Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20389

Geochemical Characterization of Groundwater from the Nubian Aquifer System, Egypt: Insights from Solute Compositions and $^{87}Sr/^{86}Sr$ Ratios

MAHMOUD SHERIF[1,2], REIKA YOKOCHI[3] AND **NEIL C STURCHIO**[4]

[1]University of Chicago
[2]Tanta University
[3]The University of Chicago
[4]University of Delaware
Presenting Author: sturchio@udel.edu

This study presents a new data set of solute concentrations and $^{87}Sr/^{86}Sr$ ratios to better characterize the geochemical processes controlling the evolution of groundwaters from the Egyptian portion of the Nubian Aquifer System of northeastern Africa. Samples were collected at five oasis areas in the Western Desert (Kharga, Dakhla, Farafra, Bahariya, Siwa) and three wadis in the Eastern Desert (Dara, Qena, Laquita). The solute compositions along with $^{87}Sr/^{86}Sr$ ratios indicate that groundwaters in the Western Desert of Egypt are geochemically distinct from those of the Eastern Desert. Groundwater samples in the Western Desert comprise two distinct subgroups. The solute compositions of groundwaters in the Western Desert are mainly controlled by dissolution of aquifer minerals within the Nubian Aquifer rocks, whereas those in the Eastern Desert reflect mixing of Nubian Aquifer water with shallow meteoric water showing evidence of evaporative enrichment of solutes. Groundwaters in some locations in the Western Desert (Baharyia, Farafra and Dakhla) have relatively low pH, alkalinity, and other solute concentrations due to high CO_2 concentrations in waters that have limited interactions with aluminosilicates or carbonates in nearly pure quartz sandstone; in contrast, groundwater in some locations in Bahariya and Siwa exhibit higher pH, alkalinity, and solute concentrations due to more extensive interaction of carbonic acid with silicate minerals during longer residence times in less pure sandstone with greater fraction of intercalated shale layers. Water from most of the investigated Western Desert wells display $^{87}Sr/^{86}Sr$ ratios that apparently reflect interaction with clastic sediments derived from granitic rocks, or with shales ($^{87}Sr/^{86}Sr$ = 0.709 to 0.720). The Eastern Desert groundwaters have relatively low $^{87}Sr/^{86}Sr$ ratios (0.706 to 0.708) indicating interaction with relatively unradiogenic limestones and/or mafic/ultramafic rocks; such unradiogenic $^{87}Sr/^{86}Sr$ ratios are also typical of some groundwaters from the Kharga oasis area adjacent to a large Tertiary limestone plateau. The Sr concentrations in the Eastern Desert waters generally exceed the US EPA health advisory limit of 4 mg/L.