Role of Deep-Sourced Fluids on the Initiation and Growth of Isolated Carbonate Build-Ups

Davide Oppo[1], Martin Hovland[2]
[1]University of Louisiana at Lafayette; [2]Tech Team Solutions

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Abstract

The relative role of the various mechanisms responsible for the formation of isolated carbonate build-ups occurring on the seafloor along continental margins is still uncertain. The interpretation of an extensive seismic dataset in the central Vulcan Sub-basin (NW Australia) allowed evaluating the role of migration and seepage of deep-sourced fluids during the initial growth of isolated carbonate build-ups. The Neogene tectonic activity along the margin generated extensional fault systems that commonly displaced the seafloor, thus apparently creating a substratum to the initiation of various carbonate build-ups during the Pleistocene. The seismic data show reflections, with enhanced amplitude respect to background values, which are associated with both isolated carbonate build-ups and normal faults. The seismic character of these reflections supports the presence of fluids that migrated within the sedimentary pile throughout the investigated area. The interpreted occurrence of methane-derived authigenic carbonates (MDAC) on the seismic surface upon which the carbonate build-ups lay suggests that seepage of hydrocarbons likely occurred at the time of their initial formation. The fluid migration appears focused in the areas above extensional faults, which breached the seals of the Mesozoic reservoirs. Combined tectonic activity and seepage are suggested to support the initial growth of the carbonate build-ups. Various smaller, buried carbonate build-ups developed contemporaneously to those on the present-day seafloor in sites that lack evidence of past hydrocarbon seepage. Their shorter life compared to those on the present-day seafloor suggests their inability to keep up with the frequent relative sea-level variations during the Quaternary and the importance of deep-sourced fluids for the carbonate build-ups growth in the central Vulcan Sub-basin. The initiation of the numerous carbonate build-ups

documented along continental margins worldwide must be explained considering the complex and dynamic interplay of all factors potentially involved, such as geological and oceanographic settings, and an active petroleum system. In particular, the migration and seepage of deep-sourced fluid can have an important role in controlling the genesis and growth of isolated carbonate buildups.