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The corundum conundrum: Constraining the compositions of fluids involved in metasomatic corundum formation.

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Corundum, including the variety ruby, is found in numerous locations in the Archaean North Atlantic Craton of southern Greenland. Corundum owes its occurrence to fluid-induced interaction among high-grade metamorphic lithologies of contrasting chemistry. Here, we present constraints on the conditions of corundum formation and the compositions of the fluids involved for the Storø and Maniitsoq ruby localities. We use thermodynamic modelling of mineral and mineral-fluid equilibria, and complement these with experimentally obtained data on mineral solubility to show that metasomatism took place at 650-725 ˚C and 7 kbar, involving a boron-rich, acidic fluid of low fO_2 and low $X(CO_2)$. Aqueous concentrations of aluminium are low and indicate that corundum saturation is the result of residual aluminium enrichment rather than aluminium mobilisation. Intrusion of the *ca.* 2.55 Ga Qôrqut granite and associated fluid release is the likely source of boron, and U-Pb dating of rutile inclusions is consistent with a temporal link between ruby formation and granite emplacement. Interaction with meta-dunite and Fe-sulfides modified the oxidized magmatic fluid, introduced SO_4, and produced the reduced, high X_{Mg} and K-rich fluid recorded by the corundum-bearing samples. These results highlight a complex interplay among lithologies involved in corundum-formation, but also demonstrate that corundum formation is a predictable part of the geological history where a magmatic intrusion expels a pulse of fluid through its lithologically heterogeneous carapace.