geoconvention
Calgary • Canada • May 15-17 2023

Diagenetically-controlled H_2S and pyrite in the Lower Triassic Montney Formation, Peace River Region, Western Canada

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The Lower Triassic Montney Formation is a world class hydrocarbon reservoir; however production is negatively impacted by the occurrence of hydrogen sulfide (H_2S) gas. The concentration of H_2S in the Montney is regionally variable with the highest concentrations occurring in gas-producing wells from western Alberta. This study addresses the role of diagenesis and associated geochemical processes in the formation of dissolved sulfate, one of the two major ingredients of H_2S formation mechanisms, and pyrite within the Montney Formation in western Alberta and Northeast British Columbia in the Peace River region. To the best of our knowledge, none of the Montney previous diagenesis-oriented studies viewed its diagenetic history from this perspective.

The Montney Formation is composed of both early and late diagenetic anhydrite and late barite cement, mostly originating from the Montney Formation pore water and incursion of structurally-controlled Devonian-sourced hydrothermal sulfate-rich fluids. Pyrite formed during early to late stages of diagenesis, occurs in three types: framboidal, recrystallized, and coalesced. The coincidence of diagenetic sulfate and sulfide phases with elevated H_2S concentrations, particularly in western Alberta, suggests a potential link between these phases and the diagenetic evolution of sulfur in the Montney Formation.

The $\delta^{34}S$ values of anhydrite/barite, H_2S, and pyrite corroborate that the diagenetic sulfur cycle of the Montney Formation was controlled by both microbial and thermochemical sulfate reduction (MSR and TSR) processes. Furthermore, the sulfur isotope values of H_2S in present-day produced gas confirms a dual dominantly *in situ* and partially migrated H_2S of TSR origin in the Montney reservoir.