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Origin of Ore-Forming Brines in Sediment-Hosted Zn-Pb Deposits of the Basque-Cantabrian Basin, Northern Spain

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Abstract

Fluid inclusion data (microthermometry and Na-K-Li-Cl-Br chemistry) from Mississippi Valley-type Zn-Pb deposits in the Basque-Cantabrian basin, north Iberian Peninsula, indicate that fluid mixing occurred during mineralization. Cl/Br ratios of the ore-forming brines suggest that the high salinity was primarily acquired by evaporation of seawater. Only in deposits near salt domes (Orduña and Murgía diapirs) do the ore-forming brines have halogen signatures indicative of halite dissolution.

Mixing of fluids frequently cannot be detected using only microthermometry or halogen data, although microthermometric data can indicate mixing where one of the end members is fresh water or a highly diluted fluid. Combining the two allows both the recognition of mixing and an estimation of the relative proportion of the different fluids involved. The effects of mixing on the salinity and halogen ratios of the resulting mixture have been calculated using four types of fluids: (1) seawater, (2) evaporated seawater before the onset of halite precipitation, (3) seawater evaporated past the point of halite precipitation, and (4) a halite-saturated brine at 25°C derived from halite dissolution. The calculated Cl/Br-Na/Br mixing curves have been compared to data from the Zn-Pb deposits of the Basque-Cantabrian basin and show that mixing between a residual brine and a halite-dissolution brine can account for the deposits in the Western Biscay district (Txomin, Matienzo, Barambio). Most of the ore-forming brines from the studied deposits around the Orduña and Murgía salt domes (Altube, Monteleón, Jugo) originated by halite dissolution, although there is also significant contribution (20–50 wt %) from a highly evaporated brine.

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