



Water-Isotopes (2H, 3H, 18O) to trace the source and timing of recharge in a fractured granite aquifer in Western Kenya, Africa

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The Vihiga District in West Kenya North-West of Lake Victoria is one of the most densely populated areas in Kenya with 1033 person per square kilometer. To find the most suitable location of an own well for a Primary School in this district, springs, school wells and creeks were sampled in the surroundings to get information about the hydrological cycle in the area. The Waluka Primary school (0.02134°N, 34.64311°E) is situated on the northern slope of the Maragoli Hills 20 km to the North-West of the Nyanzan provincial capital of Kisumu at the eastern shore of Lake Victoria. The hilly relief varies between 1535 - 1675m. The yearly precipitation is between 1200-1600 mm/a (23°C mean temperature) with biannual rainy seasons in which the long rains are generally from March to May as the Inter-Tropical Convergence Zone (ITCZ) moves northwards, and the short rains are typically from October to December as the ITCZ retreats southwards. A lateritic soil covers a thin alteration zone above the Precambrian Maragoli-Granite (Saggerson, 1952). Water circulates either in the thin alteration zone or in fault zones cutting through the Precambrian granite. From discharge measurements of two springs and a creek at the end of the dry season (February 2012) a minimum discharge of ca. 10-20 L/s km² (300-600 mm) can be estimated. The water is of the alkaline sulfate-nitrate type with low mineralization (70-150 μ S/cm, 25°C) and a low pH of about 5 to 6. The delta oxygen-18 and deuterium value ranges between -2.84 to -1.98 ‰ and -8.5 to -3.9 ‰ (VSMOW). The deuterium excess ranges from 11.7-14.2 ‰. The water of one spring and well close to the school have a tritium content of 1.42 - 1.62 TU. All groundwater has a low arsenium, fluorine and uranium content, which had only a short soil passage. The relatively elevated, but not problematic content in nitrate (10 - 16 mg/L) probably reflects the intensive agricultural activities in this area. As the mean δ 18O values during the rainy seasons are significantly lower (-3 to -4 ‰) than in the mean precipitation during the rest of the year (-2.5 to -1.9 ‰; Mwango, 2003) one can conclude that the main spring 'Anzaya' and the well in the Naboka Secondary School are recharged from deeper faults with water supplied more during the rainy season. The slightly higher d-excess of 13.4-14.2 ‰ compared to 11.7-12.6 ‰ in the rest of the samples, indicates a somewhat higher recharge area of this two sites with water vapor recycled in the precipitation around the Liailhunuu peak (ca. 1675m). This effect is also supported by spring-water measurements at the Kilimanjaro (d-excess 13.4-6.6 ‰) 400 km SE. Similarly, the tritium content of 1.42 - 1.62 TU indicate that compared to a mean tritium content of 2 TU in the rain of this area (Mwango, 2003) the mean residence time can be in the range of recent to few years only.