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10 percent in the last 20 to 50 years and the chemistry is nearly identical along the spring line. The field measured bicarbonate content at eight springs varies less than 5 percent (4.93 to 5.08 meq/l), the water is saturated with respect to calcite and dolomite, and the $\delta^{13}C$ ranges from -4.8 to -5.5‰. In contrast, the ^{14}C content ranges from 1.8 to 14.8% modern, or by a factor of 8. The ^{14}C does not correlate with HCO_3^-, $\delta^{13}C$, discharge, water temperature, nor with geographic position. About 11 km up the hydraulic gradient, water from a test hole tapping the upper 60 m of aquifer has HCO_3^-, $\delta^{13}C$, and ^{14}C values of 4.75 meq/l, -4.8‰, and 7.3%, respectively. This ^{14}C content is less than that at five of the eleven springs sampled in the discharge area. Head relations, absence of ^3H, aridity of region, great depth to aquifer, and P_{CO_2} of ground water all preclude introduction of modern ^{14}C via recharge or vapor transfer at or between the discharge area and the sampled test hole.

Hydrodynamic dispersion resulting from small and large scale aquifer heterogeneity is the most plausible of several explanations for the ^{14}C variance. The dispersion model proposed involves variable mixing of relatively old water in circuitously connected or poorly permeable fractures with considerably younger water in directly connected permeable fractures and brecciated zones. If dispersion on the order of kilometers is occurring near Ash Meadows, then hydrodynamic dispersion could be a major control on the chemical and isotopic evolution of water in other fractured and cavernous aquifers.

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GEOTHERMAL STUDIES IN NORTH-CENTRAL NEVADA

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A program of geological, geochemical, and geophysical studies evaluates three potential geothermal resource areas, Buffalo Valley, and portions of Buena Vista and Grass valleys in north-central Nevada. The region is characterized by higher than normal heat flow, 2.5 h.f.u. (Sass et al., 1970), and temperatures at depth within some hot spring systems are estimated to exceed 150°C (Mariner et al., 1974). Geological mapping of structures in alluvial and bedrock areas is aided by airborne multispectral imagery. The mapping is complemented by electrical geophysical and microseismic measurements to disclose hot water zones at depth, and the fault systems which may control the distribution of the hot waters. Results of surface geophysical techniques are compared with existing gravity and magnetic data. These studies will lead to the choice of sites for heat-flow holes (100-200m) which may, in turn, determine the locations of one or more deep (1 to 2 km) test wells.

Concurrently, samples of hot and cold spring waters, as well as of country rock are analyzed for radioactive, trace, and major elements by nuclear techniques. Geochemical "fingerprinting" of rocks and waters may illuminate the pathways of water from its source area, into the geothermal system. Besides influencing plant design, the geochemical and radiometric analyses also form the basis for environmental assessment of future resource development.