Stratigraphic Characterization of the Birds Nest Aquifer in the Uinta Basin, Utah: Implications for Saline Water Disposal from Natural Gas Production

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During deposition of the upper Green River Formation in the late Eocene, Utah's Lake Uinta transitioned from a balancedfilled basin dominated by organic-rich, laminated marlstone, to an underfilled restricted basin. During this time, the saline mineral nahcolite formed within the deep-lake sediments (depocenter in central Uintah County) as isolated crystals, nodules ranging up to one foot in diameter, and beds ranging from less than an inch to 2 ft thick. Post-deposition, the saline mineral shortite formed in fracture zones several feet thick. More recently, the Birds Nest aquifer formed from the dissolution of these saline minerals. This aquifer, ranging in thickness from <100 ft on the basin margins to >300 ft in the basin's depocenter, is targeted by natural gas operators as a potential saline-water disposal zone. Understanding the aquifer's areal extent, thickness, water chemistry, and zones of differential dissolution will help determine possible saline water-disposal volumes and safe disposal practices, both of which could directly impact the success of increased petroleum production in the region.

Preliminary research shows the Birds Nest's water chemistry in the north (averaging >10,000 ppm TDS and as high as 100,000 ppm TDS) is distinct from that in the south (averaging <10,000 ppm TDS and down to near 1000 ppm TDS). This abrupt change in water chemistry is most likely due to the differing amounts of saline mineral dissolution in the two areas; the southern area may have been flushed clean, whereas saline minerals in the northern area are still actively dissolving. The presence of intact nahcolite in the Utah State 1 core (Sec. 26, T. 9 S., R. 21 E.) on display with this poster demonstrates that there are still zones of no dissolution north of the 10,000 ppm TDS line. Just to the south of this well, the saline minerals in the Birds Nest show significant dissolution, as seen in the Utah State 13X-2 core (Sec. 2, T. 10 S., R. 21 E.) - also on display. Separating these two areas is a prominent gilsonite vein that cross-cuts the Birds Nest aquifer.

These northwest-trending gilsonite veins seem to influence groundwater flow patterns in the Birds Nest by creating "channels" of dissolution and impermeable barriers to flow. In addition, research shows the Birds Nest aquifer in this area is divided into two or three stratigraphic zones of dissolution each roughly 40 ft thick; it is currently unclear if these zones are hydraulically connected or if the Birds Nest as a whole is vertically connected to other water-bearing zones both above and below. New insights into the structure of the Birds Nest aquifer will play an important role in future disposal practices, including how best to protect fresh water resources in the area.