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Impact of Acidic Brines in the Formation of Middle Proterozoic Zawar Pb-Zn Deposits, Paleoproterozoic Aravalli Supergroup, Rajasthan, NW India

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The world's critical Pb-Zn resources consist of sedimentary-exhalative (SEDEX) mineralization. These deposits are found in rifted intracratonic and passive margin basins worldwide and range in age from Paleoproterozoic to Tertiary, mainly clustered around the Palaeozoic (300-550 Ma) and the Paleoproterozoic (1450-1850 Ma). Based on the fundamental difference in mineralizing brines' chemistry, two-fold subdivisions for SEDEX deposits are proposed. McArthur-type deposit (e.g., McArthur River, Mount Isa, Hilton) is precipitated from oxidized (SO_4^{2-} predominant), acidic to near-neutral brines that evolve from sedimentary basins dominated by carbonate evaporates, haematitic sandstones, and shales. Selwyn-type deposit (e.g., Sullivan, Rammelsberg, Selwyn basin) precipitated from acidic, reduced (H_2S predominant) connate brines that evolve in reduced siliciclastic and shale basins. The Pb-Zn bearing Middle Proterozoic rocks of Zawar, Aravalli Supergroup, Rajasthan (20 Mt of Pb+Zn) has stratiform, banded pyrite-sphalerite ore, sometimes discordant, sphalerite-galena veins, and rich massive galena ore shoots. Fluid inclusions in quartz associated with ores show that fluids forming vein-type ore are low-salinity (4.3-14.7 wt% NaCl equivalent) H_2O-NaCl fluids[1]. The trapping temperature of vein-type fluids was estimated to be 290 to 395 °C at a pressure of about 1450 bars with a pH of 5.5[1]. Fluids associated with massive galena ore are H_2O-CO_2-NaCl fluids of lower salinity (about 3-4 wt.% NaCl equivalent), and the trapping temperature ranges between 150 ° to 250 °C, with a pH of 4.25 to 4.3[1]. From the temperature versus salinity plot[2], it is evident that the fluid is less dense than the seawater regardless of the degree of mixing, and during discharge, has formed a buoyant plume. These buoyant fluids indicate a vent proximal deposit that precipitated beneath the seafloor or in the immediate vicinity to the vent because of rapid quenching of the hot fluid as it comes into contact with seawater-saturated rocks. The acidic nature of the ore fluids forming the Zawar Pb-Zn deposit and buoyant to intermediate type brine supports this deposit's Selwyn-type nature.

1. Talluri, J.K. et al., (2000), Economic Geology, 95, 1505-1525.
2. Sangster, D.F. (2002), Mineralium Deposita, 37, 149-157.