Cl-36 in Pleistocene groundwaters of Egypt and Saudi Arabia

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Chlorine-36 was measured in groundwaters from the the Nubian Sandstone Aquifer System (NSAS) in Egypt and the Rub Al Khali Aquifer System (RAKAS) of Saudi Arabia. Isotopic abundances (^{36}Cl/Cl) ranged from 5×10^{-15} to 343×10^{-15} and from 12.2×10^{-15} to 228×10^{-15} for the Eastern Desert and Western Desert of Egypt, respectively. The RAKAS has (^{36}Cl/Cl) ranges from 8×10^{-15} to 87×10^{-15}. Groundwaters from the NSAS in the Eastern Desert and the RAKAS are enriched in ^{36}Cl concentration (atoms/kg) relative to groundwater samples from the NSAS in the Western Desert. This may indicate a generally higher extent of evaporative salt enrichment in recharge waters of the Eastern Desert and the RAKAS.

Apparent ^{36}Cl model ages of NSAS groundwater ranged from <40 kyr to ~1,300 kyr in both the Eastern and Western Deserts of Egypt, and from <40 kyr to ~1,000 kyr in the RAKAS. The lowest apparent ages were from shallow wells in alluvial aquifers and in presumed aquifer recharge zones. The highest ages in both aquifer systems were from deep wells. Groundwaters are depleted in ^{2}H and ^{18}O relative to modern precipitation, consistent with recharge of these aquifers during Pleistocene wet climatic periods.

The groundwaters display a general trend of increasing age with distance from the presumed recharge areas. Initial ^{36}Cl/Cl ratio estimated for the recharge of Western Desert paleowaters is $\sim 130 \times 10^{-15}$ based on best fit of data to a hydrodynamic model, whereas that for the Eastern Desert and RAKAS paleowaters is $\sim 90 \times 10^{-15}$ based on values in groundwaters having live ^{14}C, indicating greater marine influence in the mountainous recharge areas adjacent to the Red Sea than in the Western Desert recharge area in SW Egypt. Some shallow alluvial aquifers in the Eastern Desert and Rub Al Khali have anomalously old apparent ^{36}Cl model ages likely indicating mixing of paleowaters in both aquifer systems with modern recharge in alluvial aquifers. In such cases, ^{2}H and ^{18}O abundances are less depleted than in groundwater from deeper wells.