[PS]Play Conditions of Palaeozoic in Persian Gulf Basin*

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Abstract

This paper demonstrated the play conditions of Palaeozoic in Saudi Arabia Basin by means of the study of source rocks, reservoir, seal, traps and migration.

Multiple source rocks developed in the Saudi Arabia Basin. The dominate one developed in the Qalibah Formation of Silurian. The Qusaiba Shale in the Qalibah Formation features high abundance, fine type, high thermal evolution and wide distribution. Organic matter mainly relies on type 2 kerogen. The windows of oil generation, condensate gas generation and dry gas are 230Ma, 140Ma and 90Ma, separately. These source rocks are the major factor of hydrocarbon enrichment.

Good quality reservoirs are widely distributed in the Saudi Arabia Basin. They represent thick pay, high porosity and high permeability. They have good lateral connectivity due to wide sediment and weak tectonic movement, but each underwent a different tectonic evolution, thus indicating obvious longitudinal heterogeneity. Reservoirs in the Palaeozoic are dominated by sandstone of the Devonian Jauf Formation and the Permian Unayzah Formation. Due to the influence of cementation, reservoir quality changes rapidly laterally and vertically indicating great heterogeneity.

Several seals exist in the Palaeozoic petroleum system. The widely distributed tight carbonate rocks overlay the Unayzah Formation and act as the primary regional seal. In addition, internal mudstones also can be considered effective seals. D3B Formation is the dominate seal of the Jauf Formation, the thickness of which is thin, but developed in large scale. It shows as a marker formation in the Saudi Arabia Basin.

The evolution of the Arabia plate represents a steady continent block in the long geological history. Most of the fields are dominated by anticline

structures, which feature small angle of dip, forming large-scale traps. The basement map indicates that faults developed in a north-south direction, which coincides with the distribution of grabens and horsts. Four tectonic periods are contained in the formation of traps in Palaeozoic petroleum system.

Faults are undeveloped in the Saudi Arabia Basin except for a few regional faults, thus, layers show poor connectivity in the vertical direction. Gas migration focused on the unconformity, fracture and expansion. Palaeozoic petroleum systems in the Saudi Arabia Basin feature reservoirs overlay source rocks and traps formed in the early period and gas filled in the later period.

Figure 1. Location of the study area.

