3-D Characteristic of Shallow Mounds Supports Paleocene-Eocene Cold Seeps in the Ceduna Sub-Basin (Australia)

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ABSTRACT

Shallow mound-like features found in the central Ceduna Sub-basin are thought to be caused by Paleocene-Eocene hydrocarbon leakage. It has been proposed that reactivated fault segments intersect potential oil mature source rock intervals resulting in natural hydrocarbon seeps along specific structures that supply nutrients for localised chemosynthetic communities and biogenic mound growth. The use of new 3D seismic datasets enables a much comprehensive investigation on the distribution and geometry of these mounds and their relationship to fault networks as well as the extraction of subtle geomorphological features previously unseen in 2D seismic data. Using coherency and reflectivity based seismic attributes, spectral decomposition and colours blending, the mound complexes are clearly imaged and we confirmed lateral geometries and internal configurations typical of biogenic build ups with progradational, aggradational and mounded architecture. The interpretation of these new datasets also confirmed the different characteristics between the mounds and the contemporaneous nearby extrusive and intrusive volcanics and their spatial relationship. The mound complexes mostly developed over E-W segments of larger SE-NW curvilinear faults that were active from the Albian to the Santonian and were reactivated in the Early Tertiary. These faults intersect oil- and gas-mature Early and Late Cretaceous sequences. These findings validate an emplacement model for the mounds independent of paleobathymeteric highs but primarily related to reactivated fault segments. The distribution of the mounds and their lack of connection to volcanic intrusions support a development mechanism that relies on natural hydrocarbon “cold” seeps rather than hydrothermal feedstock for these chemosynthetic communities.