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Geology of the Quartz Creek Pegmatite District, Gunnison County, Colorado

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Trace Elements Investigations Report 138

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geology - Mineralogy

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOLOGY OF THE QUARTZ CREEK PEGMATITE DISTRICT, GUNNISON COUNTY, COLORADO*

By

Mortimer H. Staatz and Albert F. Trites

April 1952

Trace Elements Investigations Report 138

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*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission

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by

Mortimer H. Staatz and Albert F. Trites

ABSTRACT

The Quartz Creek pegmatite district includes an area about 29 square miles in the vicinity of Quartz Creek in Gunnison County, Colo. This area contains, 1,803 pegmatites that are intruded into pre-Cambrian rocks.

The rocks exposed in the district range in age from pre-Cambrian to Recent. The oldest pre-Cambrian rocks are chiefly quartzites interbedded with a few arkoses and conglomerates. These rocks are surrounded by more abundant hornblende gneiss and tonalite. A small body of biotite tonalite was intruded and two thin layers of dacitic pillow lava were extruded into this series. The hornblende gneiss and tonalite have the same composition and differ only in texture. The older material (hornblende gneiss) has a well-marked lineation, whereas the younger (tonalite) is equigranular. Subsequently, a large body of quartz monzonite was intruded along the northern boundary of the mapped area. Later, coarse-grained granite was intruded into the southern part of the area. Dikes of fine-grained granite cut the coarse-grained variety. The last period of intrusive activity in pre-Cambrian time is marked by a large number of pegmatites.

The pre-Cambrian rocks were tilted and eroded, and the flatlying Jurassic Morrison formation was deposited on the irregular surface. This formation is conformably overlain by the Cretaceous Dakota sandstone. Faulting produced a vertical offset of 410 feet in the Mesozoic sediments along the only large fault in the area. At the end of Mesozoic time there

was another period of erosion. Tertiary (?) tuff is exposed in small, scattered areas in the southern part of the district. It overlies both the Dakota sandstone and pre-Cambrian formations. Glacial till occurs along the edges of Quartz Creek and Wood Gulch. Quaternary alluvium fills the valley bottoms.

Although the composition of the country rock has little effect on the shape of the pegmatites, the foliation imposed on this rock has a localizing effect and in part controls the ultimate shape of pegmatites. Zoned and related internal structures are not well developed in the pegmatites of this region. Many of the pegmatites are homogeneous and those that are zoned usually contain a large wall zone and small discontinuous cores. In addition to the more common homogeneous and zoned pegmatites, 7 percent of the pegmatites show a layered structure of textural and mineralogical units not repeated on the opposite side of the pegmatite. Other internal structural units include pegmatites which vary in composition along strike, multiple or "line-rock pegmatites", and fracture fillings.

The mineralogy of the pegmatites is described in detail. Specific attention was given to most of the 27 observed minerals. A study of the index of refraction of 439 specimens of plagioclase showed that the variation from zone to zone and layer to layer is minor and that there is no systematic variation in respect to the entire district. No correlation could be found between the refractive index of plagioclase in the pegmatites and the type of country rock, or the presence of various accessory minerals.

Index of refraction determinations on 95 specimens of muscovite showed no constant variation from wall zone to core or from layer to layer. Curved muscovite has identical optical properties with the flat variety.

The index of refraction was determined for 183 beryl specimens. The beryl in pegmatites containing only a wall zone and a core showed no difference between zones, but in pegmatites that have intermediate zones, the indices of refraction of the beryl showed an inward increase in the alkali content from the contact. Beryl occurs with almost all of the pegmatite minerals and is not restricted in its mineral associations.

Tourmaline, except the black variety, is associated with lepidolite. Dark green and blue tourmaline is found in the outer zones of pegmatites containing lepidolite, and the pink and light green varieties are found in direct contact with lepidolite.

Lepidolite occurs in aggregates of fine grains, in flat plates, and in curved plates; the three varieties are optically identical. The lighter-colored varieties have higher indices of refraction and contain less lithia than the darker varieties.

In addition, the occurrence of the following minerals is described in detail: perthite, quartz, martite, biotite, garnet, columbite-tantalite, monazite, microlite, topaz, gahnite, allanite, and an unidentified mineral.

The lack of alteration in the wall rocks adjacent to the pegmatites is interpreted as indicating that the original pegmatite magma did not have an excess of materials such as B, OH^-, and P that are needed to form alteration minerals. Because of their low concentration, the above materials were available only in the pegmatitic magma during its crystallization. Pegmatites that contain the rare minerals such as beryl, tourmaline, curved muscovite, biotite, magnetite, monazite, columbite-tantalite, cleavelandite, topaz, lepidolite, and microlite show a grouping in clusters within the district.

Beryl-bearing pegmatites occur most abundantly in hornblende gneiss and are only rarely found in either granite or quartz monzonite.

The types of minerals that form in a pegmatite appear to be determined by the character of the material segregated from the original magma and the period in which it segregated. The elements escape at one period and may be from only a specific pocket in the magma. These liquids tend to form groups of pegmatites in which the later bodies contain a high proportion of volatiles.

Inferred reserves of the district are estimated for beryl, scrap mica, both hand-cobbing and milling feldspar, lepidolite, columbite-tantalite, topaz, monazite, and microlite. No sheet mica was found. Reserves are small and transportation costs are high so substantial production of low-priced feldspar and scrap mica will depend on the adoption of economical milling techniques for recovering the large quantities of feldspar available. Beryl is irregularly distributed and its recovery as a byproduct will depend on the establishment of a stable market for feldspar and scrap mica. Lepidolite reserves are small and low grade.

INTRODUCTION

Prior to World War II the Quartz Creek pegmatite district was well known for its fine specimens of colored tourmaline, books of lepidolite, topaz, and microlite. During and after World War II small quantities of beryl, feldspar, lepidolite, and tantalum minerals were produced from the district.

Location and surface features

The Quartz Creek pegmatite district is on the western slope of the Sawatch Range in Tps. 49 and 50 N., R. 3 E., New Mexico principal meridian, Gunnison County, Colo. (fig. 1). It covers about 29 square miles in the vicinity of Quartz Creek. State Highway 162 follows Quartz Creek through the district, and joins U. S. Highway 50, 2 miles south of the southern boundary of the mapped area. A road branching from State Highway 162 crosses the southeastern corner of the area and connects with U. S. Highway 50 1 mile west of Doyleville. Unimproved roads follow several of the valleys, and a mine-access road, made during World War II, connects State Highway 162 with the Brown Derby mine. The nearest railroad shipping point, Parlin, is on a narrow-gauge line of the Denver and Rio Grande Western Railroad, which connects with standard-gauge lines at Salida (east-bound) or Montrose (west-bound).

The topography is moderately steep and has a maximum relief of 2,200 feet (pl. I). The highest peak in the district is at the northern boundary and has an elevation of 10,238 feet. Quartz Creek, the main tributary draining the area, is in a flat cultivated valley, a quarter to half a mile wide. The hills rising from Quartz Creek are usually sage-covered, and the north-facing slopes of the higher hills are covered with aspen, or spruce and pine. Quartz and Alder Creeks are the only permanent streams in the district, but water flows in Willow Creek and Wood Gulch during the spring and early summer.

Production

The recorded production of pegmatite minerals from the Quartz Creek district is about 51 tons of beryl, 283 tons of lepidolite, 140 tons of scrap mica, 5,000 pounds of tantalum and columbium minerals, and 15 pounds of monazite.

From September 1943 to the spring of 1945 the Brown Derby property was leased by the Hayden Mining Company. Prior to February 1945, 3,155.67

A. Panorama southern end of Quartz Creek pegmatite district looking north. White areas in foreground are pegmatites.

B. Panorama of the northern end of the Quartz Creek pegmatite district looking west across Quartz Creek. Outcrops in the background are the Black Wonder (No. 847) pegmatite.

pounds _/ of beryl were sold to Metals Reserve Company and 283 tons of

_/ Hanley, J. B., unpublished notes.

lepidolite to Corning Glass Company. In addition, 4,000 pounds of microlite concentrate containing 52 percent microlite was stockpiled at the mill and later sold. Though the final production figures are not available, they do not greatly exceed these figures as mining stopped in the spring of 1945.

The White Spar No. 1 and No. 2 pegmatites, which are 0.8 mile north of the Brown Derby mine, were mined for a short time during World War II by the Colorado Feldspar Company. The production of lepidolite and feldspar is not known, but was small.

There was no mining in the district from 1945 to 1947. Mr. Rod Fields located the Bucky claim on the east side of Willow Creek and started to mine beryl in the spring of 1948. Mr. Fields produced 17 tons of beryl, and in November 1948 sold the property to Beryllium Mining Company, Inc., which has produced 32.0 tons of beryl, 139.6 tons of scrap mica, 1,020 pounds of columbite-tantalite, 15 pounds of monazite, and 13 pounds of a samarskite-like mineral to May 1950. The last two minerals were sold to Ward's Natural Science Establishment, Inc.

Previous work

Early papers on the pegmatites of the Quartz Creek district have been concerned chiefly with the mineralogy of the Brown Derby pegmatites _/. A

_/ Eckel, E. B., A new lepidolite deposit in Colorado: Am. Ceramic Soc. Jour., vol. 16, pp. 239-245, 1933.
Landes, K. K., Colorado pegmatites: Am. Mineralogist, vol. 20, p. 333, 1935.
Eckel, E. B., and Lovering, T. S., Work of Eckel, Lovering, Fairchild--Microlite from Ohio City, Colorado: Report of the Committee on the Measurement of Geologic Time, pp. 77-79, Apr. 1, 1935.

Seaman, D. M., New pegmatite locality near Ohio City, Colorado: Oregon Mineralogist, vol. 2, p. 23, 1934.

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map showing the regional geology of the Gold Brick district, on a scale of 1.5 inches equal one mile, was published by Crawford and Worcester _/. The

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_/ Crawford, R. D., and Worcester, P. G., Geology and ore deposits of the Gold Brick district, Colorado: Colorado Geol. Survey Bull. 10, 1916.

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southwestern corner of their map, an area roughly 3.3 miles by 2 miles, overlaps the northern part of the present area mapped. No pegmatites are shown on their map and the area containing them is designated as "granite". The area around Tomichi Dome, several miles to the east of the Quartz Creek district, has been described by Stark and Behre _/.

_/ Stark, J. T., and Behre, C. H., Jr., Tomichi dome flow: Geol. Soc. America Bull., vol. 47, pp. 101-110, 1936.

Between September 1942 and December 1944 the Geological Survey had several field parties mapping in Colorado under E. W. Heinrich in 1942 and John B. Hanley in 1942-1944 _/. In the Quartz Creek district these parties

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_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah 1942-1944: U. S. Geol. Survey Prof. Paper 227, pp. 63-80, 1950.

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mapped in detail--on scales of 1 inch equals 20 feet to 1 inch equals 50 feet--the Opportunity No. 1 claim, the Brown Derby No. 1 claim, the Brown Derby Ridge pegmatites, Brown Derby No. 5, the White Spar No. 1, the White Spar No. 2, and the Bazooka pegmatites. A total of 25 pegmatites was mapped with plane table and telescopic alidade. Several other pegmatites were visited and described.

Field work and acknowledgments

The investigations carried out by the Geological Survey in the Quartz Creek pegmatite district during World War II were concerned primarily with pegmatites from which feldspar, muscovite, and minerals containing beryllium, tantalum, lithium, and the rare earths were produced. Such pegmatites are in the minority, and time did not permit detailed study of the more numerous associated, but unproductive pegmatites, or of the broader relations of pegmatites to the regional geology. This study, started in 1948, was made not only to provide an economic appraisal of individual deposits, but also to determine the regional relationships of pegmatites and country rock.

The field work for this report was started on July 10, 1948. M. H. Staatz and P. T. Flawn began mapping on the east side of Quartz Creek and A. F. Trites and F. L. Klinger on the west side. Field work was recessed September 7, 1948. It was resumed on June 12, 1949 and completed December 10, 1949. The writers were assisted during 1949 by F. L. Klinger for three months, and J. D. Vogel for two months. Mapping was done by pace and Brunton compass, using the Pitkin quadrangle topographic map enlarged to a scale of one inch equals 1,000 feet as a base (pl. 1). Individual pace and compass maps also were made of each pegmatite on the scales of from one inch equals 40 feet to one inch equals 200 feet, depending upon the size of the pegmatite. Petrographic work was done during the spring of 1950.

This investigation was made in part on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

GENERAL GEOLOGY

The rock units mapped in the Quartz Creek pegmatite district range in age from pre-Cambrian to Recent (pl. II). The age of the Brown Derby No. 1 pegmatite, as determined from uranium-bearing microlite by Eckel and Lovering _/, is 760 million years. The oldest pre-Cambrian rocks consist of

_/ Eckel, E. B., and Lovering, T. S., op. cit., p. 79, 1935.

metasedimentary rocks, predominantly quartzites, that are surrounded by younger and more abundant tonalite and hornblende gneiss (a meta-tonalite). Included in this series are two small bands of dacitic pillow lava and one of biotite tonalite. A coarse-grained porphyritic granite, similar in appearance _/ to the Pikes Peak granite, intrudes the earlier pre-Cambrian

_/ Eckel, E. B., op. cit., p. 240, 1933.

rocks in the south-central part of the district and a large quartz monzonite intrusive body occurs in the extreme northern part. These rocks are intruded by numerous fine-grained pink granite dikes and by a large number of pegmatites.

An angular unconformity separates the pre-Cambrian rocks from the flat-lying Jurassic Morrison formation and Cretaceous Dakota sandstone which crop out along the east and west sides of the area.

Flatlying Tertiary (?) tuff is exposed in three scattered patches overlying unconformably both the Dakota sandstone and pre-Cambrian formations. Small areas of glacial till border Quartz Creek and Wood Gulch, and Quaternary alluvium fills many of the valley bottoms.

In general, the pre-Cambrian formations dip steeply and have a northwesterly trend, which is brought out by the structure of both the metasedimentary rocks, the dacitic pillow lava, and the biotite tonalite. The pegmatites have a general northeast trend across all of the earlier structures.

Only three faults with displacements of over 20 feet were found in the area. The largest of these trends northwest and separates the Dakota and Morrison formations from the pre-Cambrian in the southwestern corner of the district. Two other faults, which are terminated by this large fault, separate a block of Dakota sandstone from the pre-Cambrian and Morrison formations.

Pre-Cambrian rocks

Quartzite

Pre-Cambrian quartzite, interbedded partly with arkosic and conglomerate quartzite (pl. II), is best exposed on the northwestern slope of Wood Gulch where there are four mappable bodies. Two other bodies of arkosic quartzite, about half a mile long, crop out along the headwaters of Tollgate Gulch, a tributary of Quartz Creek, which is northwest of Wood Gulch. Narrow outcrops, a few tens of hundreds of feet long, are found at widely scattered localities on the northern side of Quartz Creek. These rocks have been highly metamorphosed and are part of a much larger area of sedimentary rocks that are separated by intrusive tonalite and hornblende gneiss.

The pre-Cambrian quartzites are generally dark gray but in places are white and brown. The original sediments ranged from siltstone to conglomerate but most were fine-grained. Some of the quartzites are now slightly schistose. The northernmost band of metasedimentary rocks in Wood Gulch is a conglomerate containing pebbles from 0.1 to 2 inches long. Some of the pebbles are elongated; the ratio of width to length is from 1:4 to 1:5. Feldspar (orthoclase, microcline, and plagioclase) is present throughout the unit but the proportion varies widely. The rocks along Wood Gulch are commonly quartzites with only a few percent of feldspar, but those on the north side of Quartz Creek contained 20 percent or more of feldspar. The proportion of the dominant dark mineral, biotite, ranges from a trace to about 15 percent. Muscovite is common in amounts of one percent or less. In rocks rich in feldspar, epidote is prominent and may make up more than 50 percent of the rock. One specimen contains hornblende and clinozoisite as well as biotite. Apatite, zircon, and magnetite are common accessories.

Quartz-mica schists, composed chiefly of quartz, biotite, feldspar, and muscovite, are found in a few scattered outcrops in the northern part of the area. Locally, these schists contain well-developed porphyroblasts of quartz and magnetite.

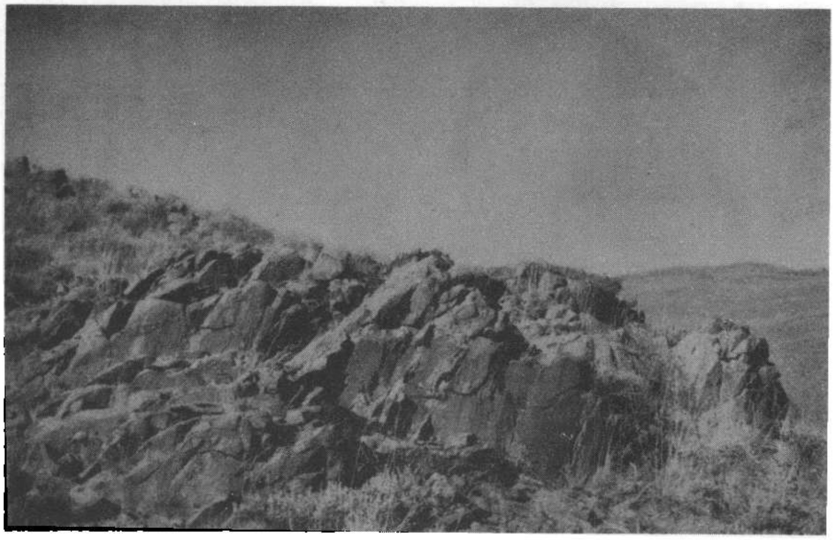
The thicknesses of the different exposures range from a few feet to a maximum of about 600 feet.

The quartzites are the oldest rocks in the district and are surrounded by younger hornblende gneiss, tonalite, and granite. One xenolith of conglomerate was found in the granite.

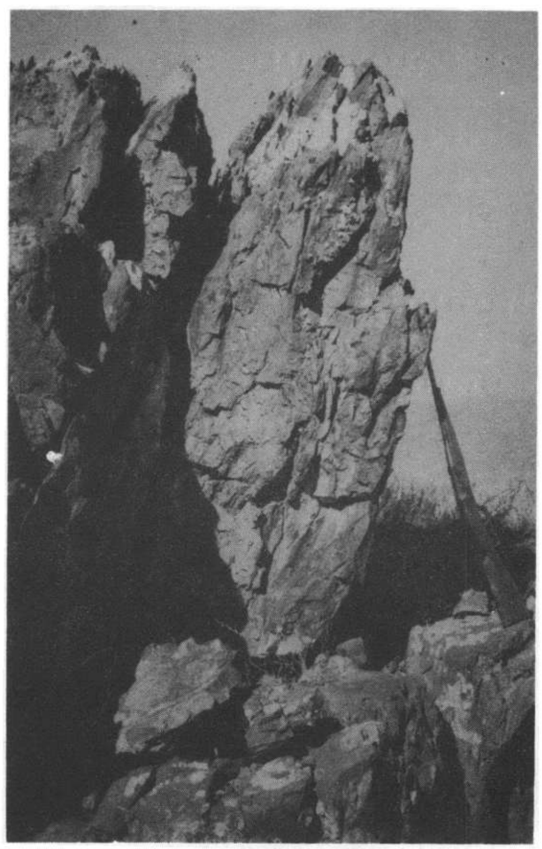
Dacite

Dacitic pillow lava (pl. II) occurs in two northwesterly-trending bands south of Quartz Creek. One of these is in sec. 11, T. 50 N., R. 3 E. on the northwestern slope of Wood Gulch, and the other is in secs. 3 and 34, about 900 feet northwest of the Brown Derby mine.

The pillow lava is yellow green to dark green depending on the proportion of epidote. It is a fine-grained dense vesicular rock, with prominent flow lines. Some vesicles contain well-developed crystals of epidote and quartz; a few are completely filled with fine-grained quartz. Large ellipsoids or pillows (pl. III, B), several feet long and about one



A. Tonalite outcrop on the northwest side of Wood Gulch.



B. Pillow lava showing ellipsoidal pillows on the northwest side of Wood Gulch.

foot wide, are common. Microscopically the unaltered rock consists of green prismatic hornblende (50 percent), quartz (30 percent), and andesine (20 percent). Epidote may be present almost to the exclusion of other minerals and is veined by calcite.

The band of pillow lava on the northwestern slope of Wood Gulch is 140 feet thick and is parallel in strike and dip to the enclosing pre-Cambrian quartzite and conglomerate. This pillow lava was extruded under water onto a sand and was buried by later sediments. A second band of pillow lava, 6,450 feet to the northwest, is enclosed in hornblende gneiss. The two areas of pillow lava (pl. II) are almost alined on strike and are probably remnants of the same band. Both bands of pillow lava are younger than the pre-Cambrian quartzites on the northeast and older than the quartzites to the southwest.

Biotite tonalite

One small body of biotite tonalite, approximately 900 feet long and 110 feet wide, is exposed in sec. 11 on the northwestern slope of Wood Gulch. It is bounded on the north by pre-Cambrian quartzite and on the south by hornblende gneiss, and is approximately 80 feet southwest of, and parallel to, a band of pillow lava.

The biotite tonalite is dark gray with prominent black hornblende crystals, 0.05 inch in diameter, in a black, speckled, fine-grained matrix. Plagioclase phenocrysts, the same size as the hornblende crystals, contain small included grains of biotite, epidote, and hornblende. Dark minerals make up about 50 percent of the rock. Hornblende, the chief dark mineral, constitutes 25 percent of the rock, and commonly forms ragged prismatic grains, but locally it occurs as small included grains in the plagioclase and quartz. Biotite constitutes 22 percent of the rock and occurs with hornblende as aggregates and in the plagioclase as a myriad of fine grains. Epidote (3 percent) and magnetite (<1 percent) are the other dark minerals. Andesine (40 percent) forms large crystals clouded with many fine crystals of biotite, hornblende, and epidote. Quartz (10 percent) is interstitial to the andesine.

The biotite tonalite occurs near the southwest edge of the pre-Cambrian quartzite and has a trend parallel to the strike of the bedding. It is similar in composition to the pillow lava, except that it is not vesicular and contains much less epidote and no calcite. It is also much coarser grained. The similarity in trend and composition suggests that the biotite tonalite and the pillow lava derived from the same magma at about the same time, but one was intrusive and the other extrusive. The biotite tonalite is younger than the quartzite to the north and probably older than the hornblende gneiss to the south.

Hornblende gneiss and tonalite

The hornblende gneiss and tonalite are gradational—sometimes in the same outcrop. The difference between the two rocks is one of texture, with the gneiss exhibiting a planar alinement of minerals. Though most of the hornblende gneiss and tonalite is clearly of intrusive origin, some units are lava flows. The hornblende gneiss and tonalite were mapped separately only along the northwestern slope of Wood Gulch, where fine-grained hornblende gneiss is very schistose and is cut by the coarser, equigranular tonalite (pl. III, A). These two rocks are evidently of different ages, the tonalite having been intruded after the older rock had been metamorphosed considerably. The intrusive tonalite bodies in Wood Gulch have a northwesterly trend, parallel to that of the pre-Cambrian quartzites.

The foliation of the hornblende gneiss south of Quartz Creek has a north to northwesterly strike and dips steeply in either direction. North of Quartz Creek the strike is between north-northwest and north-northeast, except where the foliation parallels the contact of the quartz monzonite.

The hornblende gneiss and tonalite have the widest distribution of any rock type and occupy the central part of the Quartz Creek district. These mafic rocks extend for a considerable distance to the northeast beyond the area mapped, where they have been described by Crawford _/. They are the host rocks for a very large number of pegmatites, and numerous fine-grained granite dikes.

_/ Crawford, R. D., and Worcester, P. G., Geology and ore deposits of the Gold Brick district, Colorado: Colorado Geol. Survey Bull., vol. 10, pp. 27-28, 1916.

The hornblende gneiss and tonalite range from fine-grained to coarse-grained; the maximum grain size is about 0.20 inch. Textures or structures commonly found are: (1) prominent, well banded gneissic structure, (2) diabasic texture, (3) porphyritic texture, and (4) equigranular texture. Exposures of this rock are in general poor, and even where well exposed the textural changes are so great that in most places separation into mappable units was not feasible. Both rocks are dark gray to greenish black where fresh, and weather greenish gray to reddish brown. The hornblende content ranges from 20 to 80 percent, but most of the rock contains 50 to 75 percent hornblende. Some facies are unusually rich in hornblende and the rock may then grade into a hornblendite or perknite.

The minerals in the hornblende gneiss and in the tonalite are essentially the same, but the proportions of each vary widely. Hornblende, biotite, and feldspar are the only minerals that can be identified megascopically. In places much of the hornblende has altered to biotite. Andesine is the dominant light-colored constituent, but quartz and microcline are present locally. The accessory minerals are apatite, zircon, sphene, magnetite, epidote, chlorite, and sericite.

Much of the hornblende is in distinct dark-green euhedral crystals, but part is in frayed, ragged, pale-green grains that are altered largely to biotite. In one place it is altered to chlorite. Biotite is not found in some areas, but in others it is abundant. It forms as much as 60 percent of the rock, is commonly fresh, and occurs in brown prismatic crystals. Andesine (An_{30}-An_{44}) is poorly twinned and commonly is clouded with fine kaolin and sericite. The andesine crystallized after the hornblende in most places and fills the spaces between the hornblende crystals; in a few places the reverse is true. Quartz is present in most specimens constituting a maximum of 7 percent of the rock and occurs as small, clear grains with sutured borders. This mineral is interstitial to and cuts andesine; rarely they are micrographically intergrown. Because of the presence of a small amount of quartz, the rock is called a tonalite rather than a diorite, as used by Crawford _/. Microcline is present in a few places, but in most of

_/ Crawford, R. D., and Worcester, P. G., op. cit., pp. 27-28, 1916.

the rock examined, it was absent. A trace to several percent of apatite and zircon are almost universally present as well-formed euhedral crystals associated with biotite. Epidote and sphene are found locally, usually where the hornblende is pale green and has been considerably altered. Magnetite occurs in irregular grains and is not common. Augite was noted in one specimen.

Quartz monzonite

Quartz monzonite crops out along the northern boundary of the Quartz Creek district. Pegmatites, similar in size and shape to those in hornblende gneiss, are common near the outer edge of the intrusive. Farther into the mass the pegmatites are only a few inches thick and are very irregular in shape.

The quartz monzonite is a light- to dark-gray porphyritic rock that ranges in composition from quartz monzonite to granodiorite. Poor exposures make it difficult to map the variations of this rock in the field.

Mafic minerals (12 to 22 percent) are in clots and streaks composed of biotite, hornblende, zircon, sphene, magnetite, and apatite. Hornblende (0 to 15 percent), the dominant dark mineral, generally has been frayed and altered to biotite. Biotite (7 to 14 percent) occurs in small brown unaltered flakes and in clots or aggregates that appear megascopically to be large crystals. Apatite and magnetite (1 to 2 percent) commonly occur with biotite. Zircon, in trace quantities, is universally present as small crystals. Wedge-shaped brown sphene crystals locally make up as much as 5 percent of the rock. The leucocratic minerals are quartz, andesine, and microcline. Both andesine and microcline are in large phenocrysts and in fine grains in the groundmass. The feldspar content ranges from about 12 to 45 percent microcline and from about 30 to 65 percent andesine. The plagioclase has a composition of An_{31}-An_{35}. The microcline shows cross-hatch twinning in most places. The andesine has some albite and pericline twinning and in some thin sections is covered by a thin film of kaolin and sericite. No quartz is observed megascopically, but in thin section small clear grains, interstitial to the feldspars, make up 4 to 15 percent of the rock. The quartz exhibits strain shadows and in many places has sutured borders.

The quartz monzonite was intruded into the hornblende gneiss and in turn was cut by pegmatites. It is thus intermediate in age between pegmatite and hornblende gneiss. The age of the quartz monzonite in relation to the coarse-grained and fine-grained granite is not definitely known because the two rocks are not in contact. The following evidence, however, suggests that the quartz monzonite is older: (1) in many regions the differentiation of a batholith results in the early formation of mafic rocks. Subsequently, rocks of intermediate and granitic composition are formed as in the Quartz Creek district where the quartz monzonite is intermediate in composition between the granite and the earlier tonalite; (2) the gneissic texture in the hornblende gneiss parallels the contact on the quartz monzonite (pl. II). This implies that the quartz monzonite was intruded during metamorphism; whereas the coarse-grained granite cuts across foliation in many places; (3) the pegmatites that cut the granite and quartz monzonite have a composition similar to the granite and appear to have been derived from it rather than the quartz monzonite.

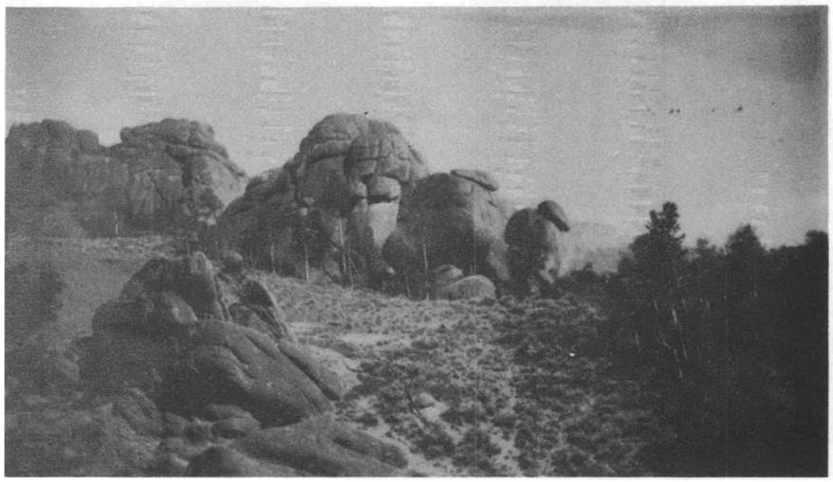
Coarse-grained granite

A large band of coarse-grained granite (pl. II) trends north-northwest across the district from the northeastern corner of sec. 22 to the northern border of sec. 33. This granite forms the prominent mountains on the southeast side of Quartz Creek. Another band of massive granite crops out a mile to the west and extends about one mile north of the southern boundary of the area mapped. These two granite masses converge several miles south of the Quartz Creek pegmatite district to form a large V. In addition to these two large granite bodies, numerous small bodies with exposed areas of from a few feet square to 2,000 feet by 800 feet, are scattered throughout the hornblende gneiss and tonalite terrane. The area of most abundant small scattered granite intrusives is west of the main granite mass and trends north-northwest.

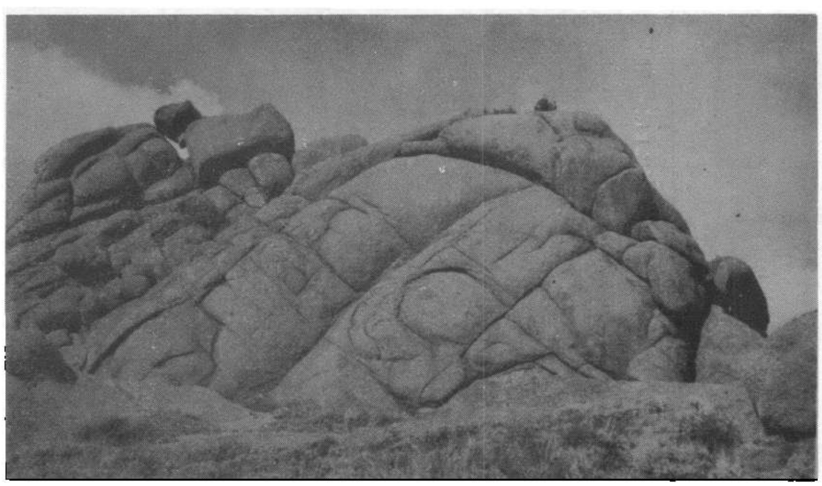
The granite is a pink porphyritic rock (pl. IV, A and B) that forms well-rounded outcrops. The phenocrysts are grains of pink microcline, 0.50 to 0.75 of an inch long, and grains of clear quartz, 0.25 to 0.50 of an inch long. In thin section the microcline phenocrysts show many small included crystals of diversely oriented microcline, quartz, biotite, and albite. The quartz phenocrysts are composed of several grains, commonly with sutured borders. The coarse-grained groundmass consists of interlocking grains of microcline, quartz, biotite, albite, magnetite, apatite, and zircon. Some specimens also contain sericite, epidote, and chlorite. The average composition of this rock is estimated to be microcline (71 percent), quartz (20 percent), biotite (8 percent), albite (1 percent), and less than 1 percent of magnetite, apatite, and zircon, and trace quantities of epidote, sericite, and chlorite. Apatite and zircon are most abundant in the biotite. Epidote commonly occurs near the biotite and the chlorite is derived from the biotite.

