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PARAGENESIS OF THE CROCKLEY PEGMATITE, REPUBLIC, MICHIGAN[1]

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The Crockley feldspar quarry is approximately four miles north-northeast of Republic in Marquette County and about $\frac{1}{4}$ mile east of State Highway 601, in sec. 22, T. 47N., R. 29W. It was reportedly opened in 1902, at which time a carload of potash feldspar was shipped to East Liverpool, Ohio, for ceramic purposes. In 1926 Mr. Carlson of Republic reopened the quarry for a short time.

The quarry, which lies on the north side of the access road, is an irregular cut $65 \times 20 \times 10$ feet in dimensions, with slumped sides. Many smaller test pits that no longer expose bedrock lie south and west of the main opening. Outcrops in the immediate vicinity are very poor owing to a thick mantle of brush-covered, swampy glacial debris.

The cut exposes a glaciated rock surface about 50 feet long, the axis of which trends N. 48° W. This surface consists entirely of pegmatite, the contacts of which are not exposed. However, some pieces of a light-colored, medium-grained granite on the old dump appear to represent the wall rock, probably the Republic granite.

The following rock types occur in the pegmatite:

(a) Along the south wall of the cut is an exposure of fine-grained white pegmatite in which microcline, quartz and small subordinate flakes of biotite can be distinguished. This fine-grained rock, which is cut by thin veinlets of quartz that probably are off-shoots from the core, is believed to represent the border zone. (b) The wall zone consists of medium-grained, reddish microcline in curved blades, aggregates of which are cut by thin films of biotite as much as an inch and one-half long. (c) The main part of the outcrop consists of curved red microcline blades as much as two inches long, throughout which are scattered blebs of white quartz, one to two inches long. This is the intermediate zone. (d) In the northeast corner of the cut is an exposure 6×3 feet across which is part of the massive white quartz core. Offshoots of quartz extend into the surrounding curved microcline (Fig. 1).

Thin sections of the border zone rock reveal the following minerals in order of abundance: (a) relatively large anhedral microcline; (b) finer-grained anhedral quartz, some of which occurs within microcline; (c) subordinate grains of oligoclase (Ab 85), some of which replace microcline anhedra along edges; (d) biotite in small euhedral blades with a general parallel orientation. The greenish biotite includes zircon grains and is partly replaced by muscovite and partly altered to chlorite. A small amount of muscovite also occurs graphically intergrown with

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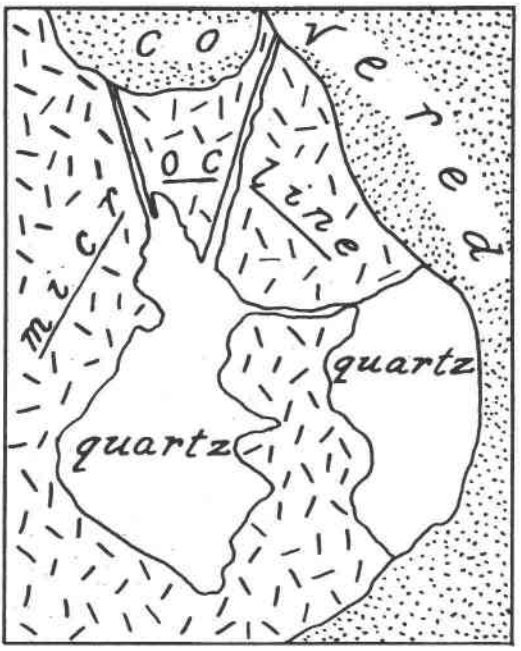

FIG. 1. Sketch of exposure of the Crockley pegmatite near Republic, Michigan, showing part of the quartz core with quartz apophyses along fractures in curved microcline of the intermediate zone. Exposure is 6 feet long.

quartz. The most abundant accessory mineral is interstitial fluorite, which is concentrated in streaks of biotite. Where fluorite occurs adjacent to grains of altered sphene, a purple mottling has been produced as the result of radioactivity emanating from the sphene. Pyrrhotite appears as scattered irregular grains. The order of formation of the minerals is: (1) zircon and sphene, (2) biotite, (3) microcline and quartz, (4) oligoclase, (5) fluorite, muscovite and pyrrhotite, (6) chlorite.

Snelgrove *et al.* (1943) also have reported metamict allanite (G = 3.2–3.4, n = 1.703) and an undefined niobium bearing mineral, possibly priorite (blomstrandine) (?), from the Crockley pegmatite. Slawson (pers. comm.) has noted flakes of molybdenite in this deposit.

Thin sections of the curved microcline from the wall and intermediate zones reveal that the unusual structure of the potash feldspar is the result of clastic deformation. The perthitic microcline is broken by numerous subparallel fractures, many of which cut the perthite lamellae nearly at right angles. Adjacent blocks of microcline have been offset and slightly rotated, and most of the fractures now are occupied by veinlets of albite (Ab 98). Also present are small blebs of quartz, minute

flakes of pale green muscovite which replace both feldspars and fine-grained calcite pseudomorphous after euhedral sphene. The order of crystallization apparently is: (1) sphene, (2) microcline, (3) quartz, (fracturing), (4) albite, (5) muscovite, (6) calcite. The results of an analysis of this microcline have been presented by Allen (1920).

It seems probable that the fracturing of the microcline and the consequent formation of the curved platey structure took place during the later stages of pegmatite consolidation and probably resulted from the final intrusive forces that brought about pegmatite emplacement. Thus the late stage albite, which stems from residual pegmatitic solutions, was precipitated along these readily accessible fractures. The quartz of the core, most of which crystallized after the microcline of the intermediate zone, as is shown by its apophyses (Fig. 1), is not granulated nor deformed. Therefore the deformation of the microcline is an intrapegmatitic, not a post-pegmatitic phenomenon.

Thus this pegmatite is of special interest for two reasons: 1) It offers clear-cut evidence for the late-stage development of the core (Fig. 1) and 2) It offers evidence that prior to core formation the wall zone had crystallized sufficiently to support fracturing.

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EXOMORPHISM AROUND AN APLITE—PEGMATITE DIKE, FELCH, MICHIGAN[1]

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The Metronite quarry is 2½ miles east-northeast of Felch in Dickinson County, Michigan. The workings have been developed in the Randville dolomitic marble (Lower Huronian) which overlies the Sturgeon quartzite, the basal Huronian in this area. The Randville, which is 500–1500 feet thick, has been intruded by the Republic granite and its dikes of post-Keweenawan age (Killarney).

The occurrence of unusual minerals in this area was recorded by Dana

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