

## Melting of subducted mélanges in mantle wedge plumes: Eutectic-like behaviour in the generation of batholiths

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Albeit the relevance of arc magmatism on a global scale, the processes involved in its generation remain controversial. Here we show new experimental data aimed to test a new conception for arc magma generation based on melting of ascending mantle wedge plumes. Partial and near-total melting of composite sources is addressed here using constraints imposed by recently developed numerical experiments on the thermo-mechanical evolution of the suprasubduction mantle wedge. Our results support the generation of large amount of hybrid, calc-alkaline magmas by partial or total sub-lithospheric melting of a mechanically mixed mantle-crust composite source corresponding to a subducted tectonic melange. According to our hypothesis generation of many batholiths is related to formation, ascent and spreading of large compositionally buoyant mantle wedge plumes triggered by hydration, deformation and melting processes atop the subducting slab. Melting experiments on composite MORB-sediment mélanges were run at 1000-1200°C, 1.5-2.0 GPa, which correspond to conditions of final sub-lithospheric emplacement of thermal-chemical plumes within the shallow sub-lithospheric mantle. The composition of melts formed after partial melting of end-members bulk compositions (greywacke and MORB) is not buffered, forming granitic (melting of greywacke) and tonalitic (melting of MORB) melts in high-variance assemblages Melt+Grt+Pl and Melt+Grt+Cpx, respectively. However, the composition of melts formed after partial melting of greywacke-MORB mélanges is strongly "buffered" (i.e stabilized in the binary-eutectic-like fashion for greywacke-MORB ratios ranging from 3:1 to 1:3), producing compositionally stable andesitic-granodioritic liquid in lower-variance phase assemblage Melt+Grt+Cpx+Pl. Our hypothesis may explain satisfactorily the geochemical and isotopic features of arc magmas without implying any hidden process or hidden geochemical reservoir.

## Interfacial water ordering and complex oxoanion adsorption on hematite and corundum surfaces

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Development of thermodynamic and kinetic models to predict the behavior of chemical species in environmental and geological systems benefit from a fundamental understanding of mineral-water interface structure and reactivity. Our work in recent years has sought to provide new insight into metal oxide-water interfaces in two areas: the ordering of water and the mechanisms of oxoanion adsorption at these interfaces.

We have explored the structure of interfacial water on a number of hematite ( $\alpha\text{-Fe}_2\text{O}_3$ ) and corundum ( $\alpha\text{-Al}_2\text{O}_3$ ) surfaces. While ordering in this water appears to be a general phenomenon, with the degree of ordering declining away from the surface on the length scale of approximately 1-2 nanometers, quantitative differences in water structure and positional disorder exist among the different surfaces examined [1-3].

We have also recently investigated arsenate ( $\text{AsO}_4^{3-}$ ) adsorption on the (012) surfaces of these minerals and have demonstrated that the accepted conceptual model for this process has been missing a key mechanism: outer-sphere adsorption. We observed that arsenate simultaneously forms inner- and outer-sphere surface complexes at pH 5 and 0.01 M ionic strength on both oxides [4]. We have begun to investigate the dependence of this unexpectedly complex adsorption behavior on pH, ionic strength, and the crystallographic orientation of the sorbent mineral phase. These studies explore how variations in chemical conditions and interfacial water ordering affect arsenate adsorption behavior. Our observations suggest that the molecular-scale arrangement of water near a mineral surface and the chemical properties of that surface are connected.

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