There are two less common varieties of the coarse-grained granite. Granite gneiss occurs in a few isolated masses near the western edge of the district and is characterized by the parallel arrangement of elongate quartz and biotite crystals, granulation, and recrystallization of the quartz. Much of the biotite has been altered and only small wisps and discolored areas remain. The gneiss is believed to be a normal granite that has been metamorphosed by shearing.

A red granite occurs in small patches within the two main granite masses. It has no large phenocrysts, has many small vugs, contains only a



A. Coarse-grained granite along the divide between Wood Gulch and Quartz Creek.



B. Coarse-grained granite with two sets of joints at right angles.

few percent of quartz and a trace of biotite, and is high in albite. This rock is thought to be an albitized variety of the normal granite.

The granite is younger than the hornblende gneiss, tonalite, and pre-Cambrian quartzites because it cuts these rocks or contains partly assimilated inclusions of them. On Indian Head, a large granite mass jutting out into the valley of Quartz Creek (pl. II, sec. 4), numerous partly assimilated fragments have large microcline porphyroblasts, and one piece has well-rounded pebbles of conglomerate. The granite is in turn cut by dikes of fine-grained granite and by pegmatite. Its relation to the quartz monzonite is not clear, but the quartz monzonite is probably older than the granite.

Fine-grained granite dikes and pegmatites

Pegmatite and fine-grained granite (pl. II) are found together in many places and cut both hornblende gneiss and the coarse-grained granite. The fine-grained granite dikes are cut by the pegmatites. The pegmatites are found throughout the district, except in the central parts of the two main granite masses. The fine-grained granite is much more restricted in distribution, and occurs in dikes in a north-northwesterly trending zone west of the largest granite intrusion. The same zone contains many small intrusive bodies of coarse-grained granite. A few fine-grained granite dikes are found in hornblende gneiss 200 feet from the northeast edge of the largest granite body.

The structure in the earlier pre-Cambrian rocks is followed in part by the granite dikes on the north side of Quartz Creek, which have a general trend of from north to N. 20° W. (pl. II). South of Quartz Creek the dikes have a general northeasterly trend, but range from N. 20° W. to N. 50° E.

The pegmatites form both long narrow dike-like bodies and irregular masses. The dikes trend, except in sec. 33, from N. 15°-60° E., cutting across the earlier structure. In the vicinity of the southeast corner of sec. 33, T. 50 N., R. 3 E. the pegmatites have an average trend of N. 35° W. and are described in detail in a succeeding part of this report.

The fine-grained granite is pink and has a grain size of about 0.015 of an inch. The dikes range in width from a few inches to 180 feet and in length from a few feet to 2,700 feet. The contacts with the surrounding rock are sharp, and the granite forms prominent outcrops. The rock is made up almost entirely of leucocratic microcline, quartz, and plagioclase. Microcline (20 to 60 percent) has crosshatch twinning. Clear quartz (15 to 40 percent) forms irregular grains, many with sutured borders, and is interstitial to plagioclase and microcline. The plagioclase (20 to 40 percent) is albite (An_4) and occurs in crystals coated with kaolin and as inclusions in microcline crystals. Biotite is the dominant dark mineral ranging from a trace to about 5 percent; the average is less than 1 percent. Ragged grains of muscovite, commonly on feldspar, is as much as a few percent in some places. A few euhedral crystals of apatite and irregular-shaped grains of magnetite are present in some specimens.

A gray facies of this rock in secs. 8 and 17 differs from the average fine-grained granite in that it contains about 5 percent biotite and has andesine (An_{32}-An_{34}) feldspar. It is poorly exposed and its relation to the other rocks is not known.

The fine-grained granite is related in age to the coarse-grained granite, and probably was derived from the same magma, but at a later date. This age relationship is indicated by their areal distribution. The small coarse-grained granite bodies and the fine-grained granite dikes crop out in the same north-northwesterly trending band west of the main granite mass and the fine-grained granite dikes also occur in a narrow zone along the northern contact of the largest granite mass. Both rocks are of the same mineral composition, but the fine-grained granite is commonly richer in plagioclase and poorer in microcline and may represent a more sodic fraction of the magma.

Mesozoic rocks

Morrison formation

The Morrison formation unconformably overlies the pre-Cambrian and is conformably overlain by the Dakota sandstone along the western and eastern edges of the Quartz Creek district. The Morrison formation is covered in more than 90 percent of the area and the outcrops are commonly of the more resistant sandstone lenses.

This formation is composed of a basal and an upper sandstone that are separated by vari-colored shale. The basal sandstone rests on the pre-Cambrian and closely resembles the Dakota sandstone in appearance. It is white to tan and weathers buff to yellowish-brown. The quartz grains are subrounded, and a few beds are quartzitic. The middle unit of the formation rarely is exposed. It is composed of green, brown, and reddish shales with a few thin limestone and sandstone beds. Above the shales is a white fine-grained sandstone flecked with iron oxide. This rock is prominently cross-bedded, is usually friable, and the individual quartz grains are well rounded. This sandstone is conformable with the basal pebble conglomerate of the Dakota sandstone.

At no place in the area is a complete section of the Morrison formation exposed, but a thickness of 355 feet was measured along the west side of Alder Creek, in sec. 36, T. 50 N., R. 2 E., from the top of the underlying pre-Cambrian (as determined by float) to the base of the Dakota formation. The thickness of this formation also was measured by Dings _/ in the southwestern corner of the adjacent Garfield quadrangle. His measurements, made under equally difficult conditions, with the exact position of the upper and lower limits inferred, indicate the thickness of the Morrison to be between 315 and 375 feet.

_/ Dings, McClelland, Personal communication, 1949.

No fossils were found and the identification of the Morrison formation in the Quartz Creek district is based on its lithologic similarity to this formation in other areas.

Dakota sandstone

The Dakota sandstone is well exposed in a series of cliffs that border Alder Creek (pl. II). This nearly flatlying formation crops out in a series of prominent steplike cliffs. In plate V, A, it is shown capping the Morrison formation along the western border of the district; it also crops out east of the mapped area.

The Dakota is composed of a basal pebble conglomerate and an upper sandstone. The conglomerate is composed of subrounded to rounded pebbles averaging 0.25 of an inch in diameter. The pebbles are for the most part quartz, with subordinate amounts of black chert and red jasper. In part the conglomerate is arkosic though much of the feldspar has altered to clay. The upper part of this unit is quite friable and commonly cross-bedded, whereas the lower part locally is cemented with chalcedony and is very resistant.

The upper unit of the formation is composed almost entirely of sandstone, but in its upper part contains thin beds of fine-grained black to

A. Cliff of Dakota sandstone.

B. Tuff with large volcanic fragment.

gray fissile shale a few inches to 1.5 feet thick. This sandstone is composed dominantly of subrounded grains of quartz, and subordinately of orthoclase. The rock ranges from a true arkose with about 25 percent feldspar to an almost pure quartz sandstone. The cliff-forming units are compact sandstone, but much of the unit is soft and friable. Locally it has been indurated to quartzite. The sandstone is white to gray and weathers buff or yellowish brown. Commonly it contains small spots of limonite, and one bed in the upper part contains radiating 1-inch spheroids of limonite pseudomorphous after pyrite.

The Dakota sandstone is not completely exposed in the area mapped and the upper surface has been eroded. The maximum thickness obtained from the six sections measured is 183 feet; the basal conglomerate is 33 feet thick.

The only fossils found in this formation were a poorly preserved unidentifiable gastropod and a few fragmentary casts of plant stems.

Tertiary rocks

Tuff

A white tuff is well exposed on the south side of Quartz Creek, in the southeast corner of the Quartz Creek district (sec. 8), where it forms a small cliff overlying the Dakota sandstone. At two other smaller areas of outcrop, in sec. 16 on the south side of Wood Gulch and in sec. 5 on the north side of Quartz Creek, the tuff overlies pre-Cambrian rocks.

The tuff is a porous, white flaggy rock occurring in layers 1 to 2 inches thick. The layering dips from 4 to 23 degrees. A few subrounded fragments of darker volcanic rock (pl. V, B) are enclosed in an aphanitic matrix containing phenocrysts, one-thirty second of an inch long, of plagioclase and biotite. The orientation of the biotite in general is parallel to the layering.

In thin section, the tuff has a clastic texture and shows many scattered phenocrysts in a brown cryptocrystalline groundmass. The phenocrysts comprise about 35 percent of the rock. Andesine-labradorite (more than 30 percent) commonly occurring as angular fragments or rarely as euhedral crystals, is the most common phenocryst. Some of the plagioclase crystals show zoning. Long fibrous crystals of brown biotite (3 percent) is the chief dark mineral. Next in abundance is black anhedral magnetite (1 percent). Other minerals in the approximate order of their abundance are: hornblende, quartz, scapolite, sphene, apatite, and zircon.

The tuff outcrops are erosional remnants, a few tens of feet thick, of a thicker and more extensive tuff bed. The tuff that overlies the Dakota sandstone along the east side of Quartz Creek has a minimum thickness of 83 feet. The tuff is younger than the faulting which brought pre-Cambrian rocks against the Dakota sandstone, because the tuff is deposited across the fault line with no apparent displacement. It is overlain along Wood Gulch by glacial till, presumably of Pleistocene age. The tuff, therefore, has been tentatively designated as Tertiary.

Pleistocene and Recent deposits

Glacial till

Pleistocene (?) glacial till overlies the other formations along both sides of Quartz Creek and Wood Gulch, and fills the broad valley of Quartz Creek where it is covered by a foot or less of soil. On the south side of Quartz Creek the till is quite thin and pegmatite outcrops protrude through it. There is considerable difference in the altitude at which the till was deposited. The highest position is on the north side of Quartz Creek at 8,700 feet; on the south side the altitude is 8,250 feet. The till deposits on the north side are part of the lateral moraine whereas those on the south side are till ridges in the valley moraine. The till near the mouth of Wood Gulch appears as thin irregular patches which seem to be remnants of a broad valley moraine.

The till is composed of clay, fine sand, pebbles, and boulders as much as 3 feet in diameter. The boulders are a heterogeneous mixture of several rock types and differ from place to place. On the south side of Quartz Creek and along Wood Gulch, hornblende gneiss and tonalite are the dominant rock types in the till and in places form more than 80 percent of it. Near the mouth of Alder Creek on the north side of Quartz Creek the till consists of pegmatite (30 percent), Dakota and Morrison sandstone (30 percent), fine-grained granite (20 percent), rhyolite porphyry (10 percent), and hornblende gneiss (10 percent). Other identifiable boulders include chert, pre-Cambrian quartzite, Sawatch quartzite, epidote rock, quartz monzonite, basalt, massive quartz, and andesite.

Alluvium

Alluvium forms a narrow strip in the bottom of most of the valleys in the Quartz Creek district. Along Quartz Creek this strip is 1/8 to 3/4 of a mile wide, and extends northeastward across the entire district. The alluvium is dominantly fine silt, 4 to 8 inches thick, and overlies glacial deposits along most of Quartz Creek.

STRUCTURAL GEOLOGY

The structure of the older pre-Cambrian rocks of the Quartz Creek district has a general northwest trend, which is cut by stocks and batholiths of younger pre-Cambrian granite and quartz monzonite. Mesozoic and later rocks are flatlying and are cut by several faults in the southern part of the district.

The general trend of the pre-Cambrian metasedimentary rocks is northwest, with a steep dip southwest. The foliation of the pre-Cambrian hornblende gneiss strikes northwest to northeast and dips steeply. On the southeast side of Quartz Creek and along the western edge of the district the foliation trends northeast and dips from 70° SE. to 59° NW. Around the edge of the quartz monzonite intrusion the foliation parallels the contact and dips steeply away from it. In the northern part of the district, the foliation strikes northeast and dips from steeply southwest to vertical.

The large granite mass dips steeply to the northeast along its northeastern side. On the west, however, the contact was not exposed, but due to the innumerable small stocks along this side (pl. II) it is believed that the granite underlies the schist at shallow depth. The contact of the quartz monzonite was not exposed but the strike of the foliation of the hornblende gneiss is oriented parallel to that of the contact, and it is probable that the dip is also parallel.

Most of the pegmatites trend northeast along joints and cut across the foliation of the older rocks. Groups of parallel lenticular pegmatites with this trend are common (pl. VI, A).

Faults are difficult to recognize in the pre-Cambrian rocks except where pegmatites have been cut and offset. The displacement observed ranges from a few inches to 4 feet. Drag folds and local disruptions in the foliation also may have been the result of unrecognized faulting.

Two sheared and mineralized fractures were mapped in the hornblende gneiss. The larger of these is south of Quartz Creek, 250 feet east of the Buckhorn pegmatite (No. 659). The second shear zone is in the northwestern part of the area mapped, where the southern part of pegmatite No. 1199 has been displaced about 3 feet to the west.

A. Pegmatites showing regional trend. Brown Derby mine in the background.

B. Anticline in center of picture is a down faulted block of Dakota sandstone.

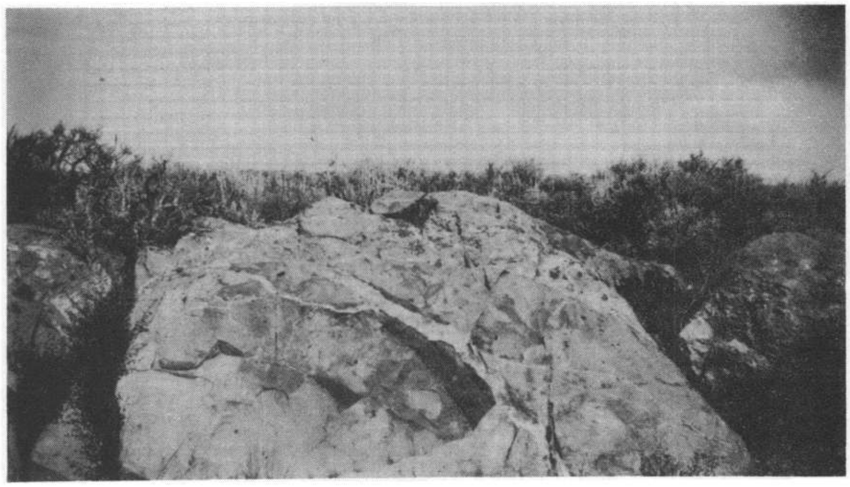
In the Mesozoic sediments faults are more readily recognized. A major fault separates Dakota sandstone from hornblende gneiss in the southwestern part of the district (pl. II) and trends N. 20°–42° W. A vertical displacement of 410 feet was measured on the west side of Alder Creek, the southern block having moved downward with respect to the northern block. On the west side of Alder Creek the Dakota sandstone has been sharply upturned by drag of the beds at the fault. In the southwestern part of the district, along State Highway 162, a small segment of Dakota sandstone has been downfaulted between the large fault and two smaller ones to the level of the highway and folded into a gentle anticline (pl. VI, B).

PEGMATITES

Size and shape of pegmatites

The pegmatites of the Quartz Creek district range in size from bodies a few inches wide and a few feet long to bodies like the Black Wonder pegmatite, 12,600 feet long by 6,700 feet in maximum width. Most pegmatites range from 100 to 400 feet in length, but 37 bodies are over 1,000 feet long. The two largest pegmatites are the Bucky deposit, 4,000 feet long by 2,600 feet in maximum width, and the Black Wonder, both of which are very irregular and have many small branches. The small pegmatites are commoner in the granite and quartz monzonite.

The pegmatites in the Quartz Creek district can be classified, on the basis of shape, as: (1) lenticular, (2) lenticular-branching, (3) oval, and (4) irregular. Examples of each are shown in figures 2 to 6 and plate VII, A and B, including both the extreme variations and the average shape in each type. Each of these examples represents many more pegmatites of similar shape. The lenticular pegmatites are 2.3 times more common than ir-



A. Small branching pegmatite cutting fine-grained granite.

B. Large branching pegmatite (No. 250) cutting hornblende gneiss.

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regular pegmatites--the second most abundant type. The general order of frequency is one oval pegmatite to 2.3 lenticular-branching pegmatites, 2.8 irregular pegmatites, and 6.6 lenticular pegmatites.

Comparison of pegmatite shapes in this district with shapes in the Black Hills _/ and other pegmatite districts has shown that the shape of a

_/ Page, L. R., et al., Pegmatite investigations 1942-1945, Black Hills, South Dakota: U. S. Geol. Survey Prof. Paper (In preparation).

granitic pegmatite is controlled primarily by the type and competency of country rock, and as the amount of material intruded becomes large it controls the shape of the pegmatite to a greater degree.

The pegmatites in the Quartz Creek district for the most part are intruded into granite, quartz monzonite, hornblende gneiss, and tonalite. The hornblende gneiss and tonalite have a similar composition, but the hornblende gneiss is foliated and the tonalite is equigranular. Both rocks are competent and the pegmatites tend to follow fractures and joints that cut the poor to well-developed foliation in the hornblende gneiss. Though the pegmatites intruded into hornblende gneiss are usually well exposed, the adjacent gneiss is rarely seen. Wherever the foliation of the hornblende gneiss was exposed adjacent to the pegmatite the angle between the foliation plane and the side of the pegmatite was measured; the results are plotted in figure 8 on a bar graph. This graph indicates that there is no constant angle at which the pegmatites cut the foliation of the country rock; though it is most common up to 60 degrees. The irregularity of the pegmatites and their numerous changes in direction point to the emplacement of the pegmatites along irregular fractures and joints. The hornblende gneiss and tonalite are too poorly exposed to allow measurement of any overall joint systems. The largest body of coarse-grained granite is well exposed and 639 joints were measured (fig. 9). In local areas of several hundred square feet where 50 to 60 joints are exposed, they are related to 2 or 3 well-developed sets of joints. Over the entire granite body, however, 639 joints show a random orientation. The main granite body is cut by pegmatites only in its northwestern end, where the lenticular, and lenticular-branching pegmatites trend N. 45° W. In the hornblende gneiss and tonalite the pegmatites trend from north to N. 45° E. (pl. II). The trend of the lenticular pegmatites in the mafic rocks is quite uniform over the whole district. This points to a district-wide joint system in the hornblende gneiss and tonalite, whereas the joint systems in the granite vary from one locality to the next. A probable explanation of this peculiar feature is that the joint system in the mafic rocks antedates the intrusion of the granite, and that the jointing in the granite was developed by local stresses at the time of the intrusion.

In comparing the various types of country rock to the shapes of pegmatites it was found that in areas of fractured competent rocks, lenticular-branching pegmatites predominate and are found along intersecting fractures; to a lesser extent irregular pegmatites and thin sinuous bodies characterize such terranes. The composition of the country rock has little to do with the shape of the pegmatite, provided the rocks being compared are of equal competency. Table 1 shows the frequency of occurrence of each shape compared to the oval shape in each of the three most common types of country rock, hornblende gneiss and tonalite, coarse-grained granite, and quartz monzonite.

Table 1.--Ratio of pegmatite shapes to the oval type in different kinds of country rock.

Rock type	Pegmatite shapes			
	Lenticular	Lenticular-branching	Irregular	Oval
Hornblende gneiss and tonalite	5.8	2.6	2.4	1.0
Coarse-grained granite	6.2	2.6	3.8	1.0
Quartz monzonite	6.4	2.0	6.0	1.0

All pegmatites that cut more than one rock type are omitted (fig. 7). Except for the larger number of irregular pegmatites in the quartz monzonite the ratios are remarkably similar. The higher ratio of irregular pegmatites in the quartz monzonite probably can be correlated there with the greater number of large pegmatites in this area. This is discussed in more detail in a succeeding paragraph. The country rocks differ greatly in their mineralogy, texture, and chemical composition, and yet the shapes of the pegmatites show little variation. The rocks of this district have one important characteristic in common: they are all tight, brittle, and competent. The effect on the shape of the pegmatites where the host rock possesses even minor foliation is quite striking. Table 2 shows the frequency of occurrence of the different shapes as a ratio related to the oval shape in hornblende gneiss and tonalite.

Table 2.--Ratio of various pegmatite shapes to the oval type in hornblende gneiss and tonalite.

Rock type	Pegmatite shapes			
	Lenticular	Lenticular-branching	Irregular	Oval
Hornblende gneiss	8.7	2.0	2.8	1.0
Tonalite	12.0	9.2	2.2	1.0

Foliation has a profound effect in simplifying the shapes of the pegmatites by decreasing the number of branching types; the lenticular-branching type is 4.6 times more common in the tonalite than in the hornblende gneiss. Pegmatites in similarly competent rocks are found also in hornblende schist in the Bridger Mountains _/, Wyoming, and in Pikes Peak granite in the

_/ McLaughlin, T. G., Pegmatite dikes of the Bridger Mountains, Wyoming: Am. Mineralogist, vol. 25, pp. 46-60, 1940.

Eight Mile Park, Colo._/

_/ Heinrich, E. W., Pegmatites of Eight Mile Park, Fremont county, Colorado: Am. Mineralogist, vol. 33, pp. 420-448, 1948.

Pegmatites in incompetent rocks such as mica schist are in general concordant with the foliation and were intruded by shouldering apart the country rock. Pegmatites of this type are most commonly lenticular, but other common forms are troughlike, arcuate, and teardrop. Lenticular-branching pegmatites are extremely rare. The schistosity of the wall rock is commonly conformable around the entire pegmatite.

The second factor influencing the shape of pegmatites is in the quantity of material intruded. With the intrusions of large quantities of pegmatite material the control of the structures in the country rock on the shape is usually obscured and the body becomes an irregular stocklike mass. The directional control that fractures had on large pegmatites like the Black Wonder, Bucky, or Buckhorn was obliterated by the large quantity of material and is found only in the small stringers that extend outward from the main mass.

Whether pegmatites are in competent or incompetent country rocks makes a great difference when it comes to predicting their position, shape, and attitude underground and in calculating ore reserves. Those in incompetent rocks may be projected with some confidence, whereas, pegmatites in competent rocks such as in the Quartz Creek district, can be predicted only if the attitudes of the controlling fractures are known.

Internal structure

The recognition of distinct lithologic and structural units within pegmatites dates back for many years. Hunt _/, who noted a remarkable

_/ Hunt, T. S., Notes on granitic rocks: Am. Jour. Sci., 3d ser., vol. 1, pp. 89, 182-186, 1871.

banded arrangement "formed by successive deposits of mineral matter" at Brunswick, Topsham, and Newry, Maine, appears to be the first American geologist to recognize a systematic internal structure in pegmatites. Many early authors of 25 to 40 years ago referred to segregations, veins, layers, bands, and streaks. An excellent historical review of these early writings is given by Cameron, Jahns, McNair, and Page _/. Until about 1940

_/ Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., Internal structure of granitic pegmatites: Econ. Geology Mon. 2, pp. 10-13, 1949.

most of the work on pegmatites was carried out by mineralogists and geologists who emphasized the mineralogy and theories of genesis of pegmatites _/,

_/ See for example:

Fraser, H. J., Paragenesis of the Newry pegmatite, Maine: Am. Mineralogist, vol. 15, pp. 349-364, 1930.
Hess, F. L., Pegmatites: Econ. Geology, vol. 28, pp. 447-462, 1933.
____________, The natural history of pegmatites: Eng. and Min. Jour.-Press, vol. 120, pp. 289-298, 1925.
Landes, K. K., Paragenesis of the granitic pegmatites of central Maine: Am. Mineralogist, vol. 10, pp. 355-411, 1925.
____________, Sequence of mineralization in Keystone, South Dakota pegmatites: Am. Mineralogist, vol. 13, pp. 519-530, 537-558, 1923.
____________, Criteria of age relations of minerals: Econ. Geology, vol. 27, p. 211, 1932.

Landes, K. K., Origin and classification of pegmatites: Am. Mineralogist, vol. 18, pp. 33-56, 95-103, 1933.
____________, Colorado pegmatites: Am. Mineralogist, vol. 20, pp. 319-333, 1935.
Schaller, W. T., The genesis of lithium pegmatites: Am. Jour. Sci., 5th ser., vol. 10, pp. 269-279, 1925.
______________, Mineral replacement in pegmatites: Am. Mineralogist, vol. 12, pp. 59-63, 1927.
______________, Pegmatites: Ore deposits of the western states, pp. 144-151, Am. Inst. Min. Met. Eng., New York, 1933.

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and put little emphasis on their structure.

After 1940, because of the wartime need for pegmatite minerals, the U. S. Geological Survey made numerous studies of the internal mineralogic and structural units in pegmatites. As the economical concentrations of valuable minerals in pegmatites tend to be concentrated in rock units distinct from the adjacent barren units, detailed mapping and interpretation of various pegmatite units have proved of much aid in exploration, development work, and mining _/. Drilling on the basis of structural interpreta-

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_/ For example see:

Smith, W. C., and Page, L. R., Tin-bearing pegmatites of the Tinton district, Lawrence County, South Dakota: U. S. Geol. Survey Bull. 922, pp. 595-630, 1941.
Olson, J. C., Mica-bearing pegmatites of New Hampshire: U. S. Geol. Survey Bull. 931-P, pp. 363-403, 1942.
Bannerman, H. M., Structural and economic features of some New Hampshire pegmatites: New Hampshire Mineral Resources Survey, pl. 7, New Hampshire State Planning and Development Commission, Concord, pp. 1-22, 1943.
Cameron, E. N., Larrabee, D. M., McNair, A. H., Page, J. J., and Shainin, V. E., Structure and economic characteristics of New England mica deposits: Econ. Geology, vol. 40, pp. 369-393, 1945.
Johnston, W. D., Jr., Beryl-tantalite pegmatites of northeastern Brazil: Geol. Soc. America Bull., vol. 56, pp. 1015-1070, 1945.
Jahns, R. H., Mica deposits of the Petaca district, Rio Arriba County, New Mexico: New Mexico Bur. Mines, Bull. 25, 293 pp., 1946.
Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., Internal structure of granitic pegmatites: Econ. Geology Mon. 2, 115 pp., 1949.
Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah: U. S. Geol. Survey Prof. Paper 227, 1950.

tion of the internal units has given excellent results _/.

_/ Page, L. R., Uranium in pegmatites: Econ. Geology, vol. 45, pp. 12-34, 1950.
Page, L. R., and Norton, J. J., Methods used to determine grade and reserves of pegmatites: (In preparation).

The internal units of pegmatites have been classified as (1) zones, (2) fracture fillings, and (3) replacement bodies _/. Many of the pegmatites

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_/ Cameron, E. N., Larrabee, D. M., McNair, A. M., and Stewart, G. W., Characteristics of some New England mica-bearing pegmatites (abstr.): Econ. Geology, vol. 39, p. 89, 1944.
Jahns, R. H., Mica deposits of the Petaca district, Rio Arriba County, New Mexico: New Mexico Bur. Mines Bull. 25, pp. 39-51, 1946.
Heinrich, E. W., Pegmatites of Eight Mile Park, Fremont County, Colorado: Am. Mineralogist, vol. 33, pp. 436-442, 1948.
Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., Internal structure of granitic pegmatites: Econ. Geology Mon. 2, pp. 13-97, 1949.

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of the Quartz Creek district differ from those in other pegmatite areas in that in addition to these three units they may contain the primary internal structure designated as banding in this paper.

Zones

The zones of a pegmatite in ideal development are concentric shells about an innermost zone or core; in many places they are incomplete, however, forming only along one end or in one part of the pegmatite. Zonal structure is formed during the primary consolidation of the pegmatite magma and may be cut by fracture fillings and replacement bodies. Zones have been classified _/ as: (1) border zones, (2) wall zones, (3) intermediate zones,

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_/ Jahns, R. H., op. cit., p. 42, 1946.
Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., op. cit., p. 20, 1949.

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and (4) cores.

Border zones are fine-grained selvages that in most pegmatites are a few inches or less in thickness. Most are of little significance in the mining or quarrying of pegmatites, and hence in the industry are not distinguished from the adjoining wall zones that are coarser grained and much thicker. Although they actually are the second zones from the margins of pegmatite bodies, they are designated as wall zones in recognition of terminology firmly established in the pegmatite mining industry. The innermost zone or core occurs at or near the center of the pegmatite either as an elongate lens or a series of disconnected segments. Any zone between the core and the wall zone is an intermediate zone. Any number of intermediate zones can exist, but few pegmatites contain more than three. If the core is not exposed at any one level, the innermost exposed zone may be identified erroneously as a core.

Banding

Banding is the name given to the layered structures forming pegmatite units that differ in mineralogy, texture, or both and tend to have a nonconcentric arrangement within pegmatite bodies. Banding in a pegmatite may divide the body either across or along the strike. Several distinct types of banding are recognized in the Quartz Creek district.

Banding parallel to strike.—Pegmatites in which banding is parallel to the strike and dip of the body are called layered pegmatites (fig. 11). The distinct bands or layers are mappable units of definite mineralogy or texture and are not repeated. The layered pegmatites commonly consist of several tabular units whose contacts are approximately parallel to the hanging-wall and footwall sides of the pegmatite. These layers differ from zones in that there is no repetition of units on the other side of the pegmatite. Pegmatites composed of two layers are by far the most common type in this district. These units commonly extend the entire length of the pegmatite and are from 1 to 30 feet thick. This type of banding is confined to narrow lenticular and lenticular-branching pegmatites or to a narrow lenticular part of irregular pegmatites. It is not found in thick parts of irregular pegmatites or oval pegmatites. The distinct upper and lower units in many of these layered pegmatites can be distinguished in only certain parts of the body and merge along strike into a single unit. Where two layers merge, or telescope, the unit formed has the bulk composition of the two combined layers and a texture intermediate between that of the upper and lower layers. In pegmatite No. 548, for example, an upper layer, consisting of perthite (50 percent), quartz (33 percent), albite (15 percent), and muscovite (2 percent), and a lower layer, consisting of albite (74 percent), quartz (20 percent), perthite (3 percent), and muscovite (3 percent), become progressively less distinct to the south and finally merge into a single unit, consisting of albite (63 percent), quartz, (20 percent), perthite (15 percent), and muscovite (2 percent).

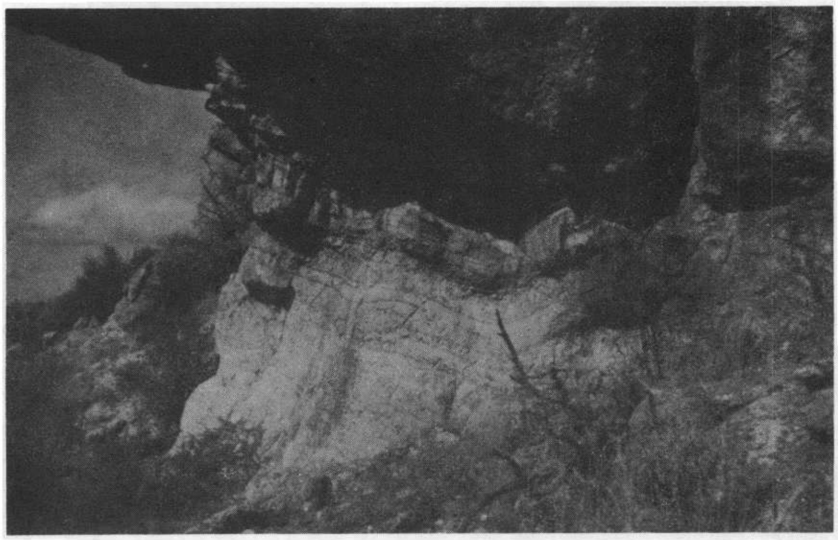
Banding across strike.--Many pegmatites are banded across the strike into two or more mappable units differing in mineralogy, texture, or both (fig. 12). These are designated as pegmatites showing variation in composition along strike. Banding across strike results in two or more pegmatite units that have their contact at an angle to, rather than parallel to, the strike of the pegmatite units. In such pegmatites the bands occupy the full width of the body, and are from 20 to several hundred feet across parallel to the strike of the pegmatite body. The units have the shape of whatever part of the pegmatite they occupy; thus, one unit may occupy the short, thin lenticular part and another long, irregular, bulbous part of a pegmatite. Banding across strike has been found only in lenticular and lenticular-branching pegmatites and all such bodies contain either two or three bands (fig. 12).

