Integrated tephrochronology of the West Antarctic region - Implications for a potential tephra record in the West Antarctic Ice Sheet (WAIS) divide ice core

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Of the many volcanoes that protrude through the West Antarctic ice sheet, Mt. Takahe and Mt. Berlin have been the most active ash-producers over the last 500,000 years. Mt. Takahe has produced a number of recent trachytic eruptions, including events at 8.2±5.4 ka, 93.3±7.8 ka and 102±7.4. Mt. Berlin has produced young events sampled in the crater region at 10.3±5.3, 18.2±5.8, 25.5±2.0. Further information about eruptions from Mt. Berlin is gained by studying a long section of exposed blue ice and intercalated tephra layers at Mt. Moulton. Eight of these tephra layers have been directly dated using $^{40}Ar/^{39}Ar$ geochronology of potassic feldspar phenocrysts, to 10.5±2.5; 24.7±1.5; 92.1±0.9; 104.9±0.6; 118.1±1.3; 135.6±0.9; 225.7±11.6; and 495.6±9.7 ka.

A total of 36 tephra-bearing layers have been recognized in the Siple Dome A ice core. The source volcanoes for these tephra layers are largely found within the Antarctic plate, although some South American and possibly a New Zealand volcano are also represented. Statistical geochemical correlations have been made between 12 of the tephra layers and source volcanic eruption. Ten of the tephra layers are correlated to known tephra layers found at Mt. Moulton or Mt. Berlin. One correlation is also made to the 8.2±5.4 ka eruption of Mt. Takahe. The existing ice core chronology agrees well with independently determined chronologies for the source eruptions.

The WAIS Divide ice core is located in central West Antarctica, in reasonably close proximity two the two main West Antarctic tephra-producing volcanoes, Mt. Takahe and Mt. Berlin, and is therefore likely to contain a number of known tephra layers from the two volcanoes. The youngest widespread tephra layer from a West Antarctic volcano is the 8.2 ka eruption from Mt. Takahe, and this layer is likely to be present in the WAIS Divide core. Mt. Berlin is likely to dominate the tephra record in the lower part of the core, and at least some of the tephra present at Mt. Waesche, Mt. Moulton and Siple Dome sites are likely to be found. Discovery of these layers in the WAIS Divide core could provide a number of useful cross-correlated time-stratigraphic markers linking the climate records.

Magma evolution in time and space at Volcán Llaima (38.7° S, Andean Southern Volcanic Zone - SVZ, Chile)

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Late Quaternary Volcán Llaima is a dominantly mafic to andesitic frontal-arc edifice (seven major eruptions and many smaller events since 1640). Holocene activity began ~13.5 ka by caldera collapse and eruption of the regional basaltic to andesitic (~52-58% SiO_2) Curacautin Ignimbrite. The Holocene edifice buried this caldera and was constructed mainly from a N-S central-vent system that is ~parallel to the adjacent Liquiñe-Ofqui Fault Zone. Mafic lavas and tephra (~51-55% SiO_2) have erupted with increasing frequency during the last ~3500 years. Magmas erupted from a partly circumferential system of flank fissures (oblique to the main cone's vent orientation) are typically more evolved and are derived from more diverse parental magma compositions. The most primitive erupted magmas are evolved basalts (<6.5% MgO) with relatively low incompatible element abundances compared to volcanoes behind the frontal arc and to those located north of 38° S. Phenocryst assemblages in mafic magmas are PL>OL>CPX>SP. Hydrous phases are absent from the most evolved pyroclastic unit (~69% SiO_2). Fractional crystallization apparently dominates differentiation from evolved basalt to andesite, although the vast majority of coarse mineral grains are out of equilibrium with host liquids: magma mixing appears to account for most of the open-system contributions. Parental magma diversity at Llaima is low and typical of this part of the southern SVZ (38-41° S), and it is far less than what is present at the Tatara-San Pedro complex (36° S). These new results are the foundation of an assault on the Llaima magmatic system designed to quantify mantle source-region parameters in the context of an understanding of how Llaima magmas ascend, interact, evolve and erupt.