

## **Distinct carbon dioxide charge locations in northeastern New Mexico**

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Naturally occurring carbon dioxide (CO<sub>2</sub>) is common in the subsurface of northeastern New Mexico<sup>1</sup>. In the Bravo Dome gas field the primary CO<sub>2</sub> reservoir is the Permian Tubb Sandstone, which is overlain by an anhydrite seal. Previously published evidence indicates that gas enters the Tubb Sandstone in the northwest area of the field<sup>2,3</sup>. There is also minor production from the shallower Triassic Santa Rosa Formation; the charge location for the Santa Rosa is unknown.

Compositional, stable isotopic, and noble gas isotopic analyses of gas produced from the Santa Rosa Formation within Bravo Dome, as well as to the southwest and the northwest of the field, indicate a different charge location than for the Tubb Sandstone. Within Bravo Dome and to the southwest, the CO<sub>2</sub> concentration of the gas is over 99 mol% with a  $\delta^{13}\text{C}$  of -4‰, and ranges from 86 to 93 mol% with a  $\delta^{13}\text{C}$  of -7‰ to the northwest. The R/R<sub>A</sub> values trend from ~2.0 in the southwest to ~1.0 in Bravo Dome, to 0.7 in the northwest. Argon and neon isotope ratios indicate a mixing of mantle and air saturated water, with the largest influence of air saturated water in the northwestern samples. The CO<sub>2</sub>/<sup>3</sup>He ratio ranges from 5.7x10<sup>9</sup> in the southwest to 7.98x10<sup>8</sup> in the northwest, indicating increasing CO<sub>2</sub> dissolution in the northwest.

The analyses of the gases present in the Santa Rosa Formation indicate a complex fluid evolution history. The trends in the data are different than those identified in the Tubb Sandstone within Bravo Dome, which may indicate that the pathway of CO<sub>2</sub> entering the Santa Rosa Formation is geographically distinct from that of the Tubb Sandstone. Within the Tubb Sandstone, the R/R<sub>A</sub> values decrease away from the northwestern charge zone, whereas in the Santa Rosa Formation the R/R<sub>A</sub> values decrease from high values in the southwest to low values in the northwest.

[1] Broadhead *et al.* (2009) NM B of Geo and Min Res OFR **514**, 131p. [2] Sathaye *et al.* (2014) PNAS **111**, 15332-15337. [3] Brennan (2016) GSA Abs w Prog **48**, n7.