Multiple banding.—Some pegmatites in the Quartz Creek district are composed of innumerable very thin bands that differ in texture, mineralogy, or both. The bands are rarely mappable on ordinary scales. This type of banded rock has been described as "line rock" in the Pala district, Calif. _/

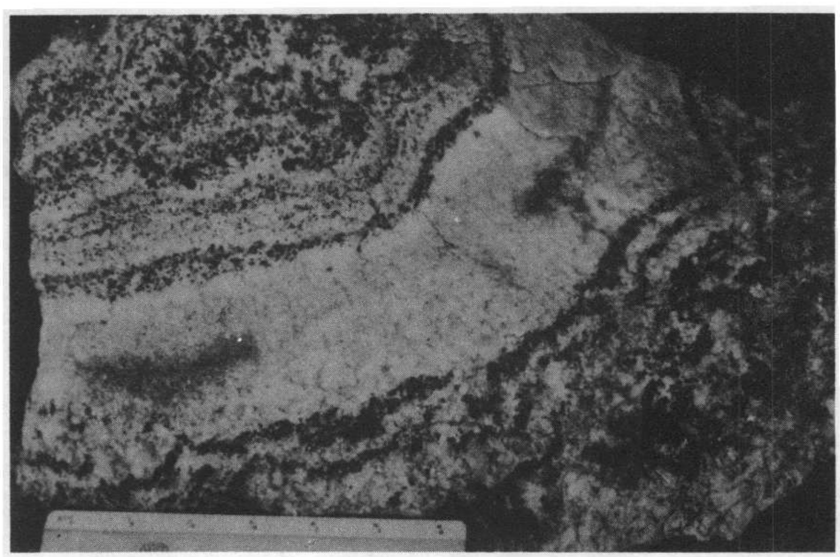
_/ Schaller, W. T., Genesis of lithium pegmatites: Am. Jour. Sci., 5th ser., vol. 10, p. 273, 1925.

Line rock in the Quartz Creek district is characterized by the repetition of bands of minerals from 0.01 inch to 0.4 foot thick; the average thickness is less than 0.5 inch. The banding in most places, as in pegmatite No. 670, is parallel to the strike of the body, but in a few places it cuts across the strike. Line rock is found commonly as patches in a small part of the pegmatite. No pegmatite with the exception of pegmatite No. 670 contains more than 15 percent of line rock, and most of them contain less than 1 percent. Line-rock-bearing pegmatites, therefore, are not classified separately.

Line rock is most common in albite-rich pegmatites where the most obvious banding is caused by layers of garnet and muscovite as much as one-quarter of an inch thick (pl. IX, A and B). Layers of fine-grained albite-quartz pegmatite are interspersed with coarser layers of perthite-quartz-albite pegmatite (a half inch to about 4 inches thick). The layers of perthite-quartz-albite pegmatite are lenticular and usually pinch out within short distances. Other layers may occur above or below to form an echelon pattern. Rarely the albite-quartz pegmatite forms the lenticular units in line rock. The banding may end abruptly against large crystals or



A. Line rock in the lower part of pegmatite No. 670. Fine dark layers are small brown garnets.



B. Line rock from pegmatite No. 461. Black layers are garnet and muscovite and white layers are mainly albite with a little quartz.

an aggregate of minerals (fig. 14). Line rock is most common adjacent to the walls of the pegmatite, especially on the footwall side. Thin layers of garnet and albite were noted terminating abruptly against euhedral perthite crystals in several places. The perthite is veined by albite along fractures and was either entirely crystallized or at least partly crystallized before all the albite was deposited. Thus, the perthite is not a late mineral which cut off the layering, but rather a buttress against which the layering stopped. The arrangement of garnets and micas in bands suggests at least local movement of the pegmatite magma with rapid minor changes in composition so that first one mineral would be crystallizing and then another. Thus a row of garnets might be formed in an area of movement up to a projecting perthite crystal, which would either turn the current or deposit a row up to its side and another along its top. This row on top might be swept off its more exposed position where narrowing of the channel caused the current to be swifter, or it might be incorporated into the perthite upon further growth. The alternating lenses of perthite-quartz-albite pegmatite in fine-grained albite-quartz pegmatite suggests zoned multiple pegmatites. They might have been formed by crystallization from lenses of trapped liquid.

Line rock is common in many pegmatites in other areas: the Crystal Mountain district, Colo._/, the Middletown district, Conn., the Pala district,

_/ Thurston, W. R., Personal communication.

Calif._/, the Eight Mile Park district, Colo._/, and the Bridger Mountains.

_/ Schaller, W. T., op. cit., pp. 272-273.
_/ Heinrich, E. W., Pegmatites of Eight Mile Park, Fremont County, Colorado: Am. Mineralogist, vol. 33, p. 448, 1948.

district, Wyo. _/

_/ McLaughlin, T. G., Pegmatite dikes of the Bridger Mountains, Wyoming: Am. Mineralogist, vol. 25, pp. 62-63, 1940.

Fracture fillings

Fracture fillings are tabular bodies that extend from inner units into outer units of the pegmatite. In places they connect directly to the core.

Fracture filling units are common in pegmatites of the Quartz Creek district but are usually small; many are only a few feet in length. Most of these units are only a minor part of a pegmatite, though there may be several in a single pegmatite. Discontinuous core segments and fracture fillings are difficult to distinguish in some irregular pegmatites.

Most of the fracture fillings are coarse-grained and consist predominantly of perthite and quartz, or quartz pegmatite. In pegmatite No. 1096 a fracture filling of massive quartz extends from the core across the wall zone.

Replacement units

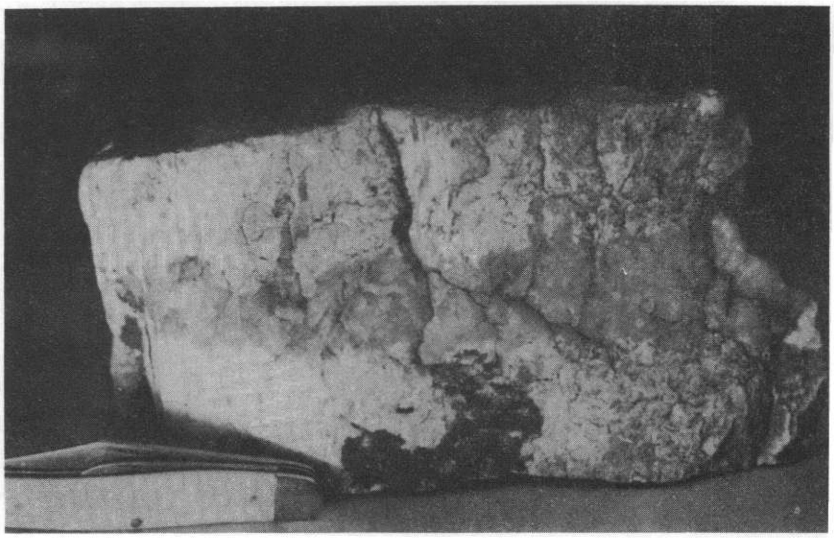
No mappable replacement units were found in the pegmatites of the Quartz Creek area, although there are several places where small areas were replaced along fractures. Replacement units form by the replacement of pre-existing consolidated pegmatite with later material. The interaction of two minerals or of a mineral with the rest solution during the process of crystallization is not considered as replacement in this paper. The embayment of one mineral by another and the filling of small fractures have been given as criteria of replacement, but these textures also can be formed if an early-formed mineral is corroded by the rest solution and subsequently coated by a later mineral.

The criteria used to distinguish a replacement body are, therefore, the presence of relic textures or structures of the pre-existing rock that indicate essentially complete consolidation. Where a pegmatite is not zoned or where no pre-existing textures or structures remain it may be very difficult to recognize a replacement body.

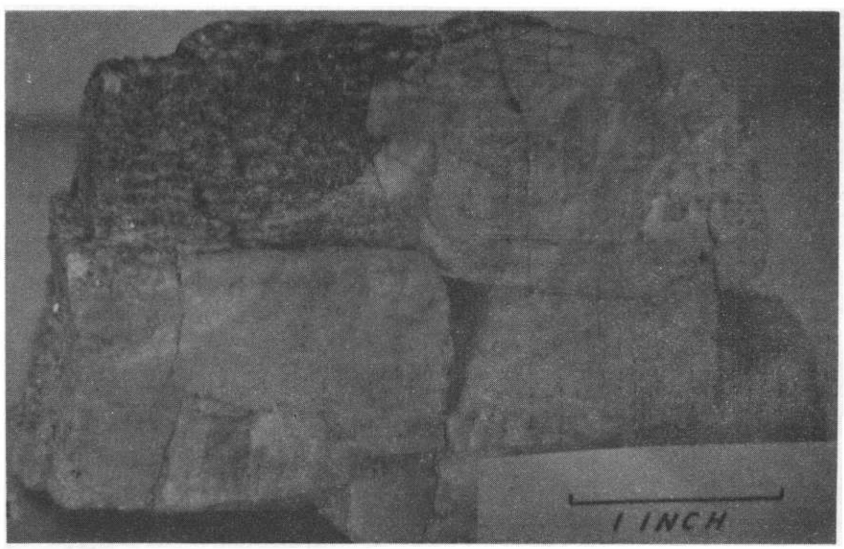
The interaction of one mineral on another during the crystallization process is more pronounced in pegmatites than in other igneous rocks because of the large grain size of the crystals which magnifies the embaying of one mineral by another and the long crystallization period caused by the presence of volatiles. Thus, a crystal of one mineral may be partly or completely grown before the equilibrium in the solution will permit a second mineral to start crystallizing. This crystal may form around the first crystal, grow out from it or, in the new equilibrium, the first mineral may be soluble and may be replaced by the second. Evidence of this sort does not prove or disprove the presence of a replacement unit. An excellent example of muscovite selectively replacing perthite and leaving narrow albite stringers of the perthite intergrowth unreplaced, is illustrated in plate VIII, B. The pegmatite was essentially homogeneous and shows no evidence of a separate replacement body.

Types of pegmatites

Pegmatites may be divided into homogeneous and heterogeneous pegmatites. The homogeneous pegmatites are simple aggregates of feldspar, quartz, and accessory minerals which cannot be divided into contrasting units on the basis of mineralogy and texture. These pegmatites form the great bulk of pegmatites in many regions, such as the Quartz Creek district, Colo., Black Hills region, S. Dak., Spruce Pine district, N. C._/, and the Crystal



A. A thin zoned pegmatite with an albite-quartz wall zone and a quartz core (grey).



B. Replacement of perthite by fine-grained muscovite (black). Note the unreplaced albite lamillae of the perthitic structure in muscovite.

_/ Brobst, D. A., Personal communication.

Mountain district, Colo. _/ Homogeneous pegmatites commonly form relative-

_/ Thurston, W. R., Personal communication.

ly small dikes and rarely contain minable concentrations of economic minerals. Because they lack the economic and rarer minerals, they have received in the past little consideration by mineralogists and geologists. Most of the pegmatite literature is devoted to descriptions of pegmatites containing the rarer minerals. Recently, however, the U. S. Geological Survey has undertaken regional mapping of pegmatite districts in South Dakota, other parts of Colorado, North Carolina, and Connecticut--similar to that described in this report--that should result in obtaining a broad knowledge of the character and distribution of all types of pegmatites. This work may yield the much-needed data required to understand the relationships of homogeneous and heterogeneous pegmatites.

Heterogeneous pegmatites are those that can be divided into different rock units on the basis of mineralogy, texture, or both.

Homogeneous pegmatites

Homogeneous or one-unit pegmatites form the great bulk of the pegmatites in the Quartz Creek district. Out of more than 1,800 pegmatites, 78 percent are homogeneous or "unzoned". Homogeneous pegmatites occur as lenticular, lenticular-branching, oval, and irregular bodies. Only a few of the larger irregular pegmatites are zoned; they contain one or more discontinuous cores. Examples of homogeneous pegmatites are shown in figures 2, 3, 4, 5, and 6. The dominant minerals are plagioclase, quartz, and perthite. Most of the pegmatites contain as much as 2 percent of one or more of the following minerals: muscovite, garnet, biotite, and magnetite. Beryl and tourmaline are present in some pegmatites but constitute only a small fraction of 1 percent.

Heterogeneous pegmatites

Zoned pegmatites.--Zoned pegmatites form roughly 14 percent of the pegmatites in the area (figs. 7 and 10); most have only a core, a wall zone, and a narrow border zone. Most of the border zones in the Quartz Creek district are only a fraction of an inch thick and are cooling selvages. Owing to their thinness they were mapped with the wall zones.

The mineralogy and texture of the wall zone usually resembles the homogeneous pegmatites in the immediate vicinity. The core, except where the wall zone is predominantly graphic granite, is commonly coarser grained, and contains more perthite, or quartz, or both, than the surrounding wall zone. Cores consisting only of massive quartz are very common (pl. VIII, A) in the northwestern part of the district. Cores of perthite-quartz pegmatite also are common. There are 14 pegmatites consisting of a wall zone and a core, that have cores of cleavelandite-quartz, or cleavelandite-lepidolite-quartz pegmatite. These pegmatites include the Bazooka, White Spar No. 2, and the Brown Derby No. 2 and No. 3 pegmatites, that have been described previously by Hanley, Heinrich, and Page _/. Not all the

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah: U. S. Geol. Survey Prof. Paper 227, pp. 66-68, 71-74, 77-80, 1950.

lepidolite-bearing and cleavelandite-bearing pegmatites are zoned pegmatites; these minerals are also found in small homogeneous pegmatites, layered pegmatites, and pegmatites which vary in composition along their length. The cores in small pegmatites may form a large proportion of the pegmatite (No. 267, fig. 10), but in large pegmatites they usually make up 1 percent or less of the total rock (fig. 7). Pegmatites having an intermediate zone as well as a core and a wall zone are rare. Only 7 pegmatites in the Quartz Creek district contain intermediate zones. In 5 pegmatites this zone consists of muscovite-albite pegmatite surrounding one or more small discontinuous cores.

The Quartz Creek district has few well-zoned pegmatites. Those which are zoned commonly consist of only a wall zone and a core. The core units are usually irregularly distributed, discontinuous segments, and constitute only a small part of the pegmatite. Judging from the sizes and distribution of the core segments only a small proportion of pegmatitic liquid remained after consolidation of the wall zone. This crystallized in scattered areas as core segments.

Layered pegmatites.--Layered pegmatites make up approximately 7 percent of all pegmatites in the Quartz Creek district. Layering is most common in the thin dike-like lenticular and lenticular-branching types of pegmatites. Layering is not common in large irregular pegmatites, although a few of the thinner irregular bodies are layered.

Most of the layered pegmatites contain a perthite-rich hanging-wall unit and an albite-rich footwall unit (fig. 11). As an example, pegmatite No. 685 (pl. II) on the north side of Wood Gulch has a hanging-wall unit of albite (30 percent), quartz (20 percent), perthite (48 percent), and muscovite (2 percent) and a footwall unit of albite (65 percent), quartz (15 percent), perthite (19 percent), and muscovite (1 percent). In a few pegmatites the hanging-wall unit has more albite than perthite but this unit always contains more perthite than the footwall unit. Pegmatite No.

1363 (fig. 11 and pl. II) is the only body that contains a higher proportion of perthite in what is believed to be the footwall unit; this pegmatite, however, is nearly vertical (81 degrees). The texture of the hanging-wall unit is coarser than that of the footwall unit, because perthite tends to form larger crystals than albite. Perthite forms in grains 0.5 to 3 inches in diameter and albite forms in grains 0.06 to 0.25 inch in diameter. In the albite-rich units the quartz grains are about the same size as the albite, but in the perthite-rich units they are nearly as large as the perthite.

Layered pegmatites with a perthite-rich hanging-wall layer and an albite-rich footwall layer have been described by Schaller _/ in the Pala

_/ Schaller, W. T., The genesis of lithium pegmatites: Am. Jour. Sci. 5th ser., vol. 10, pp. 271-274, 1925.

district, Calif.

The concentration of perthite as hoods in the upper part of zoned pegmatites is common in many districts, for example, the Keyes No. 1 pegmatite, Orange, N. H.; the W. T. Foster No. 1 pegmatite, Shelby, N. C., the Palermo No. 1, Grafton County, N. H., the Strickland-Cramer pegmatite, Portland, Conn.; the Beecher Lode, Dyke Lode, Etta, Dan Patch, Hugo, and the Bob Ingersoll Dikes Nos. 1 and 2 of the Black Hills, S. Dak. _/ The

_/ Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., Internal structure of granitic pegmatites: Econ. Geology, Mon. 2, pp. 44-45, 48, 1950.

perthite-rich hanging-wall layers in pegmatites of the Quartz Creek district appear to be the extreme development of perthite-rich hoods in thin lenticular bodies. Two of the lepidolite-bearing pegmatites, pegmatite No. 306 (Opportunity No. 4 claim) and pegmatite No. 452 (the Brown Derby

No. 1) are layered. Pegmatite No. 306 consists of an upper albite-quartz-perthite unit and a lower cleavelandite-quartz-lepidolite unit. The Brown Derby No. 1 pegmatite contains at least eight different units. Not all of these are present throughout the pegmatite and some form lenticular pods. The Brown Derby is described by Hanley _/ as having a border zone, wall

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming and Utah: U. S. Geol. Survey Prof. Paper 227, pp. 69-71, 1950.

zone, possible intermediate zone, and a compound core of three different units. The Brown Derby has more mappable units than any other pegmatite in the region. Many of these layers are found in only certain parts of the dike and merge along strike with other units. The central part of the unit has an albite-quartz wall zone on both hanging-wall and footwall sides, but to the north the wall zone on the hanging-wall side disappears and the pegmatite becomes a layered pegmatite. Other layered pegmatites probably are incompletely developed zoned pegmatites.

The layered pegmatites are most abundant in (1) along the ridge just south of Quartz Creek in the southwestern corner of the district, (2) in the vicinity of the Brown Derby mine, and (3) along the western side of Big Gulch. Layered pegmatites are sparsely scattered among other types of pegmatites in the first two areas but are the dominant type in the third area. The layered type is almost absent in other areas. The distribution of the layered pegmatites suggests that their development is controlled by a particular set of conditions. The country rock in these areas is hornblende gneiss as in many areas that are void of layered pegmatites. The conditions under which these bodies cooled and crystallized probably controlled their formation. The original composition of the pegmatite liquid may have been important, but probably was not the controlling factor, because there are different mineral assemblages in layered pegmatites, and because many unlayered pegmatites are identical to layered ones in mineralogy. The possibility of the layers being formed by replacement of preexisting pegmatite rather than by difference in crystallization history has been considered, but most of the perthite is in well-formed crystals, surrounded by later albite and quartz. The crystals are only slightly embayed and are not cut by veinlets of other minerals. The facts that the perthite layer, with only one possible exception, is on top, that the contact between the two layers is gradational, and that the layers may telescope gradually into a homogeneous unit do not seem to fit the picture of irregular replacement.

Pegmatites showing variation in composition along strike.--About 1 percent of the pegmatites have more than one unit, where the mineral composition of the unit changes along the length rather than across the pegmatite (fig. 12). In some lenticular-branching pegmatites, each branch has a different mineral assemblage. In lenticular pegmatites one end may be of one mineral composition and the opposite end the other, or the center of the pegmatite may be of one mineral composition and the ends a different mineral composition. In a few pegmatites one part may contain a core in addition to the layers across the pegmatite.

The dominant variation is from a unit rich in perthite to one in which perthite is less abundant or even absent; however, parts of some of the branching cleavelandite- and lepidolite-bearing pegmatites on the Opportunity No. 1 claim (No. 209, 213, 214, 215, and 216) are of this type.

Pegmatites showing variation in composition along strike are in lenticular, and lenticular-branching pegmatites and, in part, may represent multiple injections of pegmatite liquid.

Multiple pegmatites.--Multiple pegmatites are formed by multiple intrusions so that the walls of the pegmatite formed by the second injection are tangent to that of the first. Thus, the various units have strikes which trend within a few degrees of one another. Branching and irregular pegmatite bodies may be the result of multiple intrusion of two or more pegmatite liquids into the same spot. In general, adjacent pegmatites probably are derived from liquid fractions of the same granitic magma and may be expected to consist of the same minerals in approximately the same proportions. It may be difficult, therefore, to distinguish between a branching and a multiple pegmatite. There are in the Quartz Creek district two pegmatites that have been formed by two separate injections of pegmatitic liquids. Pegmatite No. 251 is a lenticular-branching body with a wall zone and a thin core in each branch (fig. 13). The two branches join near the north end, and instead of the cores joining as cores do in a normal branching pegmatite, there are two parallel cores at the junction showing that it is a multiple pegmatite formed at slightly different times by two different injections. Pegmatite No. 216 on the Opportunity No. 1 claim is a north-trending albite-quartz-perthite pegmatite, which is cut by a northeasterly-trending body of perthite-quartz and cleavelandite-quartz pegmatite (fig. 13). The north-trending part of the pegmatite mass is older than the northeasterly-trending branch. Though this pegmatite resembles a multiple pegmatite in that it is formed of two separate injections, the cross-cutting relationship proves it to be an earlier pegmatite cut by a later one.

Mineralogy

A total of 27 minerals has been found in the pegmatites of the Quartz Creek district. Perthite, plagioclase, and quartz are the essential minerals and form from 95 to more than 99 percent of most pegmatites. Only a very few pegmatites have units rich in muscovite, and this mineral cannot be considered an essential mineral of the pegmatites of this district. The common accessory minerals are considered to be those found in more than 10 percent of the pegmatites. These minerals, in order of their frequency, are: muscovite, garnet, biotite, magnetite, and beryl. The quantity of these minerals in any particular pegmatite is small; muscovite commonly ranges from 0.5 to 3 percent, garnet, 0.5 to 1 percent, biotite and magnetite, less than 1 percent, and beryl, a few small crystals.

The other 19 minerals are found in less than 3 percent of the pegmatites of the district and are considered as rare accessory minerals. They also commonly amount to only a small fraction of a percent of the pegmatite. Table 3 lists all the accessory minerals giving the number of pegmatites which contain these minerals and the percent of the total pegmatites in which they are found.

Table 3.--Occurrence of accessory minerals in the pegmatites of Quartz Creek district

Mineral	Number of pegmatites in which mineral was observed	Percentage of pegmatites examined (1,803) in which mineral was observed
Muscovite	1,058	57.9
Garnet	965	52.9
Magnetite or martite	422	23.1
Biotite	357	19.6
Beryl	232	12.7
Tourmaline	48	2.6
Columbite-tantalite	29	1.6
Monazite	23	1.3
Lepidolite	17	0.9
Microlite	13	0.7
Chlorite	9	0.5
Topaz	8	0.4
Gahnite	8	0.4
Samarskite	7	0.4
Epidote	3	0.2
Apatite	3	0.2
Fluorite	2	0.1
Spodumene	1	0.06
Amblygonite	1	0.06
Allanite	1	0.06
Lithiophilite-trithylite	1	0.06
Betafite	1	0.06
Chrysocolla	1	0.06
Unknown	1	0.06

Plagioclase

Plagioclase occurs in all pegmatites of the Quartz Creek district and is the dominant mineral in most of them. It may form as much as 90 percent of all types of structural or mineralogic units. The plagioclase occurs in fine-grained sugary aggregates of equigranular grains, and in coarse platy crystals (cleavelandite). Cleavelandite has been found in 28 pegmatites in this district. Where used in this report, the term plagioclase refers only to the typical granular form, and the term cleavelandite refers to the platy form. Plagioclase commonly is abundant in (1) homogeneous pegmatites, (2) wall zones of zoned pegmatites, and (3) footwall layers of layered pegmatites. These units may contain more than 98 percent plagioclase and quartz. Cleavelandite, on the other hand, is restricted for the most part to central parts of the pegmatites.

The plagioclase ranges in size from less than 0.003 inch to about 1.5 inches across; the average size is about 0.12 inch. Crystal shape is usually not discernible, but the cleavage surfaces commonly are curved or warped. Twinning is visible only on the large pieces. Plagioclase is found in graphic intergrowth with quartz in a few places. Most of the plagioclase is white, but cream-colored, brownish, and pinkish shades are common. The plagioclase locally resembles the perthite in color, but can usually be distinguished by the warped surfaces, twinning lamellae, lack of perthitic structure, and to a lesser extent by its occurrence in fine aggregates.

Cleavelandite is found in thin plates 0.003 to 0.006 inch thick and 0.5 to 4 inches in maximum dimension. The average plate is approximately 2 inches long, 1.5 inches wide, and 0.04 inch thick. The crystals are white and semi-transparent. The surface of the crystal is wavy and twin lamellae can be seen along the edges.

The lowest index ($N_{\alpha 1}$) from the (010) cleavage flakes was determined on 439 specimens of plagioclase and on 17 specimens of cleavelandite from the Quartz Creek district. The index of the plagioclase ranged from 1.527 ($Ab_{99}An_1$) to 1.541 ($Ab_{74}An_{26}$) and of the cleavelandite from 1.528 ($Ab_{97}An_3$) to 1.530 ($Ab_{95}An_5$). The plagioclase has an average of 1.532 ($Ab_{93}An_7$) and cleavelandite 1.529 ($Ab_{96}An_4$). The plagioclase ranges from sodic albite to calcic oligoclase, and the cleavelandite is a sodic albite. Table 4 gives the results of these determinations, the type of country rock, and the type of pegmatite or pegmatite unit from which each specimen was taken.

Table 4.--The range of refractive index ($N_{\alpha 1}$) of plagioclase and cleavelandite from all types of pegmatite units in the Quartz Creek district and its relation to different types of country rock.

Country rock Type of pegmatite or pegmatite unit	Number of determinations and refractive index ($N_{\alpha 1}$) of plagioclase															Number of determinations and refractive index ($N_{\alpha 1}$) of cleavelandite		
	1.527	1.528	1.529	1.530	1.531	1.532	1.533	1.534	1.535	1.536	1.537	1.538	1.539	1.540	1.541	1.528	1.529	1.530
Hornblende gneiss and tonalite																		
Homogenous pegmatite		16	41	39	11	11	8	6	8	4	10	5	2		1			
Zoned pegmatites																		
Wall zone		2	25	11	9			2	2									
Intermediate zone(s)		1		1	1												1	
Core		2	5	5	1							1					6	2
Layered pegmatites																		
Lower layer			6	3	1				1									
Median layer			1	1														
Upper layer		1	7	5														
Pegmatites which change in composition along strike	1	2		1	1				1	1								1
Fracture filling				1				1										
Granite and hornblende gneiss or tonalite																		
Homogeneous pegmatites	2	3	10	9	6	1						1						1
Zoned pegmatites																		
Wall zone			2	2	2	1		1										1
Core		1	1	2	3												1	
Layered pegmatites																		
Lower layer			2	1	2				1									
Median layer(s)			1															
Upper layer			2	2	1		1		1				1					
Pegmatites which change in composition along strike		1	1	3	1											1	2	

Table 4.--The range of refractive index ($N_{\alpha 1}$) of plagioclase and cleavelandite from all types of pegmatite units in the Quartz Creek district and its relation to different types of country rock.--Continued

Country rock Type of pegmatite or pegmatite unit	Number of determinations and refractive index ($N_{\alpha 1}$) of plagioclase															Number of determinations and refractive index ($N_{\alpha 1}$) of cleavelandite		
	1.527	1.528	1.529	1.530	1.531	1.532	1.533	1.534	1.535	1.536	1.537	1.538	1.539	1.540	1.541	1.528	1.529	1.530
Fine- and coarse-grained granite																		
Homogeneous pegmatites			6	9	9	5	10	1	1									
Zoned pegmatites																		
Wall zone			1	1														
Core			1		1													1
Quartz monzonite																		
Homogeneous pegmatite								1		4	7	19	12	5				
Zoned pegmatites																		
Wall zones											3	2		1				
Intermediate zone(s)						2			1									
Layered pegmatite																		
Lower layer												1						
Upper layer												1						
Country rock unknown																		
Homogeneous pegmatite				1		1												

The refractive indices of plagioclase were determined for all internal units in each beryl-bearing pegmatite and for a selected number of pegmatites in each type of country rock. The refractive indices of the plagioclase in pegmatites with the hornblende gneiss and tonalite wall rocks averaged 1.530, and those in the quartz monzonite averaged 1.538. Refractive indices of plagioclase in pegmatites from the hornblende gneiss near quartz monzonite are in the same range as those in the quartz monzonite. The refractive indices of plagioclase in pegmatites decrease from the quartz monzonite area southward; the difference appears to be controlled by the regional distribution rather than composition of the country rock.

In the zoned pegmatites of the Black Hills _/ and other districts,_/

_/ Page, L. R., et al., Pegmatite investigations, 1942-1945, Black Hills, South Dakota: U. S. Geol. Survey Prof. Paper (in preparation).
_/ Cameron, E. N., et al., op. cit., p. 99, 1949.

a systematic variation in the plagioclase has been noted from zone to zone with the anorthite content decreasing toward the core. Most pegmatites in the Quartz Creek district do not have the well-developed zones but when zoned show a rather large wall zone with scattered core segments. Table 5 shows that there is not much change in the indices of the 17 pegmatites that are composed of just wall zone and core; eight showed no change of index, five decreased slightly in index (0.001 to 0.002) from wall zone to core, while four increased in index (0.001 to 0.006). In two well-segregated pegmatites with intermediate zones there is a decrease in refractive index of 0.005 towards the core, indicating a decrease in anorthite content, which is in accord with previous work. In a well-segregated pegmatite the plagioclase probably will tend to show a systematic change of anorthite content toward the center; but when the zoning is poor, the plagioclase will either have the same composition or have erratically distributed values.

Table 5.—Lower refractive index ($N_{\alpha 1}$) of plagioclase in zoned pegmatites.

Pegmatite No. (pl. II)	$N_{\alpha 1}$ of plagioclase in wall zone	$N_{\alpha 1}$ of plagioclase in intermediate zone	$N_{\alpha 1}$ of plagioclase in core
174	1.529		1.528
279	1.531		1.529
289	1.529		1.530
451	1.529		1.529
453	1.529		1.529
454	1.529		1.529
455	1.529		1.529
456	1.529		1.529
535	1.535	1.529	
536	1.528		1.528
674	1.531		1.530
847	1.533		1.539
989	1.530		1.529
1002	1.531		1.530
1028	1.529		1.531
1044	1.529		1.530
1202	1.530		1.530
1402	1.537	1.532	
1666	1.529		1.529

A comparison was also made between the refractive indices of plagioclase from the hanging-wall layer and the footwall layer of two layered pegmatites (table 6). As the hanging-wall layer is relatively rich in perthite and the footwall layer relatively poor, it was thought that this change in the alkali content might be reflected in the ratio of sodium to calcium in the plagioclase. Of the eleven pegmatites investigated, six showed no variation in index and five showed an increase of 0.001 to 0.002 in index from the hanging-wall layer to the footwall layer. As the limit of accuracy of the index determinations is approximately 0.001±, the results show a negligible change. The concentration of perthite and thus the potassium content in the upper layer seems to have little effect on the ratio of sodium to calcium in the plagioclase.

Table 6.--Lower refractive index (N_{α_1}) of plagioclase in layered pegmatites

Pegmatite No. (pl. II)	N_{α_1} of plagioclase in hanging-wall layer	N_{α_1} of plagioclase in footwall layer
270	1.528	1.530
432	1.529	1.530
433	1.530	1.530
435	1.529	1.529
462	1.529	1.529
548	1.529	1.529
778	1.535	1.535
1004	1.529	1.529
1043	1.530	1.531
1105	1.530	1.531
1172	1.529	1.531

A comparison of the refractive indices of plagioclase in beryl-bearing and non-beryl-bearing pegmatites (table 11) shows that both have a wide range and that the non-beryl-bearing pegmatites have more calcic plagioclase.

