

Rate of seawater intrusion determined with radioactive noble gas isotopes of ⁸¹Kr and ³⁹Ar

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ABSTRACT

This study presents for the first time direct estimation of the rate of seawater intrusion into coastal aquifers with radioactive noble gases isotopes. Dating of deep saline groundwater in Israel, near the Mediterranean Sea, was conducted in order to estimate the rate of seawater intrusion and the connectivity of the aquifer with the sea. Several dating tools were used for old seawater, including ⁸¹Kr, ³⁹Ar, ⁸⁵Kr, together with the more commonly used tools of ¹⁴C and tritium. ⁸¹Kr-dating indicates that the saline water age is less than 26,500 years, in contradiction with previous estimates of much older ages of up to several million years which were based on hydrogeological consideration. The results imply a stronger connection between the sea and the aquifer than previously understood, which means that a reduction of the fresh water level due to over pumping would induce seawater intrusion on relatively short timescales. Moreover, this study demonstrates the suitability of radioactive noble gases for the examination of hydrogeological systems in general and of saline water intrusion specifically.