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KEYNOTE SPEAKER

In concurrent session:
Metallogenic processes within mafic-ultramafic magmatic systems

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The critical role of magma degassing in sulfide melt mobility and metal enrichment

Research studies provide growing evidence for the presence of fluids within magmatic mineral systems of mafic-ultramafic composition, although these ore-forming magmas are generally considered volatile-poor. We present an experimental study at magmatic conditions that shed light on previously unnoticed physical and chemical processes ensuing from the association between sulfide melt and fluid phases in mafic-ultramafic magmas. Our experimental results show that the association of sulfide melt and bubbles of a fluid phase is independent of the composition of the fluid phase and the mechanism generating it (e.g. magma decompression, or interaction with volatile-rich sedimentary rocks). Depending on the extent of degassing, i.e. the proportion of fluid phase, the implications can vary. When the extent of degassing is limited, the sulfide-fluid association favors the accumulation of the sulfide liquid, by facilitating the coalescence of the sulfide droplets that are attached to the same fluid bubble. This represents a possible solution to the unsolved problem of how sulfide droplets coalesce and are deposited from flowing magma. When the degassing is more extensive, sulfur degasses to the fluid phase decreasing sulfide melt stability. Consequently, the sulfide melt is consumed and its metal content increases, due to the preferential partitioning of metals into the sulfide melt. In our experimental samples, extensive degassing leads to metal enrichment of the sulfide melt, whereas extreme degassing generates platinum group minerals. Accumulation and metal enrichment of sulfide droplets and formation of platinum group minerals are key components necessary for the formation of a magmatic Ni-Cu-Co-PGE ore deposits. The occurrence of a fluid phase in a mafic-ultramafic magma may therefore represent a significant boost for magmatic sulfide ore forming processes, by favoring sulfide melt accumulation and increasing tenors. We show how sulfide-fluid associations preserved in the world-class Noril'sk-Talnakh ore deposits, in Polar Siberia, record the processes that we have demonstrated experimentally.

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Giada is a CNRS researcher working at the Institut des Sciences de la Terre d'Orléans in France. She is an experimental petrologist with a background in volcanology and a strong interest in the role of volatiles in magmatic processes. Giada's current research focuses on the interactions between magmas and their host rocks: her work is directed at understanding the implications of these interactions for magma degassing and ore processes. She uses high pressure-high temperature experiments to identify the critical factors controlling the formation of magmatic ore deposits, e.g. redox conditions, fluid involvement, element partitioning between different magmatic phases.