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## Hydrodynamic Petroleum Entrapment Potential in the Arabian Platform

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Active hydrodynamics in the Arabian platform can potentially create a non-conventional family of traps in major parts of the basin, when combined with structural styles usually not considered as prospects in the traditional exploration practice. Hydrodynamics, resulting from gradients in groundwater potential, have been previously reported in the Arabian platform, and were known to cause tilting in oil-water interfaces. Based on theoretical and numerical simulation analyses, such hydrodynamic forces are natural products of gradients in groundwater potential existing platform-wide due to regional topographic configuration, geological history, and hydrogeological stratification. The presence of such gradients offer an additional subsurface hydrocarbon trapping force, allowing structures such as noses, monoclines, and plunging anticlines with no traditional four-way structural closure, called here hydrodynamic conjugate structures, to trap hydrocarbons; given that the appropriate structural and hydrodynamic conditions are satisfied.

A simple numerical model, simulating Hubbert's oil driving forces in the subsurface, reveals that entrapment by a combination of opposing buoyancy forces provided by hydrodynamic conjugate structures, and hydrodynamic forces resulting from down-dip drop in groundwater potential (known in the Arabian platform), can entrap hydrocarbons in a multitude of scenarios. The scenarios are created by variations in the magnitude of regional and local structural gradients and geometries, magnitudes of groundwater potential gradients, and the densities of both formation water and the hydrocarbon phases. The hydrodynamic analyses conducted here for parameters known in the Arabian platform, combined with conceptual and numerical basin hydrogeological models, provide a predictive tool and prospect generating methodology for additional non-conventional petroleum reserves in the Arabian platform — presenting a new dimension in exploration strategy.

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