Groundwater ages of Saharan and Sahelian aquifers: the ^{36}Cl perspective

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Although the potential of the long-lived radionuclide ^{36}Cl ($T_{1/2}$= 301 ka) as a powerful tracer in groundwater studies has been recognized since 80's, its widespread use has been limited by the few accelerator mass spectrometry (AMS) facilities capable of detecting and quantifying natural ^{36}Cl levels. For the last 5 years, the CEREGE group has launched several ^{36}Cl investigations of aquifer systems of Northern Africa by using a recently set up facility, the 5 MV ASTER AMS [1].

In Sahelian and Saharan parts of Africa, large sedimentary aquifer systems are widely distributed. They act as key strategic reserves as they respond much more slowly to climatic conditions than surface water and, as such, provide a natural buffer against climate variability. Despite their critical importance for water supply in semi-desertic areas, they have attracted less attention that they deserve. However, the assessment of the current and past recharge rates of these aquifer systems, as well as groundwater residence time, is crucial for their sustainable management. In this prospect, the cosmonuclide ^{36}Cl is one of the rare geochemical tracers with ^{81}Kr providing insights on water transit time at the Quaternary timescale.

Here, we will present a synthesis of key results acquired in the frame of studies carried out on the North Western Saharan Aquifer System, the Nubian Sandstone Aquifer System and the Deep Aquifer System from Lake Chad Basin. More than 150 groundwater samples from these aquifers were analysed for their ^{36}Cl content. This unexampled dataset allows to picture the behaviour of ^{36}Cl -and consequently of chloride- in these large aquifer systems and to better constrain the initial $^{36}Cl/Cl$, a pivotal parameter for age groundwater determination. This allows us for aquifer systems free of halite-bearing evaporites to provide reliable groundwater ^{36}Cl ages. We will show that when combined with simple hydrological modelling based on piston flow model and basic climatic scenario we are able to quantify the paleorecharge of these systems over the Quaternary period [2].

[1] Bouchez, C. et al. (2015), *Chem. Geol.* 404, 62-70
[2] Petersen et al. (2014), *Applied Geochem.* 50, 209-221.