Volatiles released in subduction zones and their role in sustaining magmatism

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It is widely accepted that the generation of arc magmas is triggered by fluids released from the subducting slab and by their interaction with the overlying mantle wedge [1]. The major lithologies involved in devolatilization are pelites, hydrothermally altered basalts, and serpentinized harzburgites. Thermodynamic calculations and experiments predict that HP fluids are dominated by H_2O. Nevertheless, the importance of carbon species has been highlighted in the last years because of the relevant CO_2 content of arc magmas and the observation of carbon-bearing phases in mantle-wedge peridotites. Experiments have shown that the release of volatiles extends over several tens of km depths and result from a succession of continuous and discontinuous reactions involving hydrous phases in the subducted lithosphere, such as antigorite and chlorite in ultramafics; amphibole, lawsonite, zoisite, and chloritoid in mafic rocks. Phengite and biotite are involved in melting reactions of a variety of bulk compositions whenever K is available. Carbonates once formed are refractory and stable at very high pressures. Therefore, the transport of carbon in the mantle wedge, via solute species in aqueous fluids or via advecting rock masses in buoyant "cold plumes" have been proposed. In the metasomatized mantle wedge, the stability of hydrous phases depends on bulk alkali content, amount of available fluid and possibly the redox state of the system. In COH-bearing systems, the framework of phase relationships is more complex and the position of the solidus is controlled by a number of factors. In fluid-undersaturated COH-systems, the bulk composition (i.e., X_{Ca}, X_{Mg}, alkalies) and the redox state of the Fe-bearing phases are variables that strongly influence the solidus position. Peridotites saturated in a COH-fluid melt at lower temperatures compared to H_2O-free, CO_2-bearing peridotites. However, the increase of bulk CO_2 shifts the solidus, so that fluid-saturated COH peridotite can eventually melt at higher temperatures compared to fluid-undersaturated COH peridotites. Apparent discrepancies concerning solidus position reflect the variety of experimental strategies adopted, which can be applied to a wide range of geodynamic settings.

[1] Schmidt & Poli (2003) *Treatise on Geochemistry* **3**, 567-591.

The formation of elemental sulfur nodules; A modified 'thiosulfate shunt' in unique environments

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Elemental sulfur, also known as 'native sulfur', has been found in a range of natural environments, including marine and lake sediments, often forming large nodules or veins, millimeter to centimeter in size. What governs the formation of elemental sulphur nodules remains enigmatic. While most of the literature suggests it is formed by partial re-oxidation of hydrogen sulphide, elemental sulfur can also form during incomplete bacterial sulfate reduction, during sulfur disproportionation, or even during gypsum metamorphism.

We present sulfur isotope ($\delta^{34}S$) and major element data from sulfur nodules and surrounding gypsum, from the Lake Lisan formation near the Dead Sea, Israel. The $\delta^{34}S$ in the nodule is constant between -9 and -11‰, 27 to 29‰ lighter than the surrounding gypsum, consistent with their formation in an 'open system'. Iron concentrations in the gypsum increase toward the nodule, while manganese concentrations decrease, suggesting a redox boundary at the nodule-gypsum interface during aqueous phase diagenesis. We suggest that sulfur nodules in the Lake Lisan formation are generated through bacterial sulfate reduction, which terminates at elemental sulfur. Sulfate-saturated pore fluids, coupled with the low electron-donor availability, terminate the trithionate pathway before the terminal two-electron reduction, producing thionites, which disproportionate via a modified thiosulfate shunt to form abundant elemental sulfur.

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