

Geothermal Gradient Anomalies of Hydrocarbon Entrapment at Central Sirte Basin, Libya: A Mature Basin Rejuvenation Technique

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ABSTRACT

Compensated Geothermal Gradient (CGG-ESTI©) software* was used for bottom-hole temperatures (BHTs) database creation, raw BHTs correction, geothermal gradients plotting, geothermal cross-plot analysis and geothermal gradient contouring of 50 wells in the Hagfa (Marada) Trough of central Sirte Basin. The compensated geothermal gradient contours revealed higher geothermal gradients for most producing wells against a background of lower geothermal gradients for most dry-holes in the Hagfa Trough. In mature hydrocarbon producing Hagfa Trough of Sirte Basin, such anomalies reflect the presence of sealed permeable, heat-convecting subsurface traps, and can provide justifications for post-mortem analysis of dry-holes showing anomalous geothermal gradients, that may lead to re-entry to test missed, bypassed shallow traps, or deepen the “dry-hole” to test unreached hydrocarbon traps of such geothermally anomalous possible, probable and potential “un-discovery wells”. Two examples of successful discoveries are cited: the first for deep condensates discovery via deepening an old dry-hole in the Hagfa Trough, drilled when shallow reservoirs were the primary targets during early exploration years, and the second for shallow oil discovery by re-entry of a dry-hole, drilled when deeper targets became the primary exploration targets and shallow reservoirs got bypassed during later exploration days.