Cleavelandite occurs in crystals commonly many times larger than the plagioclase, has a flat platy crystal habit compared to more equant grains of plagioclase, and is invariably white or bluish white whereas plagioclase is white, yellow, green or pink. These two varieties probably did not form under identical chemical and physical conditions. Cleavelandite occurs in 20 pegmatites in the Quartz Creek district and has been noted in homogeneous, zoned, and layered pegmatites, and pegmatites which vary in composition along the strike. In zoned pegmatites it is found in the intermediate zone in three places and in the core in sixteen. The tendency for cleavelandite to form in the central part of pegmatites has been noted in other parts of Colorado _/ and in other districts in the United States _/.

_/ Hanley, J. B., et al., op. cit., p. 7, 1950.
_/ Cameron, E. N., et al., op. cit., p. 58, 1949.

Cleavelandite has distinctive mineral associations. In the Quartz Creek district it is associated with quartz, lepidolite, microlite, beryl, topaz, columbite-tantalite, perthite, muscovite, garnet, and tourmaline. Many of these minerals are normally found with cleavelandite though the reverse is not always true. Cleavelandite is associated with lepidolite in 14 of the 17 lepidolite-bearing pegmatites, with topaz in 8 of the 8 topaz-bearing pegmatites, and with microlite in 12 of the 13 microlite-bearing pegmatites. The association of cleavelandite with lithium minerals and some of the rare accessory minerals has been noted in other districts. In the Tin Mountain pegmatite, Custer County, S. Dak., cleavelandite occurs in the core associated with spodumene, lithium mica, beryl, amblygonite, cassiterite, columbite-tantalite, apatite, microlite, and pollucite. In the Harding mine near Dixon, N. Mex. _/ cleavelandite in fracture fillings

_/ Adams, J. W., Personal communication.

is associated with purple muscovite, microlite, and spodumene. In the Rutherford and Morefield pegmatites near Amelia, Va. _/, cleavelandite is

_/ Glass, J. J., op. cit., pp. 761-763, 1935.

associated with cassiterite, manganotantalite, microlite, and zircon. The regional distribution of cleavelandite-bearing pegmatites (fig. 20) shows that with the exception of two bodies, all the deposits containing cleavelandite also contain lepidolite or are adjacent to pegmatites containing lepidolite. This suggests that some of the elements common to lepidolite and its associated minerals may be responsible for the formation of platy plagioclase. The elements that might promote the growth of cleavelandite are lithium (in lepidolite, zinnwaldite, amblygonite, and spodumene), rubidium or cesium (in lepidolite, muscovite, tourmaline, beryl, and pollucite), and fluorine (in lepidolite, fluorite, and topaz). Fluorine is more difficult to evaluate because it may be present as an essential constituent, as in fluorite, topaz, or lepidolite, or it may occur undetected as a minor constituent in other minerals such as muscovite by substituting for the OH^- radical. Spectrographic analyses of both cleavelandite and albite from a number of pegmatites should be made to find whether small quantities of lithium, fluorine, or other elements are present in one type of plagioclase and not in another.

Perthite

All the potassium feldspar examined in pegmatites of the Quartz Creek district was white, cream-colored, or pink perthite; no orthoclase or microcline free of vein-like laminations of albite was noted. The albite laminae are thin, roughly parallel, and white. The albite is well twinned and the twinning is parallel in all laminae. The twin planes parallel the long dimension of the albite laminae and have the same orientation in a single perthite crystal.

Perthite occurs in most pegmatites and in some it is the predominant mineral. It is absent from some sodic-rich units, but forms as much as 93 percent of perthite cores. Sodic-rich pegmatites commonly contain less than 15 percent perthite; other pegmatites are in a large part graphic granite. Generally the perthite-rich pegmatites are most abundant in the northwest part of the district.

All pegmatite units contain perthite, but it is most abundant as graphic granite in homogeneous pegmatites, wall zones of zoned pegmatites, or as blocky perthite in cores of quartz-perthite pegmatite. The largest perthite-bearing pegmatites in the district contain graphic granite whereas graphic granite is not common in the small cores of zoned pegmatites. The hanging-wall unit of layered pegmatites is commonly rich in perthite.

The perthite is in crystals a quarter of an inch to 8 feet in maximum dimension. The crystals are largest in cores where they average 1.5 feet. Perthite crystals in the wall zone or in layered and homogeneous pegmatites are 2 to 3 inches in size. In fine-grained plagioclase-rich pegmatites the perthite crystals are smaller than in pegmatites where perthite is the dominant mineral. Graphic granite crystals are from a half to 4 feet in length and average about 80 percent perthite and 20 percent quartz. About a ton of graphic granite was crushed, quartered, and analyzed _/. This analysis (table 7) indicates that the soda is almost

_/ Analysis obtained through the courtesy of C. A. Wemlinger, Vice President in Charge of Operations, Beryllium Mining Co., Inc.

entirely in the albite laminae of the perthite. Normative minerals _/,

_/ Washington, H. S., U. S. Geol. Survey Prof. Paper 99, pp. 1162-1165, 1917.

calculated from this analysis, verify that there is little present other than quartz and feldspar and that the microcline molecule is 4.5 times as abundant as that of plagioclase.

Perthite forms blocky equidimensional crystals that are surrounded and veined by an aggregate of quartz, albite, and muscovite. In most places perthite is the first essential mineral to crystallize, but rarely it appears to be later than some or all of the associated minerals.

Table 7.--Chemical analysis 1/ of graphic granite from the Bucky mine, Quartz Creek district, Colorado

Oxide	Percent
SiO_2	71.56
Al_2O_3	14.82
K_2O	10.97
Na_2O	1.69
CaO	0.08
Fe_2O_3	0.01
MgO	Trace
Cr_2O_3	None
	99.13

1/ C. A. Parker, analyst.

Quartz

Quartz comprises 15 to 30 percent of all pegmatites in the district; the average is about 20 percent in homogeneous pegmatites, non-lepidolite-bearing layered pegmatites, and wall zones of zoned pegmatites. Although the ratio of perthite to plagioclase varies widely in these types of rock, the quartz content is nearly everywhere 15 to 20 percent. Many cores and fracture fillings are made up solely of milky quartz, whereas other cores and fracture fillings are mixtures of blocky perthite and quartz. The quartz in fracture fillings, intermediate zones, and cores is 10 to 100 percent of the unit.

The quartz is generally white to gray, although smoky varieties are found in a few pegmatites, usually as small oval blobs of from 1 to 10 feet. The smoky varieties are usually associated with radioactive minerals, for example, with microlite in pegmatites No. 215, No. 216, and No. 452, and with allanite in pegmatite No. 847. Small patches of smoky quartz have been found without visible radioactive minerals.

Quartz in most places fills interstices and forms veins in perthite crystals, indicating that it crystallized after the perthite. Rarely, however, the reverse is true. The quartz associated with blocky perthite is in crystals 2 to 18 inches in size and is commonly slightly finer grained than perthite. In graphic granite, the quartz forms crude cuniform-shaped rods 0.03 to 0.25 inch thick and as much as 1.5 feet long.

Albite is interstitial to quartz and in places appears to vein it. This relationship indicates that albite crystallized last, but in many places the mutual intergrowths suggest a contemporaneous age. Where quartz occurs solely with albite it forms crystals 0.03 to 0.5 inch in diameter; as the proportion of perthite increases in the unit the size generally increases. Muscovite and quartz in many places are intergrown and appear to have crystallized at about the same time.

Muscovite

Muscovite is found in about 60 percent of the pegmatites in the Quartz Creek district. On the east side of Quartz Creek it occurs in 85 percent of the pegmatites. On the west side the iron content of the pegmatites is higher, considerable magnetite is present, and biotite occurs in place of part of the muscovite. Muscovite is found in all types of internal units in the pegmatites and forms 0.5 to 3 percent of the rock; rare small pegmatites contain as much as 10 percent.

The muscovite is clear to green and individual sheets show black mineral staining. The larger pieces have reeves and "A" structure. Most of the muscovite, however, is about 0.25 inch in diameter, and commonly is intergrown with quartz. In only two pegmatites, the Buckhorn (No. 659) and the Bucky (No. 1574), are muscovite books more than 3 inches in size; books 1 foot in size occur in the Bucky pegmatite.

The muscovite is in both flat and curved forms. The flat variety is common in most rocks; the curved variety is found in 23 pegmatites, all on the northwestern slope of Wood Gulch, where it occurs in a series of concentric shells 0.12 to 0.5 inch thick.

The composition of muscovite is expressed in three constituent molecules _/, the end members of a triangular composition diagram, and the

_/ Winchell, A. N., Elements of optical mineralogy: pt. II, p. 268, 1947.
Volk, G. W., Optical and chemical studies of muscovite: Am. Mineralogist, vol. 24, pp. 255-266, 1939.

composition of any sample of muscovite can be expressed in terms of these three end members. The end members are potassium muscovite ($H_4K_2Al_6Si_6O_{24}$), phengite ($H_6K_2(Fe,Mg)_2Al_4Si_6O_{24}$), and ferric iron muscovite ($H_4K_2Fe_2Al_4Si_6O_{24}$). The refractive indices of muscovite increase with the proportion of the ferric iron muscovite in the mineral. The total amount of iron can not be ascertained by optical methods alone, however, as the iron may also be in the ferrous form in the phengite member. Specimens containing phengite and the potassium muscovite member have the same indices for equal amounts of the ferric iron muscovite. Information obtainable from refractive index determinations on the chemical composition of muscovite is therefore less useful than similar data on plagioclase and beryl. Volk _/ made

_/ Volk, G. W., op. cit., pp. 257-259, 1939.

22 chemical analyses and obtained the optical data on muscovite from various pegmatites scattered throughout the world. These analyses are in an area on the diagram midway between potassium muscovite, phengite, and 0 to 38 percent ferric iron muscovite. The median refractive index (N_β) was determined on 95 specimens of muscovite from the Quartz Creek district and ranged from N_β = 1.585 to 1.606 (table 8), indicating from 0 to 28 percent of the ferric iron muscovite molecule. It was thought originally that a

variation in the refractive indices, and thus in ferric iron content, might be found between units or layers. Table 9 shows the median refractive indices (N_β) of muscovite from the wall zone and core of seven zoned pegmatites. There is a small variation in the refractive indices but the variation is not constant, either in direction or amount. The median refractive indices of muscovite in layered pegmatites (table 10) show a small but unsystematic variation between the hanging-wall to the footwall layers. A comparison of median refractive indices of muscovite from pegmatites in various types of country rock was made. The lack of sufficient samples from pegmatites in the granite and quartz monzonite made this work inconclusive, but the variations are in the same range as those from pegmatites in the hornblende gneiss or tonalite. Comparison was also made between the muscovite in various beryl-bearing and non-beryl-bearing units. The refractive indices of the muscovite in the beryl-bearing units were in the same range as those in the non-beryl-bearing units.

Table 8.—Number and distribution of median refractive indices (N_β) found in flat and curved muscovite

Median index (N_β)	Number of specimens	
	Flat muscovite	Curved muscovite
1.585	1	1
1.586	1	0
1.587	1	0
1.588	0	0
1.589	0	2
1.590	0	1
1.591	0	0
1.592	4	2
1.593	1	0
1.594	7	0
1.595	4	2
1.596	4	0
1.597	12	1
1.598	7	0
1.599	4	3
1.600	7	0
1.601	8	1
1.602	5	1
1.603	6	1
1.604	1	0
1.605	5	1
1.606	1	0

Table 9.—Median refractive index (N_β) of muscovite from zoned pegmatites

Pegmatite No.	N_β of muscovite in wall zone	N_β of muscovite in core
174	-----	1.592
208	1.599	1.578 (zinnwaldite)
213	1.592	1.599
245	1.596	1.594
266	1.597	1.595
288	1.595	1.597
321	1.594	-----

Table 10.—Median refractive index (N_β) of muscovite in layered pegmatites

Pegmatite No.	N_β of muscovite in hanging wall	N_β of muscovite in footwall
913	1.597	-----
927	1.604	1.600
937	1.597	-----
944	1.601	1.601
953	1.599	1.602
954	1.605	1.603
958	1.606	1.598
959	1.605	1.605
963	1.605	1.603
969	1.605	1.602
975	1.598	1.601
997	1.603	1.598
1132	1.601	1.601
1172	1.595	1.594

It was thought that the curved muscovite in the Quartz Creek district might also be a lithium mica, but median indices (N_β) determined for 16 specimens of curved muscovite show the same range of index and approximately the same distribution as the flat muscovite (table 8). Furthermore, the angle 2V of the curved mica (40 degrees) is much too high for a lithium mica. Several lithium micas were found, however, in making refractive index determinations on muscovite. These micas are colorless, flat, and associated with cleavelandite. Their median index ranges from 1.560 to 1.578 which is below that of the muscovite series. These specimens are in the zinnwaldite range of the lepidolite series. There is no sure way to distinguish white lithium mica from muscovite in hand specimen. The lithium micas are more brittle, and the presence of cleavelandite should lead one to consider the possibility of lithium micas being present. A simple test to distinguish the two involves the use of a blowpipe: the lithium micas can be fused but muscovite can not.

Garnet

Approximately 55 percent of the pegmatites of the Quartz Creek district contain minor quantities of garnet. It is commonly in crystals less than 0.03 inch in diameter and may be overlooked easily. Garnet ranges in size from less than 0.01 inch to 1 inch in diameter, but crystals over 0.15 inch are rare. This mineral occurs in all the pegmatite units, but has a decided preference for the fine-grained plagioclase-rich parts, such as found in the footwall units of layered pegmatites, the wall zones of zoned pegmaties, and homogeneous pegmatites. It is found in crystals 0.20 inch and larger in the coarser-grained cores, but in most cores it is absent. Though garnet is widely distributed throughout the district, is constitutes only a trace to less than 1 percent of most pegmatites; in a few of the smaller ones it makes up as much as 1 percent of the rock. Garnet is erratic in distribution, and some parts of a pegmatite may contain several percent while others contain none. In the Bucky pegmatite (No. 1574) rock exposed in two pits contains several percent garnet, whereas in the same unit in other pits the mineral is absent. Brown garnet is conspicuous in "line rock", forming long thin bands which contrast with the white plagioclase-rich bands.

The garnet occurs singly or in clusters as light-brown, reddish-brown, and black euhedral crystals. Some crystals are black on the outside due to manganese staining, but others are black throughout the crystal. The garnet in many pegmatites is clear reddish brown with no manganese staining. One of the larger crystals is an intergrowth of garnet and quartz.

The garnet group may be divided into six members: almandite ($Fe_3Al_2Si_3O_{12}$), spessartite ($Mn_3Al_2Si_3O_{12}$), pyrope ($Mg_3Al_2Si_3O_{12}$), grossularite ($Ca_3Al_2Si_3O_{12}$), andradite ($Ca_3Fe_2Si_3O_{12}$), and uvarovite ($Ca_3Cr_2Si_3O_{12}$).

Ford _/, Fleischer _/, and Wright _/ have shown that garnet specimens do

_/ Ford, W. E., A study of relationships existing between the chemical, optical and other physical properties of the members of the garnet group: Am. Jour. Sci., 4th ser., pp. 33-49, 1915.

_/ Fleischer, Michael, The relation between chemical composition and physical properties in the garnet group: Am. Mineralogist, vol. 22, pp. 751-759, 1937.

_/ Wright, W. I., The composition and occurrence of garnets: Am. Mineralogist, vol. 23, pp. 436-449, 1938.

not correspond usually to any single chemical type, but contain two or more molecules in solid solution. It was shown first by Ford _/ that the index

_/ Ford, W. E., op. cit., pp. 33-49, 1915.

of refraction and specific gravity of a garnet depend in a simple and direct way on the chemical composition. He calculated the index of refraction and the specific gravity of 23 garnets from their chemical composition. These values agreed within less than 2 percent with those determined by direct measurement. The reverse process is not so simple, as a single determination of refractive index or specific gravity may correspond to several combinations of end members. It would be possible from a series composed of three different molecules to have a number of different combinations with the same index of refraction. The problem is somewhat simplified because all garnets are in one of two groups: the aluminum-bearing garnets (almandite, spessartite, and pyrope) and the calcium-bearing garnets (grossularite, andradite, and uvarovite). These two groups, as shown diagrammatically by Winchell _/, are miscible with each other only in limited amounts.

_/ Winchell, A. N., Elements of optical mineralogy: pt. 2, p. 175, 1947.

Wright _/ compiled 35 analyses of garnets from pegmatites and 18 from

_/ Wright, W. I., op. cit.,pp. 439, 446, 1938.

granites which he converted into weight percent of the five common members of the garnet group, namely: almandite, spessartite, pyrope, grossularite, and andradite. His conclusions from studies of garnet from pegmatites and other types of rock are: (1) that there is a remarkable constancy of one variety of garnet in each rock type, and (2) that spessartite and almandite constitute 85 to 90 percent of the molecules from pegmatites and granites. Thus, if one of the major constituents is known, the other can be estimated within a limit of error of 5 to 15 percent. Winchell _/ has compiled data

_/ Winchell, A. N., op. cit.,pp. 179-181, 1947.

by Ford and others into several diagrams from which, if the garnet group is known, and the specific gravity and index of refraction have been determined, a general composition in terms of the garnet molecules can be derived.

Indices of refraction were determined on garnet from 15 widely scattered pegmatites in the Quartz Creek district. Specific gravity was not determined, but all specimens were qualitatively tested and found to contain manganese. All the indices of refraction are between 1.810 and 1.820 with many specimens having refractive indices about 1.815. The indices of refraction show small variations, but in general the garnet of this region is remarkably similar in index and composition. The proportion of almandite and spessartite can be roughly evaluated by neglecting the small percent pointed out by Wright to be taken up by the other garnet molecules and assuming that the mineral to be made up only of spessartite and almandite. In this case the garnet would range from 67 percent spessartite, 33 percent almandite (N = 1.1810) to 33 percent spessartite, 67 percent almandite (N = 1.820). Most of the values would be closer, however, to 50 percent spessartite and 50 percent almandite (N = 1.815).

Garnet is associated with all the common and almost all the rare pegmatite minerals. It does have, however, a tendency to occur more abundantly with fine-grained plagioclase. In pegmatite units that are perthite-rich, garnet, if present, commonly will be associated with the plagioclase.

Magnetite and martite

Magnetite, commonly altered to martite, is widespread in minor quantities and is found in approximately 20 percent of the pegmatites. Most pegmatites contain only a few scattered crystals, but several of the smaller pegmatites have about 1 percent.

Magnetite and martite are dull to steely black in color and rarely form well-developed octahedra. Almost all specimens, however, have good octahedral (111) parting which easily distinguishes this mineral from columbite-tantalite. The mineral ranges in size from grains less than 0.10 inch in size to round masses as much as 3 inches in diameter.

Magnetite and martite are found as an accessory mineral in the feldspathic pegmatites, but are not found in any of the lepidolite-bearing units. They are in both the perthite-rich and the albite-rich pegmatites, and are one of the few accessory minerals found in graphic granite. The distribution of magnetite and martite is usually erratic; a few small areas in the pegmatite may contain 1 or 2 percent and the rest of the pegmatite only a trace. They are associated commonly with perthite, albite, quartz, and biotite, and in a few places with garnet. Few beryl-bearing pegmatites contain either magnetite or martite; the two minerals are nowhere adjacent to each other. Muscovite is nowhere associated closely with the magnetite although they may both be in the same pegmatite, whereas biotite is closely associated with magnetite or martite.

The association of magnetite with biotite but not with muscovite is easily explained. Those parts of the pegmatite with sufficient iron to form magnetite also had sufficient iron to form biotite; those parts free of iron would contain muscovite in place of biotite.

Biotite

Biotite is found in almost 20 percent of the pegmatites on the west side of Quartz Creek, but is found in only 6 percent of the pegmatites on the east side. In most of the pegmatites biotite forms considerably less than 1 percent of the rock; in a few of the smaller pegmatites it forms several percent.

Biotite is dark to greenish black and occurs in widely scattered blades from a fraction of an inch to 8 inches in maximum dimension; in most pegmatites the blades are 0.25 to 0.5 inch. The larger blades usually occur in small areas and may be either restricted to core segments or small patches in the otherwise uniform homogeneous pegmatite or the wall zone of a zoned pegmatite.

The median refractive index (N_β) of seven specimens ranges from 1.636 to 1.671. Not only do the refractive indices vary from specimen to specimen but also in different parts of the same book. Much of the biotite is partly altered to chlorite and the variation in refractive index depends on the extent to which the biotite has been altered. These median refractive indices indicate that the biotite approximates siderophyllite _/ in

_/ Winchell, A. N., Elements of optical mineralogy: pt. II, p. 273, 1947.

composition and is high-iron rather than high-magnesium biotite.

Biotite was found in part of the lepidolite-bearing pegmatites, but it is not in the same units as lepidolite. It is common in both perthite- and albite-rich pegmatite and is one of the few accessory minerals in graphic granite. Biotite is commonly associated with magnetite or martite; muscovite is found only in the magnetite-free part of these pegmatites.

Beryl

Beryl is found in 232 pegmatites and is widely distributed; in most pegmatites in the Quartz Creek district there are only a few small crystals. Beryl is found in all types of pegmatites and pegmatite units: homogeneous pegmatites; core, intermediate, and wall zones of zoned pegmatites; various layers of layered pegmatites; and units of pegmatites that differ in composition along strike.

Beryl may be brown, white, gray, greenish white, pale green, greenish gray, or pale blue green. The white, brown, and greenish white beryl is the most common, and it is difficult to distinguish from feldspar in many exposures. The beryl crystals range from 0.006 inch to 2 feet in diameter. In fine-grained albite-rich pegmatites the beryl crystals are 0.10 to 0.25 inch in diameter, but larger crystals occur in the coarser-grained intermediate zones and cores. Although beryl was found in a higher percentage of the albite-rich units than in perthite-rich ones only the latter contained beryl in pieces large enough to be hand cobbed. The average beryl crystal is approximately twice the size of the albite and about half the size of the associated perthite grains.

Beryl occurs as subhedral to euhedral hexagonal crystals; tapered crystals are rare except at the Bucky pegmatite (No. 1574). Intergrowths of beryl with feldspar, quartz, tourmaline, or other minerals are common in some regions, as in northeastern Brazil _/, New Hampshire, Connecticut _/,

_/ Johnston, W. D., Jr., Beryl-tantalite pegmatites of northeastern Brazil: Geol. Soc. America Bull., vol. 56, pp. 1032-1034, 1945.
_/ Shaub, B. M., Contemporaneous crystallization of beryl and albite vs. replacement: Am. Mineralogist, vol. 22, pp. 1045-1051, 1937.

and the Eight-Mile Park district, Colo. _/, but in the Quartz Creek dis-

_/ Heinrich, E. W., Pegmatites of Eight Mile Park, Fremont County, Colorado: Am. Mineralogist, vol. 33, pp. 557-558, 1948.

trict only one mixed crystal was found. It was intergrown with garnet and quartz near the center of the crystal and with albite near the outer edges.

Beryl may contain as much as the theoretical maximum of 14.0 percent BeO. In most beryl, however, substitutions involving Cs_2O, Li_2O, Na_2O, and Al_2O_3 lower the BeO content and it commonly ranges from 11 to 13 percent _/. Winchell _/ and later Schaller _/ have shown that the decrease

_/ Schaller, W. T., Unpublished chart.
Adams, J. W., Beryllium deposits of the Mt. Antero region, Chaffee County, Colorado: U. S. Geol. Survey Bull., (in preparation).
_/ Winchell, A. N., Elements of optical mineralogy: part II, p. 213, 1947.
_/ Schaller, W. T., Unpublished chart.

in BeO content is accompanied by an increase in the refractive indices, and have compiled charts showing the alkali and BeO content for any particular refractive index. According to Schaller's chart, the refractive index of the slow ray (N_ω) of beryl containing 14 percent BeO is 1.566, whereas the refractive index of beryl containing 10 percent BeO is 1.600.

The refractive index of the slow ray (N_ω), determined for 183 beryl specimens from various units, ranges from 1.573 to 1.585 and averages 1.578.

These determinations are compiled in table 11 together with the determinations of the minimum refractive index on cleavage plates of the associated plagioclase. The table is divided according to country-rock types and subdivided according to the type of pegmatite and internal structure. This table shows that the refractive index of beryl, and therefore the composition, varies irregularly in the different types of pegmatites and internal units. There appears to be no correlation between type of country rock and the refractive index of beryl. Only two specimens of beryl were obtained from pegmatites in the quartz monzonite and six from pegmatites in fine- and coarse-grained granite.

It has been noted in the Black Hills _/ and other districts _/ that

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_/ Page, L. R., et al, Pegmatite investigations, 1942-1945, Black Hills, South Dakota: U. S. Geol. Survey Prof. Paper (in preparation).
_/ Cameron, E. N., et al, op. cit., p. 99, 1949.

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there is a systematic increase in the alkali content of beryl from the wall zone inward toward the core. Similar data on beryl from zoned pegmatites from the Quartz Creek district is rather meager because a large part of the beryl found was from a single zone of a zoned pegmatite. The refractive indices of beryl from different units of zoned pegmatites are compiled in table 12 together with the minimum refractive index of albite for comparison. Most pegmatites have only small cores and are zoned poorly. A difference of 0.001 is all that is noted from wall zone to core of the more simply zoned pegmatites. The refractive indices of the slow ray of beryl from three pegmatites that contain beryl in an intermediate zone as well as either a core or a wall zone differ as much as 0.003 between the intermediate zone and either the core or wall zone. This increase inward in alkali content is in accord with the findings of previous workers.

Table 11.---The number of refractive index determinations of plagioclase and beryl, their relation to different types of country rock, and types of pegmatites or units.

Country rock and type of unit	Lowest refractive index on cleavage plates of plagioclase					Highest refractive index on cleavage plates of beryl							
	1.528	1.529	1.530	1.531	Other	1.575	1.576	1.577	1.578	1.579	1.580	1.581	Other
Hornblende gneiss and tonalite													
Homogeneous pegmatite	13	16	21	6	1.532-5 1.533-3 1.534-1	4	7	10	17	13	2	3	1.573-1 1.582-2 1.583-1 1.585-1
Zoned pegmatites													
Wall zone	1	18	6	2	1.534-1		3	3	1	1	1		
Intermediate zone(s)	1	1	1	1						1	1		
Core	1	7	3	1		3	2	4	7	4	2		1.582-2
Layered pegmatites													
Lower layer		5	3	1				1		1			
Median layer(s)		1							1				
Upper layer	1	6	5	1		1	2	3	2	1			
Pegmatites which change composition along strike	2	1	3	1	1.527-1					2			
Fracture filling			1		1.534-1		2						
Granite, and hornblende gneiss and tonalite													
Homogeneous pegmatite	3	8	9	6	1.527-2 1.532-1	2	2	4	6	3	4	2	1.574-1 1.584-1 1.585-1
Zoned pegmatites													
Wall zone		2	2	1							1	1	
Intermediate zone(s)		1			1.533-1		1						
Core	1	2	2	3	1.539-1	1	2		3	3	2		
Layered pegmatite													
Lower layer		2	2	2	1.535-1		1	1					
Upper layer		3	1	1	1.535-1			1	1				
Pegmatites which change along strike	2	3	2	1				2	2		1		1.574-1

Table 11.--The number of refractive index determinations of plagioclase and beryl, their relation to different types of country rock, and types of pegmatites or units.--Continued

Country rock and type of unit	Lowest refractive index on cleavage plates of plagioclase					Highest refractive index on cleavage plates of beryl							
	1.528	1.529	1.530	1.531	Other	1.575	1.576	1.577	1.578	1.579	1.580	1.581	Other
Fine- and coarse-grained granite													
Homogeneous pegmatite		3	1	1			1				1	1	1.583-2 1.584-1
Quartz monzonite													
Zoned pegmatites													
Wall zone					1.537-1						1		
Core					1.532-1 1.535-1				1				
Country rock unknown													
Homogeneous pegmatites			1		1.532-1	1	1						

Table 12.--Refractive indices of plagioclase and beryl from beryl-bearing units of zoned pegmatites

Pegmatite No.	Wall zone: $N_{\alpha 1}$ of plagioclase	Wall zone: N_{ω} of beryl	Intermediate zone: $N_{\alpha 1}$ of plagioclase	Intermediate zone: N_{ω} of beryl	Core: $N_{\alpha 1}$ of plagioclase	Core: N_{ω} of beryl
174	1.529				1.528	1.580
250	1.530	1.580				1.579
279	1.531	1.576			1.529	
289	1.529				1.530	1.578
436	1.529	1.578				1.577
454	1.529				1.529	
455	1.529				1.529	1.578
535	1.534	1.577	1.529	1.580		
847	1.533			1.576	1.539	1.579
989	1.530				1.529	1.580
1002	1.531				1.530	1.578
1025	1.529				1.531	1.578
1044	1.529				1.530	1.575
1202	1.530				1.530	1.578
1402	1.537		(1) 1.532 (2) 1.535	1.578		
1574			(1) 1.528 (2) 1.530	1.579	1.528	1.582

Refractive indices of beryl and plagioclase from layered pegmatites have not been published. Table 13 gives the refractive indices of these two minerals in 12 two-layered pegmatites. These pegmatites contain an upper layer of perthite-rich rock and a lower layer of albite-rich rock. Most of the beryl is found in the coarser-grained upper layer; in two pegmatites it occurs in both layers. In these two pegmatites the beryl showed essentially no change in refractive index between units.

Beryl is associated with plagioclase, quartz, perthite, muscovite, garnet, lepidolite, tourmaline, topaz, microlite, tantalite, monazite, gahnite, and biotite. Beryl is not associated with any one of these pegmatite minerals to the exclusion of the others. It has not, however, been found in graphic granite pegmatite. Beryl usually is in clusters or groups of crystals; in many pegmatites only three or four closely spaced crystals are found. In pegmatite No. 279, 35 crystals of beryl were found in an area about 2 feet square. This was the only beryl noted, although this branching pegmatite exceeds 720 feet in length. Many other pegmatites have a similarly spotty distribution of beryl.

Table 13.—Refractive indices of plagioclase and beryl from beryl-bearing layered pegmatites

Pegmatite No.	Lower layer		Upper layer	
	N_{α_1} of plagioclase	N_ω of beryl	N_{α_1} of plagioclase	N_ω of beryl
270	1.530		1.528	
417	1.529	1.577	1.530	1.577
432	1.530		1.529	1.576
433	1.530		1.530	1.577
435	1.529		1.529	1.575
462	1.529		1.529	1.578
548	1.529		1.529	1.576
778	1.535		1.535	
985	1.530	1.578	1.530	1.577
1004	1.529		1.529	
1105	1.530	1.579	1.531	
1172	1.531		1.529	

Tourmaline

Tourmaline is relatively rare in the Quartz Creek district, and has been found in only 48 of the 1,803 pegmatites studied. In many pegmatite areas tourmaline is present in most pegmatites, but the Quartz Creek district is distinctive for its lack of tourmaline and the low boron content of its pegmatites. Except in the lithium-bearing pegmatites, only a few grains occur in each pegmatite. Some units in the lithium-bearing pegmatites contain as much as 3 percent tourmaline.

The tourmaline is black, dark green, blue, light green, and pink. The green, blue, and pink varieties are found only in the lepidolite-bearing pegmatites; the black variety occurs in both lepidolite- and non-lepidolite-bearing pegmatites. Of the 48 tourmaline-bearing pegmatites 38 contain only the black variety. It occurs in subhedral to anhedral crystals; commonly the m($10\bar{1}0$) and a($11\bar{2}0$) prism faces are the only faces developed. In many places it is in small pods of coarse-grained quartz or quartz-perthite pegmatite in an otherwise homogeneous body. Black tourmaline has been found associated with quartz, perthite, albite, muscovite, beryl, garnet, cleavelandite, biotite, monazite, columbite-tantalite, and gahnite, but not with lepidolite and topaz.

