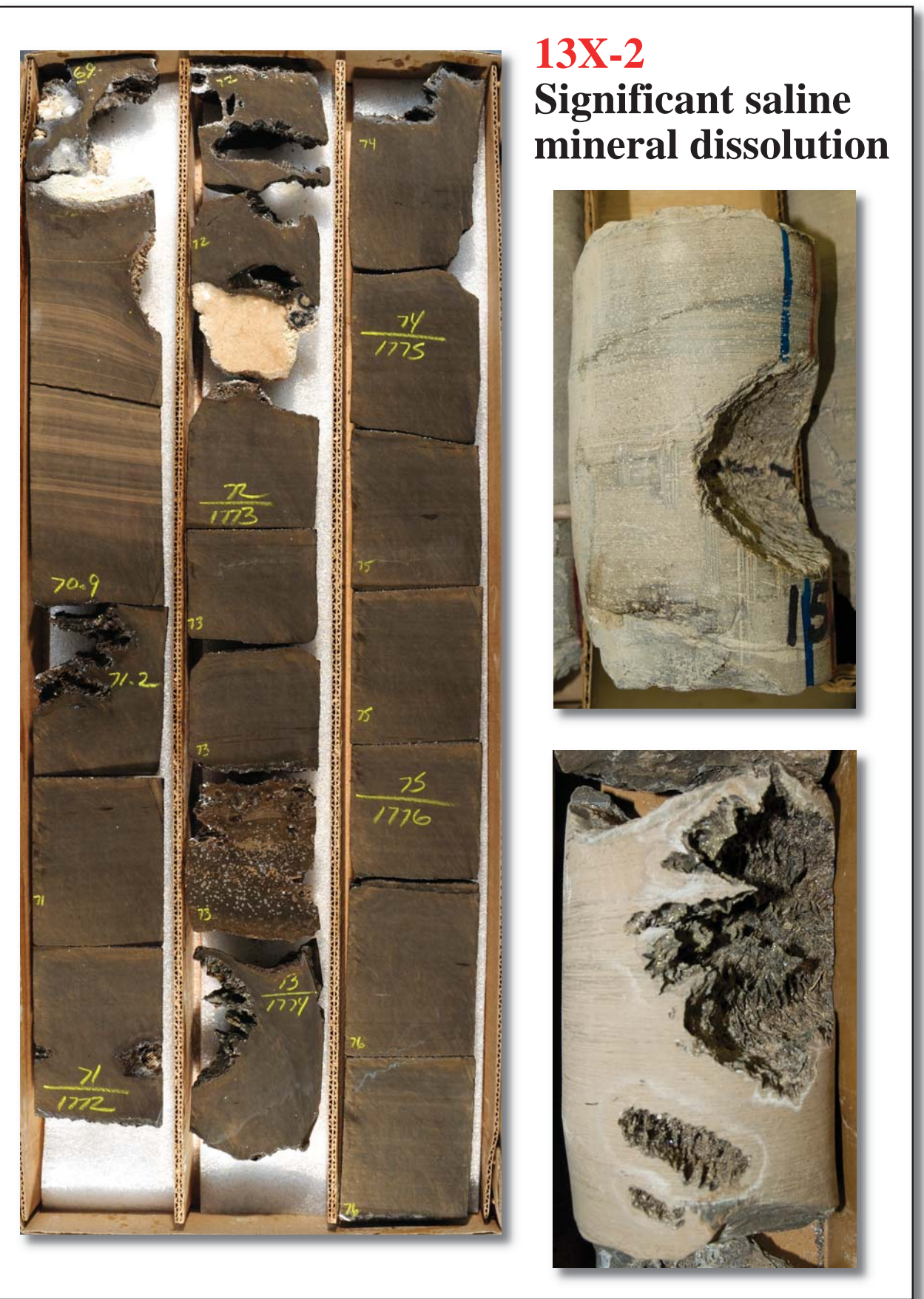
