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Compositional Variation and Storage Conditions Through Time at Mount Waesche, West Antarctica

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Lavas from Mount Waesche (Executive Committee Range, Marie Byrd Land, West Antarctica) that erupted during the last peak interglacial period (ca. 100-130 ka) and preceding glacial period (ca.138.7-150.5 ka) shared common lower crustal storage depths, despite an uptick in eruptive activity during the interglacial period. These results suggest that changes to the cryosphere have minimal impact on the depth of the crustal magmatic storage system. In this work, we evaluate the geochemistry and petrology of glacial and interglacial lavas older than 150.5 ka to understand if lower crustal storage conditions persist for all lavas erupted from Mount Waesche. The samples in this study have ages from 170.4 to 425.9 ka, span three interglacial periods, range in composition from basanite to phonolite. The samples contain plagioclase + Fe-Ti oxides ± clinopyroxene ± olivine ± apatite, with total crystallinities ranging from ~1.4 to 44.5%. We selected six interglacial and three glacial samples for microprobe analysis of major mineral phases. We applied an iterative method of H_2O-dependent clinopyroxene thermobarometry which combines clinopyroxene and plagioclase compositions, and outputs from a plagioclase hygrometer, to obtain pre-eruptive pressure, temperatures and H_2O contents. Our results show the lavas span a range of temperatures from 941 (±20; 2 sigma) to 1252 (±14°C), where temperature decreases as whole rock composition evolves from basanite to phonolite. The H_2O contents in the lavas scale with temperature, where the hottest lavas are anhydrous and the highest water contents (4.0 ±0.2) are found in evolved samples. Lavas older than 150 ka from Mount Waesche have storage pressures that range from 3.4 (±1.1) to 13.8 (±0.7) kbar, where the most common storage pressures fall in the range of 6-9 kbar. The storage pressures for lavas older than 150 ka are similar to those for lavas erupted during the most recent interglacial period (6-10 kbar), suggesting that lower crustal storage has persisted through time and glacial cycles at Mount Waesche. Comparison of whole rock compositions with eruptive age reveal that there a history of bimodal volcanism at Mount Waesche that is truncated by episode of intermediate volcanism beginning about 200 ka.