

## **Fluid Evolution through Different Deformation Stages: Stable Isotopes Define Tectonic Responses in Permian and Older Carbonate in Central and Western Thailand: Implications for Fractured Basement Reservoirs**

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### **Abstract**

Stable isotopic studies, focused on calcite cement, vein-fill calcite, various bioclasts and early burial diagenetic cement rims and replacements, can be used to define the burial evolution of ancient carbonates in outcrop in central Thailand and the resulting curve applied to better understand the timing and positions of subsurface poro-perm evolution. To establish a burial evolution base-curve for carbon and oxygen isotope covariant isotope curve, texture-aware sampling was undertaken across a mapped suite of variably deformed and thrust Lower and Middle Permian carbonates of the Saraburi Group, as well as older (mostly Ordovician) carbonates in western Thailand. Samples were collected in a number of quarries in the thrust succession in the Saraburi-Lopburi area, from cuttings in the Phu Horm gas field and within the shear zone of the Three Pagoda Fault Damage Zone of the Western Highlands of Thailand.

Across Thailand, the integration of isotope data with its structural setting establishes a clear separation in burial-fluid events in carbonate matrices, related to two time-separate tectonic episodes in a world-class suture belt. Its stable-isotope fluid chemistry defines platform burial and porosity loss, followed by the Permo-Triassic closure of the Paleotethys with thrust fault veining, and its subsequent reactivation and porosity creation during the Tertiary collision of India and Asia. This combination of outcrop and subsurface derived isotope covariant plots demonstrates the utility of isotope studies in defining the diagenetic and poro-perm history of ancient structurally-overprinted carbonates. Once a base-line burial curve is established, subsequent work can be done solely using drill cuttings. This offers a new paradigm to the oil industry where drill cuttings can be used to define proximity to zones of tectonic deformation, cementation and porosity creation.