

# Palaeoclimatic trends deduced from the hydrochemistry of a Triassic sandstone aquifer, United Kingdom.

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[Bath, A.H.;](#) [Edmunds, W.M.;](#) [Andrews, J.N.](#)

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AbstractAbstract

[en] A detailed geochemical study (elemental, isotopic and dissolved inert gases) of unconfined and confined sections of the Triassic non-marine sandstone aquifer in eastern England has been undertaken. Aspects of the recharge history of this aquifer over the past 40,000 years are revealed by examination of the data.  $^{14}\text{C}$  activity and  $\delta^{13}\text{C}$  values show downgradient decrease and increase, respectively, the latter from -12 to -13 per mille (PDB) at outcrop to -8.5 per mille in deep confined groundwaters, indicating a continuing reaction between water and carbonate mineral phases. Although the bulk carbonate contained in sandstone samples gives  $\delta^{13}\text{C}$  around -7 per mille, modelling of the carbon isotopic evolution and consideration of the resulting  $^{14}\text{C}$  age corrections suggest that a carbonate with  $\delta^{13}\text{C}$  closer to 0 per mille has played a major role in at least the earlier stages of hydrochemical evolution. The corrected radiocarbon age ranges, generated by the computer program WATEQF-ISOTOP, are used as a framework in which the palaeo-environmental information from oxygen and hydrogen isotope data, inert gas contents, and chloride levels are

discussed. The measurement of dissolved helium levels demonstrates an excess of  $^4\text{He}$  in many samples, which correlates with radiocarbon ages. The assumption of bulk chemical and physical properties for the aquifer rock allows independent 'excess  $^4\text{He}$ ' ages to be computed, which are mostly in excess of the corrected  $^{14}\text{C}$  ages. The trend of  $\delta^{18}\text{O}$  is from about -8 per mille at outcrop to -9.7 per mille (SMOW) downgradient, which is significantly more depleted than has been found in previous studies of UK basins. The  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  values are related by the regression line  $\delta^2\text{H}=6.6\delta^{18}\text{O}+1$ ; data from other UK studies also lie close to this trend

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International Atomic Energy Agency, Vienna (Austria); United Nations Educational, Scientific and Cultural Organization, 75 - Paris (France); Proceedings series; v. 2 p. 545-566; [ISBN 92-0-040179-1](#); ; 1979; v. 2 p. 545-566; IAEA; Vienna; International symposium on isotope hydrology; Neuherberg, Germany, F.R; 19 - 23 Jun 1978; IAEA-SM--228/27

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