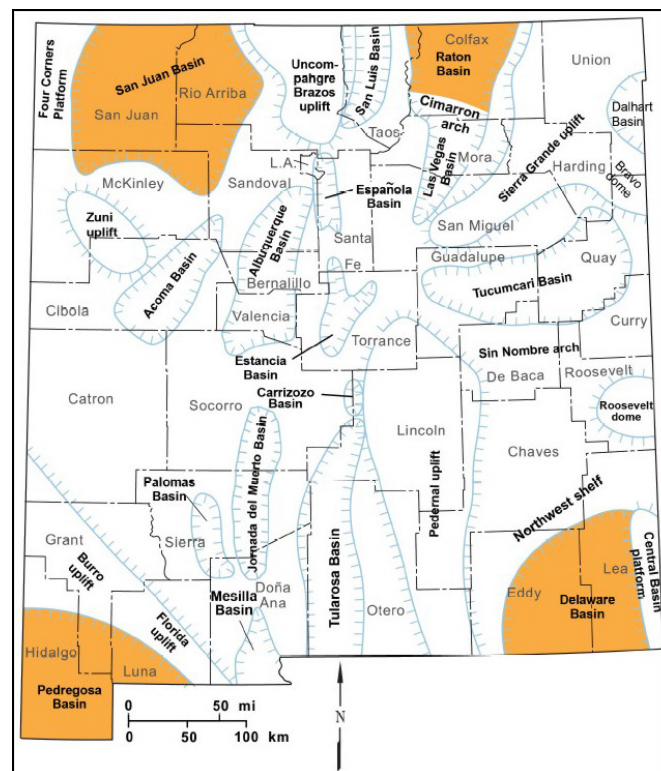


Overview of Selected Shale Plays in New Mexico

This presentation was given by Ron Broadhead of the New Mexico Bureau of Geology and Mineral Resources at the RMAG lunch talk on August 6. Mr. Broadhead received his BS in Geology from New Mexico Tech and his MS in Geology from the University of Cincinnati. Before joining the New Mexico Bureau of Geology and Mineral Resources in 1981, he worked with Cities Services Oil Company in Tulsa and Oklahoma City. From 1982 through 2013, he taught subsurface and petroleum geology at New Mexico Tech. Most recently he has been studying the Mancos Shale in the San Juan Basin and on induced seismicity. From 2011 through 2014 Mr. Broadhead has been the editor of Search and Discovery, the online journal of the AAPG.

New Mexico, with its multiple production and frontier basins of different ages, has many opportunities for shale plays in strata ranging in age from Early Paleozoic to Upper Cretaceous. In this presentation, Mr. Broadhead placed emphasis on the Mancos shale play in the San Juan Basin. He also discussed productive and potentially productive shale plays in the Raton Basin, the Permian Basin, and a frontier play in the Pedregosa Basin of southwestern New Mexico.



Horizontal drilling and multistage fracturing of shales has revived production in New Mexico. Production started in 1924 and peaked in 1969 at 129 million barrels per year. It declined until the last 4 years when shale drilling started in the Delaware Basin. Since

then it has been increasing at 17-19% per year and is currently at 100 million barrels per year. Production is expected to surpass its previous peak within the next 2 years.

In the San Juan Basin, the Mancos Shale has been productive from three plays; the basal Niobrara (“Gallup”) offshore marine sandstone bar in the southwest; the naturally fractured oil-filled Mancos Shales along the southwestern and northwestern flanks of the basin; and the “offshore” shales with thinly interbedded sands that occur northeast of the offshore bars. The first two plays are conventional and mature, while the third is unconventional and has been produced mostly sub-economically by vertically drilled wells. However, one of these wells did IP at 454 bbl/day, probably due to natural fracturing. With the advent of horizontal drilling and multistage fracturing, this play now has the potential to be economically developed on a large scale, particularly along the southwestern trend of this play as it is in the oil window. There are currently four rigs drilling.

The Raton Basin is a Laramide Basin similar to the San Juan Basin. The Niobrara Shale of the Raton Basin is an emerging gas play and has been productive from five vertical exploratory wells.

Several plays are present in the Permian Basin. The Bone Spring Formation has seen extensive development within the Avalon Shale, but horizontal drilling has mostly switched to the Second and Third Bone Spring sandstones as the Avalon has proven gas prone. The Bone Spring sandstones have been mostly responsible for the rise of New Mexico oil production from 70 million barrels to 100 million barrels over the past three years. He also mentioned the Mississippian Barnett Shale where thermal maturation trends are depth independent.

The Pedregosa Basin of southwestern New Mexico has experienced multiple stages of tectonic deformation from the Pennsylvanian to the late Tertiary. The marine Percha Shale (Upper Devonian) is dominated by gas prone kerogens and is affected structurally and thermally by all tectonic stages. It extends from 800 ft to 12,000 ft in depth within a mile. The Percha is within the thermogenic gas window through southwestern New Mexico and is metamorphosed where proximal to large intrusive bodies. Exploration is challenging in the Pedregosa because of the difficulty of predicting both maturation and formation depths because of these multiple tectonic episodes. However, there is an existing interstate gas pipeline running across the basin for wells to tie into.

A member of the audience asked about Pierre Shale and Niobrara drilling extending into Rio Arriba County. Mr. Broadhead replied that there were questions about thermal maturation and there could be local opposition to drilling. There was also a query about the Tucumcari Basin. He replied that there is potential as the shales have a high TOC. A bonus is that some of the Pennsylvanian Rocks in this basin contain helium which sells for \$80 per mcf and present reserves are dropping at the Amarillo storage facility.

Helium is a vital industrial gas. Methane would be sold as a byproduct of the helium production.

The graphics for this talk may be downloaded from Search and Discover [here](#)