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Abstract

Karst has a big impact on the future development of hydrocarbon reservoirs such as well planning where karst causes problems with losses and completion length. Hence, there is a strong business case to map out karst in detail as input for the field development plans (Chung et al., 2012). This study aims to propose a workflow to characterise karst base on multiscale data analysis comprises of drilling parameters, thin section, core, well logs and seismic interpretation.

This study involved systematic mapping of loss circulation depth and chalkified/rubble/vuggy zones described from core of the Jintan platform. Loss circulation depths recorded and compared to core samples that showed characteristics indicative of dissolution and exposure, such as chalkified texture, and were marked on well logs to understand the well-logs respond in karst intervals. Petrographic analyses were done identify the morphology of karst. All possible karst intervals were documented to integrate with seismic. Seismic interpretation and spectral decomposition attributes techniques applied on Jintan and M1 seismic data to map the karst features.

Core description analysis on Jintan-2 and Jintan-3 wells revealed up to 10 meters of chalkified and rubble interval as well as ≥0.5cm-1cm large vugs and moldic porosity observed which confirmed the existence of dissolution karstification process on the platforms. Well logs respond showed unusually high porosity readings in the karstified intervals. Quantitative analysis on thin sections revealed that vuggy and moldic porosity in both wells are 25% of total pore types in Jintan-2 and 29% of total pore types in Jintan-3. Vugs of 2–4 mm in size with 1–2 mm moldic pore size and blocky calcite precipitates on the interior of fossils/molds were observed, which indicated the apparent rapidity of the dissolution process occurring in mixing zone. Petrographic analysis on mixing zone diagenesis in the subsurface of Florida and the Bahamas revealed a petrographic fabric of moldic porosity and blocky to dogtooth calcite cementation which are similarly observed on Jintan-2 and Jintan-3. Seismic interpretation revealed dendritic, round and elongated patterns of several hundred meters in diameter and tens of meters deep features. These features are particularly well-developed below backstepping external buildup geomorphology. The analysis showed that particularly strong losses occurred in stratigraphic intervals located towards the centre of buildup.

Integrated multiscale analysis done to characterise karst on carbonate platform in Central Luconia has provided informative input in understanding the karst morphology and geometries. A karst prediction workflow proposed at the end of this study could be imposed in well development planning to avoid drilling into karst features in the future. On top of that, understanding karst are important for Carbon Capture and Storage (CCS) in carbonate build-up planning as karst increase the porosity of a carbonate build-up.

References

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