Correlation of Pennsylvanian and Permian Strata in Coconino County, Arizona

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Includes 2 pages of text (4 Xerox pages) and 4 Plates:
Vertical scale 1 inch / 140 ft. Horizontal scale 1 inch / 5.7 miles

Contents

Plates

Explanatory text to the cross sections

Subsurface strata of Pennsylvanian and Permian age in the western Holbrook Basin are correlated with outcrops in Grand Canyon and the Sedona area (Plates 1-4). Subsurface correlations on the four cross sections are based on geophysical (gamma ray, neutron, density, and sonic) and lithologic logs from 14 wells. Outcrop data in Grand Canyon and the Sedona area are from published reports. The cross sections represent a continuation of subsurface correlations that started in southern Apache County (Rauzi, 1999) and were extended into the western part of the Holbrook Basin (Rauzi, 2000).

In 1994, Ridgeway Arizona Oil Corporation discovered carbon dioxide (CO_2) in rocks of Permian age south of St. Johns, Arizona. By 1998 Ridgeway had drilled a total of 21 wells between St. Johns and Springerville. Six of the wells were drilled just east of the state line in Catron County, New Mexico. These new wells, together with existing wells, provided an excellent opportunity to correlate the subsurface rock units in southern Apache County.

Rauzi (1999) used geophysical and lithologic logs from 27 wells to correlate the subsurface rocks of Permian age in the St. Johns – Springerville area. The nomenclature Winters used to define the widely exposed Permian Supai Formation in the nearby Fort Apache area was readily applied to geophysical log correlation of the Supai in southern Apache County. From the top, the Supai Formation consists of the Corduroy, Fort Apache, Big A Butte, and Amos Wash Members. This interval is correlative with the Yeso and underlying Abo Formation equivalents in adjoining New Mexico.

Rauzi (2000) used geophysical and lithologic logs from 223 wells to extend the correlations first made in the St. Johns – Springerville area into the western Holbrook Basin. He continued to use the nomenclature of Winters (1963) because of its straightforward application to the geophysical log correlation of the Supai Formation throughout the Holbrook Basin.

In the current cross sections, the correlations are extended to the west and northwest from the Holbrook Basin to the outcrop areas where stratigraphic studies have been concentrated. The correlations indicate that (1) the Fort Apache Member of the Supai Formation in the Holbrook Basin can be traced into outcrops in the Sedona area, (2) if the Fort Apache Member was present in Grand Canyon, its approximate stratigraphic position would be below the Hermit Shale, and (3) the Hermit Shale, which crops out in Grand Canyon, pinches out toward the east and south. These conclusions are similar to those made previously by Peirce (1989) but differ from those of Elston and DiPaolo (1979) and Blakey and Knepp (1989).

Blakey (1979 and 1990), Elston and DiPaolo (1979), and Peirce (1989) developed different nomenclature for Permian rocks in east-central Arizona based on regional interpretations and correlation of the Hermit Formation of the Grand Canyon region with units in east-central Arizona. Blakey (1979, Figure 3) correlated the Hermit Formation with the Amos Wash Member of Winters, which he renamed the upper Supai Formation (Blakey, 1990, Figure 2). Elston and DiPaolo (1979, Plate 1) correlated the Hermit Formation with the uppermost clastic interval of the Big A Butte Member of Winters. Peirce (1989, Figures 4 and 5) interpreted the Hermit Formation to pinch out between the Esplanade Sandstone and overlying Coconino Sandstone southeast of Grand Canyon.

Production of helium near Holbrook and CO_2 near St. Johns demonstrates that reservoir rocks are present and that subsurface conditions are favorable for the generation of these gases. Shows of oil and gas have been recorded in many of the wells used in the three studies. The shows indicate that oil has either been generated in these rocks or has migrated into them. Petroliferous rocks also have been reported in outcrops along the Mogollon Rim.

The cross sections in the current and previous studies correlate the units that contain oil shows, helium, and CO_2 in the Holbrook Basin with outcrops in Grand Canyon and the Sedona area. The cross sections reveal numerous stratigraphic changes and local structures which could provide potential traps for additional discovery and development of oil, natural gas, helium, and CO_2 over a large undrilled area in east-central Arizona..

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