

Englacial tephra from Mount Erebus, Antarctica

C.J. Harpel^{1,2}; P.R. Kyle²; N.W. Dunbar³

1. Department of Geology and Geological Engineering, University of North Dakota, Grand Forks, ND, 58202-8358, USA

2. Department of Earth and Environmental Science, New Mexico Institute of Mining and Technology, Socorro, NM, 87801, USA

3. New Mexico Bureau of Geology and Mineral Resources, Socorro, NM, 87801, USA

Englacial tephra layers provide insight into the explosive eruptive history of Mount Erebus. Most of the tephra occur proximally within the Barne Glacier, ~1-15 km from source. Two distal tephra occur in blue ice at Manhaul Bay and Mt. DeWitt in the Transantarctic Mountains, ~210 and ~180 km from source, respectively. The proximal tephra are exposed in stratigraphic order and have $^{40}\text{Ar}/^{39}\text{Ar}$ ages of $<71 \pm 5$ ($\pm 2\sigma$) ka at the bottom and 15 ± 4 ka near the center of the section. The distal Mt. DeWitt tephra is 39 ± 6 ka. Major element analyses of glass and feldspar indicate that the samples are nearly identical in composition and are typical of Mount Erebus anorthoclase phonolite. Trace element analyses of selected samples are indistinguishable. The proximal tephra have fluidal and blocky shard morphologies indicating strombolian and phreatomagmatic eruptions. Some tephra are mixed, having shards indicating both eruptive mechanisms. Spherical droplets, Pele's hair, and lattice-work and budding shards are occasionally present. Phenocrysts of anorthoclase, apatite, Fe-oxides, and olivine are present in all samples. Analcime crystals in some samples are interpreted as xenocrysts scavenged from a hydrothermal system. The Mt. DeWitt tephra contains abundant bubble wall shards typical of those produced by plinian eruptions and potentially correlates to summit caldera formation. The Manhaul Bay tephra contains predominantly blocky shards suggesting a phreatomagmatic origin. The distal tephra can be potentially used as regional stratigraphic markers in blue ice areas. These englacial tephra indicate that Mount Erebus has a history of phreatomagmatic, strombolian, and rare plinian eruptions.