The black tourmaline was found only in outer zones, completely free of lepidolite; in many zones it is restricted to the extreme hanging-wall or footwall part. Dark-green tourmaline was found either in zones containing lepidolite or the adjacent zones. It is common in the outer part of lepidolite-bearing units and the inner part of the adjacent unit. It is nowhere in contact with lepidolite, but occurs in the cleavelandite-quartz part of the zones. Pink and pale-green tourmaline occur adjacent to lepidolite in lepidolite-bearing units. These two varieties of tourmaline commonly occur together; the pink variety is more abundant. In the Brown Derby No. 1 pegmatite (No. 452) these varieties are together as "watermelon" tourmaline, in crystals which have a pink core and light-green rim. The dark blue variety of tourmaline is not present as individual crystals, but forms massive wavy bands in lepidolite-bearing pegmatites where it occurs in part with the black tourmaline and in part with the dark-green tourmaline. There is commonly a thin band of small garnets in the center of the blue bands. Figure 15, a sketch of part of pegmatite No. 453, shows the relation of various colored tourmalines to the pegmatite units.

The indices of refraction vary as well as the color. Table 14 gives the higher refractive index (N_{ω}) of 19 tourmaline specimens; eleven are of black tourmaline and range from 1.652 to 1.664. The two specimens with the lowest refractive indices are from the outer edges of lithium-bearing pegmatites. Three dark-green tourmaline specimens have refractive indices of 1.646 and 1.647, all lower than black tourmaline. The black variety grades into the dark-green variety and it is to be expected that, if enough determinations of indices were made, a gradational series would be formed, with the green varieties having the lower refractive indices. Two pink tourmaline specimens from different pegmatites have refractive indices (N_ω) of 1.643 and 1.637. A pale-green tourmaline and a pink tourmaline from adjacent areas in pegmatite No. 452 have a refractive index for the slow ray of 1.637; the pink core and the pale-green rim of a "watermelon" tourmaline had a refractive index for the slow ray of 1.634. The pale-green and pink varieties appear to vary in composition and variation can not be correlated with color. The different colors may be caused by either the presence of a minor element that does not affect the refractive indices, oxidation or reduction of an element in different states of oxidation, or to a slight rearrangement of the molecular structure of tourmaline. The sequence from black tourmaline on the outer parts of lepidolite-bearing pegmatites to pale-green and pink tourmaline in the lepidolite-bearing part can be correlated with a progressive change in refractive indices, but the pale-green and pink crystals which grew together in the same environment without detectable changes in index can not.

Table 14.--Refractive index (N_ω) of tourmaline, Quartz Creek district

Pegmatite No.	Pegmatite Name	Color	N
205		Black	1.657
215	Opportunity No. 1	Black	1.652
231		Black	1.657
251		Black	1.657
306	Opportunity No. 4	Black	1.655
311		Black	1.663
1238		Black	1.657
1238		Black	1.659
1278		Black	1.6555
1322		Black	1.664
1607		Black	1.664
215	Opportunity No. 1	Dark Green	1.646
306	Opportunity No. 4	Dark Green	1.647
306	Opportunity No. 4	Dark Green	1.646
306	Opportunity No. 4	Pink	1.643
452	Brown Derby No. 1	Pink	1.637
452	Brown Derby No. 1	Pale Green	1.637
452	Brown Derby No. 1	(Pale Green rim) (Pink center)	1.634

Early work has shown that change in color in tourmaline commonly varied with the density of the crystals _/, the axial ratio a:c _/, and the re-

_/ D'Achiardi, A., Mineralogia della Toscana, Pisa, 1872.
_/ D'Achiardi, G., Le tourmaline del graniteo elbano: Atti della soc. Toscana di Scienze Naturali, Memorii 15, 1896.

fractive indices. Color also was shown to vary with the chemical composition by more recent spectrographic work _/; Carobbi and Pieruccini _/ con-

_/ Warner, T. W., Spectrographic analysis of tourmalines with correlation of color and composition: Am. Mineralogist, vol. 20, pp. 531-536, 1935.
_/ Carobbi, G., and Pieruccini, R., Spectrographic analysis of tourmalines from the island of Elba with correlation of color and composition: Am. Mineralogist, vol. 32, pp. 121-130, 1947.

clude from their studies that the pink color is caused by manganese with lithium and cesium. In the Quartz Creek district, manganese is present in most units but appears to be concentrated in the outer zones as indicated by the higher concentration of garnets. The presence of manganese in a unit does not insure that the tourmaline will be pink, though the pink variety usually is high in manganese. Shainin _/ had spectrographic analyses made

_/ Shainin, V. E., Unpublished analyses of tourmaline from Newry-Rumford area, Maine.

of the minor base elements in four tourmaline specimens (table 15). These analyses show that the greatest amount of manganese (0.5 percent) occurs in a pink specimen and that all specimens contain manganese but that another pink specimen contains no more manganese than the green and blue specimens.

Table 15.—Spectrographic determination of minor elements in tourmaline from Maine 1/

Color	Mn	Ti	Ga	Sn	Pb	Zn
Deep blue	.2	.01	.02	.01	<.001	.5
Green	.2	.005	.02	.05	.02	.1
Pink	.5	<.001	.02	.01	—	.2
Deep pink	.2	<.001	.01	.05	.05	.02

1/ Analysis made in the Investigations Section of the Geochemistry and Petrology Branch of the U. S. Geological Survey for Vincent Shainin. Janet Fletcher, Analyst.

Lithium and cesium are both more abundant in the lepidolite units, lithium is a major component and cesium a minor component. Stevens _/ in an

_/ Stevens, R. E., New analyses of lepidolites and their interpretation: Am. Mineralogist, vol. 23, p. 615, 1938.

article on lepidolites gives the analyses of 17 lepidolites from widely scattered districts in which Cs_2O ranged from 0 to 0.67 percent; the average was 0.23 percent. These analyses show that cesium is concentrated in appreciable amounts with the lithia, and that the two are comparatively abundant in those parts of the pegmatite where the pink and pale-green varieties of tourmaline occur. The coloring elements are difficult to determine because of the large number that are present in minor amounts in tourmaline. Tourmaline acts as a scavenger and takes into its structure small quantities of a great variety of elements.

A list compiled from the spectrographic work of Shainin _/, de Azcona _/,

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_/ Shainin, V. E., Unpublished analyses from Newry-Rumford area, Maine.

_/ de Azcona, J. M. L., Is there lead of radioactive origin in tourmaline: Report of the Committee on the Measurement of Geologic Time 1943-1944-1945-1946, p. 61, 1947.

Carobbi and Pieruccini _/, and Warner _/ includes the following 30 elements

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_/ Carobbi, G., and Pieruccini, R., op. cit., p. 123, 1947.

_/ Warner, T. W., op. cit., p. 535, 1935.

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found in tourmaline: B, Si, Al, Ti, Fe, Ni, Mg, Mn, Cu, Ca, Na, K, Ba, Li, Sr, Cs, Be, V, Ta, Sc, Sn, Ce, Ga, Pb, Zn, Cr, Co, Se, Ag, and Sb. Some of these elements are reported in tourmaline from only one area, while others are almost universal. The presence of some of these elements depends on whether or not they were available in the pegmatitic liquid at the time the tourmaline was formed.

Many elements appear to have little or no effect on the color of tourmaline as they are present in some colored tourmalines and absent in others. Other elements may be responsible for a change in color only when found together with some other elements.

In résumé, all tourmalines in the Quartz Creek district other than the black variety are in the lepidolite-bearing pegmatites. There is a gradual color change from black through blue and dark green to pink and light green paralleled by a change in refractive indices as the lepidolite-bearing parts of the pegmatite are approached. Changes in the concentration of a group of alkalies, such as lithia, cesia, and probably others parallel the changes in color of the tourmalines. The amount of alkalies probably is responsible for the color change and these elements probably have a greater affinity for the tourmaline structure than many metallic elements. Iron and manganese are usually equally available in most pegmatite units. When iron is allowed into the structure it helps to darken the mineral to black or dark green, but the development of the lighter shades demands the presence of lithia and other alkalies. The various shades of green and blue are probably caused by the presence of various other elements.

Columbite-tantalite

Columbite-tantalite has been found in 29 pegmatites of the Quartz Creek district. It occurs in homogeneous pegmatites; wall zone, intermediate zone, and core of zoned pegmatites; layered pegmatites; and in parts of pegmatite which show variation along strike. These columbite-tantalite-bearing pegmatites are widely scattered over the entire district. Columbite-tantalite is found in only a few crystals in most pegmatite units except in pegmatites No. 1234 and No. 452 (Brown Derby No. 1). In the latter pegmatite it makes up 1.4 percent of the rock in a small unit about 20 feet long and 1 foot wide.

In the Quartz Creek district the columbite-tantalite is black with a dull to lustrous surface. It has a black to brown streak. The tabular crystals range from the thickness of a sheet of paper to 1 inch and are from a fraction of an inch to 4 inches long. The crystals are usually subhedral to euhedral with the brachipinacoid, b(010), forming the tabular faces present in most specimens. Other faces which were noted on some of the columbite-tantalite crystals are: a(100), d(110), g(130), k(011), and u(111).

The columbite-tantalite, $(Fe,Mn)(Cb,Ta)_2O_6$, series is one of complete gradation between iron and manganese, and columbium and tantalum. Members of this series are divided on purely arbitrary standards with the columbite consisting of that part of the series where columbium exceeded tantalum in amount, and the tantalite part of the series where tantalum is in excess. A secondary division is made in these two main divisions by naming the mineral ferrocolumbite or ferrotantalite if the ratio of iron to manganese is greater than 3:1, and manganocolumbite or manganotantalite if the ratio of manganese to iron is in excess of 3:1. The specific gravity, the streak _/, and prob-

_/ De Almeida, S. C., Johnston, W. D., Leonardos, O. H., and Scorza, E. P., The beryl-tantalite-cassiterite pegmatites of Paraiba and Rio Grande do Norte, Northeastern Brazil: Econ. Geology, vol. 39, p. 218, 1944.

ably certain other physical properties vary with the columbium and tantalum content. Because chemical analysis of these two elements is expensive, the approximate composition is obtained by specific gravity determinations and reference to charts that related the specific gravity to the columbium-tantalum ratio. The ratio of iron to manganese has only a minor effect on the change of gravity, and the higher the specific gravity the higher the tantalum content. Table 16 gives the specific gravity of 8 specimens from the Quartz Creek district as determined on a Jolly balance. These specimens range from an almost pure manganocolumbite (specific gravity 5.0 and 5.1) to a columbium-rich tantalite (specific gravity of 6.7). As only the latter specimen falls in the tantalite field, this district appears to be one that contains columbite almost to the exclusion of tantalite. Hanley _/ gives the

_/ Hanley, J. B., et al., op. cit., p. 71, 1950.

specific gravity of a piece of columbite-tantalite from pegmatite No. 452 (Brown Derby No. 1 claim) as 5.61 and the chemical composition of 72 percent Cb_2O_5 and 6 percent Ta_2O_5.

The specimen on which the chemical work was done was collected by Eckel _/,

_/ Eckel, E. B., op. cit., p. 244, 1933.

and was a different specimen from a different pegmatite unit from the Hanley specimen. Because the columbium-tantalum ratio commonly varies from zone to zone and evidently does on the two specimens used, the agreement is not good between the composition obtained from the specific gravity and that given by Eckel.

Table 16.--Measurements of specific gravity on columbite-tantalite

Pegmatite Number	Internal Unit	Specific gravity
205	Core	6.1
205	Core	6.3
245	Core	5.7
452	Layer	5.8
1234	Wall zone	5.0
1234	Wall zone	5.1
1557	Core	6.7
1574	Intermediate zone	6.0

Columbite-tantalite is found in direct contact with the following minerals in one or more pegmatites: quartz, albite, perthite, beryl, muscovite, monazite, biotite, tourmaline, and gahnite. It also has been found in the same zones, but not in direct contact with: garnet, topaz, microlite, martite, and lepidolite. Though it is associated with almost all the pegmatite minerals, there are three associations which are most common in the Quartz Creek district: (1) with massive quartz, (2) with cleavelandite or cleavelandite and quartz, and (3) with feldspar (either perthite or plagioclase) and monazite. That its association with monazite is not pure happenstance can be seen in that 9 of the 24 monazite-bearing pegmatites, or 37 percent, contain columbite-tantalite (fig. 19).

Monazite

Monazite, $(Ce,La,Nd,Pr)PO_4$, is found in 24, or approximately 1.5 percent of the pegmatites. It occurs in homogeneous pegmatites; cores, pods, and intermediate zones in zoned pegmatites; and in layered pegmatites. In three pegmatites, namely the Brown Derby No. 1 (No. 452), the Black Wonder (No. 847), and the Bucky (No. 1574), monazite is found in more than a half-dozen crystals. A unit 20 feet long and 1 foot wide at the Brown Derby No. 1, pegmatite No. 452, contains aporoximately 2.2 percent. Of two localities in the Black Wonder pegmatite (No. 847), one is worth special attention in that it contains 0.05 percent monazite in an intermediate zone of plagioclase-muscovite-quartz pegmatite surrounding a quartz pod. This intermediate zone is about 4 feet thick, and the quartz pod is approximately 15 feet long and 6 feet wide. In the Bucky pegmatite (No. 1574) the monazite occurs erratically in the mica zone around the quartz core.

Monazite occurs as euhedral, dark-red to clove-brown crystals, that range in size from 0.25 inch long, 0.12 inch wide, and 0.03 inch thick to 2 inches long, 1.5 inches wide, and 0.5 inch thick. Most of the larger specimens come from the Brown Derby No. 1. Crystal forms identified include the a(100), m(110), n(120), v($\bar{1}$11), r(111), x($\bar{1}$01), c(001), and h(305) faces. The crystals are usually flattened parallel to the a(100) face, and some of them are also twinned parallel to this face.

The specific gravity of the monazite varies from 5.0 to 5.6, as determined by the Jolly balance.

Optically, the monazite is colorless to yellow, with high birefringence. The lower index of refraction, (N_α), ranges from 1.78 to 1.80, averaging about 1.79. Table 17 shows that the specific gravity and lower indices (N_α) do not vary with a consistent relationship.

In the Quartz Creek district monazite is associated with quartz, albite, perthite, muscovite, columbite-tantalite, gahnite, biotite, and garnet. It usually is found, however, in a feldspar-rich part of the pegmatite, and commonly produces a red stain in the feldspar immediately adjacent to it. Of the 24 pegmatites containing monazite, 9 also contain columbite-tantalite.

Table 17.—Lower index of refraction (N_α) and the specific gravity of monazite

Pegmatite Number	Internal unit	Index of refraction (N_α)	Specific gravity
452	Pod	1.80	5.3
290	Pod	1.79	5.1
847	Pod	1.78	5.1
847	Intermediate zone	1.78	5.6
997	Footwall layer	1.79	5.3

Lepidolite

Lepidolite is found in 17 pegmatites, comprising homogeneous pegmatites, core, and intermediate zones of zoned pegmatites, interior layers of layered pegmatites and in parts of pegmatites which show variation in composition along strike. Thus, no particular type of pegmatite seems to be favored. In the limited number of zoned pegmatites it appears to be commonest in the central parts.

The lepidolite is white, lilac, or various shades of purple; lilac to purple varieties are most common. It has three forms: (1) fine-grained aggregates with individual sheets less than 0.25 inch in diameter,

(2) large platy books 2 to 10 inches in diameter, and (3) curved concentric books, 0.5 to 2 inches across (pl. X). The large-plate lepidolite is found in 5 of the 17 pegmatites and form a group between the Brown Derby No. 1 dike (No. 452) and the Brown Derby No. 5 dike (No. 535), a maximum distance of 2,200 feet. Only three pegmatites on the Brown Derby No.1 claim (No. 452, 454, and 457) have curved lepidolite. The plate and curved lepidolite are either purple or lilac. An analysis is reported by Stevens _/ on large

_/ Stevens, R. E., New analyses of lepidolites and their interpretation: Am. Mineralogist, vol. 23, p. 615, 1938.

plates of pale-purple lepidolite from Ohio City. The sample probably came from either dikes No. 452, No. 453, or No. 454 (Brown Derby No. 1 claim), as these dikes were the only ones that had been developed at the time containing lepidolite in large plates. The analysis follows:

Li_2O	5.05	MgO	None
SiO_2	49.58	MnO	2.78
Al_2O_3	23.87	TiO_2	0.06
K_2O	10.14	H_2O-	0.51
NaO	0.57	H_2O+	1.22
CaO	None	F	7.49
Rb_2O	1.62		103.19
Cs_2O	0.09	Less O = F	3.15
FeO	0.21 1/		100.04

1/ Total iron reported as FeO.

The formula for this lepidolite as determined from the analysis is $K_4Li_7Al_5.Al_2Si_{15}O_{40}(F,OH)_8$. Hanley _/ reports that the physical and

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah: U. S. Geol. Survey Prof. Paper 227, p. 72, 1950.

optical properties of all the lepidolite from the Brown Derby claim (pegmatites No. 452, No. 453, and No. 454) are similar and the only chemical difference is that the manganese content of the large plates is slightly

Lepidolite from left to right: fine-grained aggregate, curved plates, and large plates.

higher. Winchell _/ in a triangular diagram shows that the median index of

_/ Winchell, A. N., Elements of Optical Mineralogy: Part II, 3d ed., p. 271, 1927.

the lepidolite group of mica increased from the polythionite ($H_2K_2Li_3Al_3Si_8O_{24}$) and lepidolite ($H_4K_2Li_3Al_5Si_6O_{24}$) end members to the protolithionite end member, ($H_4K_2LiFe_4Al_3Si_6O_{24}$). This increase of refractive index is in general paralleled by an increase of iron and a decrease of lithium and can be used to determine the approximate Li_2O content. The median index (N_β) of 14 lepidolite specimens from six different pegmatites (table 18) ranged from 1.555 to 1.578. Six specimens are white, or white with just a tinge of lilac, and these specimens have the highest indices (1.560, 1.564, 1.564, 1.565, 1.575, and 1.578). The two specimens with the 1.575 and the 1.578 median index give a strong qualitative test for iron, and fall well in the range of zinnwaldite rather than true lepidolite. The other four lepidolite specimens with high refractive indices are probably between lepidolite and zinnwaldite in composition. Three specimens of book lepidolite had median indices of 1.557, 1.559, and 1.562 and one specimen of curved lepidolite had a median index of 1.560. These values average only a little higher than the purple lepidolite occurring in fine-grained aggregates and show that the chemical composition of the different forms vary only to a minor extent. The shape and size of lepidolite gives no clue as to its chemical composition or optical properties. The best guide noted was color, with the paler and whiter forms having higher refractive indices and less lithia.

Table 18.—Median refractive index (N_β) and description of lepidolite from Quartz Creek district

Pegmatite No.	Pegmatite Name	$N\beta$	Description
208		1.578	White (1/4-1/8 inch sheets).
215	Opportunity No. 1	1.565	White with lilac tinges elongate (3/4 inch) blades in a radial aggregate
306	Opportunity No. 4	1.557	Lilac, 1/4-1/2 inch sheets
306	Opportunity No. 4	1.558	Purple, fine-grained aggregates (1/32 inch sheets)
306	Opportunity No. 4	1.564	White with lilac tinge (1/4 inch sheets)
452	Brown Derby No. 1	1.557	Purple, fine-grained aggregates (1/16 inch sheets)
452	Brown Derby No. 1	1.555	Purple, fine-grained aggregates (1/8 to 1/4 inch sheets)
452	Brown Derby No. 1	1.559	Lilac, book lepidolite (6-inch sheets)
452	Brown Derby No. 1	1.560	Purple, curved lepidolite (1 to 2 inch curved books)
461		1.562	Purple, book lepidolite (2 inch sheets)
535	Brown Derby No. 5	1.560	Silvery white blades (1/4-1/2 inch sheets)
535	Brown Derby No. 5	1.564	White, fine-grained aggregate (1/16 inch sheets)
535	Brown Derby No. 5	1.557	Lilac book lepidolite (5 inch sheets)
637		1.575	White (in aggregate with 1/8-1/4 inch sheets)

Lepidolite is found in amounts that range from a trace to 95 percent. Only the Brown Derby No. 1 (No. 452) has units containing lepidolite in excess of 10 percent of the rock, the White Spar No. 2 (No. 602) has lepidolite making up 6 to 10 percent of the rock, and all others contained smaller proportions. The units, that contain lepidolite and are commonly lens shaped, are usually small; several are less than 15 feet long. The Brown Derby No. 1 pegmatite (No. 452) contains by far the largest lepidolite body. This unit is 319 feet long.

Lepidolite was associated with the following minerals: cleavelandite, quartz, muscovite, perthite, topaz, beryl, microlite, albite, pink and green tourmaline, columbite-tantalite, and apatite. Cleavelandite, the usual form of albite found with lepidolite, is its commonest associate. In two small pods the lepidolite is white and probably zinnwaldite. Topaz, microlite, and colored tourmaline characterize the lepidolite units and are rarely found outside of them.

Lepidolite in many places grows in compact aggregates with cleavelandite or quartz; these minerals appear to have crystallized simultaneously. In other places, lepidolite veins and cuts cleavelandite, quartz, and perthite. Topaz commonly is surrounded by a rim of lepidolite that may be in part a product of reaction with the remaining liquid. Lepidolite appears to have been deposited late in the course of crystallization because in zoned pegmatites it is confined to the core where it is in part contemporaneous with the quartz and cleavelandite, and in part of later age.

Pyrochlore-microlite

Pyrochlore-microlite is found in 14 pegmatites, all on the east side of Quartz Creek. It does not occur in homogeneous pegmatites, wall zone of zoned pegmatites, or the hanging-wall layer of layered pegmatites; but it is found in the intermediate zone and cores of zoned pegmatites, interior and lower layer of layered pegmatites, and units of pegmatites which change in composition along strike. The most favorable place is the core of zoned pegmatites, as 7 of the 14 pegmatites that contain pyrochlore-microlite occur in this unit. Pyrochlore-microlite commonly occurs in a few scattered crystals, except in pegmatite No. 217 (Opportunity No. 1 claim) and pegmatite No. 452 (Brown Derby No. 1). In pegmatite No. 217 it occurs in concentrations of 10 or 12 crystals in cleavelandite and quartz, whereas pegmatite No. 452 contains 0.35 percent microlite _/ in a central lepidolite

_/ Hanley, J. B., et al., op. cit., p. 73, 1950.

unit.

Pyrochlore-microlite is light yellow, light greenish yellow, olive green, light brown, or dark brown. The crystals are from 0.01 to 0.4 inch in diameter. In massive fine-grained lepidolite the crystals are anhedral, but in quartz and cleavelandite they are euhedral with well-developed to distorted octahedrons, o(111), and modified dodecahedrons, d(110).

Pyrochlore is essentially $NaCaCb_2O_6F$, and microlite is essentially $(Na, Ca)_2\ Ta_2O_6(O, OH, F)$. The two species form an isomorphous series with the columbium-rich members called pyrochlore and the tantalum-rich members microlite. Besides the elements given in the above formulas, oxides of some of the following elements may comprise several percent of the mineral: K, Mg, Fe, Mn, Sb, Ce, La, Di, Er, Y, Th, Zr, U, Ti, Sn, and W.

Considerable work has been done on the microlite from the Brown Derby No. 1 (pegmatite No. 452), especially during World War II, when it was mined along with the lepidolite. An analysis of microlite from this pegmatite by J. G. Fairchild has been previously reported _/ and is given below:

_/ Eckel, E. B., and Lovering, T. S., Work of Eckel, Lovering, Fairchild, Microlite from Ohio City, Colorado: Report of the Committee on the Measurement of Geologic Time, pp. 78-79, 1935.

Ta_2O_5	68.47	BeO	none
Cb_2O_5	4.45	P_2O_5	none
TiO_2	.10	CaO	9.19
SnO_2	.95	MgO	.04
UO_2	1.69	PbO	.40
UO_3	2.40	Na_2O	2.94
ThO_2 + rare earths	none	K_2O	.25
Al_2O_3	.10	F	1.51
Fe_2O_3	1.91	Cl	none
MnO	.11	Insol. + SiO_2	.92
ZnO	none	H_2O	2.84
CuO	.04		98.41
Bi_2O_3	.07	Less O = F	.64
As_2O_5	trace(?)		97.77

The specific gravity of this material is 5.604, and its index of refraction, as determined by J. J. Glass of the Geological Survey, is close to 1.93. This analysis indicates that the mineral is microlite having a high ratio of tantalum to columbium. As would be suspected from the uranium content this mineral is highly radioactive and can be easily detected with a Geiger-Mueller counter.

The material from the Brown Derby No. 1 pegmatite (No. 452) is dark brown to light brown. An olive-green specimen from the Brown Derby No. 5 pegmatite (No. 535) was analyzed spectrographically, and it was found that the tantalum was more abundant than the columbium. This specimen is also on the microlite side of the series. It gave a positive test with the Geiger-Mueller counter, but not as strong as that given by the dark-brown variety.

One light-greenish-yellow specimen from pegmatite No. 461 gives no reaction to the Geiger-Mueller counter. The dark color of the pyrochlore-microlite may be caused by the radioactivity of the uranium, as are the brown halos surrounding the dark pyrochlore-microlite in the lepidolite.

Similar observations were made by Adams _/ at the Harding mine near

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_/ Adams, J. W., Personal communication.

Dixon, N. Mex., where he found that light microlite was not radioactive but dark microlite was.

Pyrochlore-microlite is associated in the Quartz Creek district with: cleavelandite, lepidolite, quartz, and muscovite. The two types of occurrences are: (1) with massive fine-grained lepidolite, and (2) with cleavelandite and smoky quartz. In eight pegmatites it occurs in lepidolite and in six in cleavelandite and quartz. In most places, where it occurs in lepidolite, cleavelandite is present in minor amounts; where it occurs in cleavelandite, lepidolite is a minor constituent. Lepidolite is present in 12 out of the 14 pyrochlore-microlite-bearing units, and cleavelandite in 13. The occurrence of pyrochlore-microlite with either lepidolite, cleavelandite, or both, is common in pegmatites in other areas. It occurs with lepidolite and cleavelandite at the Bob Ingersoll mine, Penfield County, S. Dak., with cleavelandite and lepidolite at the Tin Mountain mine, Custer County, S. Dak., with cleavelandite and a lithium mica in the Harding mine, near Dixon, N. Mex. _/, with cleavelandite at the

_/ Adams, J. W., Personal communication.

Rutherford and Morefield mines, near Amelia, Va. _/, and with lepidolite

_/ Glass, J. J., The pegmatite minerals from near Amelia, Virginia: Am. Mineralogist, vol. 20, p. 753, 1935.

and albite (type not defined) from a pegmatite at Topsham, Maine _/.

_/ Palache, C., and Gonyer, F. A., Microlite and stibiotantalite from Topsham, Maine: Am. Mineralogist, vol. 25, p. 412, 1940.

Topaz

Topaz is relatively rare in pegmatites and the pegmatites of many districts do not contain this mineral. The Quartz Creek district contains eight topaz-bearing pegmatites, which is less than half of a percent of all pegmatites mapped.

The topaz is milky white, though some has a greenish stain on the outside. The crystals are subhedral to euhedral and are predominantly long tapering prismatic crystals. They are usually 4 to 8 inches in diameter and a foot or two in length, but specimens have been found which attained 12 inches in diameter and 4 feet in length. The prism faces, m(110), and the pyramid faces, i(223), are the best developed. The basal pinacoid, c(001), was noted on a few specimens, and probably other faces could be found with continued study. Basal cleavage is well developed on most specimens. The lower index of refraction (N_α) was determined to range from 1.616 to 1.618 (table 19) on four topaz specimens from three different pegmatites. Winchell _/ and Pardee, Glass, and Stevens _/ have shown that the indices

_/ Winchell, A. N., Elements of Optical Mineralogy: Part II, p. 199, 1947.

_/ Pardee, J. T., Glass, J. J., and Stevens, R. E., Massive low-fluorine topaz from the Brewer mine, South Carolina: Am. Mineralogist, vol. 22, pp. 1063-1064, 1937.

of topaz increase with the increase of water content and decrease of the fluorine content. The indices of topaz in the Quartz Creek district show that there is a uniform water and fluorine content, and by interpolating from a table given by Winchell _/ that they contain between 17.0 and 18.5

_/ Winchell, A. N., op. cit., p. 199, 1947.

percent fluorine and 0.9 to 1.5 percent water.

Table 19.--Lower index of refraction (N_α) of topaz from the Quartz Creek district

Pegmatite Number	Pegmatite Name	N_α
215	Opportunity No. 1	1.616
452	Brown Derby No. 1	1.617
452	Brown Derby No. 1	1.618
1574	Bucky	1.616

Topaz is found only in lepidolite-bearing pegmatites and is directly associated with the following minerals in one or more pegmatites: lepidolite, cleavelandite, quartz, muscovite, beryl, perthite, and tourmaline. It is always found with the first three minerals. Purple lepidolite commonly forms a coating around topaz. Its association with lepidolite would be expected as this mineral also contains fluorine in its chemical composition. Stevens _/ made analyses on 17 different lepidolite specimens and

_/ Stevens, R. E., New analyses of lepidolites and their interpretation: Am. Mineralogist, vol. 23, p. 615, 1938.

found the fluorine content ranges from 4.09 to 9.19 percent, the average is 7.03 percent. On the Opportunity No. 1 claim, pegmatite No. 215, some of the topaz has a thin pale-green micaceous coating of polylithionite. This specimen of polylithionite is biaxial negative and has N_β = 1.558 and N_γ = 1.565. Both polylithionite and lepidolite appear to form as a product of reaction between the early-formed topaz crystals and the residual liquid, and corrode the surface of the topaz crystals in some places. The topaz always occurs with the lepidolite, as the fluorine evidently comes off from the original magma at the same time as the lithium. Thus, in a pegmatite district in which both topaz and lithium minerals are present they should be associated. Less than 0.5 percent of the pegmatites of the Quartz Creek district contain topaz, yet almost 50 percent of the lepidolite-bearing pegmatites have topaz, and all of the topaz-bearing pegmatites contain lepidolite.

Gahnite

Gahnite, the zinc spinel, is a rare mineral found in only eight pegmatites. It occurs in homogeneous pegmatites, in intermediate zones and cores of zoned pegmatites, and in layered pegmatites.

Gahnite is greenish black to dark green, and occurs in anhedral masses. The crystals are from 0.03 to 0.75 inch in diameter. The mineral is green, isotropic, and has an index of refraction of 1.81 ± 0.005.

Gahnite does not appear to have any favored mineral association . In pegmatite No. 1540 it is found with massive quartz, and muscovite, in pegmatite No. 1574 with albite, quartz, muscovite, and beryl, and in pegmatite No. 452 with albite columbite-tantalite, monazite, tourmaline, garnet, biotite, and quartz. The pegmatites containing this mineral are widely scattered and its presence depends upon the availability of zinc in the pegmatitic liquid.

Gahnite is rare or absent in most pegmatite districts, but has been reported from the Tims Hill deposit in Connecticut _/.

_/ Foye, W. G., Mineral localities in the vicinity of Middletown, Connecticut: Am. Mineralogist, vol. 7, p. 9, 1922.

Allanite

Allanite is rare in the Quartz Creek district. In the Black Wonder (No. 847) it occurs in several pods, a few feet thick and about 10 feet long. This pegmatite is over 6,700 feet wide and 12,600 feet long and the pods represent only a minute fraction of the total pegmatite. The pods are quartz (about 90 percent) and albite. A few scattered crystals of allanite occur in smoky quartz.

The allanite is in prismatic crystals, with a square cross section, as much as 0.5 inch across and 2 inches long. The mineral is black, has a shiny lustre, and is ringed by a reddish-brown decomposition product. At least three different substances are observed under the microscope. One is isotropic, reddish brown in color, and has a refractive index a little less than 1.62; the second is anistropic and colorless; and the third is isotropic and grayish green. These observations are in agreement with those of Hitchens who describes the allanite from Fitchburg, Mass. _/

_/ Hitchens, C. S., The pegmatites of Fitchburg, Massachusetts: Am. Mineralogist, vol. 20, p. 18, 1935.

Unidentified mineral

An unidentified shiny greenish-black mineral, believed to be a new species, was found at the Bucky pegmatite (No. 1574). This mineral occurs in scattered pockets in the mica zone. A total of 17 pounds was collected during the mining operation. This mineral is associated with muscovite, altered feldspars, quartz, monazite, and columbite-tantalite. It appears to be most closely associated and in places intergrown with columbite-tantalite.

