HP-UHP FLUID INCLUSION POST-ENTRAPMENT EVOLUTION PREDICTED BY MOLECULAR AND ELECTROLYTIC FLUID THERMODYNAMIC MODELS

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A reliable characterization of the fluids released from a subducting plate is of primary importance to understand the processes that regulate the long-term chemical cycles. Ultrahigh-pressure (UHP) fluids are composed of solvent COHNS molecular volatiles and by solute non-volatile elements bounded to inorganic and organic species. Both direct (fluid inclusion, FI) and indirect (thermodynamic modeling, TM) approaches to study UHP fluids have reliability issues: i) post-trapping processes can affect the chemical composition of the FI, ii) the relatively few applications make the electrolytic-fluid TM still a poorly tested method to reconstruct subduction fluid compositions. In this work, we evaluated compositional data from primary FI trapped within UHP diopside from a chemically simple (CMFS-COHS) marble showing evidence for multiple events of mineral dissolution-precipitation (Brossasco-Isasca Unit, Dora-Maira Massif, Italian Western Alps). These FI are tri-phase multisolid aqueous inclusions (5-25 µm in diameter) consisting of H_2OLiq (with traces of dissolved chlorides) + different kinds of solids (Cc/Mg-Cc ± Tlc ± Dol ± Serp ± Tr ± Py ± Gr) + bubble (H_2OV ± N_2 ± CH_4). Classical molecular-fluid TM allowed to model post-trapping reactions between FI and host diopside (i.e., discrimination among daughter, step-daughter, and incidentally trapped minerals). Electrolytic-fluid TM allowed modeling the chemical composition of the peak solute-bearing aqueous fluid (H_2O: 88.5 wt%; solutes: 11.34 wt%; CO_2 + H_2S + CH_4: 0.17 wt%) generated by progressive rock dissolution. The comparison between the modeled fluid composition with that reconstructed from FI allows to recognize the kind and extent of post-trapping chemical re-equilibration that occurred within UHP FI. Applying this multidisciplinary approach, we demonstrate i) that the most impacting post-trapping process in UHP FI is the H2O loss, with consequent preservation of the geochemical information in those FI lacking relevant post-trapping host-diopside chemical contamination; ii) that the electrolytic-fluid TM is highly supportive of the classical FI study to retrieve geochemical information on deep subduction fluids.