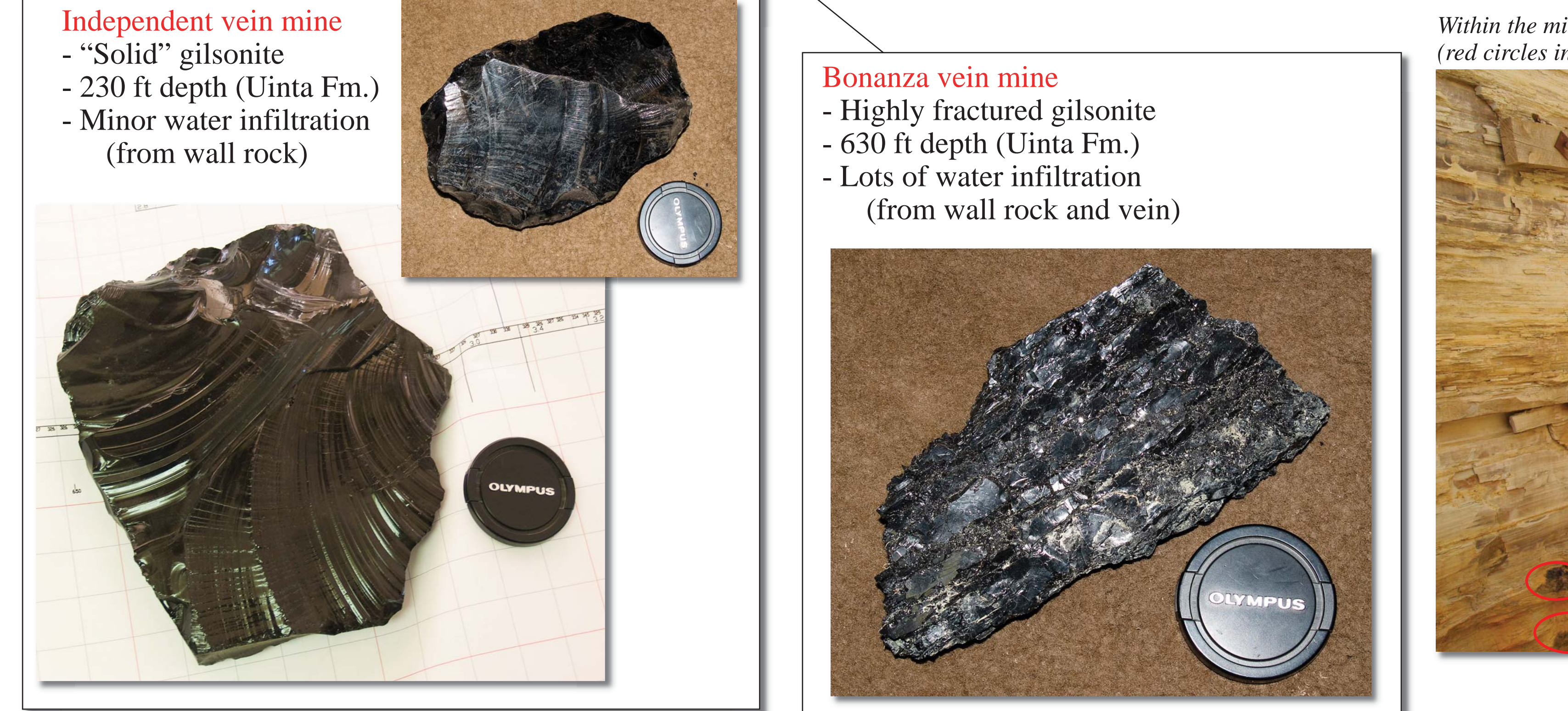
