Salt Collapse or Karst? A New Model for Reservoir Development in Paleozoic Carbonates of the Potash Mining District of Saskatchewan

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Geologists who've worked Saskatchewan are familiar with the structural disturbances caused with dissolution of the Middle Devonian Prairie salt. Typically, removal of the salt creates vertical "chimneys" or slump features in overlying strata. The accepted interpretation, or "standard model", of these disturbances is that normally competent and impermeable carbonate rocks were fractured, brecciated, and deformed by collapse into the solution void, thus creating extensive fracture-controlled reservoirs.

The standard model was used by PCS Potash for analyzing mining conditions until it was noted that in some cases, disturbances of the overlying Paleozoic strata were not related to dissolution of the Prairie salt, nor was the disturbance related to dissolution of minor overlying Upper Devonian salts. Furthermore, in some disturbances that had dissolution of Prairie salt, the amount of vertical disturbance was less extensive than predicted from mining experience.

Geological and geophysical analysis suggests that two distinct, yet at times coincident, processes are responsible for creating the deformational structures seen on seismic sections. Karstification of the Upper Paleozoic carbonates associated with regional sequence boundaries and working from above may form disturbance trends independent of trends caused by dissolution of underlying Prairie salt, which can be shown to proceed upward into the carbonate beam from below. It is when these two processes coincide that the classic, vertically extensive solution collapse "chimney" is created.

Although aspects of the "karst and collapse" model are unclear at this time, it does provide an alternative hypothesis for the formation of Devonian plumbing systems.