

## **A tale of two fluids in the Sandwich Point intrusion-related gold setting, South Mountain Batholith, Nova Scotia, Canada**

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The chemical discrimination of fluids in intrusion-related gold deposit settings is generally limited to data for the bulk chemistry of fluid inclusions, which implicates a low-salinity (i.e., about 5–10 wt.% eq. NaCl) H<sub>2</sub>O-CO<sub>2</sub> ± CH<sub>4</sub> type fluid with X<sub>CO<sub>2</sub></sub> = 0.05–0.15 that may, at times, unmix into other fluid types. Although additional chemical data may be reported, such as the traditional stable isotopes (O, D, C, S), there is a lack of quantitative data for the solute chemistry, such as that generated using evaporate mound SEM-EDS or LA ICP-MS analysis of fluid inclusions. Herein the chemistry of fluids related to the formation of a mineralized (Au-As-Bi-Sb; to 0.5 g/t Au) zone at the eastern contact of the Halifax Pluton, part of the ca. 376 Ma South Mountain Batholith, is presented. At Sandwich Point, sheeted quartz ± arsenopyrite veins and extensive zones of F-rich muscovite greisen are centred on a pegmatite body near its contact with calcareous and sulphidic metasedimentary rocks of the Goldenville and Halifax groups. Locally, these wall rocks record hornfelsing, skarn development, and formation of quartz-tourmaline-carbonate-arsenopyrite veins. Fluid inclusion studies indicate mixing occurred between a high T (600°C), low-salinity (3 wt.% eq. NaCl) fluid (type 1) with minor CO<sub>2</sub> (X<sub>CO<sub>2</sub></sub> ≤ 0.03), and a lower T (400°C) but higher salinity (20–25 wt.% NaCl-CaCl<sub>2</sub>) fluid (type 2). The fluids are further characterized with δ<sup>18</sup>O of vein quartz and evaporate mound and in situ LA ICP-MS analysis for fluid inclusions. These data indicate the δ<sup>18</sup>O<sub>H<sub>2</sub>O</sub> for type 1 and 2 fluids are + 11‰ and < + 20‰, respectively. In addition, whereas type 1 fluid shows relative enrichment in B and As, type 2 fluid is dominated by Ca, Mn, Fe, Mg, Ba, Sr, F, and Pb, but also with elevated Li, Rb, and Cs. These data are interpreted to reflect generation of two fluids from very different processes: type 1 reflects the exsolution of a low-salinity magmatic fluid, perhaps related to the pegmatitic zone, whereas type 2 fluid relates to wall rock devolatilization due to the intrusion. However, some features of the type 2 fluids, such as enrichment in F, Li, Rb, and Cs, suggest mixing between type 1 fluid with wall rock derived type 2 fluid. This study highlights the need to more fully characterize the chemistry of fluids in ore deposit settings to better understand the interplay of different fluid reservoirs present in such settings.