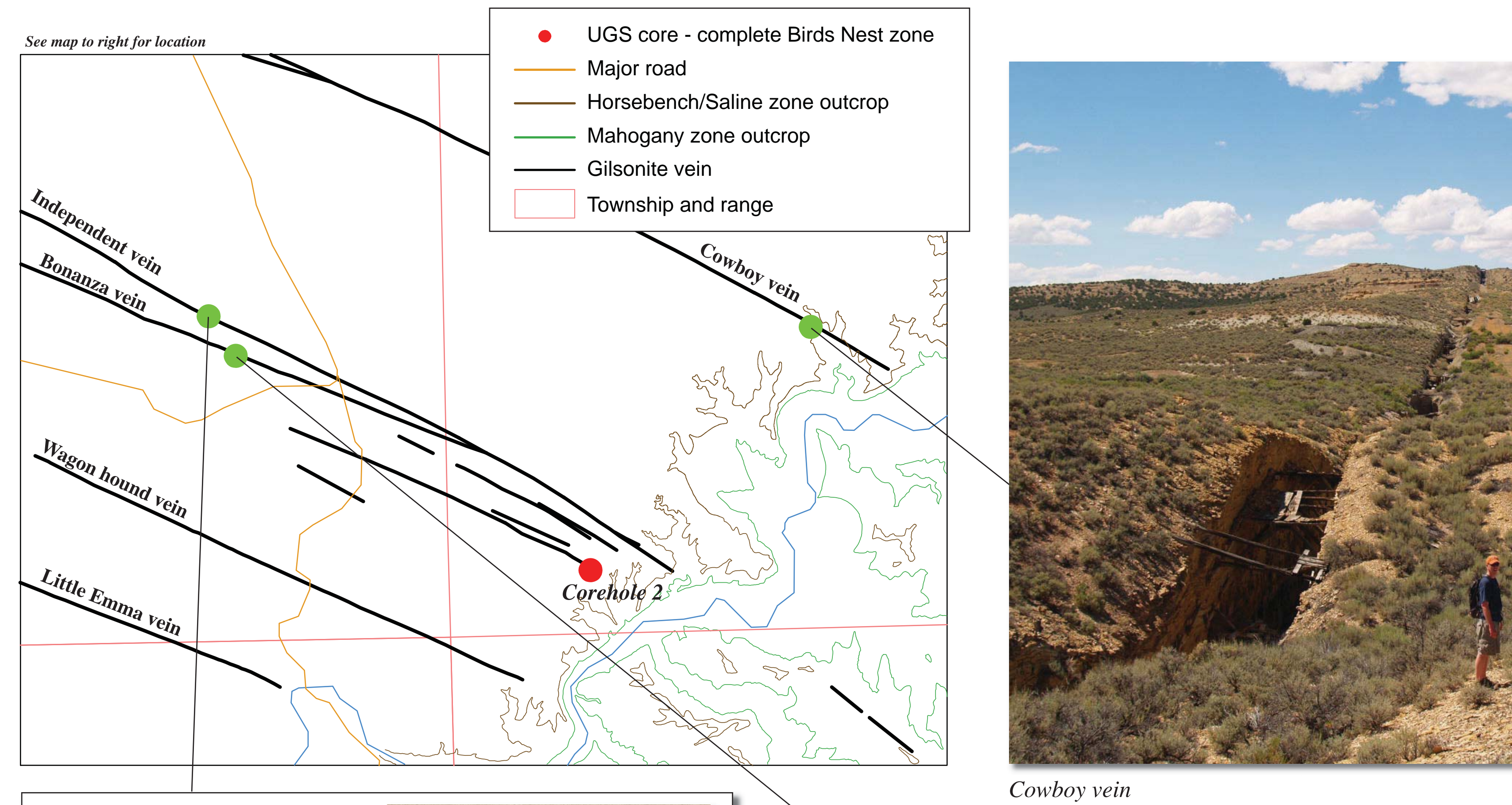


