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HEAVY MINERALS IN THE SYENITES OF PLEASANT MOUNTAIN, MAINE

WILLIAM F. JENKS, *Harvard University.*

In the course of petrographic work on material collected in 1931 on Pleasant Mountain, Maine, a qualitative study of the heavy minerals was made. The mountain, situated between Bridgeton and Fryeburg in the western part of the state, is held up by an oval-shaped stock of syenites, including nordmarkite, augite syenite, analcite syenite, and numerous porphyritic varieties of each of these.[1]

Observations were made with the following objectives in mind: (1) to determine what minerals are characteristic of each rock type, and hence get a broad idea of the variations within the stock as a whole; (2) to determine the degree of constancy of the heavy mineral suite within a given rock type; (3) to determine just how useful a qualitative mineralogical analysis of heavy minerals within a small stock such as that at Pleasant Mountain would be in correlation and identification of rocks whose relationship is in doubt.

Method. Of each sample selected for analysis a piece about a quarter the size of a hand specimen was ground to pass an eighty mesh screen. In addition two smaller meshes were used, the 160 and 250. Material which passed the 250 mesh screen was discarded, most of it consisting of feldspar particles. The two coarser grades were then passed separately through bromoform of a density approximating 2.9. After washing and drying the heavy residue a further separation was made with an electromagnet, the result being fairly clean concentrations of the various minerals. In general the magnetite was removed with a weak magnet, pyroxene, hornblende, biotite, and titanite with increasingly strong magnets. Apatite and zircon were non-magnetic.

[1] A paper by the writer on the petrography of the Pleasant Mountain intrusives will be published shortly in the *American Journal of Science.*

The greatest number of determinations was made on the nordmarkite, since it is the most extensive of the rocks. On most of the other types represented a single determination was deemed sufficient.

Results. The mafic minerals, biotite, augite, and hornblende, vary somewhat in relative and absolute proportion within a rock type, the nordmarkite being taken as an example. Between the different rock types there is a similar variation. Within the nordmarkite the amount of heavy concentrates varies from 3 to 11.7 per cent of the sample by weight. The most variable of the mafic minerals, augite, fluctuated from zero to about 17 per cent of the total heavies. Biotite and hornblende were more constant, maintaining together a proportion of 75 to 95 per cent of the heavy concentrates, the two minerals being present in about equal amounts.

TABLE I. TABLE SHOWING THE DISTRIBUTION OF THE HEAVY ACCESSORY MINERALS IN SOME OF THE ROCKS OF THE PLEASANT MOUNTAIN STOCK

	Titanite	Apatite	Magnetite	Zircon	Allanite
Augite syenites	a	a	a	vc	
Analcite syenite	a	c	vc	c	r
Monzonite and diorite	a	a	a	c	
Nordmarkite	a	a	a	vc	
Porphyritic hornblende syenite	a	a	a	vc	
Fine porphyritic syenite	a	a	a	s	
Coarse anorthoclase syenite porphyry	a	a	a	vc	

Explanation: a = abundant, vc = very common, c = common, s = scarce, r = rare.

Magnetite, apatite, titanite, and zircon were accessories in every sample examined. The only additional accessory is rare allanite, found only as nearly opaque and nearly isotropic dark red grains in the concentrate from the analcite syenite. In every rock but the analcite syenite the relative and absolute percentages of apatite, titanite and zircon remain fairly constant. For instance in the nordmarkite and anorthoclase syenite porphyry the non-magnetic concentrate was two to four per cent of the total heavy concentrate, and consisted of apatite and zircon in the ratio of about three to one. The samples from the analcite syenite, on the other hand, had a non-magnetic concentrate which was only 0.7 per cent of the total heavies, but the ratio of apatite to zircon was still ap-

proximately three to one. In the latter samples, however, the titanite was estimated to form six per cent of the total heavy minerals, whereas in the nordmarkite and other rocks examined titanite

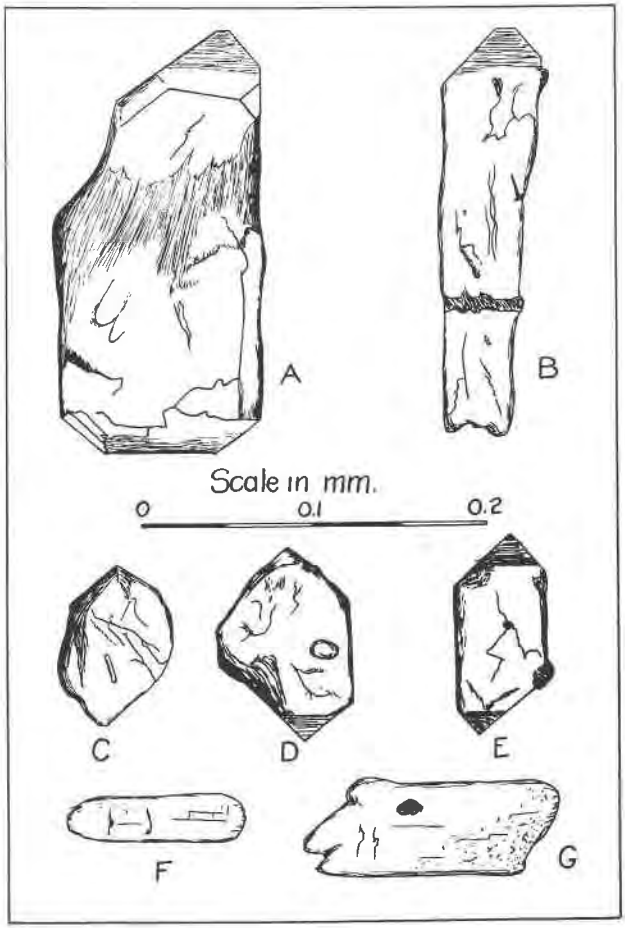

FIG. 1. Camera lucida drawings of zircon (A–E) and apatite (F and G) from heavy concentrates.

formed only about two per cent of the total heavies. Relative abundance of the various heavy accessory minerals in the several rocks of the stock are given in Table I.

The zircons, examples of which are shown in Figure 1, are color-

less or very light gray and commonly occur as euhedral, doubly terminated crystals. The usual forms are the first order prism and pyramid, with occasional development of the second order pyramid (see Fig. 1A). It was kindly determined by Professor A. C. Lane that the zircons in one sample are not radioactive. This fact is difficult of explanation, since the small zircons of igneous rocks are commonly more radioactive than the large ones. The titanite appears in the heavy concentrates as pale yellow-brown angular grains, while the apatites are long prismatic, in many cases with rounded or broken ends (see Fig. 1, F and G). Sometimes there is a trace of a basal termination.

Conclusions. As indexes of rock types the heavy accessories are practically useless. Not only do the relative and absolute proportions of the minerals vary almost as much within a rock type as within the stock as a whole, but the crystal habit and color are in addition practically invariant. This conclusion is only natural in a small stock where all the rocks are derived from a common magma within a relatively short interval of time. The interesting thing is that one rock of the series, the analcite syenite, should have a somewhat different combination of heavy minerals. Of little value to the petrographer, perhaps the mere listing of the accessory minerals will prove of use to students of sedimentation as a key to the provenance of any post-intrusive sediments that might be found in this part of New England.