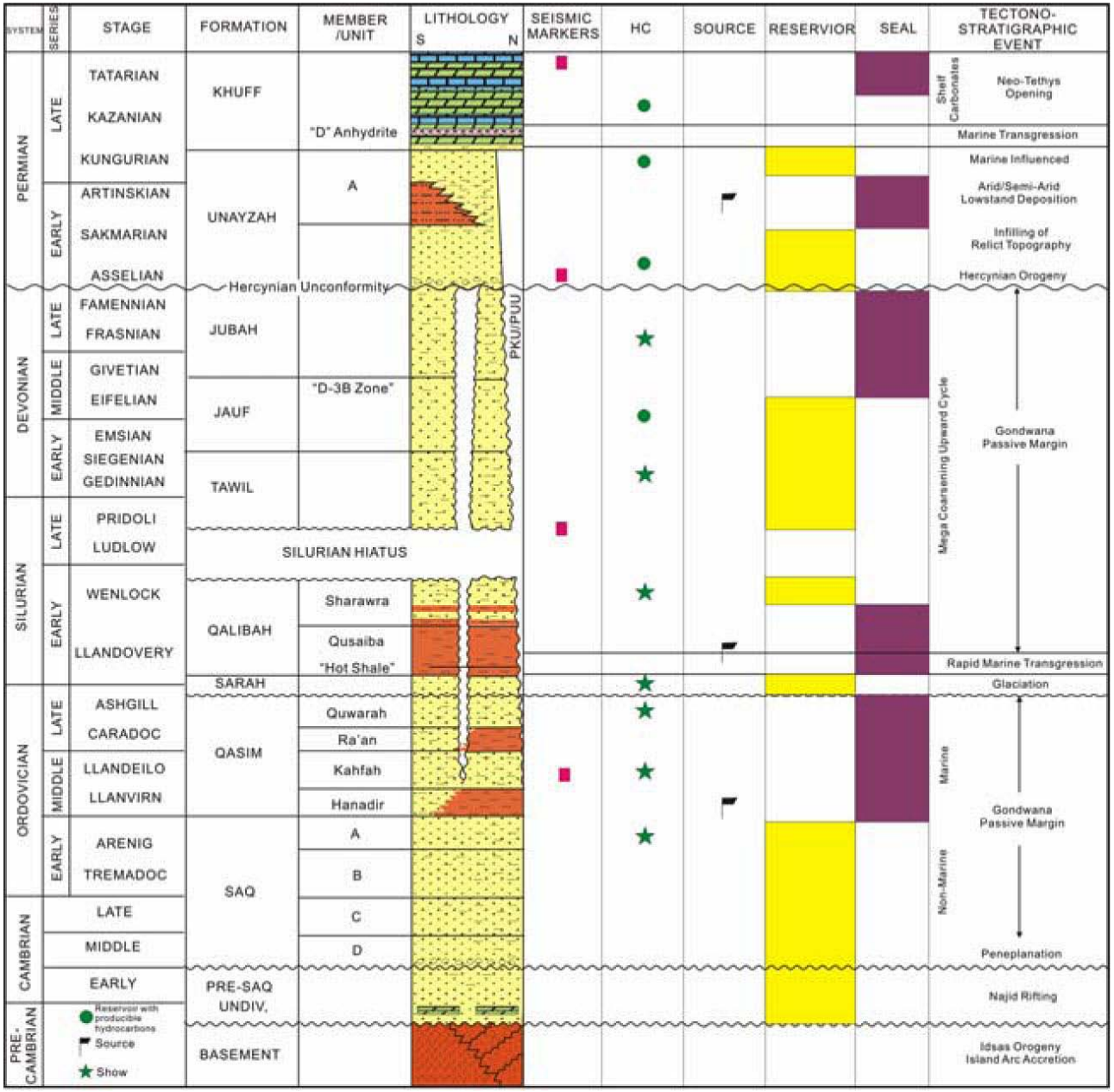

Figure 2. Stratigraphy and tectonic events chart for the Paleozoic section in Persian Gulf Basin, also showing reservoirs containing proven producible hydrocarbons (Modified from Wender et al., 1998).

