GROUNDWATER AND LAND USE STRATEGIES FOR THE TOS, MOROCCO, INFERRED FROM MINERALOGICAL, HYDROCHEMICAL AND ISOTOPIC INVESTIGATIONS

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The Quaternary terrestrial sedimentary deposits of the Tafilalet Oasis System (TOS) in the south of Morocco's High Atlas are very important for the local water supply and land use in this Saharan oasis, particularly under the aspects of global climate change. Two ephemeral streams, Ziz and Rheris, drain the mountainous areas of the High Atlas, which are thought to provide the main water source of TOS ground- and well waters. However, due to the complex regional geology and the lack of data, the potential source of the well waters as well as the water-sediment/rock-interactions in the TOS are not yet fully understood. We therefore aim to gain a mechanistic understanding of the climatic and anthropogenic processes affecting the TOS system, in order to (i) evaluate the vulnerability of the ground- and well waters and (ii) to develop sustainable strategies for future water and land use management. The overall project therefore follows a multi-disciplinary approach integrating geographical, mineralogical as well as hydrogeochemical investigations. In one attempt, we studied the mineralogical composition of the Quaternary sediments of the TOS using X-ray diffraction, focusing on the spatial distribution of silicate phases (e.g., quartz, clay minerals) and carbonates across the TOS. Complementary, we investigated the strontium isotopic ($^{87}Sr/^{86}Sr$) and the hydrogeochemical composition of several well waters and of the ephemeral stream waters of Ziz and Rheris.

For all mineralogical and hydrogeochemical aspects analyzed, we reveal distinct spatial distribution patterns, displaying a gradual trend from north to south along the TOS basin axis. Moreover, mineral phase distribution exhibits a lateral trend related to present-day river channels and ambient floodplains. Isotopic and hydrogeochemical signatures on the other hand mimic the north-south trend. We observe low Mg/Ca ratios and low Sr concentrations in the north, which are anticorrelated to the respective $^{87}Sr/^{86}Sr$ ratios. Especially the latter isotopic ratios indicate significant and unexpected water-rock interactions with the underlying Paleozoic rocks of the Antiatlas. To summarize, this study shows the importance of understanding the dynamic processes within the TOS, such as sediment provenance and genesis in relation to hydrogeochemical and environmental conditions, because of the limited contribution of rain and stream waters to the ground- and well waters within the TOS, a fact that directly influences long-term water supply and land use.