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Isotopic and geochemical characterization of groundwater of the Carnot-Berbérati sandstone formation (Western Central African Republic)

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The hydrogeology of the Cretaceous sandstone formations of Carnot-Berbérati (covering an area of 46.000 km2) in the western part of the central African Republic is poorly known. In order to improve the access of local populations to a clean and safe drinking water resource, new investigations have been carried out in order to characterize groundwater in terms of quality, origin, residence time and sustainability.
Two sampling campaigns were organized in August 2014 (rainy period) and April 2015 (dry period) on respectively 31 and 43 points including boreholes, wells and river waters.
Conventional hydrogeochemical tools in conjunction with isotope hydrology tools were used to evaluate the water types and the anthropogenic fingerprint on groundwater, their recharge processes and the flow organization scheme.
Investigations have shown the existence of interesting amounts of groundwater within what seems a single, well hydraulically connected unconfined aquifer of max. 400m thick.
Groundwaters are characterized by two main water types: CaMg-HCO_3 (for deep boreholes and river waters) and CaMg-$ClNO_3$ (shallow wells). The latter clearly showing the very strong influence of anthropogenic activities (washing, dumps, latrines) in the near vicinity of wells and boreholes used for the drinking water supply. This is also highlighting the total lack of protection zone around the wells and boreholes.
Stable isotopes of the water molecule (18O and 2H) are in agreement with a local recharge of groundwater and show a relatively homogeneous composition within the whole aquifer system. Tritium data indicate a modern recharge with a high renewability potential for shallow groundwater but very low tritium levels are observed in the deepest boreholes indicating the probable occurrence of complex flow conditions within the system in some sectors.
From these results and because of its extension and storage potential, the Carnot-Berbérati sandstone aquifer appears as a groundwater resource with a strategic interest for the Central African Republic. The lack of investigation boreholes of important depth is still an obstacle towards a full understanding of the hydrogeological conditions, but isotopic surveys were able to bring new information about the behavior of the aquifer system.

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