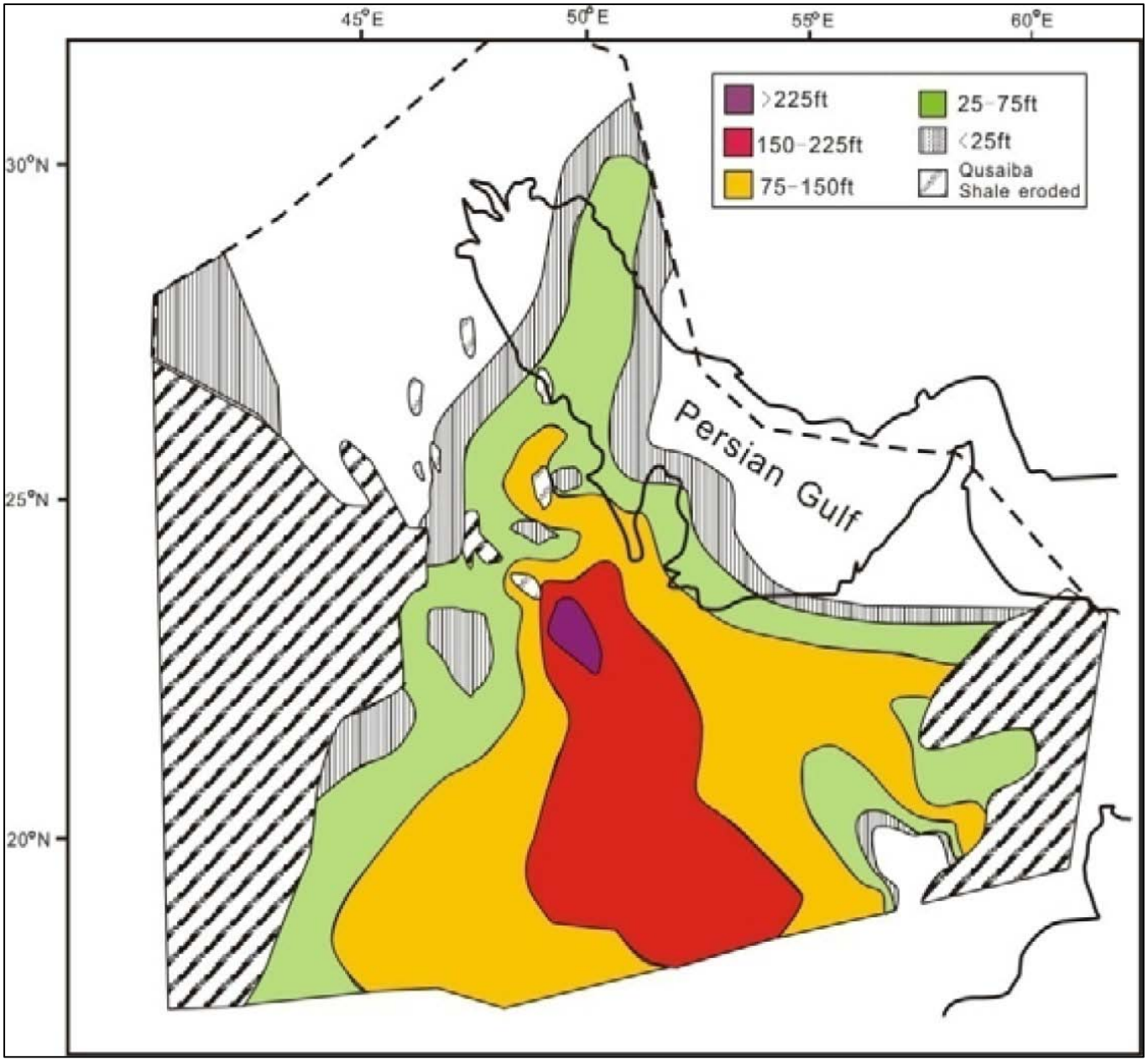

Figure 3. Source rock distribution map in Persian Gulf Basin (after Jones and Stump, 1999.).

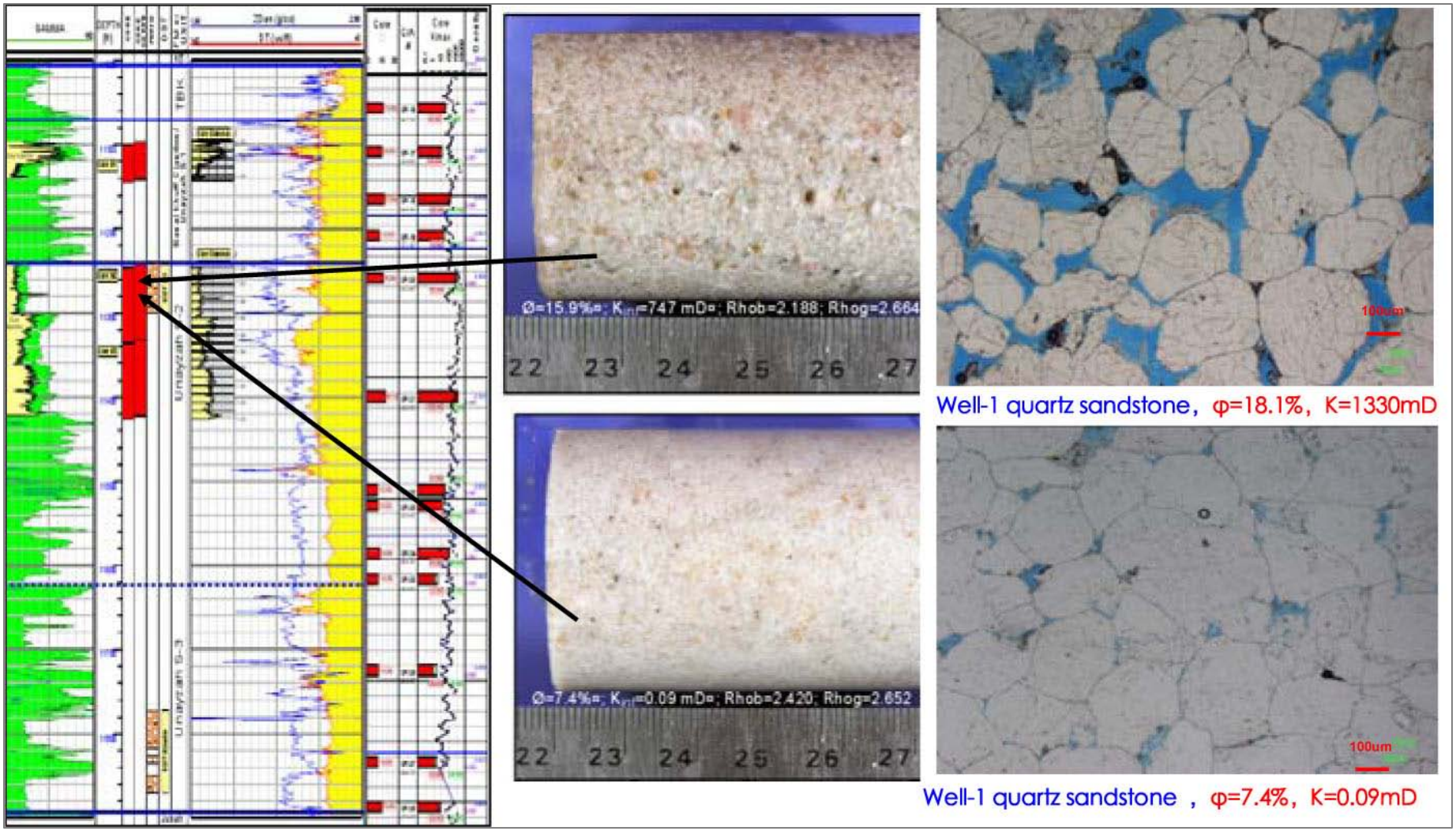

Figure 4. Cores of Unayzah reservoir in well-1.

