

USING MELT INCLUSIONS TO TRACK THE EVOLUTION OF PRIMITIVE ALKALIC MAGMAS FROM ROSS ISLAND, ANTARCTICA

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Melt inclusions (MI) provide a means for measuring the dissolved volatile (H₂O, CO₂, S, Cl, F), major and trace element compositions of magmas at depth. Such data are valuable for assessing the physical and chemical conditions within a magmatic system by providing snapshots of magma compositions during ascent and evolution. Here we examine MI in 9 samples of rapidly quenched basanitic ash and hyaloclastite from three locations (Hut Point, Mt. Terror, Mt. Bird) on Ross Island, Antarctica, which radially surround the active, phonolitic Erebus volcano. Ross Island is an intraplate volcanic center located at the southern end of the Terror Rift, an area of active continental extension. Geophysical data show that below the 19-27 km thick crust is a localized region of anomalously hot upwelling mantle.

We analyzed volatiles and major elements in 93 olivine-hosted (Fo 78.2-88.3) MI using FTIR spectroscopy and electron microprobe analysis, and all compositions were corrected for the effects of post-entrapment olivine crystallization. Preliminary results show the MI have a range of basanite compositions (SiO₂ 39.1-45.2 wt.%; Mg# 50.1-66.5). The MI major element trends further suggest the 9 samples are genetically related and may have a common low degree partial melt parental magma. CO₂ contents range from ~0.1 to 0.85 wt.%, which are amongst the highest ever measured in MI. H₂O contents are ~1 to 1.9 wt.%. The MI also have high concentrations of S, Cl, and F with maximum values of 0.27, 0.22, and 0.14 wt.%, respectively. The H₂O and CO₂ concentrations require entrapment pressures between ~250 and 600 MPa. Thus, the MI record a magmatic history that begins at near-Moho depths and is exceptionally CO₂-rich. Because of its low solubility in magmas CO₂ must be the major volatile driving the eruption of these alkalic magmas. More evolved Erebus MI (SiO₂ 43.4-53.6 wt.%; Mg# 32.9-55.1) from an earlier study [1] have consistently lower H₂O concentrations.

[1] Oppenheimer et al. (2011) EPSL. 306, 261-271.