the short offset data to produce a stacked 3D-cube volume. Additional velocity control for the eventual migrated volume will be obtained from a long-offset seismic profile that was acquired by OGS over the features in 1980.

This poster will present preliminary results from the processing of the 3D-seismic data, showing the extent to which the high spatial data density affords resolution of the internal geometry of the mud volcanoes, their stratigraphic relation to surrounding sediments and the nature of the shallow feeding structures. Detailed analysis of the 3D-seismic volume over the coming months will be used to understand the relation of the mud volcanoes to shallow gas and/or fluids and their functioning over time.

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