Near-conservative behavior of ^{129}Iodine in the Orange County Aquifer System, California

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Iodine is a biophilic element with one stable isotope, ^{127}I, and one long-lived radioisotope, ^{129}I. Radioiodine ^{129}I originates in the surface environment almost entirely from anthropogenic activities such as nuclear fuel reprocessing in Europe and thus provides a point source tracer. Very few studies have evaluated the geochemical behavior of iodine isotopes in the subsurface. The concentrations of ^{129}I and ^{127}I were measured in wells fed by a series of artificial recharge ponds in the Forebay Area of the Orange County groundwater basin (California, USA) to evaluate their potential use as hydrological tracers. To substantiate interpretation of ^{129}I and ^{127}I concentration data, the aquifer system was evaluated using literature values of aquifer water mass age based on ^{3}H/^{3}He, Xenon and δ^{18}O tracer data. The aquifer data demonstrate the nearly conservative behavior of ^{129}I, with ^{129}I/^{127}I ratios likely reflecting variations in source functions as well as climatic conditions, and with inferred particle-water partition coefficients (K_d) of 0.1 cm^3 g^{-1} or less.

Age-dating groundwater discharge in the Merced River basin, California using noble gasses and chlorine-36

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Using a combination of water quality and isotopic analyses, ages of groundwater inputs to the Upper Merced River were characterized. Between Nov. 2003 and July 2004, monthly water quality samples were taken from Happy Isles to the inlet of Lake McClure, a 75 km reach. These samples demonstrated the expected dilution due to snowmelt in the spring. In the fall, the spatial profile matched the geology with anion concentrations increasing as downstream of the transition from the Sierra Nevada batholith to the country rock, suggesting significant groundwater inputs. From July 2004 – January 2005, radon-222 and other noble gases (He, Ne, Ar, Kr and Xe abundances and ^{3}He/^{4}He ratio) were measured along a 40 km reach of the Merced River, extending from the top of Yosemite Valley to the confluence of the South Fork of the Merced River. Radon-222 activity varied from about 1 to 500 pCi/L indicating significant, spatially variable groundwater discharge into the Merced River. The highest ^{222}Rn were observed during baseflow. For a representative groundwater end-member, radon-222 activity measured in Fern Spring, Yosemite Valley was about 1200 pCi/L. Excess ^{4}He from U and Th decay is observed in samples with elevated ^{222}Rn. Preliminary ages range from 15 yr for Fern Spring to greater than 50 yr for some discharging groundwater. There is a trend of older water discharging further downstream. Chlorine-36 results corroborate the noble gas results.