

THE BUTCHER RIDGE IGNEOUS COMPLEX: A UNIQUE FERRAR (183Ma) INTRUSION

Background: The Butcher Ridge Igneous Complex (BRIC) is a 16 km long, 600 m high escarpment located 280 km southwest of McMurdo Station, Antarctica near Darwin Glacier and is bounded to the west by the East Antarctic ice sheet. The BRIC is a hypabyssal sill-like intrusive body composed of rocks that range from basalt to rhyolite in composition. In many places, the rocks are layered (due to glassy/vitrophyric layers) and are also chaotically folded. Larger vitrophyric bodies are commonly seen and appear to be diapirs of felsic magma rising and mixing within the sill. The BRIC is thought to be a new type of layered igneous intrusion, a result of mixing between silicic magmas and a mantle-derived mafic magma (Ferrar Group) by melting of upper crustal granitoids.

Objective: The fundamental objective is to make a detailed mineralogical and geochemical examination of Butcher Ridge. Despite the obvious uniqueness of the BRIC, it has not been studied in any detail. This unique igneous complex can help to provide clarity on magma mixing dynamics, which is a widely invoked process that hasn't been demonstrated in the Ferrar Group previously. The BRIC can also provide further insight on the processes for generation of felsic magmas in flood basalt provinces as well as explore the role of crustal melting by mid-crustal intrusions of Ferrar magmas.

Questions: possible questions to be addressed include:

1. What evidence is there of crustal assimilation in the BRIC?
2. What role does crustal contamination play in the petrogenesis of the Ferrar magmas?
3. What are the dominant controls on the nucleation and crystallization of superheated felsic magmas?
4. What is the mineralogy of the rocks in this unique body, and how do these compare to typical Ferrar rocks and the granitoid contaminants?
5. Can you use the analyzed rock compositions to improve the geologic field map?

Samples: A suite of igneous samples of variable composition collected from the BRIC between 1977 and 1980 are archived at the Polar Rock Repository and available for analysis (prr.osu.edu). About 160 samples have unpublished major element and trace element data (Excel file available), and a smaller number of Sr and O isotope analyses are available. Rock powders are available for most analyzed samples.

Suggested studies:

1. Make detailed petrological and mineralogical observations of the samples. Look for evidence of mixing of a crustal derived granitoids. Make microprobe analyses of representative samples.
2. Use the whole rock chemical analyses to refine the geological map. Make a chemical map of the escarpment and compare to the field map (available from PRR)
3. Evaluate current models for the formation of this unique igneous body.

Background references:

Shellhorn, Mark Alan (1982). The role of crustal contamination at the Butcher Ridge Igneous Complex, Antarctica; Ph.D. Thesis, New Mexico Institute of Mining and Technology, Socorro, New Mexico, 169 pages.

Nelson, D. A., Cottle, J. M., & Schoene, B. (2020). Butcher Ridge igneous complex: A glassy layered silicic magma distribution center in the Ferrar large igneous province, Antarctica. *Bulletin*, 132(5-6), 1201-1216.

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