

Potential for Basin-Centered Gas in Saudi Arabia; Southwest Ghawar Basin — A Case Study

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The potential for basin-centered gas (BCG) accumulations in Saudi Arabia was investigated by reviewing the Paleozoic petroleum system elements. As a case study, a detailed analysis was conducted on the Southwest Ghawar Basin.

Several Paleozoic basins have been revealed through mapping the subcrop of the Hercynian regional unconformity. These basins are deep and contain the essential element for generating BCG accumulations — the Silurian Qusaiba shale, which has been generating gas since the Late Cretaceous. The Southwest Ghawar Basin was selected as a case study for detailed analysis of the potential for BCG accumulations in the basins.

The southwest Ghawar study focused on the Silurian-Permian clastic sequence that directly overlies the Qusaiba shale. The study involved analysis of the critical interaction between the thermal maturity of the Qusaiba shale, the low permeability of the Silurian-Permian clastic reservoirs, and their relationship with reservoir pressure and fluid type distribution. The analysis indicates a high potential for an effective basin-centered gas system. A breach in the gas system is indicated by the presence of water on the flanks of the basin-centered gas accumulation system, as well as locally around faults in the central parts of the basin.

The southwest Ghawar basin case study has established a new evaluation process for generating basin-centered gas play concepts. This process focuses on analyzing six critical elements denoted as “BCG System Elements.” The BCG System Elements include the thermal maturity of the source rock, proximity of reservoirs to the source rock, reservoir quality, abnormality of reservoir pressures, regional fluid distribution, and the effectivity of interactions among these elements.