Determination of Groundwater Flow Paths in a Coastal Southern California Aquifer

[1]Robert Anders and [2]Kiyoto Futa

[1]USGS San Diego WSC, 4165 Spruance Rd., Ste. 200, San Diego, CA, 92101
[2]USGS Denver Federal Center, Box 25046, MS 963, Bldg. 21, Denver, CO, 80225

The U.S. Geological Survey (USGS) is conducting a comprehensive geologic, hydrologic, and geochemical investigation of groundwater resources in the San Diego coastal area. The regional assessment includes five drainage basins, in order to gain a better understanding of the hydrogeology of the areally extensive San Diego Formation. An integral part of the investigation is the installation of 10 multiple-well monitoring sites to collect groundwater samples from discrete intervals and to extract pore-water fluids from selected sections of drill core. The analytical protocol includes major dissolved ions, trace metals, stable isotopes, and strontium isotopes ($^{87}Sr/^{86}Sr$). Strontium isotopes have proven to be especially useful in detecting mixing among waters of different sources and histories, as well as in characterizing the effects of water-rock interaction.

This paper will present groundwater and pore-water data collected from two, east-west pairs of monitoring-well sites located in the Sweetwater River and the Otay River drainage basins as well, as a monitoring-well site located on a plateau between the two drainage basins. These data indicate the hydrogeology of the San Diego area can be characterized as alternating layers of marine and non-marine sediment lacking large-scale lateral uniformity. The dissolved strontium concentrations from these groundwater samples and pore-water fluids ranged from as low as 100 μg/L to more than 18,000 μg/L, and the $^{87}Sr/^{86}Sr$ ratios ranged from about 0.7060 to 0.7090. One potential source of groundwater in the San Diego area is modern seawater, which has a $^{87}Sr/^{86}Sr$ ratio of about 0.7092; another is recharge from the topographically higher elevations east of the study area that has $^{87}Sr/^{86}Sr$ ratios between 0.7050 and 0.7060. Finally, the similarities in $^{87}Sr/^{86}Sr$ ratios between groundwater samples and pore-water fluids provide insight into the relative hydraulic conductivity among these discontinuous aquifers.