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Do ancient brines trapped as fluid inclusions in unconformity-related deposits differ from present-day porewaters in Triassic aquifers of the Paris basin?

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In this study, we discuss the physical and chemical properties of primary fluid inclusions trapped in geodic fluorite crystals dated at 130 Ma ± 15 Ma [1] from two F-Ba ore deposits located above the basement/sediment unconformity in the southeastern edge of the Paris basin. Microthermometry reveals minimal trapping temperatures of ca. 110°C, while salinity averages 18 wt% eq. NaCl, calcium chloride salts being dominant. Oxygen and hydrogen stable isotope composition of fluid inclusions measured by micro-equilibration indicate the contribution of meteoric waters. Major dissolved ions in fluid inclusions were measured using a bulk crush-leach method [2]. Cl/Br ratios show that salinities were acquired through the evaporation of seawater beyond halite precipitation. However, $\delta^{37}Cl$ values are lower than the expected composition of an evaporated seawater. We propose that fluorite precipitated from the mixing of two fluids: 1) an evaporated seawater expelled during the compaction of sediments, diluted by 2) meteoric waters infiltrated along the basement fractures.

Present-day deep groundwaters flowing through Triassic aquifers in the central part of the Paris basin [3,4] display comparable chemical and isotopic compositions with those measured in fluid inclusions trapped in 130 ± 15 Ma fluorite crystals. This indicates that the salinity of present-day brines may also originate from ancient evaporation of seawater. Similar brines, with elevated concentration in Ca and F, were also documented in the fractured basement in the central Paris Basin [5]. The upward migration of these fluids through fractures in the crystalline basement and the associated pressure/temperature drop leads to fluorite precipitation, as witnessed in the present-day outcropping southeastern edge of the basin.

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