The mineral has a conchoidal fracture, and superficially resembles samarskite, fergusonite, or euxenite. A powder X-ray film was compared with the files of known minerals in the X-ray libraries of the Geological Survey and Columbia University with negative results. A spectrographic analysis made by A. T. Meyers in the Geological Survey Trace Elements

Section Washington Laboratory indicates with the order of magnitude of concentration, the following components:

Cb_2O_5	X0.0	Y_2O_3	.X
Ta_2O_5	X.0	SnO_2	.X
U_3O_8	X.0	La_2O_3	Traces
ThO_2	.X	TiO_2	.X
MnO	.X	PbO	.X
Fe_2O_3	.X	Sb_2O_3	.0X
CaO	.X	MgO	Trace
ZrO_2	.X		

Looked for but not found: Na, Bi, W, and P.

A determination of equivalent uranium made by measuring the radiation from uranium and thorium, gave a value of 11 to 12 percent which would show that the X.0 given for U_3O_8 would be nearly 10 percent. Like many other radioactive columbo-tantalates this mineral is metamict.

This mineral, in thin section, is pale yellow, isotropic, and has an index of refraction of 1.80 ± 0.05.

The mineral has a specific gravity of 3.8, and some of it contains small cavities lined with a fine-grained yellow material.

Other minerals

Finely-grained chlorite occurs in nine small pegmatites in the Quartz Creek district. It comprises several percent of these small pegmatites. The grain size is from 0.03 to 0.06 inch. Chlorite is found in fine-grained albite-rich pegmatites and is in part an alteration product of biotite.

Samarskite, or a similar mineral, such as euxenite, is present in seven pegmatites. Only one or two crystals of this mineral, 0.03 to 0.5 inch long, are found in each pegmatite. It has refractive indices above 1.83 and in feldspar is surrounded by a reddish halo. This mineral is commonly associated with smoky quartz, and is strongly radioactive.

Epidote occurs in three pegmatites as fine-green veinlets, and was introduced into the pegmatite after its solidification.

Light-blue apatite, as crystals 0.25 to 0.5 inch across, occurs in three pegmatites. In most pegmatite districts apatite is very common, but in the Quartz Creek district it is very rare.

Light purple fluorite is found in two pegmatites as grains about 0.06 inch in size. It is extremely rare.

Spodumene and amblygonite occur only in the Bazooka pegmatite (No. 424) in a circular core unit 20 feet in diameter. Spodumene in white lathlike crystals is found on the small dump. No amblygonite was found by the writer, but was observed by Hanley _/.

_/ Hanley, J. B., et al. op. cit., pp. 66-68, 1950.

Phosphates of the lithiophilite—triphylite series and their alteration products are found in the Bucky pegmatite (No. 1574). Two crystals were noted in the mica zone and one crystal was found in perthite-quartz pegmatite adjacent to a subsidiary core segment, approximately 2,500 feet to the southeast.

Betafite is reported by Hanley _/ associated with monazite, gahnite,

_/ Hanley, J. B., et al., op. cit., p. 71, 1950.

and columbite-tantalite in the Brown Derby No. 1 pegmatite (No. 452). It was not observed by the writer and is probably very rare.

Alteration of wall rocks

The alteration of wall rock by the introduction of pegmatitic materials is common in many districts. Jahns _/ describes impregnation of quartzite

_/ Jahns, R. H., Mica deposits of the Petaca district, Rio Arriba County, New Mexico: N. Mex. Bur. Mines Bull. 25, pp. 52-54, 1946.

and mica schists in the Petaca district by muscovite, microcline, and plagioclase to the extent that the contact between some of the pegmatites and the country rock is gradational. The formation of muscovite and tourmaline in the country rock adjacent to the pegmatites in New England has been briefly mentioned _/. Numerous pegmatites in the Black Hills of South Dakota show

_/ Cameron, E. N., Larrabee, D. M., Page, J. J., Stewart, G. W., and Shainin, V. E., Pegmatite investigations in Maine, New Hampshire, and Connecticut, 1942-1945: U. S. Geol. Survey Prof. Paper. (In preparation.)

abundant alteration at the wall rock-pegmatite contact _/. The Helen

_/ Page, L. R., et al, op. cit. (In preparation).

Beryl pegmatite in Custer County has patches of granulite along its sides from a few inches to 6 feet thick. The granulite varies in composition from place to place and consists of quartz (30 to 70 percent), muscovite (5 to 30 percent), biotite (2 to 15 percent), and minor quantities of tourmaline and apatite. The Elkhorn pegmatite, also in Custer County, has intensely tourmalized the quartz-mica schist on the hanging-wall side of the pegmatite.

In the Quartz Creek district, however, there has been practically no alteration of the country rock adjacent to the pegmatite. The only noticeable alteration was of hornblende gneiss, which appeared slightly more friable adjacent to the contact. The three main types of country rock, hornblende gneiss and tonalite, granite, and quartz monzonite, are equally free of alteration.

Alteration of the country rock might not be expected in the granite and quartz monzonite, as both rocks contain essentially the same minerals as the pegmatites. On the other hand, the hornblende gneiss and tonalite are markedly different in chemical composition from the pegmatites. Similar hornblende rocks in other districts have been intensely altered. Jahns _/

_/ Jahns, R. H., op. cit., p. 54, 1946.

in his description of the Petaca district states, "where amphibole schist lies against pegmatite, as in the Green Peak deposit, it has been converted to a dense aggregate of biotite flakes". McLaughlin _/ in a paper on the

_/ McLaughlin, T. G., Pegmatites of the Bridger Mountains, Wyoming: Am. Mineralogist, vol. 25, p. 53, 1940.

pegmatites of the Bridger Mountains, Wyo., states that all the older pegmatite dikes are accompanied by alteration on the hanging-wall side of the dike, where the percentage of hornblende in the original hornblende schist was greatly reduced and quartz became the predominant mineral.

The type of country rock may affect the kind or amount of alteration, but the type of country rock does not appear to be the prime controlling factor. The only difference between the pegmatites of the Quartz Creek district and those of many other districts that have widespread alteration along pegmatite contacts, is in the composition of the original pegmatite liquid. Tourmaline, apatite, and muscovite are some of the commonest minerals formed in the zone of alteration. Both tourmaline and apatite are among the commoner minerals in most pegmatite districts and may occur in almost every pegmatite; but in the Quartz Creek district tourmaline is a minor constituent of 48 out of 1,803 pegmatites and apatite is found in two. Tourmaline is the only boron mineral found; but phosphorous occurs in apatite, in lithiophilite—triphylite in one pegmatite, in amblygonite in another, and in monazite in twenty-three. Muscovite, though common in the number of occurrences, is small in amount as compared to many other areas.

These facts indicate that the original pegmatitic magma contained little B, P, and OH, and possibly other volatiles. Alteration of the wall rock is dependent upon solutions derived from the cooling pegmatite; therefore, this deficiency of water and other volatiles is a determining factor in adding new minerals to wall rocks.

The lack of alteration in the Quartz Creek district appears to be caused by the insufficient concentrations of the elements needed to form alteration minerals, though they were available in the pegmatite magma to form rare minerals in the pegmatite during all stages of crystallization.

Distribution of minerals

Some pegmatite districts are important as a source of lepidolite, sheet mica, columbite-tantalite, beryl, or other pegmatite minerals. The granitic pegmatites of most districts consist essentially of perthite, plagioclase, quartz, and muscovite, but not all pegmatite districts have the same assemblage of minor minerals. It is this assemblage of minor minerals and variants of common minerals, such as curved muscovite and colored tourmaline, that indicate the differences in the overall composition in the original source magmas of each district.

Not only do the less common minerals vary from district to district, but from pegmatite to pegmatite. During World War II the U. S. Geological Survey was studying pegmatites that produced critically needed materials and pegmatites were grouped simply according to minerals of economic interest. It was recognized by many investigators that a certain type of mineral would occur in certain groups of pegmatites, that is, the lithium-bearing pegmatites of a district would not be scattered haphazardly throughout an area but would occur in a cluster or groups throughout a district. This grouping of mineralogically similar pegmatites is illustrated in the Black Hills of South Dakota where such well-known lithium producing pegmatites as the

Etta, Peerless, Hugo, and Edison, are all in one group; and the Helen Beryl, Helen Beryl No. 2, and Tin Mountain, in another.

The areal mapping on which this report is based afforded an excellent opportunity to study the distribution of minerals in a medium-sized pegmatite district. A series of maps, (figs. 16, 17, 18, 19, and 20), show the distribution of beryl, tourmaline, curved muscovite, biotite, magnetite, monazite, columbite-tantalite, cleavelandite, topaz, lepidolite, and microlite throughout the Quartz Creek district. Some minerals such as flat muscovite, and garnet are too widespread to be significant, whereas others like chlorite, amblygonite, and spodumene, are too rare to be of use statistically. Each pegmatite that contains at least one crystal of a particular mineral is indicated on the map as a bearer of that mineral. This scheme of representation has the serious defect in that large pegmatites appear to have a greater quantity of the mineral than do the smaller pegmatites. For example, the Black Wonder pegmatite (12,600 feet long by 6,700 feet wide), contains only a few crystals of beryl in two small pockets, yet it appears on the map to be a large beryl-bearing area. Two facts are emphasized by these maps: (1) the relation of distribution of certain minerals to all the pegmatites in the district, and (2) the constant association of two or more minerals. The associated minerals are grouped on the same figure.

Two hundred and thirty-two beryl-bearing pegmatites are shown in figure 16. The group of beryl-bearing pegmatites in the northwestern corner of the area mapped has a northeastwardly trend; a second group extends northeast from near Opportunity claims in the southwest part of the area mapped; a third group extends from Wood Gulch northwest to the Brown Derby mine; a fourth small group occurs in the vicinity of the Buckhorn mine on the eastern edge of the district; and a fifth small group is around the Bucky mine in the northeast corner of the district. There are scattered beryl-bearing pegmatites, including the Black Wonder, in the north-central part of the area mapped, which actually contain a little beryl.

Figure 17 shows the location of the groups of tourmaline- and curved muscovite-bearing pegmatites. Tourmaline is most abundant in an area near the Opportunity claims on the southwestern edge of the district, in the vicinity of the Brown Derby No. 1 pegmatite, and adjacent to the quartz monzonite in a small area along the northern edge of the map. Curved muscovite is found only in the northwestern slope of Wood Gulch. It is surprising that these relatively rare minerals are grouped so closely in the hundreds of pegmatites mapped.

Magnetite and biotite are found in 422 and 357 pegmatites, respectively. Almost every pegmatite in the northern part of the area (fig. 18) contains these two minerals, but in the southern part these minerals appear only in small clusters of pegmatites.

Figure 19 shows the distribution of columbite-tantalite-bearing and monazite-bearing pegmatites. Although they are not as abundant as the other minerals studied, the special association of pegmatites containing these minerals are clearly the same. Only one or two crystals of these minerals were formed in each pegmatite. They tend to occur in clusters of several pegmatites, as is apparent from the maps.

Figure 20 shows the grouping of lepidolite-, cleavelandite-, topaz-, and microlite-bearing pegmatites. The intimate association of these four minerals is clear. These minerals are abundant in four main groups of pegmatites: (1) in southwestern part of the district around the Opportunity claims, (2) in the vicinity of the Brown Derby mine, (3) in the vicinity of the White Spar claims, and (4) in the vicinity of the Bucky property.

Relationship of the pegmatites to the country rock

One of the problems of pegmatites, as with many other igneous rocks, is the effect the country rock has on their occurrence and mineral composition. The pegmatites in the Quartz Creek district occur more commonly in hornblende gneiss and tonalite, and less frequently in granite and quartz monzonite. If the pegmatites were derived from the same magmas as either the granite or quartz monzonite, they would tend to occur along the outer edges of the parent igneous rock and in the adjacent country rock. In the Quartz Creek district, however, pegmatites are found on the edges of both the granite and the quartz monzonite. Also the pegmatites would not penetrate far into the granitic rocks, if they came from the outside.

An equally logical reason for the pegmatites distribution in this area is that the granite and quartz monzonite are less fractured and afford less easy passage to the pegmatite solutions. The pegmatites find zones of weakness to intrude only on the edges of these bodies, where cooling fractures are common. This does not preclude that the pegmatites were not derived from the original magma of either of these two rocks. It does seem, however, that the presence or absence of pegmatites in a particular rock or part of a rock may be the result of the ease of intrusion rather than the source from which they are derived.

A statistical count of the types of pegmatite minerals found in the various rock units was made on the pegmatites in the chief rock types. All pegmatites that occurred in two or more types of country rock were excluded. Certain minerals such as plagioclase, quartz, and perthite are omnipresent and thus show no differences; whereas others like topaz, gahnite, and spodumene are too rare to give a significant statistical count. Another problem is the distribution of minerals in groups which may appear to show concentrations of a mineral in one rock type, but which are related to the areal distribution rather than to the rock type. Some minerals such as lepidolite and cleavelandite are not found in pegmatites in either the granite or the quartz monzonite. The small number of pegmatites in which they are found, however, precludes any statement as to the effects of the country rock. Tourmaline, on the other hand, is fairly uniformly distributed in the three dominant types of country rock considering that it is found in only 48 pegmatites. The ratio of tourmaline-bearing to non-tourmaline-bearing pegmatites is 1:30 for hornblende gneiss and tonalite, of 1:21 for granite, and of 1:85 for quartz monzonite.

Beryl-bearing pegmatites show a marked preference for certain types of wall rock. Beryl occurs in 232 pegmatites and though irregularly distributed, it is believed, at least in the case of granite, which is also irregularly distributed in many areas of beryl-bearing pegmatites, that the distribution is wide enough to discount the general areal pattern of beryl occurrences. The ratio of beryl-bearing pegmatites to non-beryl-bearing pegmatites is 1:6.4 in hornblende gneiss and tonalite, 1:20 in granite, and 1:189 in quartz monzonite. These figures show wide variance and suggest that the concentration of the beryl in pegmatites is influenced by the country rock. It was thought that the granite might absorb BeO from the pegmatite liquid, and, therefore, bulk samples were taken from a graphic granite-rich pegmatite (No. 512) and the adjoining coarse-grained granite. The pegmatite sample consisted of perthite (62 percent), quartz (20 percent), albite (15 percent), and muscovite (3 percent). A little more than half of this rock was graphic granite. The granite was estimated to contain microcline (67 percent), albite (20 percent), quartz (8 percent), and biotite (5 percent). The pegmatite contained a trace of BeO and the granite contained an amount less than was detectable spectrographically (under 0.0001 percent). Bulk samples were taken also of the footwall layer of the Brown Derby No..1 pegmatite (No. 452) and of the hornblende gneiss, within 8 inches of the contact. Samples were split down from about 1,000 pounds of original material. The pegmatite was estimated to consist of albite (89 percent), quartz (10 percent), tourmaline (1-2 percent), muscovite (less than 1 percent), and garnet (trace). It had an average grain size of 0.12 inch and there was no visible beryl. The analysis showed this pegmatite to contain 0.030 percent BeO and the hornblende gneiss a trace. The results of these two sets of samples should be supplemented by much more data. Graphic granite pegmatites are commonly lean in beryl and the Brown Derby pegmatite had beryl in other units than the one sampled. This small amount of work seems to indicate that granite does not absorb BeO from the pegmatite fluid and thereby cause the difference between the BeO content of pegmatites in granites and in hornblende gneiss. The possibility of the BeO being derived from the country rock has not been investigated. Samples of the hornblende gneiss away from the pegmatite are needed to see if it too contains a trace of BeO. More probably, however, the trace of BeO in the hornblende gneiss is derived from the pegmatite, as BeO tends to be concentrated in the last stages of magmatic differentiation _/ and is chiefly

_/ Rankama, K., and Sahama, T. G., Geochemistry, p. 443, 1950.

found throughout the world in granites and nepheline syenites.

Origin

The problem of the origin of pegmatites is complex and involves not only the method by which they are derived from the original magma, but also their crystallization. Pegmatites appear in many areas to be related areally to large bodies of intrusive rock. Most of these intrusive rocks crystallized from magmas of silicic composition and thus pegmatites are commonly associated with igneous rocks such as granites. Goranson _/ has

_/ Goranson, R., The solubility of water in granitic magmas: Am. Jour. Sci., 5th ser., vol. 22, p. 481, 1931.

shown that certain natural rhyolitic glasses may contain 8 to 10 percent water. Thus, from a granitic magma, containing only 1 to 2 percent water, the amounts of water released in the later stages by slow crystallization of such a magma would be very large. In addition to water, the other volatile elements such as F, Cl, B, and P, would be concentrated. The alkalies, Na, K, Li, Cs, and Rb, also tend to be concentrated in the later stages of crystallization.

Granitic pegmatites have some of the properties of granites and some of various types of veins. They appear to be an intermediate type and have been correlated by various writers to both igneous rocks and veins. Beryl, a typical pegmatite mineral, is found in both granites and quartz veins as well as in pegmatites suggesting a continuous gradation between these rock types. Beryl, for example, is found in the granites on Mt. Antero, Colo. _/

_/ Adams, J. W., Beryllium deposits of the Mt. Antero region, Chaffee County, Colorado: U. S. Geol. Survey Bull. (In preparation.)

and in the Victorio Mountains, N. Mex. _/ and beryl-quartz veins are found

_/ Holser, W. T., Unpublished Geol. Survey report on the occurrence of helvite and beryl in the Victorio Mountains, New Mexico.

in the Victorio Mountains _/, the California vein on Mt. Antero _/, the

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_/ Holser, W. T., op. cit.
_/ Adams, J. W., op. cit.

Boreana vein, Arizona _/, and Kazakhstan, Russian _/.

_/ Hobbs, S. W., Tungsten deposits in the Boreana district and the Aquarius Range, Mohave County, Arizona: U. S. Geol. Survey Bull. 940-I, p. 254, 1944.
_/ Sinegub, E. S., Berill: Nemetallicheskiye iskopayemye SSSR, Moscow-Leningrad, vol. 2, pp. 129-157, 1943.

Most of the pegmatites in the Quartz Creek district are simple pegmatites composed of minerals typical of granites—perthite, quartz, plagioclase, muscovite, and garnet. The unusual "distinctive" minerals of pegmatites rarely are found. Such minerals as cleavelandite, lepidolite, topaz, microlite, gahnite, and columbite-tantalite occur in less than 2 percent of the pegmatites in the Quartz Creek district. The predominant mineralogical difference between pegmatites in many districts and their associated granites is that the pegmatites are somewhat higher in muscovite, indicating a higher water content of the original liquid. In the Quartz Creek district, however, muscovite is a relatively minor mineral, suggesting that the original magma was water-poor. The few pegmatites that have minerals containing other volatile elements are the result of a later stage of segregation and crystallization.

More than 90 percent of the pegmatites in the Quartz Creek district have an average grain size of less than 1 inch. This texture is commonly aplitic, and may resemble that of a fine- to coarse-grained granite. Many of the pegmatites in the Quartz Creek district resemble typical igneous rocks and have been mapped by Crawford and Worcester _/ as granite in the

_/ Crawford, R. D., and Worcester, P. G., Geology and ore deposits of the Gold Brick district, Colorado: Colorado Geol. Survey Bull. 10, 1916.

northern part of the area. The lepidolite-bearing Brown Derby pegmatites, on the other hand, are much coarser textured and contain many minerals distinctive of pegmatites that have been described as showing "abundant evidence of hydrothermal replacement," by Landes _/.

_/ Landes, K. K., Colorado pegmatites: Am. Mineralogist, vol. 20, p. 333, 1935.

The pegmatites of every district have distinctive characteristics that usually are reflected in the rare minerals. For example, the pegmatites of the Black Hills are in general rich in tourmaline, muscovite, apatite, and other phosphate minerals. Very little topaz and lepidolite are found in this large district. These minerals show that the original magma was comparatively rich in P, B, OH, and poor in F. The pegmatites of the Quartz Creek district, on the other hand, differ from those in the South Dakota district and many others in that they are relatively lean in muscovite, biotite, tourmaline, and phosphate minerals, and are relatively rich in topaz, lepidolite, and columbite-tantalite. These minerals indicate that the original magma of the Quartz Creek district pegmatites was lean in OH, B, and P, and comparatively rich in F, Ta, and Cb. In the entire Quartz Creek district, only three pegmatites contain enough muscovite to be considered as sources of scrap mica; the content is commonly 0.5 to 3 percent. Biotite is less than 1 percent. The lack of these two minerals in most pegmatites indicates that the pegmatites of this area contain relatively little OH. Tourmaline is found in only 48 pegmatites and the content is only a fraction of 1 percent. The dominant phosphorous mineral is monazite, which is present only as a few small crystals in 24 pegmatites. Other phosphate minerals are apatite, amblygonite, and lithiophilite-triphylite, which are found in only one or two pegmatites and are exceedingly rare. Fluorine is a constituent of topaz in 8 pegmatites, lepidolite in 17 pegmatites, microlite in 14 pegmatites, and in fluorite in 2 pegmatites. Columbium and tantalum are present in columbite-tantalite in 29 pegmatites; in microlite in 14 pegmatites, and in samarskite (?) in 7 pegmatites, and in an unidentified mineral in 1 pegmatite.

Within a particular district considerable variation is shown in the areal distribution of pegmatite minerals. As previously discussed, pegmatites of some of the rare elements occur in groups. Thus, beryl-bearing pegmatites are found in several clusters scattered over the area (fig. 16). This is also true for some of the other rare minerals as lepidolite, topaz, cleavelandite, microlite, columbite-tantalite, monazite, tourmaline, and curved muscovite (figs. 17, 18, 19, and 20). Pegmatite magma evidently escapes from a particular part of the chamber of its parent granitic magma in a specific direction dividing into separate units before final emplacement. This would account for the distribution of certain types of pegmatite minerals in one area. The distribution of these minerals in different groups is related to their origin. As the parent granite magma cools, pegmatite liquids are segregated in different parts of the magma and escape from various parts at different times. The pegmatite magma which is driven from the parent chamber earliest probably contains less volatile material, and forms the greater part of all pegmatites—those that most closely resemble other granitic rocks. The minerals found in any pegmatite depend on the original composition of the material segregated in a pocket, and on the stage of crystallization at which it was derived. The more highly volatile constituents are in the later derivations and form the few rare pegmatites. Many minerals are almost always found in close association with another mineral because these minerals may contain common ions which make their association imperative, or elements that are concentrated at the same stage in crystallization.. Minerals containing common ions include: lepidolite, topaz, and microlite—all of which contain F; and lepidolite, and colored tourmaline which contain Li. Minerals which owe their association to elements segregated at approximately the same stage are columbite-tantalite and monazite. In places where these two minerals are not associated it probably reflects a lack of elements to form one or the other mineral.

The commoner minerals are segregated continuously or recurringly through the differentiation of the parent granite. In pegmatites that contain the rarer elements, minerals such as plagioclase, perthite, quartz, and muscovite are still the predominant minerals. The rarer elements such as Li, Cs, Rb, F, Cl, Cb, and Ta are probably in the more soluble part of the pegmatite material and certainly are among the last to crystallize.

The reaction of these late crystallizing rest solutions on the earlier crystallized material causes embayment and veining of the earlier crystallized minerals. This is given as proof of replacement by later solutions by some authors _/. Whether the first magmatic part of a pegmatite was re-

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_/ Schaller, W. T., The genesis of lithium pegmatites: Am. Jour. Sci., 5th ser., vol. 10, pp. 269-279, 1925.

______________, Mineral replacement in pegmatites: Am. Mineralogist, vol. 12, pp. 59-63, 1927.

Landes, K. K., Paragenesis of the granite pegmatites of central Maine: Am. Mineralogist, vol. 10, pp. 355-411, 1925.

______________, Origin and classification of pegmatites: Am. Mineralogist, vol. 20, pp. 81-105, 153-175, 1935.

Hess, F. L., The natural history of the pegmatites: Eng. and Min. Jour.-Press, vol. 120, pp. 289-298, 1925.

Gevers, T. W., Phases of mineralization in Namaqua land pegmatites: Trans. Geol. Soc. South Africa, vol. 39, pp. 331-377, 1936.

Andersen, Olaf, Discussions of certain phases of the genesis of pegmatites: Norsk. geol. Tidsskr., Bd. 7, pp. 1-55, 1931.
Berry, D. R., The genetic relationships of pegmatites, aplites and tin veins: Geol. mag., vol. 68, pp. 454-475, 1931.
Jahns, R. H., Mica deposits of the Petaca district, Rio Arriba County, New Mexico: New Mexico Bur. Mines Bull. 25, pp. 72-75, 1946.

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placed by hydrothermal solutions brought in after the first part of the pegmatite had solidified, or whether the earlier crystallized minerals were acted on by a rest solution that became unstable with the earlier crystallized minerals as the pressure and temperature changed the results would give identical textural relations with the earlier formed minerals being corroded and veined by the later. Evidence on whether pegmatites were formed in a closed system or by a series of hydrothermal replacements must depend on the mineralogical and structural relations rather than on a textural study. Studies of internal structure of the pegmatites and the order of sequence of mineral groups are markedly uniform and can be correlated from district to district as well as among pegmatites in the same district. The uniformity of sequence of mineral assemblages, and the relationship of the minerals themselves point to a similarity of conditions which would not be expected from hydrothermal replacement. A discussion of hydrothermal replacement versus forming in situ has been discussed thoroughly by Cameron, Jahns, McNair, and Page _/; Stockwell _/; Hanley _/; and Page _/, and will

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_/ Cameron, E. N., et. al., op. cit., pp. 97-106, 1950.
_/ Stockwell, C. H., Genesis of a lithium pegmatite on the Bear Mineral claim, Southeast Manitoba: Royal Soc. Canada Proc. and Trans., 3d ser., vol. 27, pp. 27-36, 1933.
_______________, The genesis of pegmatites of southeast Manitoba: Royal Soc. Canada Proc. and Trans., 3d ser., vol. 27, pp. 37-51, 1933.
_/ Hanley, J. B., et. al., op. cit., pp. 7-9, 1950.
_/ Page, L. R., et. al., op. cit. (In preparation.)

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not be repeated here.

Reserves

Reserves of pegmatite minerals are difficult to estimate because normal procedures of sampling can not be used. The grade, however, can be obtained by measuring the areas of industrial minerals exposed on pegmatite surfaces and relating it to the total exposed area. The percent of mineral exposed may be converted to a weight percent of mineral by making proper corrections for specific gravity.

The tonnage of rock containing an industrial mineral can be calculated from a detailed map of the internal structure of pegmatite.

Reserve calculations have been made for all of the industrial minerals in pegmatites of the Quartz Creek district. The minerals that sustained mining operations in the past were lepidolite or scrap muscovite and beryl. Potash feldspar might sustain mining operations, if transportation were less costly.

The total reserves of clean hand-cobbable feldspar are estimated to be 795,600 tons of potash feldspar and 9,740 tons of soda feldspar. These feldspar reserves are all in pegmatite units containing more than 25 percent feldspar, in grains greater than 12 inches in length. The minimum size of a unit included in these calculations was 200 feet long and 40 feet thick.

In addition, there is considerable feldspar recoverable by milling. Most of this feldspar is in the form of graphic granite. A number of these pegmatites pose considerable transportation difficulties because they are several miles over mountainous terrain from the nearest road. A total of 251,300,000 tons of milling grade feldspar are calculated in 40 pegmatites. This is an average of 6,028,000 tons per pegmatite. The largest tonnage is in the Black Wonder (No. 847), which has 225,200,000 tons of milling feldspar.

There is no sheet mica and very little scrap mica in the Quartz Creek district. The total reserves of scrap muscovite is estimated to be 13,500 tons of which 1,400 tons is recoverable by hand methods. The scrap mica obtained is a byproduct of the mining of beryl-bearing pegmatites. There are only three pegmatites (the Bucky, the Buckhorn, and the Beryl and Rare Minerals Lode) which contain either enough muscovite or muscovite in large enough pieces to be considered recoverable as a byproduct of beryl mining. The muscovite reserves of these three pegmatites are calculated as 1,400 tons.

The total beryl reserve estimated for the Quartz Creek district is about 350 tons. The second largest pegmatite in the district was estimated to contain 160 tons of beryl as of November 1949. This deposit is twice as large as the reserves of any other pegmatite. Pegmatite No. 452 (Brown Derby No. 1 dike) contains 75 tons, the second largest beryl reserve in the area and pegmatite No. 538 is third with 40 tons of beryl. Thirty-eight of the pegmatites contain less than 10 tons of beryl. Of the total 350 tons of beryl, probably 325 tons are hand cobbable.

Some of the pegmatites that have beryl reserves also contain lepidolite, microlite, topaz, columbite-tantalite, and monazite. The lepidolite reserves of the entire area amount to 3,560 tons. The largest deposit is the Brown Derby No. 1 dike (pegmatite No. 452) which has 1,600 tons of reserve. Only four lepidolite deposits have reserves over 100 tons. The topaz reserves are 900 tons, those of microlite 900 pounds, columbite-tantalite 4,000 pounds, and monazite 400 pounds. The reserves of the last three minerals, because they occur in such small widely distributed quantities, are very difficult to calculate.

Prospecting for beryl

Of the 1,803 pegmatites found in the Quartz Creek district, 232 of them contain some beryl. Only one or two crystals of beryl, 0.10 to 0.25 inch in diameter, occur in most of these pegmatites. Of the 232 pegmatites, 42 have more than 2 square inches of beryl exposed, and of these only a very few could be considered as possible sources of appreciable beryl production.

The finding of pegmatites that contain beryl in sufficient quantities to be of commercial value is very difficult. The beryl in this district is commonly white and approximates the physical appearance of feldspar or quartz. It is commonly overlooked by prospectors. Favorable beryl-bearing zones occur in covered areas in many places and diligent prospecting in these favorable areas might uncover worthwhile deposits.

Several broad statements can be made concerning the favorable and unfavorable areas for finding beryl in pegmatites in the Quartz Creek district. Granite and quartz monzonite appear definitely unfavorable as a host rock for beryl pegmatites. Only three pegmatites were found in granite that contained beryl and none of the exposures contained as much as 2 square inches of beryl. Only one pegmatite in quartz monzonite contained beryl. All pegmatites in the Quartz Creek district that contained as much as 2 square inches of beryl had hornblende gneiss wall rocks. The hornblende gneiss covers a large area that is favorable for detailed prospecting.

Detailed studies also indicate that beryl is most common in albite-rich pegmatites. The albite-rich pegmatites are almost universally fine grained. The grain size of the beryl in these pegmatites ranges from 0.06 to 0.5 inch and no beryl has been recovered commercially from them. Perthite-rich pegmatites, though less common as a source of beryl, have a large enough grain size so that most of the beryl can be hand cobbed. The small grain size of the beryl-bearing albite-rich pegmatites precludes economic recovery of beryl under present technological conditions, though at some future date, such beryl-rich rock, if found in sufficient quantities, may be of economic importance and warrant the erection of a mill. Deposits of this type, therefore, can not be expected to be of immediate concern to the prospector.

Some pegmatites have both albite- and perthite-rich parts. The perthite-rich parts may be a source of beryl at the present time but the albite-rich parts, though equally rich in beryl, will be too fine grained to mine. The beryl in pegmatites containing cleavelandite is coarse grained and may be recovered by hand methods, consequently cleavelandite-bearing pegmatites should be prospected carefully.

Graphic granite pegmatites, one of the most common types of perthite-rich pegmatites in the district, do not contain beryl and should be avoided in searching for beryl deposits. Beryl favors blocky perthite-quartz pegmatite units or perthite-muscovite-rich units, though the very irregular distribution of beryl may cause one part of a unit to be completely barren of beryl, whereas in other parts it may be abundant. Prospecting for beryl should be most intense in perthite-quartz units, and the edge of quartz cores especially where a feldspar-rich muscovite-bearing unit may be covered by float. Much beryl is found in lepidolite-bearing pegmatites and lepidolite is considered one of the more favorable indicators of beryl in prospecting.

In general, the Quartz Creek district is not too favorable a district to prospect for beryl, because the good mica and feldspar deposits are of small size and production of beryl in the past has been as a byproduct of mining for one or the other of these minerals. There are no sheet mica deposits in the district, the scrap mica deposits are not large, feldspar in large quantities must be recovered by milling of graphic granite, and deposits of hand cobbable feldspar are small. The size of the deposits of these minerals added to the high cost of transportation almost preclude profitable mining operations in this district at 1951 prices. Little feldspar has been sold by local producers, and the high cost of transportation and the small size of the perthite units are not encouraging for the production of feldspar. Because of these factors that concern muscovite and feldspar, the future of this district as a source of beryl is not too bright.

