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BOOK REVIEW

PETROLOGY, MINERALOGY AND EVOLUTION OF THE JAN MAYEN MAGMA SYSTEM. By Páll Imsland. Vísindafélag Íslendinga, University of Iceland, 101 Reykjavík, Iceland, 1984. 332 pages.

The active volcanic island of Jan Mayen is located at 71°N in the North Atlantic near the intersection of the Jan Mayen fracture zone and the Mohns Ridge spreading center. It is roughly spoon-shaped, with a 2700-m-high, equant volcano (Beerenberg) connected to a narrow volcanic isthmus oriented northeast. The island comprises about 38 km^2, most of which is covered by glaciers and snow fields. A dramatic eruption in 1970 focused attention on the island and initiated the modern phase of study of this very interesting volcano.

This book by Páll Imsland contains 132 figures, about one third of which are photomicrographs, and about 50 tables; mostly chemical analyses of rocks and minerals. The book is divided into ten chapters; however, all but four are very short. Most of the book, faithfully reflecting its title, is about mineral chemistry (Chapter 8: about 150 pages), petrography (Chapter 6: about 50 pages), modeling of fractional crystallization (Chapter 7: about 25 pages). The remaining 70 pages contain short discussions of previous work, rock classification, alteration, and sampling, plus a summary and references. This book will no doubt stand for some time to come as the definitive work on the petrography, mineral chemistry, and chemical composition of the lavas and xenoliths of Jan Mayen Island. I recommend it to all petrologists interested in the petrology and mineral chemistry of volcanic islands.

The sections on petrography and mineral chemistry are the greatest strength of the book. Hundreds of high-quality microprobe analyses of minerals from the lavas and xenoliths are supplemented by discussion of their significance for determining their conditions of crystallization (P, T, f_{O_2}, etc.). The section on petrogenesis is weaker, insomuch as petrogenetic modeling consists almost entirely of major-element, fractional-crystallization mixing calculations. Imsland tests the hypothesis that the porphyritic ankaramite to trachyte series of Jan Mayen could be produced by fractional crystallization of an ankaramitic parent (18.5 wt% MgO) that he considers to represent a liquid. Even though this hypothesis seems to work out very well, Imsland rejects it because the trace elements, principally Sr and Y, do not agree well for the evolved rocks of the series. He concludes that Jan Mayen has three primary magmas: ankaramite (from the mantle), fractionated Ne-normative basalt (from crustal melting), and trachyte (also from crustal melting). He believes that fractional crystallization played a major role in deriving basalts from ankaramitic liquids but not for the rest of the suite. He attempts to relate melting and differentiation events to the complex rifting history of the Aegis and Kolbeinsey ridges in the North Atlantic.

While Imsland may be correct, I was disappointed by the lack of geological data that could be used to constrain petrogenetic hypotheses. The geology of the island, its volcanological development, measured ages and isotope measurements of lavas are hardly discussed at all, though data on the geology and volcanology of the island in earlier geologic reports by the authors are referenced. References on geochronology (Fitch, 1964; Fitch et al., 1965) and seismic and volcanological instrumentation of the island (Sylvester, 1975) are not included in the otherwise very complete reference list.

Some readers may wish to quibble, as I do, with some of Imsland's interpretations. For example, I believe that Imsland's data support the notion that the ankaramites are basalt liquid partly mixed with disaggregated clinopyroxene- and olivine-rich mantle xenoliths. He mentions that phenocrysts in the ankaramites, including strain-banded olivine (up to Fo_{92}) are identical to crystals in the ultramafic xenoliths, but interprets this as evidence that even the most porphyritic ankaramites (18.5 wt% MgO) are liquids and that the ultramafic xenoliths are cognate. He thus interprets excellent matches of mixing models to support this notion. He does not discuss the alternative interpretation of deriving ankaramites from basalts by adding disaggregated ultramafic xenoliths, even though he cites Goles' (1975) opinion that the ankaramites are not liquids but rather liquids with abundant cumulate crystals. In short, some readers may disagree with some of the petrogenetic conclusions, but most of the data needed by interested readers who wish to test alternatives are provided (one exception is that modal abundances are not provided for individual samples).

I would recommend this book very highly to petrologists and mineralogists interested in alkalic igneous rocks and their xenoliths. This book is a must for persons interested in the petrology and mineralogy of oceanic islands.

References

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