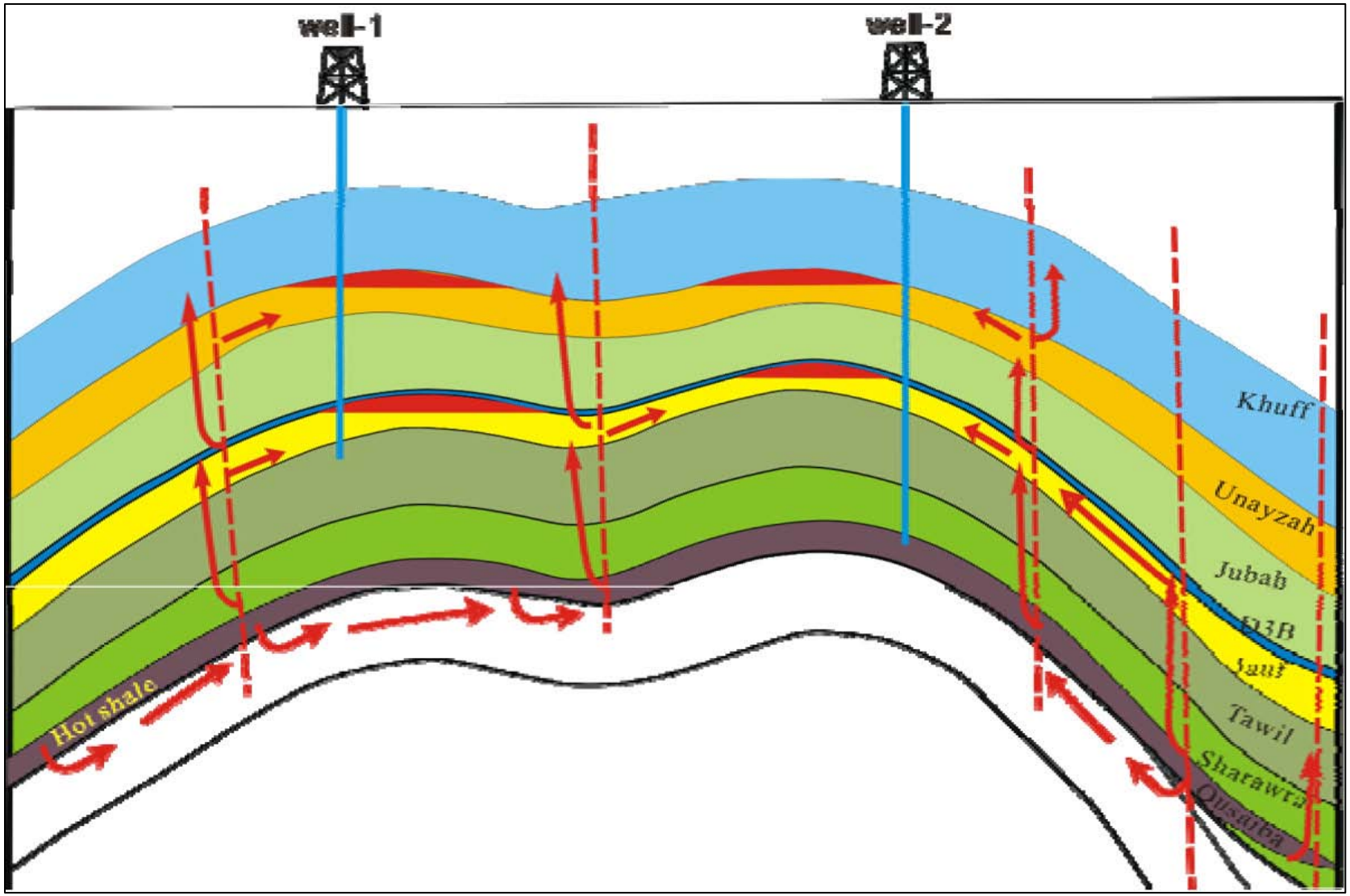

Figure 5. Paleozoic hydrocarbon accumulation chart in Persian Gulf Basin.