DESCRIPTIONS OF INDIVIDUAL DEPOSITS

Opportunity No. 1 claim (pegmatite No. 215)

The Opportunity No. 1 claim is in the NE$\frac{1}{4}$ sec. 17, T. 49 N., R. 3 E., New Mexico principal meridian. This prospect is claimed by Earl A. Serry, and is south of the Doyleville road on the eastern slope of a north-trending ridge. The claim covers more than 10 pegmatites, but the main workings are on the largest one, No. 215. This pegmatite is exposed by five small cuts, the largest of which is 37 feet long, 10 feet wide, and 10 feet deep; the other four are each about 8 feet long, 4 feet wide, and 5 feet deep. No minerals have been produced from this prospect.

The pegmatite is a lenticular-branching pegmatite 730 feet in maximum length and 40 feet in maximum thickness. Much of the pegmatite, however, has a thickness of less than 5 feet. It dips 45° to 80° SE., and cuts both fine-grained granite and hornblende gneiss.

The pegmatite is divided into four units along the strike of the body (fig. 21). Albite-quartz-perthite pegmatite forms a unit in the stringers extending from the northeast, the southwest, and the central part of the pegmatite. This unit has an average grain size of 0.25 inch and is estimated to consist of albite (65 percent), quartz (20 percent), perthite (15 percent), muscovite (less than 1 percent), and one small--0.25 inch--pale-green beryl crystal. Near the south end of the pegmatite, the body widens considerably at the junction of a small northward-trending branch with the main body of the pegmatite. This wide area contains several units. Along the western side is a unit of quartz-albite pegmatite that has an average grain size of 3 to 4 inches, and is estimated to contain quartz (75 percent), albite (20 percent), muscovite (3 percent), perthite (2 percent), and tourmaline (less than 1 percent). The eastern side of this bulge area is dominantly perthite-cleavelandite-quartz pegmatite, has an average grain size of about 2 to 3 inches, and is estimated to consist of pink perthite (60 percent), white cleavelandite (20 percent), quartz (20 percent), muscovite (less than 1 percent), black tourmaline (less than 1 percent), and garnet (trace). The perthite occurs in crystals as much as 12 inches long. The central part of this bulge, and the remainder of the pegmatite to the north, is cleavelandite-quartz pegmatite. This pegmatite has an average grain size of 1.5 inches and is estimated to consist of white cleavelandite (69 percent), quartz (20 percent), perthite (8 percent), muscovite (2 percent), black and dark green tourmaline (1 percent), lepidolite (less than 1 percent), topaz (less than 0.5 percent), beryl (0.1 percent), and garnet (trace), microlite (trace), columbite-tantalite (trace), and monazite (trace). Locally clots of varying lepidolite content are present. In one 3-foot area lepidolite constitutes as much as 5 percent of the rock. It occurs as fine-grained aggregates and in larger plates 0.25 to 1 inch in diameter. The topaz is milky white, has a good cleavage and commonly occurs with white beryl. Beryl and topaz have an irregular distribution. Microlite is found in the southern part of this unit with smoky quartz and platy cleavelandite as clusters of distorted octahedrons, modified by dodecahedrons as much as 0.25 inch in diameter. Probably the microlite content of this small part of the pegmatite is a few pounds per ton. Columbite-tantalite is less common than the microlite, and only a few small crystals, the largest an inch across, were found. Monazite was noted in four crystals and is associated with columbite-tantalite.

Pegmatite No. 417

Pegmatite No. 417 (pl. II) is on the western side of the western branch of Wood Gulch, near the western edge of sec. 2, T. 49 N., R. 3 E., New Mexico principal meridian. It is a few feet above the canyon bottom and can be reached by the secondary road running up Wood Gulch. It is opened by one small pit 18 feet long, 4 feet wide, and 4 feet deep at its western face.

The pegmatite is irregular, and is approximately 370 feet long and 105 feet in maximum width. Part of the irregularity is the result of its exposure on a dip slope. The pit, which is near the center of the pegmatite, cuts completely through the body, and at this point the pegmatite is 6 feet thick. The pegmatite intrudes hornblende gneiss, and has a wall zone and a core. The wall zone is the greater part of the body and has an average grain size of 0.12 inch. It consists of albite (55 percent), quartz (35 percent), perthite (5 percent), muscovite (5 percent), and beryl (0.75 inch crystal). The core has an average grain size of 3 inches and consists of perthite (45 percent), albite (42 percent), quartz (8 percent), muscovite (5 percent), beryl (0.2 percent), and one small piece of samarskite. The beryl forms pale green, euhedral crystals that range in size from 0.25 inch by 0.25 inch to 2 inches by 4 inches. A grain count of 101 square feet of the core contained 0.2 percent beryl in 33 crystals. The beryl reserves of this unit are calculated as 3.8 tons.

Brown Derby Dike No. 1 (pegmatite No. 452)

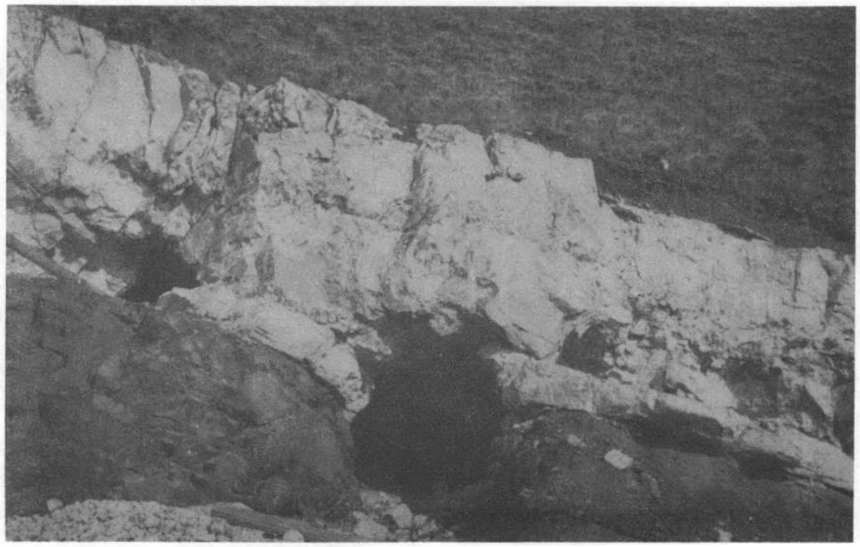
The Brown Derby Dike No. 1 is the easternmost of the Brown Derby group of dikes, in sec. 3, T. 49 N., R. 3 E., New Mexico principal meridian. This dike is a few hundred feet below the crest of a long ridge at 9,300 feet on the east side of Quartz Creek. An access road was built by the Federal Government from Colorado State Highway 162 to the workings, a distance of approximately 2 miles.

The pegmatite has been described by J. B. Hanley _/. Since this mapping

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U. S. Geol. Survey Prof. Paper 227, pp. 68-71, 1950.

was finished (December 1944), the high-grade pod-shaped concentration of lepidolite in the lepidolite-quartz-cleavelandite core has been completely mined out (pl. XI). In addition, the lepidolite-quartz-cleavelandite core in tunnel 2 has been mined approximately 30 feet east of the former face to a width of 20 feet. This additional work was completed by the Hayden Mining Company before it ceased mining in 1945.

In May and June, 1950, the U. S. Bureau of Mines drilled two core holes. Diamond-drill hole No. 1 (fig. 22) is inclined 60 degrees, has a bearing of N. 77° W., and was drilled from the dump of dike No. 1. The hole has a length of 208.5 feet, and cut both dikes No. 2 and No. 3. Diamond-drill



Mouth of stope of the Brown Derby No. 1 pegmatite (No. 452) showing contact of pegmatite with hornblende gneiss.

hole No. 2 was drilled from the hillside above tunnel 3 and cut dikes Nos. 1, 2, and 3. The bearing of the hole is N. 88° W., and the inclination is a minus 65 degrees.

The Brown Derby No. 1 dike is a lenticular and branching pegmatite, with two branches at its southern end. It is exposed for a total length of 913 feet.

The west branch is exposed in a series of six prospect pits. It is made up of a wall zone of albite-quartz pegmatite and a core of albite-quartz-biotite pegmatite.

The albite-quartz pegmatite forms nearly all of the west branch of the dike. It has a grain size of 4 to 6 inches and is estimated to contain quartz (52 percent), cleavelandite (45 percent), muscovite (3 percent), and less than 1 percent of garnet, tourmaline, and lepidolite.

The albite-quartz-biotite pegmatite of the core is exposed in pit No. 11, and is 20 feet long by 1.5 feet wide. The grain size of the core ranges from 0.12 to 0.25 inch. The unit contains albite (86 percent), quartz (5 percent), biotite (4 percent), monzonite (2.2 percent), columbite-tantalite (1.4 percent), gahnite, the zinc spinel (1 percent), and less than 1 percent garnet, tourmaline, and trace quantities of fluorite and betafite. Monazite forms well developed euhedral crystals, 0.25 to 1.5 inches across, and columbite-tantalite are tabular crystals, 0.25 to 1 inch across.

The main part of the pegmatite is composed of six different units, identified from hanging wall to footwall as follows: perthite-albite-quartz pegmatite (hanging-wall layer), hanging-wall quartz pod, curved lepidolite layer, lepidolite-microlite pod, quartz-cleavelandite-lepidolite-topaz layer, and albite pegmatite (footwall layer).

The perthite-albite-quartz pegmatite makes up the entire width of the northern part of the dike and the eastern branch of the southern part of the dike. Elsewhere, in the lepidolite-bearing part of the dike, it occurs as the hanging-wall layer, with the exception of the vicinity of the inclined shaft where it is missing. At this point the quartz pod takes the place of the perthite-albite-quartz pegmatite. This pegmatite has an average thickness of about 8 feet. In the lepidolite-bearing part of the pegmatite it does not exceed 4 feet. The grain size of the unit is about 12 inches, and the composition is estimated to be perthite (40 percent), albite (30 percent), quartz (20 percent), muscovite (10 percent), beryl (0.1 percent), and trace of tourmaline. Beryl crystals range from 0.25 to 2 inches in diameter.

The hanging-wall quartz pod is approximately 84 feet long and 2 feet thick. Its grain size is 24 inches, and the constituents are estimated as quartz (70 percent), cleavelandite (25 percent), and lepidolite (5 percent). The lepidolite is in sheets from 3 to 4 inches across.

The curved lepidolite layer is the uppermost of the lepidolite-bearing units; it is 190 feet long and averages 2 feet thick. This unit forms the back of the extension of tunnel 2 and much of the back of the stoped area in the inclined shaft. The grain size of the curved lepidolite layer is 4 to 5 inches and the composition is cleavelandite (44 percent), quartz (40 percent), curved lepidolite (15 percent), topaz (1 percent), less than one percent muscovite and tourmaline, and a trace of apatite. The curved lepidolite ranges from 0.25 to 2 inches across, and the topaz ranges from 4 to 8 inches across.

Two principal lepidolite-microlite pods are known. In addition, smaller pods have been exposed in pits and trenches. The largest pod was mined in the inclined shaft and the other was discovered underground and mined by tunnel 2. The pod at the inclined shaft was approximately 60 feet long with a maximum width of 8 feet. It was mined from the inclined shaft for a total length of about 170 feet down the dip. The pod exposed in tunnel 2 is approximately 30 feet wide by 6½ feet thick, and is present in in the face of the tunnel. The mined length is approximately 40 feet. The average grain size of the unit is 1 inch, and the average composition is cleavelandite (43 percent), lepidolite (40 percent), quartz (15 percent), topaz (2 percent), microlite (0.35 percent), and a trace of beryl. The lepidolite is in crystals 0.03 to 0.12 inch across, and is irregularly distributed within the pods. Microlite crystals range from less than 0.01 inch to 0.25 inch in diameter and are in shoots within the pods. This unit in tunnel 2 is extremely low in microlite, and has also a low lepidolite content. The pod has been nearly mined out in the incline; the remainder shown in the bottom is pinching to the southeast.

The quartz-cleavelandite-lepidolite-topaz layer is the footwall part of the lepidolite-bearing units of the pegmatite. It is exposed on the surface for 319 feet and has an average thickness of 2 feet. The unit has an average grain size of 4 to 6 inches and consists of quartz (55 percent), cleavelandite (25 percent), lepidolite (10 percent), topaz (10 percent), less than 1 percent muscovite, and less than 0.1 percent beryl. Lepidolite is in flat books ranging from 1 to 7 inches across and topaz crystals are as much as 42 inches long. Beryl is in crystals ranging from 1 to 4 inches in diameter.

The albite pegmatite (footwall layer) has an average thickness of 1.5 feet. It occurs discontinuously along the lepidolite-bearing part of the pegmatite. It has a grain size of 0.25 inch, and composition estimated to be albite (90 percent), quartz (8 percent), tourmaline (2 percent), less than 1 percent garnet, and a trace of biotite.

Reserves estimated for the entire dike total 30,500 tons of perthite, 7,600 tons of scrap mica, 3,980 tons of soda feldspar, 1,571 tons of lepidolite, 823 tons of topaz, 76 tons of beryl, 282 pounds of monazite, 179 pounds of columbite-tantalite, and 57 pounds of microlite.

Brown Derby No. 5 (pegmatite No. 535)

The Brown Derby No. 5 (pegmatite No. 535) (pl. II) is in a small gulch on the west side of the Brown Derby ridge at an elevation of 8,900 feet. It is in the south-central part of sec. 34, T. 50 N., R. 3 E., New Mexico principal meridian.

This claim is reached by a short spur road from the main Brown Derby road and is owned by Mrs. Marie Disberger. The workings consist of two small open cuts and an adit. The larger cut has a main part, 32 feet long, 15 feet wide, and 18 feet deep at the eastern face. The southern branch of this cut is 12 feet long, 6 feet wide, and 6 feet deep at the northeast face. An adit, approximately 10 feet long, was driven from the eastern end of this cut. A second shallow cut, 10 feet long and 8 feet wide, is northeast of the main cut. This pegmatite was originally mapped by J. B. Hanley and R. Miller III, on September 3, 1943, with plane table and telescopic alidade. The internal structure of the pegmatite was revised by the writer in September 1949 (fig. 23).

The Brown Derby No. 5 pegmatite intrudes greenish-black tonalite. The pegmatite is irregular in shape, has a length of 210 feet, and a maximum width of 50 feet. It consists of three zones: wall zone, intermediate zone, and core. The wall zone is 2.5 feet thick where it is exposed in the large open cut, has a range in grain size of 0.12 inch to 0.25 inch, and consists of albite (61 percent), quartz (25 percent), perthite (10 percent), muscovite (4 percent), black to greenish-black tourmaline (<1 percent), lepidolite (trace), garnet (trace), and beryl (<0.1 percent). One exposed area of the wall zone, about 3 feet square, contains 17 beryl crystals ranging in size from 0.5 inch by 0.5 inch to 1 inch by 1.3 inches. This unusually rich area averaged 1.13 percent beryl, but contained only three cobbable crystals. The beryl is in blue-green euhedral crystals.

Inside the wall zone a small intermediate zone is found in the southeastern part of the pegmatite. This zone is approximately 50 feet long and 14 feet thick. It has an average grain size of 4 inches and consists of quartz (55 percent), white cleavelandite (35 percent), lepidolite (5 percent), white blocky perthite (4 percent), muscovite (1 percent), beryl (0.1 percent), topaz (<1 percent), garnet (<1 percent), greenish-black tourmaline (<1 percent), apatite (trace), microlite (trace), and columbite-tantalite (trace). Lepidolite occurs as fine-grained aggregates and as large flat sheets that are 4 to 6 inches in diameter. The workings are on this zone, and mining was directed toward the recovery of the fine-grained lepidolite; most of the large sheets were thrown onto the dump. The beryl is in blue-green euhedral crystals from 0.5 to 3.5 inches in diameter. The beryl content increases in the northern part of the zone and appears richest in the small northern pit. A beryl count made on an area 4 feet by 5 feet in this upper pit contained 0.43 percent beryl. About 15 pounds of beryl were also found lying on the dump from this pit. The topaz is milky white and forms euhedral crystals 4 to 6 inches long adjacent to the lepidolite. The garnet forms crystals as much as 1.5 inches in diameter, and commonly is surrounded by coronas of muscovite. It is most common near the contact with the underlying wall zone. The apatite is in widely scattered light-blue 0.5 inch crystals. Microlite was not seen in place, but was found on the dump in distorted octahedrons 0.12 to 0.25 inch in diameter. The olive-green microlite is faintly radioactive and is found between plates of cleavelandite. One crystal of columbite-tantalite, 0.06 inch thick by 0.75 inch wide, was found between plates of cleavelandite.

The core at its southeastern end has a gradational contact with the intermediate zone. The minerals of the core have an average grain size of 6 inches. It consists of white massive quartz (40 percent), white blocky perthite (39 percent), albite (20 percent), muscovite (1 percent), lepidolite (trace), blue-green beryl (1 crystal, 4 by 6 inches), and columbite-tantalite (two thin pieces, 0.5 inch long by 0.06 inch thick).

The reserves of the intermediate zone are estimated to be 0.75 tons of beryl, 30 tons of perthite, 7.5 tons of scrap mica, 260 tons of cleavelandite, and 37 tons of lepidolite.

Pegmatite No. 537

Pegmatite No. 537 (pl. II) is on a small ridge in the SE¼ sec. 34, T. 50 N., R. 3 E., New Mexico principal meridian. It contains one small adit approximately 4 feet wide and 6 feet long. This working is several hundred feet above and 600 feet to the northeast of the Brown Derby mine road. An old unidentified location marker is found near the adit.

Pegmatite No. 537 is an irregular dumbbell-shaped body (fig. 24) 530 feet long and 84 feet in maximum width. The pegmatite intrudes hornblende gneiss, has a fine-grained wall zone, and has three small discontinuous core segments. The wall zone is more than 90 percent of the pegmatite and has an average grain size of 0.25 inch. It consists of albite (60 percent), quartz (25 percent), perthite (10 percent), muscovite (5 percent), and garnet (less than 1 percent).

The northern and southern core segments of this pegmatite have an average grain size of 6 inches and consist of perthite (66 percent), quartz (20 percent), albite (10 percent), and muscovite (4 percent). The perthite ranges in size from 3 to 12 inches. Beryl is found in only the northern core segment. A grain count on the sides of the small adit in this core showed 0.31 percent beryl. The beryl is present as 22 pale green euhedral crystals that range in size from 0.25 by 0.12 inch to 2.5 by 4 inches. The core segment containing beryl is 52 feet long and 10 feet wide, and is estimated to contain 3.4 tons of beryl. The central core segment is a few feet wide, has an average grain size of 6 inches, and contains quartz (85 percent), perthite (10 percent), albite (5 percent), and muscovite (less than 1 percent). No beryl was noted in this pod.

Pegmatite No. 538

Pegmatite No. 538 (pl. II) caps the top of a small ridge in the SE$\frac{1}{4}$ sec. 34, T. 50 N., R. 3 E., New Mexico principal meridian. One small cut, 6 feet square by 1 foot deep, exposes the southern end of this pegmatite. This cut is approximately 650 feet northeast of the Brown Derby road and several hundred feet above it. Pegmatite No. 538 is an elongate lenticular-branching pegmatite, approximately 550 feet long and 60 feet in maximum width (fig. 24). The pegmatite intrudes hornblende gneiss, and consists of wall zone and three small discontinuous core segments located in the thicker parts of the pegmatite. The wall zone comprises more than 60 percent of the pegmatite, has an average grain size of 0.25 inch, and consists of albite (57 percent), quartz (25 percent), perthite (10 percent), and muscovite (8 percent). The core segments have an average grain size of 4 inches and consist of quartz (50 percent), perthite (32 percent), albite (15 percent), and muscovite (3 percent). Perthite occurs in crystals 6 to 8 inches in diameter. Pale-green beryl was noted only in the southernmost core segment, where it was estimated, from several beryl counts, to be 0.95 percent of the rock. The beryl crystals range from 0.12 inch by 0.12 inch to 6 inches by 6 inches in area. The southern pod is 128 feet long and has a maximum width of 35 feet. It was calculated to contain 42 tons of beryl to a depth of 24 feet.

Pegmatite No. 560

Pegmatite No. 560 (pl. II) is an unclaimed pegmatite at the foot of the mountains on the east side of Quartz Creek in the west central part of sec. 34, T. 50 N., R. 3 E., New Mexico principal meridian. This pegmatite is 1,500 feet south of State Highway 162 and lies directly across a meadow. It is extremely irregular (fig. 25) and has a maximum length of 430 feet and a maximum width of 200 feet. It cuts across the hornblende gneiss-granite contact. This pegmatite consists of a narrow wall zone, a large core, and a small pod on the south end. The wall zone has an average grain size of 0.12 inch and is estimated to consist of albite (60 percent), quartz (36 percent), perthite (4 percent), muscovite (less than 1 percent), and garnet (trace). The core comprises the greater part of the pegmatite and has an average grain size of 4 inches. It consists of perthite (50 percent), quartz (30 percent), albite (20 percent), and muscovite (trace). On the south end of the pegmatite there is a lenticular pod, 78 feet long and 18 feet wide. This pod has an average grain size of 1 to 2 feet, and contains perthite (75 percent), quartz (20 percent), albite (5 percent), and beryl (0.45 percent). The beryl is pale green and ranges in size from 1 by 2 inches to 4 by 8 inches. This pod contains the only beryl that was noted in the pegmatite. Reserves of beryl are calculated to be 9.5 tons to a depth of 20 feet.

Beryl and Rare Minerals Lode (pegmatite No. 590)

The Beryl and Rare Minerals Lode (No. 590, pl. II) is a small lenticular pegmatite on the north-facing slope of Tollgate Gulch, in the SE$\frac{1}{4}$ sec. 34, T. 50 N., R. 3 E., New Mexico principal meridian. This lenticular pegmatite is 154 feet long and 55 feet wide, and dips gently to the south at the angle of 5 to 10 degrees (fig. 25).

The property is about a quarter of a mile south of a small private road in the bottom of Tollgate Gulch, and is reached by a narrow path winding up the hillside.

The claim on this pegmatite was located by Jesse Field on November 27, 1949. Mr. Field has opened at least six small pits ranging from a few feet square by 1 foot deep, to 22 feet long, 10 feet wide, and 2 feet deep. These pits are on local concentrations of beryl and thus expose the richest parts of the beryl-bearing pegmatite. To date Mr. Field has recovered approximately 480 pounds of beryl, 2 pounds of columbite-tantalite, and approximately 800 pounds of muscovite. The Beryl and Rare Minerals pegmatite intrudes hornblende gneiss and may be divided into three zones: wall zone, intermediate zone, and core. The top of the pegmatite has been eroded, exposing the flatlying central units. The wall zone is thin and irregular, and is exposed in only a few places along the edge of the pegmatite. It has an average grain size of 0.25 inch and consists of albite (55 percent), perthite (20 percent), quartz (25 percent), and muscovite ($<$ 1 percent).

The intermediate zone is well exposed by the workings. It has an average grain size of approximately 3 feet and is estimated to consist of perthite (50 percent), muscovite (30 percent), quartz (20 percent), albite (<1 percent), beryl (0.1 percent), columbite-tantalite (<0.05 percent), gahnite (traces), and an unidentified mineral which resembles the samarskite, fergusonite, or euxenite group of minerals. The perthite occurs in crystals from 1 to 5 feet in diameter. The muscovite is abundant in the outer part of this zone and occurs in books as much as 8 inches across. It is reeved, soft, and heavily stained and is all scrap mica. It closely resembles the mica obtained at the Bucky and Buckhorn properties. Beryl ranges from 0.5 to 8 inches in diameter and is white. The percentage of beryl obtained in the pits is estimated from the amount of beryl recovered and the size of the workings to be 0.4 percent. Because the pits were in the beryl-rich parts of the pegmatite and as many parts of this zone are completely barren of beryl, the overall content in this zone is approximately 0.1 percent. Columbite-tantalite was found intergrown with perthite in one pit. These crystals are from 0.01 to 0.12 inch thick and as much as 2 inches across, but no columbite-tantalite is exposed in the rest of the pegmatite. Gahnite is intergrown with fine muscovite in one small area. This mineral crystallizes as dark-green octahedrons 0.01 inch in diameter. Inside the intermediate zone is a core made up entirely of quartz, that extends the length of the pegmatite.

White Spar No. 2 (pegmatite No. 604)

The White Spar No. 2 pegmatite is in sec. 35, T. 50 N., R. 3 E., New Mexico principal meridian. It is on the north side of Tollgate Gulch, 0.9 mile from State Highway 162, and is reached by a mine road that follows the gulch. The pegmatite is now being mined for lepidolite by Consolidated Feldspar Company. It was located in August 1942 and is owned by the Colorado Feldspar Company.

The pegmatite was examined and mapped with plane table and telescopic alidade by E. W. Heinrich and Roswell Miller III, on July 28, 1943 _/.

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U. S. Geol. Survey Prof. Paper 227, pp. 77-80, 1950.

Two prospect pits have been made in the pegmatite, one about 40 feet long and 10 feet wide at the north end of the dike and one approximately 60 feet long and 25 feet wide at the south end.

The pegmatite is about 260 feet long and ranges in width from 6 feet near the center to nearly 50 feet at the north end. The trend is north, but the southern contact of the pegmatite strikes N. 15° W., and dips 70° NE. The pegmatite cuts hornblende gneiss, whose foliation strikes N. 25° W. and dips 70° to 80° NE. The pegmatite consists of a core of fine-grained albite-quartz-perthite-lepidolite pegmatite surrounded by a discontinuous wall zone of albite-perthite-quartz-muscovite pegmatite. The wall zone is discontinuous over the length of the pegmatite, and has a maximum width of 5 feet. Its grain size averages 0.25 inch, and the composition is estimated to be 45 percent albite, 30 percent perthite, 20 percent quartz, 5 percent muscovite, and less than 1 percent lepidolite. The lepidolite has an average grain size of 0.12 inch, but occurs in books as much as 1 inch across. The core ranges from 6 to 32 feet wide. It has a finer grain size than the wall zone, averaging 0.02 inch, and contains 45 percent plagioclase, 35 percent quartz, 10 percent perthite, 10 percent lepidolite, less than 1 percent garnet, and traces of beryl, microlite, fluorite, and chrysocolla. The lepidolite has an average grain size of 0.03 inch, and occurs in lenses and stringers up to 4 inches wide. The lepidolite exposed in the northern pit is banded with coarser-grained albite and quartz.

A grab sample of the core taken by Heinrich _/ from the southern pit

_/ Hanley, J. B., et al, op. cit., p. 80, 1950.

and analyzed spectrographically by the Geological Survey contained 0.7 percent Li_2O, or about 17 percent lepidolite, 0.05 percent BeO, and no Cb or Ta.

White Spar No. 1 (pegmatite No. 636)

The White Spar No. 1 pegmatite is in sec. 35, T. 50 N., R. 3 E., New Mexico principal meridian. It is on the north side of Tollgate Gulch and is connected to State Highway 162 by a mine road 0.7 mile long running up the bottom of the gulch. A claim was located on this pegmatite in 1942 by the Colorado Feldspar Company. E. W. Heinrich and Roswell Miller III of the Survey examined and mapped this property with plane table and telescopic alidade on July 29, 1942. _/

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., Pegmatite investigations in Colorado, Wyoming, and Utah, 1942-1944: U. S. Geol. Survey Prof. Paper 227, pp. 77-80, 1950.

The mine workings consist of five prospect pits, the largest of which is 50 feet long and has a maximum width of 25 feet.

The pegmatite crops out on the top and on the south-facing slope of a narrow ridge paralleling and separating Tollgate Gulch from a gulch to the north. The pegmatite is intruded into hornblende gneiss, but none of the contacts are exposed.

The pegmatite trends N. 20° E., and dips 30°-35° SE. It has a length of 200 feet and a maximum width of 85 feet.

Four zones are well developed within the pegmatite. A wall zone of fine-grained albite-perthite-quartz-muscovite pegmatite completely surrounds an intermediate zone of fine-grained cleavelandite-quartz-perthite-lepidolite pegmatite and cores of lepidolite-quartz pegmatite and quartz pegmatite. The wall zone is 9 feet thick on the hanging-wall side and 33 feet on the footwall side _/, and has an average grain size of 2 inches.

_/ Hanley, J. B., Heinrich, E. W., and Page, L. R., op. cit., p. 77, 1950.

The composition is estimated to be 45 percent albite, 32 percent perthite, 20 percent quartz, and 3 percent muscovite. Perthite is in crystals as much as 24 inches long and 15 inches wide, and muscovite books average 1.5 inches across and 1 inch thick.

The cleavelandite-quartz-perthite-lepidolite intermediate zone on the western and southern edges of the quartz core, is 90 feet long and ranges in width from 1 to 18 feet. The grain size is 1 inch, and the zone is estimated to contain 55 percent cleavelandite, 25 percent quartz, 15 percent perthite, 5 percent lepidolite, 0.01 percent beryl, 0.003 percent topaz, and 0.0003 percent columbite-tantalite, and a trace of microlite. Perthite crystals average 12 inches in length and 8 inches in width. The lepidolite is in books 3 inches across and 0.5 inch thick. The beryl is yellow to pale blue-green and occurs in crystals from 0.5 to 1.75 inches in diameter. Topaz crystals are small, ranging in size from 0.06 to 1 inch. The columbite-tantalite crystals are as much as 0.4 inch long and 0.25 inch wide.

The pegmatite cores are of two types: white massive quartz pegmatite and lepidolite-quartz-microlite pegmatite. The quartz pegmatite occurs as one large irregular mass 80 feet long and 3 to 13 feet wide, and seven smaller lenses.

The core of the lepidolite-quartz-microlite pegmatite is on the west side of the quartz pegmatite, between the core and the intermediate zone of cleavelandite-quartz-perthite-lepidolite pegmatite. This core is 20 feet long and from 1 to 8 feet wide, and has a grain size of 0.03 inch, and contains approximately 90 percent lepidolite, 10 percent quartz, and 0.1 percent microlite.

Buckhorn (pegmatite No. 659)

The Buckhorn (pegmatite No. 659, pl. II) caps the top of a ridge on the north side of Tollgate Gulch in the SE¼ sec. 27, T. 50 N., R. 3 E., New Mexico principal meridian. This irregular pegmatite (fig. 26) has a maximum length of 1,750 feet and a maximum width of 1,360 feet. It is between 8,900 and 9,400 feet above sea level and 350 to 850 feet above Tollgate Gulch. The nearest road is State Highway 162, 0.4 mile to the west.

At least three claims have been located on this pegmatite. Claim notices show two of these to be: the Buckhorn, which is on the northwestern part of the pegmatite and the Feldspar claim in the northeastern part of the pegmatite, both located by Bert and Florence Tucker. On the Buckhorn claim there are several small trenches, the largest is 30 feet long and 5 feet wide, and the smallest is about 4 feet long, 3 feet wide, and 2 feet deep. The Feldspar claim has a trench 15 feet long, 3 feet wide, and 2 feet deep. Several hundred feet to the east of the Feldspar claim is an unnamed claim which has a small shaft, 4 feet square and 8 feet deep, and a trench 15 feet long and 3 feet wide. No mining has been done on these claims.

The Buckhorn pegmatite (fig. 26) intrudes hornblende gneiss and tonalite. The greater part of this pegmatite has only one zone, but it contains several small disconnected core segments in its upper part along the ridge. Around one of these cores is a small intermediate zone. The small cuts in the Buckhorn claim are made on this intermediate zone. The wall zone, which forms more than 90 percent of the pegmatite, has an average grain size of 0.25 to 0.5 inch. It is estimated to contain albite (59 percent), quartz (20 percent), white to pink perthite (20 percent), fine-grained gray-green muscovite (1 percent), garnet (trace), and biotite (trace). Though most of these minerals are fine grained, the perthite occurs in blocky crystals 1 to 3 inches in diameter.

