Fluids generated during contact metamorphic reactions related to magmatic sill intrusions in the Guaymas Basin

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Résumé

The intrusion of magmatic sills into sedimentary basins plays an important role in fluid circulation and element transfer (carbon, sulfur, major/minor elements) between deep and shallow reservoirs. The Guaymas Basin represents the nascent stage of an oceanic basin characterized by the sedimentation of siliceous sediments (diatom oozes) rich in organic matter (about 2 wt%), deposited at high sedimentation rates. A dense network of shallow sill intrusions recently invaded the basin, interacting with the soft sediments. This study, based on samples collected during the IODP Expedition 385 in the Guaymas Basin, aimed to quantify the potential fluid circulation and chemical element transport associated with contact metamorphism induced by the sill emplacement. Geochemical and mineralogical characterization of sediments in contact with the sills indicates significant dehydration, primarily affecting the silica polymorphs and the sulfide minerals during contact metamorphism. The opal CT-quartz and pyrite-pyrrhotite transitions are good markers of the metamorphic aureole. Isotopic C- and O-isotope compositions of newly precipitated carbonates in the metamorphic aureoles suggest that the released carbon was completely removed from the system. In contrast, mass balance calculations suggest limited element mobility in the upper metamorphic aureole, while the lower contact aureole exhibits element redistribution within it, with varying levels of enrichment in CaO, Na2O, Fe2O3, and metals (Cu, As, Zn...). During contact metamorphism, minerals dehydrate, releasing large amounts of fluids including some major elements, carbon, and sulfur, and that can ascend to the seafloor.

Mots-Clés: igneous sills, contact metamorphism, fluid, rock interaction, Guaymas Basin

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