

Helium in Southern Saskatchewan: Accumulation and Geological Setting

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Saskatchewan is experiencing renewed interest in potential helium production due to increasing commodity prices. Helium was reported in gas analyses from wells in southwestern Saskatchewan as early as the 1950s, with anomalous values of helium up to 2%. Helium was produced in the early 1970s from four wells and recently three wells have produced in Saskatchewan, with another 13 wells that have recently been drilled for helium targets.

With the mounting interest in helium, a study was initiated to better understand the generation, accumulation and geological setting of helium resources in the province. This included an examination of 5532 analyses from 4240 wells analyses in Ministry of the Energy and Resources well files from southern Saskatchewan, which identified anomalous helium concentrations in stratigraphic intervals ranging from the Cambrian to the Cretaceous. Of these, it was found that, 17 wells have helium values of greater than 1%, with the most shows concentrated in southwestern Saskatchewan.

Understanding the source, migration and trapping of the helium is critical in understanding where the economic accumulations occur. Although the physical processes required to trap economic amounts of helium are similar to hydrocarbon natural gas traps, it requires a more robust seal for its reservoir. The two likely models for the development of helium plays in southern Saskatchewan are: 1) generation of helium by radioactive decay of uranium and thorium in Precambrian granitic basement rocks; migration along fracture/fault systems developed throughout the Phanerozoic by the numerous tectonic elements in this part of the province (e.g. the Great Falls Tectonic Zone); and pooling/entrapment in sediments draping structural highs with effective seals; and 2) generation of helium by radioactive decay of uranium and thorium naturally occurring in the shales of the lower Paleozoic rocks (primarily Deadwood Formation shales) with migration into stagnant pore water, partitioning of the helium from the water into gas, and pooling/entrapment as noted above.