Influence of gilsonite veins on the Birds Nest aquifer:

Gilsonite (a solid hydrocarbon) occurs in veins ranging in thickness from a couple inches to tens of feet and originates in the rich oil shale beds of the upper Green River Formation, continuing up to the surface, cross-cutting the Birds Nest aquifer. Questions remain as to how these veins might affect groundwater movement through the Birds Nest aquifer; could they act as barriers to flow or could they create vertical and/or horizontal pathways for water transmission.

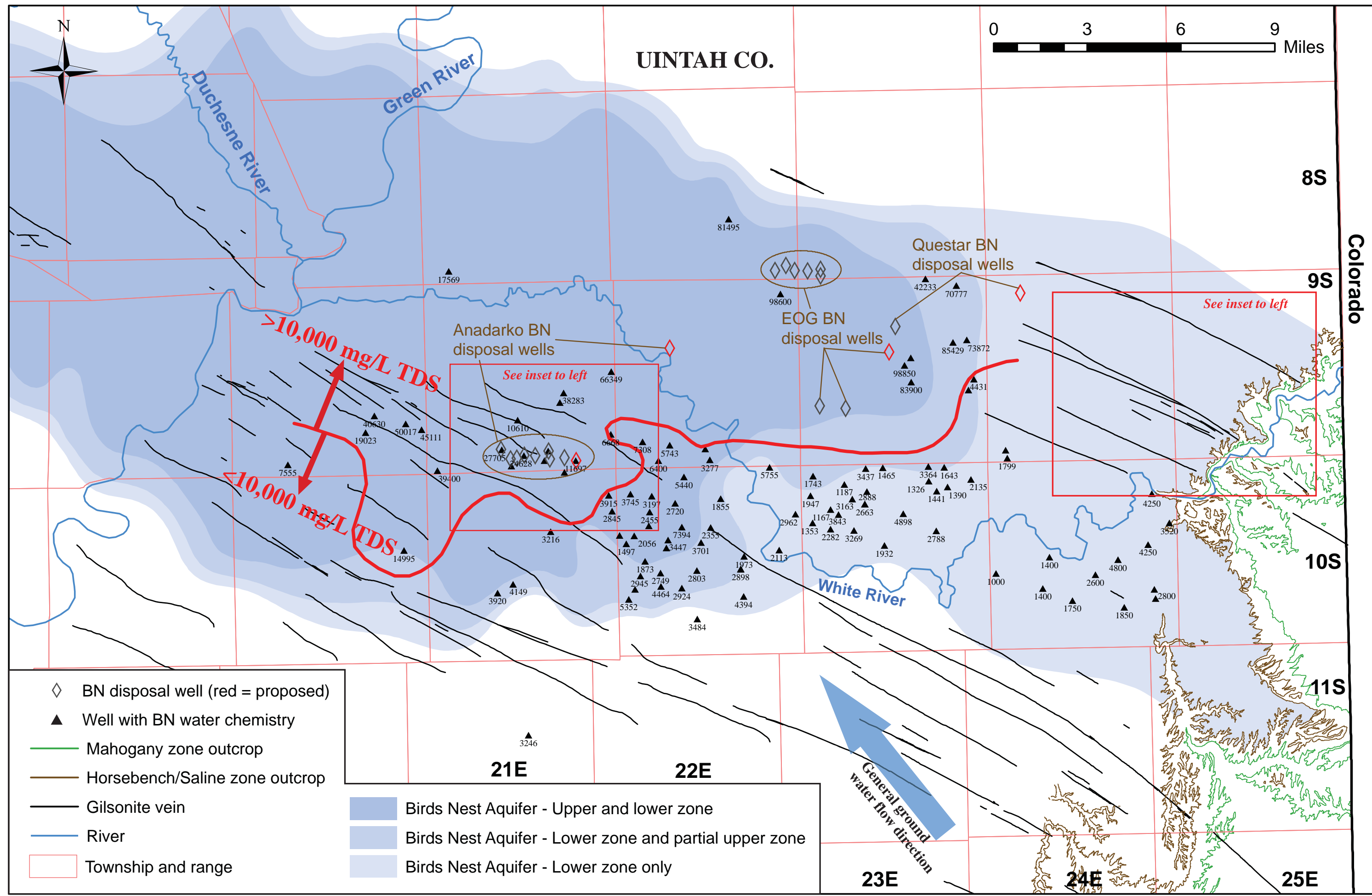
- Evidence for barrier:** Near the basin's depocenter, several cores exist that recovered the entire Saline zone. Most of these cores (e.g., 13X-2) show significant saline mineral dissolution, in fact, Anadarko has begun disposing saline water into the Birds Nest in this area. However, there is one well (Utah State 1) with core slightly to the north, which shows no signs of saline mineral dissolution. This core is separated from the others by a gilsonite vein. With the beds dipping to the northwest, water generally travels from southeast to northwest. Water within the Birds Nest has dissolved the saline minerals to the south of the vein, but the gilsonite vein seems to stop water from reaching the area on its northern side, creating a zone of no dissolution. It is assumed that similar areas of no saline mineral dissolution exist throughout the Birds Nest aquifer, but it is difficult to quantify these areas without core.

- Gilsonite mine tour, evidence for both transmission and barrier:** UGS geologists toured two mines in different gilsonite veins. The first contained a highly fractured type of gilsonite which easily transmitted water through the vein. The second mine contained a type of gilsonite that was very solid and transmitted no water. These observations suggest that gilsonite veins could act as both barriers or corridors for water depending on the type of gilsonite in the vein. However, gilsonite type at depth is impossible to identify in the absence of an actual mine.



Birds Nest aquifer water chemistry:

Chemistry of Birds Nest water (mostly acquired by Anadarko) in the north (averaging >10,000 mg/L TDS and as high as 100,000 mg/L TDS) is distinct from that in the south (averaging <10,000 mg/L TDS and down to near 1000 mg/L 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. This transition is important because produced saline water can only be disposed into the aquifer where the water is currently 10,000 mg/L TDS and above (only north of the red line). In some areas, like near Anadarko's disposal wells, it seems that the presence of gilsonite veins has had an influence on the shape of the 10,000 mg/L TDS line. The gilsonite veins could be acting as barriers, creating underground channels of groundwater flow (see discussion to left).



Regional cross sections through the Birds Nest aquifer:

Regional cross sections were constructed to help define the areal extent of the Birds Nest aquifer. The areas shaded in blue represent the presence of large saline nodules/beds in one or two zones, the dissolution of which creates the porosity and permeability for potential large-scale saline water disposal.

