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Geophysical signatures of collapsed paleokarst structures in the Upper Miocene reefal complex of Mallorca (Balearic Islands)

Albert Casas (1), Mahjoub Himi (1), Raúl Lovera (1), Joan Fornòs (2), Lucila Montes-Egito (3), Washington Evangelista-Teixeira (3), Anderson de Medeiro-Souza (3), Ismael Casado (4), and Francisco Pinheiro-Lima Filho (3)

(1) University of Barcelona, Dept. Geochemistry, Petrolgy and Geological Prospection. Barcelona, Spain (albert.casas@ub.edu), (2) University of Balearic Islands, Dept. of Earth Sciences, Palma de Mallorca, Spain, (3) Federal University of Rio Grande do Norte, Dept. of Geology. Natal, RN, Brazil, (4) Miami University, Dept. of Geology and Environmental Earth Science. Oxford, OH, USA

Collapsed paleokarst structures of Mallorca Island represent one of the best examples of collapsed paleocaves because of the good outcrops existing along sea cliffs. These structures have been produced by roof collapse of caverns developed in the underlying reefal complex. Coalesced systems of collapsed paleocaves form an important class of carbonate reservoirs that have arisen from shallow karst processes, followed by collapse, burial and diagenesis. These paleokarts structures are characterised by highly irregular subsurface conditions and for better defining their structure different geophysical methods have been tested over well-defined models exposed in a coastal cliff.

Electrical resistivity tomography (ERT) profiles were acquired using a Wenner-Schlumberger array and electrodes 2m apart. Inverted resistivity sections show high contrasted electrical properties between different sedimentary facies, ranging from low resistivity values (< 40 ohm•m) for clayey infill sediments to high resistivity values (> 1000 ohm•m) for high porosity breccias.
Ground probing radar (GPR) profiles were recorded along the same lines using a constant-offset a station spacing of 0.2 m, with an antenna of 50 MHz of dominant frequency. The total recording time window was 500 ns at a sample interval of 1600 ps. These parameters were determined by a series of tests prior to the main acquisition. Different GPR facies have been recognized.
Finally, seismic refraction profiles were recorded in order to define the geometry and distribution of seismic velocities of the models along the same profiles.

This geophysical investigation demonstrates that the combination of detailed geological (sedimentology, geomorphology, structural geology...) with high resolution geophysical techniques yields the best results for characterizing such geologically complex structures.