Introduction

The U.S. Geological Survey (USGS) recently completed an assessment of the undiscovered conventional oil and gas potential of 128 of the world’s petroleum provinces (U.S. Geological Survey World Energy Assessment Team, 2000). In each province, the USGS defined Total Petroleum Systems, and Assessment Units in each Total Petroleum System, and then quantitatively estimated the undiscovered conventional oil and gas resources. Of the eight global regions studied by the USGS, the Arabian Peninsula portion of the Middle East region was estimated to contain the greatest volumes of undiscovered oil and gas. The Lower Silurian Qusaiba Member of the Qalibah Formation is the source rock for some of the most important Total Petroleum Systems of the Middle East region. For example, the sources of the gas in the supergiant North Field of Qatar and Iran and recent giant light oil discoveries in central Saudi Arabia were largely organic-rich Qusaiba marine mudstones.

Lower Silurian Qusaiba-Paleozoic Total Petroleum Systems

Mudstones of the Qusaiba Member were deposited during Early Silurian time along the entire northern part of the passive margin of what is now part of the Arabian Plate and following melting of a Late Ordovician ice cap. Today, Qusaiba mudstones are found from the edge of the Arabian Shield eastward to the Zagros, from the Rub’ al Khali basin in the south to basins of the Levant in the north. The basal part of the Qusaiba is the most effective hydrocarbon source-rock facies in the Paleozoic, with as much as 75 m of hot shale having total organic carbon as high as 14 percent (Mahmoud and others, 1992; Cole and others, 1994; Bishop, 1995; Milner, 1998; Abu-Ali and others, 1999; Jones and Stump, 1999; Konert and others, 2001).

Across the eastern Arabian subcontinent, the Qusaiba hot shale is mostly thermally mature for gas generation; however, the Qusaiba is overmature for gas generation in the deeper parts of some basins, and mature for oil generation along some basin margins. The USGS defined six Assessment Units in four regional Lower Silurian Qusaiba-Paleozoic Total Petroleum Systems along the eastern Arabian subcontinent (fig. 1; table 1). Reservoirs in the six Assessment Units are mainly Permian Khuff shelf carbonates along the Arabian-Persian Gulf, and Lower Paleozoic marine and Permian alluvial and eolian sandstones within the interior platform and homoclinal adjacent to the Arabian Shield (Evans and others, 1997; Aqrawi, 1998; Winter and others, 1998; Sharland and others, 2001).

Figure 1. Lower Silurian Qusaiba-Paleozoic Total Petroleum Systems and Assessment Units (AU) of the Arabian Peninsula.
Summary

Organic-rich mudstones of the Lower Silurian Qusaiba Member of the Arabian Platform, central Saudi Arabia, are the source of oil and gas for one of the most prolific petroleum-generating systems in the Middle East region. The USGS estimates a mean of 37 billion barrels of oil and 88 trillion cubic feet of gas of undiscovered conventional resources in six Assessment Units of four Lower Silurian-Qusaiba-Paleozoic Total Petroleum Systems across the Arabian Peninsula.

References Cited


Table 5. Assessment results for Lower Silurian Qusaiba-Paleozoic Total Petroleum Systems.

<table>
<thead>
<tr>
<th>Field Location</th>
<th>Field Name</th>
<th>Area/km²</th>
<th>Oil (bbl)</th>
<th>Gas (MMCF)</th>
<th>NGL (MMBGL)</th>
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</table>

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