European Mineralogical Conference
Vol. 1, EMC2012-446, 2012
European Mineralogical Conference 2012

Interpreting disequilibrium textures in crystals erupted from the Garibaldi volcanic complex, British Columbia, Canada: deciphering pre- and syn-eruptive magmatic signals and their significance in eruption forecasting

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The Garibaldi volcanic complex is located in southwestern British Columbia; it lies within the most densely developed part of British Columbia, and close to the cities of Vancouver and Whistler. The Garibaldi complex comprises two fields: the northerly, Garibaldi Lake volcanic field and Mt. Garibaldi volcanic field to the south, and includes numerous large stratovolcanoes, smaller tephra cones, isolated lava flows and domes. Volcanism in both areas was largely contemporaneous, beginning at ∼1.3 Ma (Black Tusk and Mt. Price); the most recent activity occurred at ∼0.01 Ma with the eruption of the Ring Creek flow from Opal Cone (Green, 1990). Glacial activity and erosion have played their part in the evolution of the complex. For example, progressive melting of glacial ice that filled the surrounding valleys led to the collapse of the western flank of the supra-glacial Atwell Peak cone and subsequent eruption of dacitic lava from Dalton Dome. The Rubble Creek lava flow, which erupted from Clinker Peak, was partly confined by a wall of ice, resulting in a flow some 240 m in thickness. The steep, northern edge of this flow has partly collapsed several times forcing the abandonment of the nearby village of Garibaldi; the most recent collapse occurred in 1855-1856.

On account of the proximity of the Garibaldi volcanic complex to several, highly populated areas it is important to evaluate the likelihood of an eruption, its nature and potential hazards this may result in. This study aims, therefore, to investigate past eruptions and eruptive products with a goal of interpreting and characterising the volcanic history of Garibaldi complex volcanoes. Further, it will attempt to constrain their eruptive nature and any cyclicity that may be recorded in magmatic crystals present in products erupted across the spectrum of volcanoes and magma types. Our study includes both petrological investigation and detailed analysis, modelling and quantification of disequilibrium textures preserved to elucidate pre- and syn-eruptive processes, such as recharge or magma-mixing. Zoning phenomena are preserved in orthopyroxene, plagioclase and olivine, the latter of which have recently been applied in modelling very short time intervals between magma recharge and subsequent eruption at Nea-Kameni on Santorini (Martin et al., 2008).

The results of our studies are timely and could prove valuable in hazard evaluation and emergency preparation for an eruption from the Garibaldi volcanic complex, as this would likely pose significant risk to the local communities, infrastructure and include disruption of international air travel through tephra eruption.

References

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