THE EFFECT OF Cl AND S ON MINERAL SATURATION IN INTERSTITIAL MELTS OF THE CHASSIGNY DUNITE: PETROGENETIC IMPLICATIONS

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Introduction: Experimental data assessing mineral stability in cumulate lithologies commonly focus on the cumulus phases and the assemblages within partly crystallized melt inclusions as these most closely yield the crystallization history of the magma from which the cumulus lithologies formed [e.g. 1-2]. However, the intercumulus assemblages provide important information on open-system processes at work within planetary bodies, processes such as melt and fluid migration. [3] proposed that the differences in mineral phases and their compositions between the melt inclusions of the Chassigny meteorite and the regions interstitial to the cumulus olivine arose from exchange between interstitial melt and upward migration of Cl-rich, water-poor fluids from hotter deeper parts of the magma plumbing system. Experimental data were obtained by [4] in order to evaluate the effect of dehydration of the interstitial melt and the addition of Cl and S on mineral stability. The work here focuses on comparing petrogenetic information on the observed interstitial assemblages with experimentally-determined phase relations in order to assess the extent to which the melt interstitial to the Chassigny meteorite could have been affected by fluid-re-equilibration.

Results: Addition of Cl and S and decrease in melt water content results in the destabilization of olivine, augite, amphibole, and calcic feldspar, the formation of more Fe-rich low-Ca pyroxene and more sodic feldspar, and in the precipitation of pyrrhotite [4]. Consistent with the experimentally-observed effects of reducing water content and increasing Cl content, poikilitic augite in the interstitial regions of the Chassigny meteorite is replaced by low-Ca pyroxene (low-Ca pigeonite and orthopyroxene) at lower temperatures. The absence of clinopyroxene-hosted apatite in the interstitial regions (compared to the melt inclusions) suggests that clinopyroxene stopped crystallizing before apatite appeared, in keeping with the experimental results. The apatite in the interstitial regions has high Cl contents, consistent with those obtained experimentally. The presence of ilmenite in the interstitial regions rather than Ti-amphibole or Ti-biotite (in the melt inclusions) is further consistent with the experimental data. The effect on feldspar is more difficult to ascertain since the change in An content changes makes comparison difficult.

Conclusions: Changes in mineral assemblages between the melt inclusions and interstitial regions are generally consistent with a decrease in melt water content and increase in melt Cl and S content in the Chassigny interstitial melt. The higher Cl content of the interstitial apatite in the mineral assemblages, and the absence of interstitial hydrous minerals relative to the experimental assemblages suggest bulk water contents less than 0.4 wt% and bulk Cl/F higher than the experimental value.

References: [1] Nekvasil H et al. 2007 *Meteoritics & Planetary Science* 42 979-992. [2] Nekvasil H. et al. 2009. *Meteoritics & Planetary Science* 44: 853-869. [3] McCubbin F. M. and. 2008. *American Mineralogist* 93:676-684. [4] Ustunisik G and Nekvasil H. (this volume)