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Understanding the age and origin of groundwater in the Great Western Erg sub-basin of the North-Western Sahara aquifer system: insights from Krechba, central Algeria

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Abstract: The North-Western Sahara aquifer system (NWSAS) forms an important transboundary groundwater resource whose properties remain to be fully understood across its whole extent. For example, groundwater flow in the Cretaceous Continental Intercalaire (CI) unit of the NWSAS is well-characterised in the northern part of its range around the Algeria/Tunisia/Libya borders and in the Great Eastern Erg sub-basin immediately to the south. To the southwest, however, the CI of the Great Western Erg sub-basin has been much less studied. The present paper reports hydrogeochemical data from a wellfield in central Algeria which will contribute to a better understanding of this sector of the NWSAS in terms of the age and origin of groundwater within it.

Groundwater pumped from five deep boreholes in the CI aquifer overlying the Krechba gas field has been studied using a variety of environmental tracers including hydrochemistry, environmental isotopes, and reactive and noble gases (the latter being reported for the first time for this sub-basin). All the waters were dilute (SEC 460–600 µS/cm), contained detectable O_2 (6.3–7.5 mg/L), showed evidence of evaporation (relative enrichment in $\delta^{18}O$), gave late-Pleistocene ^{14}C model ages (13.5–19.3 ka), and yielded lower than present-day noble gas recharge temperatures (14.3–17.6°C). Various lines of evidence suggest that these waters are the product of mixing between water recharged direct to the CI and leakage from the Neogene–Quaternary Erg aquifer. The results support the long-held concept of regional flow from a palaeo-recharge area to the northwest. Finally, while the Krechba gas field (Carboniferous) has been since 2004 the site of a pilot carbon capture and storage (CCS) project, the data revealed no evidence for leakage of fluids (gas or brines) into the overlying CI aquifer at the time of sampling (October 2014).

Keywords: Continental Intercalaire aquifer, stable isotopes, radiocarbon, noble gases, palaeo-recharge

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