USING STRONTIUM ISOTOPES TO DETERMINE SOURCES OF HIGH-CHLORIDE WATER IN A COASTAL SOUTHERN CALIFORNIA AQUIFER

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The U.S. Geological Survey currently is assessing regional groundwater resources in the San Diego area. The regional assessment includes the installation of 9 USGS multiple-well monitoring sites in the San Diego, Sweetwater, Otay, and Tijuana drainage basins to depths of as much as 2,000 feet in order to effectively gather detailed information about the San Diego Formation. In addition to geologic and hydrologic data, water samples were collected from these multiple-well monitoring sites and analyzed for a broad range of chemical constituents.

On the basis of the composition of major ions and selected minor ions relative to Cl^- concentrations, the chemical composition of the groundwater in these four drainage basins can be characterized as mixed cation-Cl to Na-Cl type; the chemical composition of several near coastal water samples resembles that of seawater. Stable isotopes of hydrogen and oxygen in groundwater samples collected from the multi-level monitoring wells indicate at least three distinct sources of recharge in the drainage basins. These results suggest that seawater intrusion presently is not a predominant source of high-Cl^- water in the San Diego Formation.

Strontium isotopes were analyzed to gain a better understanding of the sources of high-Cl^- groundwater to wells in the San Diego Formation. The strontium isotopic composition is expressed as $\delta^{87}Sr$, the per mil deviation of $^{87}Sr/^{86}Sr$ from the value for modern seawater (0.70920). For water samples collected from the multiple-well monitoring sites, $\delta^{87}Sr$ values ranged from less than -4.00 to almost $0.00^{o}/_{oo}$, with higher values generally near the coast along with high Sr concentration. In contrast, water samples collected away from the coast had lower $\delta^{87}Sr$ values with corresponding low Sr concentrations. These results suggest that the dissolution of soluble salts characteristic of the underlying marine deposits is the predominant source of high-Cl^- groundwater in the San Diego Formation.