

## Applications in Utilizing Soil Gas Geochemistry to Calibrate Helium Exploration Models on the Four Corners Platform, USA

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### Summary

A key unknown of helium (He) systems is if surface soil gas surveys can be an effective exploration tool for He when combined with other datasets. Here we present the results of seven new soil gas He gas surveys (n=1974) at the Akah Nez Field, Beautiful Mountain Field, Porcupine Dome area, Rattlesnake Field, Tom area, Tohache Wash area, and White Rock area, on the Colorado Plateau, Four Corners area, USA. Utilizing 2D seismic, well logs, and geophysical potential field data we construct structural maps of potential He reservoirs at depth and examine relationships. Given we are examining geospatial relationships using the soil gas survey data, it is important to understand the mechanism that allows subsurface He to migrate upwards into the soil. We find that in several fields interpreted basement faults act as migration conduits from the basement to the surface (i.e., leaky reservoir seals), and in other cases there is evidence for reservoir flank/crest fracturing likely due to differential compaction. Based on the regional geologic history, we propose that advection systems are likely responsible for the observed He soil gas signatures. Additionally, based on the Tohache Wash data (most prospective He area) we present an effective and risk-reducing novel technique to calibrate a predictive He exploration model utilizing soil gas geochemistry, high-resolution geophysical data, well data, and seismic data using Bayesian regression techniques, which may be translated to areas outside of the Four Corners Area, USA.