

## Preliminary estimates on magma storage conditions of the Heise volcanic field, Snake River Plain

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Tuffs and ignimbrites of the Heise and the Yellowstone Plateau eruptive centers, representing the silicic magmatism of the Snake River Plain – Yellowstone volcanic province, were studied to evaluate pre-eruptive storage conditions prevailing in rhyolitic magma chambers. We performed petrographic study of Blacktail Creek Tuff (6.62Ma), Tuff of Wolverine Creek (5.59Ma) and Kilgore Tuff (4.45Ma) of the Heise and the Huckleberry Ridge Tuff (2.05Ma) of the Yellowstone eruptive centers. Mineral and glass shard compositions obtained by electron microprobe were used to estimate temperatures, redox conditions and relative melt water contents.

In general, the set of mineral phases observed in studied rhyolites is similar to that of observed in BJR eruptive center [1] and are: Pl, ± Fsp, ± Cpx, ± Pig, Mt, ± Ilm, ± Qtz, ± Fa, apatite and zircon. QUILF thermometry calculations performed on low- and high-Ca pyroxene pairs yield the ranges of temperatures between 818 and 830°C for Heise and 905 and 930°C for Huckleberry Ridge rhyolites. The ilmenite-magnetite oxybarometer yields oxygen fugacity values to be about QFM, which is in a good agreement with previous data [2]. The water contents of the natural rhyolitic melts, which are below 2 wt%, were only roughly estimated by projecting glass shard compositions on the ternary Qz – Ab – Or diagram with eutectic and cotectic compositions experimentally determined at hydrous conditions in the range of 50MPa to 1000MPa.

Our temperature estimates obtained for younger centers together with previously determined relatively high temperatures for Bruneau Jarbidge eruptive center (~11Ma, 905 – 980°C, [1]) suggest the change of pre-eruptive temperatures in rhyolitic magma bodies along the track of Yellowstone hotspot.

The study of melt inclusions hosted in plagioclase and fayalite is still in progress and will be presented in addition to mineral thermometry data.

[1] Cathey & Nash (2004) *J. Petrology* **45**, 27-58. [2] Honjo & Bonnicksen (1992). *Bull. of Volcanology* **54**(3): 220-237

## Numerical modelling for peridotite phase melting trends in the SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-FeO-MgO-CaO system at 2 GPa

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The partial melting is the mechanism that better explain the variability of the major refractory lithophile elements (RLE) of the upper mantle rocks through time and space. Several numerical and experimental models (e.g.: Hirshmann *et al.*, 1998; Herzberg, 2004; Niu, 2004) are available to simulate major element depletion trends using whole rock but no particular attention has been devoted to the compositional evolution of the single minerals. On the basis of various primitive chemical composition of the mantle (PM) and using the experimental results of Herzberg (2004) at 2.0 GPa, various melting trends which constrain the composition of the four mineral phases in the peridotite system, are calculated. This accounts for the 98.59 wt% of the upper mantle composition (SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-FeO-MgO-CaO) with spinel as the aluminium phase admitted for these bulk compositions. A mass balance calculation has been applied to find the theoretical compositions of ol, cpx, cpx and sp at various degrees of partial melting. The modelling was constrained by i) mineral compositions adjusted in order to account for the properly formula units and ii) the experimental and theoretical intermineral Fe/Mg and Al partition coefficients. An iterative calculation varying the modal contents of the peridotite phases where applied to minimize the differences between calculated and whole rock compositions experimentally determined at various melting degrees. The starting point for each phase depends on the chosen whole rock PM composition and on the modal percentage that minimize the residuum. The several melting trajectories may account for a multiplicity of mantle occurrences where bulk rock analyses are not available. This model provides a new tool for unravelling the melting processes occurring within the Earth's mantle.

[1] Niu, Y. 2004, *J. Petrol.* **45**, 2423-2458. [2] Herzberg, C. 2004, *J. Petrol.* **45**, 2507-2530. [3] Hirshmann *et al.*, 1998, *GCA* **62**, 883-902.