Noble gases used as an indicator of groundwater mixing in Azraq, Jordan

T. KAUDSE* AND W. AESCHBACH-HERTIG

Institute of Environmental Physics, Heidelberg University, 69120 Heidelberg, Germany (*correspondence: Tillmann.Kaudse@iup.uni-heidelberg.de)

Several sources contribute to the noble gas content in groundwater. One component arises from an equilibrium between soil air and percolating water. Excess air (EA) accounts for an additional noble gas contribution [1]. This applies to all noble gases. Helium has additional sources: ^{4}He is generated by radiogenic production within the aquifer matrix, while ^{3}He originates from tritium decay in young groundwater. A mantle helium component can shift the ^{3}He/^{4}He ratio to higher values. To determine the excess helium component all other noble gases need to be measured in order to separate the excess from the equilibrium and the EA component.

As part of an interdisciplinary research initiative to study water issues in Jordan, we use noble gases to investigate groundwater origin and recharge. In the region of Kerak in Western Jordan, a groundwater recharge estimation project is being conducted, based on tritium-^{3}He dating.

Here a study of groundwater origin in the Azraq Basin in Eastern Jordan, which is affected by groundwater depletion, is presented. The excess of ^{4}He as well as the ^{3}He/^{4}He ratio are used to identify groundwater mixing near the Azraq Oasis. In this area groundwater is used only from the upper aquifer, since the deeper one consists of highly saline water. However, a few production wells in the upper aquifer have shown a rising salt content over the past years. A correlation between the salinity and the ^{4}He excess is detected which argues for an inflow of water from the saline and old aquifer below. In the case of Azraq also the ^{3}He/^{4}He ratio seems to corroborate the above finding, as a ^{3}He/^{4}He vs. Ne/^{4}He isotope plot indicates mantle helium in the saline wells.

[1] Aeschbach-Hertig *et al.* (2000) *Nature* **405**, 1040–1044

Implications of U-Pb-Hf detrital zircon data on the Precambrian crustal evolution of NW India

PARAMPREET KAUR[1]*, ARMIN ZEH[2], NAVEEN CHAUDHRI[1], AXEL GERDES[2] AND MARTIN OKRUSCH[3]

[1]Centre of Advanced Study in Geology, Panjab University, Chandigarh-160 014, India (*correspondence: param.geol@gmail.com)

[2]Institut für Geowissenschaften, Goethe-Universität, Altenhöferallee 1, 60438 Frankfurt am Main, Germany

[3]Lehrstuhl für geodynamik und Geomaterialforschung, Universität Würzburg, 97074 Würzburg, Germany

We have integrated *in situ* U-Pb-Hf data for 217 zircon grains from two quartzite samples of NW Indian plate to understand the Precambrian crustal evolution of this region. The U-Pb data unravel prominent probability age peaks at ca. 1.77, 1.85, 2.2, 2.5, 2.7 and 2.9 Ga. Barring 1.77 and 2.2 Ga age peaks, others are correlatable with most of the magmatic events identified in the basement of NW India.

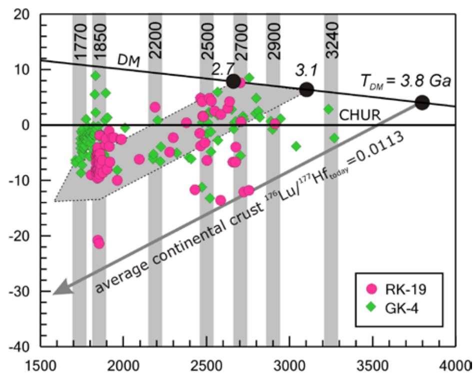

Figure 1: εHf$_{(t)}$ versus ^{207}Pb/^{206}Pb diagram showing results of detrital zircons from NW India.

The Lu-Hf isotope analyses indicate that at 1.77 and 1.85 Ga, reworking of Neoarchaean crust dominated over juvenile input as indicated by their largely subchondritic εHf values. At 2.5 Ga the zircons show a wide scatter in εHf values but the dominace of subchondritic values also indicate substantial reworking of older crust at this time. On the contrary, during 3.1–2.7 Ga, variable but mostly superchondritic to nearly chondritic εHf values suggest the dominant production of juvenile crust. The Hf model ages for Neoarchaean zircons also signify that the oldest crust in the NW Indian plate was formed from a depleted mantle source at around 3.8-3.7 Ga.