The intermediate zone is 1.5 to 2 feet thick. It has an average grain size of approximately 1 foot, and consists of perthite (50 percent), muscovite (40 percent), and quartz (10 percent). A few greenish crystals of beryl, approximately 1 inch in diameter, were noted. Adjacent to the core in a feldspar-rich part of this zone three or four crystals of columbite-tantalite and monazite, about 0.5 inch long, were found. The muscovite in the intermediate zone occurs in books as large as 10 by 18 inches. It is greenish-gray, and has a strong "A" structure. It crumbles easily between the fingers. It closely resembles the scrap mica from the Bucky mine, which is prized as a grinding mica. The intermediate zone is about 150 feet long, and diminishes in grade to the south. The amount of scrap mica available, therefore, is small.

The core segment inside the intermediate zone is south of the other core segments and differs considerably from them in composition and texture. This core has an average grain size of 2 feet and consists of perthite (91 percent), quartz (7 percent), muscovite (1 percent), and beryl (0.7 percent) as determined by a beryl count along the sides of the largest cut. The beryl is pale green and ranges in size from 0.017 by 0.058 foot to 0.27 by 0.45 foot.

The other cores lying along the top of an east-west trending ridge are only 10 to 20 feet thick. They may be the eroded remnants of a once much larger and continuous core. The average grain size of the minerals in these core segments is 8 to 12 inches, and though they vary in the percentage of minerals, they are estimated to contain perthite (53 percent), quartz (45 percent), albite (1 percent), and muscovite (1 percent).

The small shaft to the east of the Feldspar claim was sunk in a quartz-rich part of this pegmatite. It yielded approximately 75 pounds of beryl. These beryl crystals are 1 to 2 inches across, are white, and closely resemble quartz. This appears to be a beryl-rich pocket and others might be found on further exploration. The amount of beryl is not likely to be large, as the core segments are extremely thin. A limited amount of feldspar could be obtained from these core segments, but as the cost of feldspar is low and transportation costs are high, the economic feasibility of this is questionable.

Black Wonder (pegmatite No. 847)

The Black Wonder pegmatite is the largest pegmatite in the district, covering parts of secs. 20, 21, 22, 27, 28, 29, 32, and 33, T. 50 N., R. 3 E., New Mexico principal meridian. It is 12,600 feet long and has a maximum width of 6,700 feet. The northeast end is less than 200 feet from Willow Creek and the southwest end is at Big Gulch. A road from Big Gulch to the State Highway 162 traverses the pegmatite for 1.5 miles. Much of the eastern edge is within a quarter of a mile of the highway. The western part of the pegmatite forms the southern extension of a prominent north-trending ridge. This ridge rises to the north, and the highest point on the pegmatite is over 9,700 feet. The southern and eastern edges of the pegmatite are at an altitude of slightly above 8,500 feet.

The Black Wonder is extremely irregular, consisting of a large number of intersecting dikes of uneven spacing and size.

Most of the pegmatite intrudes hornblende gneiss, but part of it cuts coarse-grained granite at the southeast and pre-Cambrian sediments in a small area at the northeast.

The pegmatite has aroused little mining interest. Two claims have been filed on different parts of the pegmatite: the Black Wonder and the Beryl claim. The Black Wonder prospect, in the eastern part of sec. 29, was located in May 1948 on a magnetite-rich area in the pegmatite, and consists of one small pit. The Beryl claim, located in June 1948 by Bert Tucker, is in sec. 27 and consists of three pits on a beryl-bearing unit and a fourth on a monazite-bearing unit.

The pegmatite consists of a thick wall zone enclosing small widely scattered cores and cut by occasional fracture fillings. Only a few of the cores have an intermediate zone between them and the wall zone. The wall zone, constituting over 95 percent of the pegmatite, varies in texture and composition. In the southern and western parts of the pegmatite it is a graphic granite unit, grading to the north and northeast into a unit with only a few crystals of graphic granite in a matrix of albite and quartz. The wall zone at the south and west end has an average grain size of 3 inches and is estimated to contain 60 percent perthite, 24 percent albite, 15 percent quartz, 1 percent martite, less than 1 percent biotite, and a trace of garnet. Graphic granite crystals, as much as 5 feet across, constitute 50 percent of this part of the wall zone. Small local concentrations of martite are common, such as the one upon which the Black Wonder claim was made. Martite comprises 10 percent of the wall zone at the prospect pit and to the northeast for 50 feet, in crystals as much as 4 inches across. The wall zone to the north and east has an average grain size of 1.5 inches and is estimated to contain 55 percent albite, 30 percent perthite, 15 percent quartz, less than 1 percent garnet, and a trace of martite. Graphic granite constitutes less than 10 percent of this part of the wall zone in crystals less than 6 inches across.

At the Beryl claim, two different types of intermediate zone surround quartz cores. One intermediate zone contains monazite and columbite-tantalite, and the other beryl crystals. The intermediate zone that contains beryl is between two small quartz pegmatite cores, 7 feet apart, the larger of which is 25 feet long by 10 feet wide. Two prospect pits, the larger of which is 9 feet long by 6 feet wide, are along the east side of the larger quartz pegmatite core. Another pit, 15 feet long and 4 feet wide, is on the east edge of the smaller quartz pegmatite core. The intermediate zone is not exposed completely around the larger core, but lies east of it, surrounding the smaller one. This zone has a maximum size of 30 feet long and 15 feet wide. The grain size averages 2 inches, and the zone is estimated to contain 79 percent albite, 10 percent quartz, 5 percent perthite, 5 percent muscovite, 1 percent garnet, and 0.2 percent beryl. The muscovite is in books from 0.25 to 5 inches across. Garnet crystals range in size from 0.25 to 2 inches. Beryl is concentrated along the eastern edge of the larger quartz pegmatite core in semitransparent yellowish-green crystals from 0.5 to 1.25 inches in diameter.

The monazite-bearing intermediate zone is approximately 400 feet northeast from the beryl-bearing zone, and is exposed by a prospect pit 4 feet long and 3 feet wide, on the east side of a quartz pegmatite core. The core is 15 feet long, 6 feet wide, and is 2 feet thick at its edge in the pit. This intermediate zone is estimated to be 15 feet long and 4 feet wide. Its grain size is 6 inches and the composition is estimated to be 55 percent albite, 30 percent muscovite, 15 percent quartz, and traces of monazite and columbite-tantalite. Muscovite books are as much as 8 inches across, and monazite crystals average 0.75 inch long by 0.12 inch wide. The columbite-tantalite averages 0.12 inch by 0.06 inch.

The cores are nearly all small, measured in tens of feet long and less than 10 feet wide. They range from 100 percent quartz to 10 percent quartz and 90 percent perthite. In the northeast part of the pegmatite muscovite books form as much as 30 percent of the cores in crystals as much as 5 inches across. In some of the cores the quartz is smoky, suggesting the presence of radioactive minerals. Several small crystals of allanite were found in one core.

In various places the wall zone is cut by fracture fillings of white quartz. These fracture fillings range from a fraction of an inch to 6 inches in width.

Trio No. 1 (pegmatite No. 1402)

The Trio No. 1 pegmatite is on the ridge west of Willow Creek at an altitude of 10,000 feet, in secs. 16 and 21, T. 50 N., R. 3 E., New Mexico principal meridian. The nearest road is along Willow Creek 1 mile northeast of the claim. This road joins State Highway 162, 2.5 miles to the southeast. The claim was located on May 2, 1949 by Bert Tucker, George Tucker, and A. T. Pearson. Discovery workings consist of four small prospect pits, the largest of which is 13 feet long, 10 feet wide, and 4 feet deep.

The pegmatite is 644 feet long and has a maximum width of 152 feet. It is irregular in shape and is intruded into quartz monzonite. The pegmatite is made up of four zones: a large thick wall zone constituting over 90 percent of the pegmatite, two small intermediate zones, and several small discontinuous cores. The wall zone has an average grain size of 0.75 inch and is made up of albite (45 percent), perthite (40 percent), quartz (15 percent), biotite (less than 1 percent), and martite (less than 1 percent). The intermediate zones are of two types: a quartz-albite-perthite pegmatite and a quartz-albite-muscovite pegmatite, both found around one core. The quartz-albite-perthite pegmatite intermediate zone, 20 feet long by 15 feet wide, is east of the quartz-albite-muscovite pegmatite intermediate zone and separates it from the wall zone. This quartz-albite-perthite pegmatite has an average grain size of 6 inches and is estimated to contain quartz (35 percent), albite (34 percent), perthite (30 percent), garnet (0.5 percent), and biotite (0.5 percent). Six beryl crystals from this zone were found on the stockpile, ranging from 1 to 8 inches in diameter and from 1 to 6 inches in length. The quartz-albite-muscovite pegmatite is 3.5 feet thick and surrounds the core of quartz pegmatite. This zone has an average grain size of 1 inch and is made up of quartz (60 percent), albite (25 percent), muscovite (15 percent), and garnet (less than 1 percent). Muscovite crystals average 1 inch across and 1.5 inches thick.

Cores of quartz pegmatite occur in several places and are as much as 15 feet long by 12 feet wide. The core on which the workings are located is 20 feet long by 5 feet wide and consists entirely of quartz.

Bucky (pegmatite No. 1574)

Introduction

The Bucky pegmatite is an irregular pegmatite on the ridge between Willow and Illinois Creeks. Numerous claims are located on this pegmatite in the E$\frac{1}{2}$ sec. 22, T. 50 N., R. 3 E., New Mexico principal meridian. The Bucky claim on which the main workings are found is on its northern end, covering a quartz pod 100 feet long and 60 feet wide. This claim was originally owned by Rod Fields, who has driven several small adits along the southern side of the pod and has produced approximately 17 tons of beryl, 100 pounds of columbite-tantalite, 25 pounds of an unidentified samarskite-like mineral, and 15 pounds of monazite. Scrap mica was at first discarded but approximately 20 tons were stockpiled in September 1948. In the fall of 1948, Mr. Fields sold the property to the Beryllium Mining Company, Inc., which has operated from open pits excavated by blasting and bulldozing. A road was constructed to the mine workings approximately 400 feet above the valley bottom by the Beryllium Mining Company, Inc. In May 1950 a small mill for separating the scrap mica was built alongside the mine road. Prior to May 15, 1950, the Beryllium Mining Company, Inc. had produced 32 tons of beryl, 139.6 tons of scrap mica, 1,020 pounds of columbite-tantalite, 15 pounds of monazite, and 13 pounds of a samarskite-like mineral.

The beryl was sold to various buyers in Colorado, and was trucked to Longmont or sold on the property. The scrap mica is sold to Western Nonmetallics in Pueblo, Colo., at $25.00 a ton, delivered in Pueblo. No columbite-tantalite has been sold, and the monazite and the samarskite-like mineral have been sold to Ward's Natural Science Establishment for resale as mineral specimens.

The Bucky mine workings were mapped by Staatz and Flawn between September 28 and 31 in 1948, with plane table and telescopic alidade. This map (figs. 27 and 28) covered an area from the northern contact of the pegmatite with the schist to a point 180 feet south of the main quartz pod. A beryl count was made in the mine workings. On November 22, 1949, the map was revised by Staatz and Trites to show the new workings. The outline of the whole pegmatite was mapped by Staatz (pl. II) in the course of regional mapping in September 1949.

Geology

The Bucky pegmatite has been intruded chiefly into hornblende gneiss, but it also cuts several small bands of quartzite. The pegmatite is extremely irregular and contains many small inclusions or pendants of country rock. The main bulk of the pegmatite is a fine-grained discontinuous wall zone and a coarse-grained graphic granite intermediate zone. Inside this are scattered 36 cores of quartz pegmatite segments at least 10 feet long. Some of these core segments are surrounded by one to three intermediate zones. The core segments have a peripheral arrangement in the pegmatite (fig. 27) and some may be fracture fillings rather than true core segments.

The wall zone is discontinuous; it is absent in some parts and several hundred feet thick in others. It has an average grain size of 0.25 inch, and consists of albite (60 percent), perthite (20 percent), quartz (16 percent), muscovite (4 percent), and a trace of garnet.

Inside the wall zone is a thick intermediate zone made up chiefly of graphic granite. The graphic granite aggregates range from 2 inches to 1 foot in diameter, and average about 5 inches. Besides graphic granite, this pegmatite unit contains 3 to 4 percent of cream-colored blocky perthite, 1 percent of white quartz crystals, 3 percent of fine-grained cream-colored albite, and less than 1 percent of biotite. The biotite occurs in thin, 6-inch blades that are localized in small areas in this rock. The albite is difficult to distinguish from the perthite but is most abundant along the contact of the quartz-albite perthite pegmatite. The albite has a minimum index of refraction ($N_{\alpha 1}$) of 1.530 ± 0.002. The estimated bulk composition of this rock is perthite (77 percent), quartz (20 percent), albite (3 percent), biotite (1 percent). Quartz albite pegmatite is the most common type of pegmatite adjacent to and encircling quartz pods. Some quartz pods have no other intermediate zones separating them from the graphic granite pegmatite, while others have as many as three. Good exposures of this zone are found around the large pod on the Bucky claim. The quartz-albite pegmatite has an average grain size of 0.5 inch, and usually contains equidimensional quartz grains surrounded by albite. The estimated composition of this rock is quartz (55 percent), albite (40 percent), perthite (3 percent), muscovite (1 percent), and garnet (1 percent). The albite is cream-colored and usually fills around the quartz crystals. It has a minimum index of refraction ($N_{\alpha 1}$) of 1.532 ± 0.002. The perthite is commonest near the perthite-quartz pegmatite zone where it occurs as graphic granite, and near the muscovite-feldspar-quartz-beryl zone where it occurs as cream-colored blocky crystals about 4 inches across. The muscovite is in light-colored irregular books 0.25 to 0.75 inch long. It occurs in local aggregates, comprising as much as 10 percent of the rock. Adjacent to the core of the Bucky mine the feldspar is considerably kaolinized.

Muscovite-feldspar-quartz-beryl pegmatite predominates around the large Bucky core segment (figs. 27 and 28) but is also well developed around at least two other core segments and may be present to a minor extent around several more. This zone weathers easily and is usually concealed by quartz float. It has been well exposed along the southern and eastern side of the Bucky claim, where mine faces are over 20 feet high. This zone extends around three-fourths of the Bucky core segment but pinches out in the northwest quarter and is from 1 to 10 feet thick. The muscovite-feldspar-quartz-beryl pegmatite zone has a grain size which ranges from 3 inches to over 8 feet and has an average of about 2 feet. It has an estimated composition of muscovite (40 percent), feldspar (31 percent), quartz (20 percent), beryl (8.9 percent), columbite-tantalite (0.11 percent), samarskite-like unidentified mineral (0.003 percent), and monazite (0.003 percent), topaz (< 1 percent), gahnite (< 1 percent), phosphates (trace), and lepidolite (trace). Muscovite makes up from 10 to 80 percent of the rock and is found in books as much as 1 foot across; the average is 6 inches. The books are heavily lined, have irregular surfaces, contain minute crooked fractures, and have a prominent "A" structure. Both red and black mineral staining is common. This mica is also scrap and is quite soft, which makes it an excellent grinding mica. The feldspar occurs chiefly as cream-colored blocky perthite and as cream-colored fine-grained albite. The albite is commonest in heavy muscovite concentrations and has a minimum index of refraction ($N_{\alpha 1}$) of 1.531 ± 0.002. Because of the heavy kaolinization of both feldspars, the relative proportions of perthite to albite could not be readily determined. Quartz occurs as large white crystals several feet in diameter. Beryl is found in large white to pale-green euhedral crystals. A total of 64 beryl crystals was noted in 344.5 square feet of muscovite-feldspar-quartz-beryl pegmatite measured along the mine walls. The crystals ranged in area across their bases from 0.007 to 5.0 square feet, and averaged 0.70 square feet. Beryl is more common and occurs in larger crystals in the perthite-quartz-rich part than in the muscovite-rich part. A beryl count made in Fields' early workings, which were driven on a beryl-rich concentration, gave an average of 13 percent beryl. Since that time most of this zone has contained much less beryl. A second pocket was opened in April 1950, from which approximately 9 tons of beryl had been taken prior to June of the same year. The beryl in this, as in all zones, is concentrated in pockets separated by almost barren rocks. The beryl has a maximum index of refraction (N_{ω}) of 1.578 ± 0.002, which corresponds to approximately 13.2 percent BeO. A small part of the beryl has been kaolinized. The columbite-tantalite, monazite, and an unidentified samarskite-like mineral usually occur together in erratic pockets. They were found in some of the early workings adjacent to the core segment. The columbite-tantalite occurs in black tabular crystals as much as 6 inches across. Monazite occurs in 0.25 to 1 inch long reddish-brown euhedral crystals and the adjacent feldspar is frequently stained red. The samarskite-like unidentified mineral has been found in masses as much as 5 inches across. It is dark greenish-black in color, has conchoidal fracture, a greasy luster, and no apparent crystal form. This mineral is metamict and its X-ray pattern does not agree with that of samarskite, fergusonite, euxenite, allanite, or uraninite. A more complete discussion of this mineral is given in the section on mineralogy.

Topaz has been reported from the Bucky core segment but is found in greater abundance around a small pod on the southwestern part of the pegmatite. The zone in this area may contain as much as 1 percent of topaz in crystals 1 to 4 inches across. Lepidolite has been found adjacent to the topaz but is quite rare and in very fine-grained aggregates.

Lithiophilite-triphylite has been found in a few rare crystals adjacent to the Bucky core segment and another small pod in the extreme northeastern end of the pegmatite.

In addition to the muscovite-feldspar-beryl pegmatite, there is a coarse-grained perthite pegmatite around the Bucky core segment. This rock has an average grain size of 6 feet and is estimated to consist of 93 percent of cream-colored blocky perthite, 7 percent of quartz, and less than 1 percent of albite and muscovite. The perthite is slightly kaolinized. About 30 tons of cream-colored perthite has been stockpiled at the mine, but none had been sold prior to June 1950.

Quartz core segments are found scattered throughout the pegmatite and range from a few feet long and less than 1 foot wide to the one 100 feet long and 80 feet wide on which the Bucky claim is located. The quartz pegmatite is made up of 100 percent white massive quartz. As this rock is resistant to erosion, it forms prominent knobs, and joint blocks commonly cover the adjoining pegmatite.

A unit which is believed to be a fracture filling was found in two places along the outer edge of the pegmatite. This unit has an average grain size of 3 feet and is estimated to consist of 50 percent quartz and 50 percent perthite.

Table 20.--Mineralogy of pegmatites

Number and name of pegmatite (Pl. 2)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
1	Tonalite.		Not exposed.	Lenticular.	One unit.	3/4	45		35				25		< 1											
2	Do.		Do.	Do.	Do.	2-3	15		49				35		1											
3	Do.		Do.	Oval.	Do.	1/4-1/2	47		25				25		3		< 1									
4	Do.		Do.	Lenticular.	Do.	3/4-1	53	1/16	15				30	12	1		1	1/8						Biotite. Gahnite. Beryl.	Trace. Trace. 4Crystals.	1/32 1/8-3
5	Tonalite and coarse-grained granite.	None.	Cross-cutting.	Lenticular- branching.	Do. Do.	1/4	54		20				25		1		< 1									
6	Granite.	Do.		Lenticular.	Do.	1/8-1/4	65		15				20		< 1		Trace.									
7	Tonalite and granite.		Not exposed.	Lenticular-branching.	Do.	1/8-1/4	58		20				20		2		< 1									
8	Biotite gneiss and granite.	None.	Conformable.	Lenticular-branching.	Do.	1/4	60		20				20		< 1		Trace.									
9	Tonalite and granite.	Do.	Cross-cutting.	Lenticular.	Do.	1/4-1/2	62		18				20		< 1		< 1									
10	Unknown.			Do.	Do.	1/16	69		10				20		Trace.		< 1									
11	Tonalite.	None.	Cross-cutting.	Lenticular-branching.	Do.	1/4	60		20				20		< 1		< 1									
12	Tonalite, coarse-grained granite, fine-grained granite.	Do.	Do.	Do.	Do.	1/4-1/2	44		35				20		< 1		< 1									
13	Coarse-grained granite.			Lenticular.	Do.	1/8-1/4	65		15				20		< 1		Trace.									
14	Tonalite.		Cross-cutting.	Lenticular.	Do.	1/8-1/4	65		15				20		< 1		< 1		Trace.							
15	Fine-grained granite.			Do.	Do.	1	30		35				35		2		< 1									
16	Tonalite.		Not exposed.	Lenticular.	Do.	1/2-3/4	50		15				35		< 1		< 1									
17	Unknown.		Do.	Lenticular-branching.	Do.	1/2-3/4	55	1/8	25	4-6			20	4-6	< 1		< 1									
18	Tonalite and coarse-grained granite.	None.	Cross-cutting.	Do.	Do.	3-4	15	1/8	59	8-10			25	8-10	1	3-4	< 1									
19	Tonalite.		Not exposed.	Lenticular.	Do.	4	25		50				25				Trace.									
20	Do.	None.	Cross-cutting.	Irregular.	Do.	1/8	72		7				20		< 1		< 1									
21	Do.		Not exposed.	Lenticular.	Do.	1/2	55		25				20		< 1		< 1							Beryl. Columbite tantalite.	1 Crystal. 3 Crystals.	1/4

Table 20.--Mineralogy of pegmatites --(Continued)

Number and name of pegmatite (Pl. 2)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
22	Tonalite.		Cross-cutting.	Lenticular.	Wall zone.	1/4	59		15				25		1		< 1									
					Core.	6-8	10		5				85		< 1									Beryl.	1 Crystal.	4
23	Do.		Do.	Lenticular-branching.	Southern branch.	1-2	40		20				40		< 1		Trace.									
					Northern branch Wall zone.	1/4	69		5				25		1		< 1									
					North branch core.	6	10		53				35		2	1-4	< 1							Beryl. Monazite. Columbite-tantalite.	13 Crystals. 3 Crystals. 5 Crystals.	1-1½ 1/? 3/4
24	Do.		Not exposed.	Lenticular.	One unit.	1	44		25				30		1		< 1							Beryl.	1 Crystal	1/2
25	Do.		Cross-cutting.	Lenticular-branching.	Main unit.	1/4-1/2	45		30				25		< 1		< 1									
					Fracture-filling. 15' long	6-8			10				90													
26	Coarse-grained granite.			Lenticular.	One unit.	1/8-1/4	60		20				20		< 1		Trace.									
27	Do.			Lenticular-branching.	Do.	1/8-1/4	72		7				20		1		Trace.									
28	Coarse-grained granite.	None.		Lenticular-branching.	One unit.	1/16	70		10				20		Trace.		Trace.							Magnetite.	Trace.	
29	Do.			Do.	Do.	1/8	80		5				15		< 1		Trace.									
30	Do.	None.		Do.	Do.	1/8	80		5				15		< 1		< 1									
31	Do.			Lenticular	Do.	1/8	59		15				25		1		< 1									
32	Do.			Do.	Do.	1/8	73		7				20		< 1		Trace.									
33	Coarse and fine-grained granite.			Lenticular-branching.	Do.	1/4	44		25				30		1		Trace.									
34	Coarse-grained granite.	None.		Do.	Do.	1/8-1/4	64		15				20		1		Trace.									
35	Do.	Do.		Do.	Do.	1/8-1/4	60		20				20		< 1		Trace.									
36	Do.		Not exposed	Do.	Do.	1/8-1/4	54		25				20		1		Trace.									
37	Do.		Do.	Lenticular	Do.	1/8-1/4	60		20				20		< 1		Trace.									
38	Do.		Do.	Do.	Do.	1/8	77		3				20		< 1		Trace.									
39	Do.		Do.	Do.	Do.	1/8	69		5				22		4		Trace.									
40	Do.			Lenticular-branching.	Do.	< 1/16	79		5				15		1		Trace.									

Table 20.--Mineralogy of pegmatites -- Continued

Number and name of pegmatite (Pl. 2)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
41	Hornblende gneiss.		Not exposed.	Lenticular-branching.	One Unit	1/8	71		8				20		1		Trace.									
42	Do.		Do.	Irregular.	Do.	1/16-1/8	74		10				15		1		1									
43	Coarse-grained granite.	None.		Do.	Do.	1/8-1/4	48		30				20		2		1									
44	Do.			Lenticular.	Do.	1/8	74		5				20		1		1									
45	Hornblende gneiss.		Not exposed.	Do.	Do.	1/4	65		15				19		1											
46	Do.		Crosscutting.	Lenticular-branching.	Do.	1/8	74		5				20		1		1									
47	Hornblende gneiss and granite.		Do.	Do.	Do.	1/8-1/4	65		15				20		<1		Trace.									
48	Hornblende gneiss.		Do.	Do.	Do.	1/8-1/4	69		10				20		1		<1									
49	Do.		Do.	Do.	Do.	1/16-1/8	64		10				25		1		<1									
50	Do.		Not exposed.	Lenticular.	Do.	1/4	65		15				20		<1		Trace.									
51	Do.		Do.	Irregular.	Do.	1/4	65		15				20		Trace.		Trace.									
52	Tonalite		Crosscutting.	Lenticular-branching.	Do.	1/8-1/4	70		7				23		Trace.											
53	Hornblende gneiss.			Lenticular	Do.	1/32	80		5				15		Trace.		<1									
54	Do.		Not exposed.	Do.	Do.	1/4	55		20				25		<1		<1									
55	Tonalite		Crosscutting.	Irregular.	North end. South end.	1/4 1-2	59 27		20 27				20 45		1 <1		Trace.							Beryl.	1 Crystal	1-1/2
56	Do.		Not exposed.	Lenticular	One unit.	1/8	75		5				20		<1		<1									
57	Hornblende gneiss.		Do.	Do.	Wall zone Cores	1/8-1/4 1	70 25		15 35				15 40		Trace. <1		Trace.									
58	Tonalite		Do.	Do.	One unit.	1/16-1/8	77		3				20		Trace.		Trace.									
59	Do.		Do.	Do.	Do.	1/8	80		5				15				Trace.									
60	Do.		Do.	Irregular.	Do.	1/8	71		8				20		1		1									
61	Do.		Do.	Lenticular	Do.	1-2	35		30				35		1											
62	Do.		Do.	Do.	Wall zone Core	1/8 10-12	70 5		15 10				15 85		1 1		1									
63	Do.		Crosscutting	Lenticular-branching.	One unit	1	54		20				25		1		Trace.									

Table 20 .--Mineralogy of pegmatites -- Continued

Number and name of pegmatite (Pl. 2)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture	Mineralogy: Flagioclase Per-cent	Flagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
64	Tonalite.	None.	Crosscutting.	Lenticular-branching.	Wall zone West branch.	1/8-1/4	69		15				15		1		<1									
					Core West branch.	6	15		43				40		2									Columbite-tantalite	3 Crystals.	1½
					East branch.	1/8-1/4	55		25				20		<1		<1							Monazite Tourmaline.	1 Crystal Trace.	1/4
65	Do.		Not exposed.	Do.	One unit	1/8	69		10				20		1		<1									
66	Do.		Do.	Lenticular.	Do.	1/2-1	45		10				45		<1		Trace.									
67	Coarse-grained granite.		Do.	Do.	Do.	1/4	65		12				23		<1		<1									
68	Tonalite.		Do.	Do.	Do.	1/2-1	50		25				25		<1		Trace.							Beryl.	2 crystals	
69	Do.		Crosscutting.	Do.	Do.	1/8-1/4	64		15				20		1		<1									
70	Do.		Do.	Lenticular-branching.	Do.	1/8	72		8				20		<1		Trace.									
71	Tonalite and coarse-grained granite.	None.	Do.	Lenticular.	Do.	1/4-1/2	50		25				25		<1		Trace.									
72	Do.	None.	Do.	Lenticular-branching.	Do.	1/8-1/4	65		15				20		<1		<1									
73	Tonalite		Not exposed.	Lenticular.	Do.	1/8-1/4	55		20				25		<1		Trace.									
74	Do.		Crosscutting.	Lenticular-branching.	Do.	1/8-1/4	65		15				20		<1		<1									
75	Do.		Not exposed.	Do.	Do.	1/8-1/4	55		20				25		<1		<1									
76	Do.		Do.	Lenticular	Do.	1/8-1/4	60		20				20		Trace.		<1									
77	Do.		Do.	Do.	Do.	1/4	60		25				15		Trace.		<1									
78	Do.		Do.	Do.	Do.	1	40		25				35		Trace.		Trace.							Beryl.	2 Crystals	1/4
79	Do.		Do.	Do.	Do.	1/4	59		15				25		1		Trace.									
80	Do.		Crosscutting.	Lenticular-branching.	Do.	1/4	60		20				20		<1		Trace.							Beryl.	2 Crystals	1/8
81	Tonalite and fine-grained granite		Do.	Lenticular-branching.	Do.	1/4	62		15		5	graphic albite.	22		1		<1							Beryl.	1 Crystal	1/8
82	Do.	None.	Do.	Lenticular	Do.	1/8-1/4	75		5				20		<1		Trace.									
83	Do.	None.	Do.	Do.	Wall zone	1/8-1/4	71		3				25		1		Trace.									
					Core	?	1		1				98													
84	Tonalite.		Not exposed	Do.	One unit	3/4-1	45		25				30		Trace.		Trace.							Beryl.	2 Crystals.	1/8
85	Tonalite and fine-grained granite.			Do.	Do.	<1/16	62		3		5	graphic albite	35						1							

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
86	Tonalite and fine-grained granite.		Crosscutting.	Lenticular-branching.	One unit.	1/4	55		20				25		< 1		Trace.							Beryl.	2 crystals.	
87	Tonalite.	None.	do.	Irregular.	do.	1/2-3/4	50		25				25		Trace.		Trace.									
88	Hornblende gneiss.			Lenticular-branching.	Northern end.	1/4	65		10				25		< 1		Trace.							Beryl.	1 crystal.	1/4
					Southern end.	1/16	93		Trace.				7											Epidote.	Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
89	Tonalite.		Not exposed.	Lenticular-branching.	One unit.	1/8	70		10				20		<1		Trace.									
90	Coarse-grained granite.		do.	Lenticular.	do.	1/8	76		4				20		<1		Trace.									
91	do.		do.	Irregular.	do.	1/8	73		2				25		<1		Trace.									
92	do.		do.	Lenticular.	do.	1/2-3/4	60		20	3-7			20	1/4-2	<1		Trace.									
93	Tonalite.		do.	do.	do.	1/64	68		1				30		1		Trace.	1/8								
94	Hornblende gneiss and fine-grained granite.	None.		do.	do.	2	20		45				35		Trace.											
95	Tonalite and coarse-grained granite.		Crosscutting.	do.	Northern end.	1/4	65		10				24		1											
					Southern part.	1	34		40				25	1-6	1											
96	Tonalite.	None.	do.	Lenticular-branching.	Wall zone northeast part.	4	28		50		60-70	12-24	20		2											
					Wall zone southwest part.	1/4	66		12		2-3	6	20		2											
					Cores.	8	10		41				45		4	1/2-2										
97	Tonalite and fine-grained granite.	do.	do.	do.	Wall zone southwest end.	6-8	15		63		80	4-12	20		2		Trace.									
					Wall zone northeast end.	1/4-1/2	53		15				30		1		1									
					Cores.	6-8	5		40				54		1											
98	Coarse-grained granite.	do.		Lenticular.	Wall zone.	1/8	77		5				15		3		Trace.							Biotite.	<1	
					Core.	8	[1]20		10				68		2											
99	do.	do.		do.	Wall zone.	1/4	62		20				18		<1											
					Core.	6	[1]1		30				69		<1		Trace.							Biotite.	Trace.	
100	Tonalite and coarse-grained granite.	do.	Conformable.	do.	One unit.	1/8	79		1				20				Trace.									
101	do.	do.	Crosscutting.	Lenticular-branching.	do.	1/8-1/4	72		8				19		1		Trace.							Magnetite.	1 crystal.	
102	do.			do.	West branch.	1/4-1/2	67		15				18		<1		Trace.							Beryl.	2 crystals.	1/4
					East branch.	1/32	88		1				10				1-2									
103	Tonalite.			Lenticular.	One unit.	1/4	67		15				18		<1		<1									
104	do.			do.	do.	1/16-1/32	74		1				25				Trace.	1/8								
105	Tonalite and coarse-grained granite.		do.	Lenticular-branching.	Northeast and southwest branches.	1/16-1/32	74		1				25				Trace.	1/8-1/4								
					Northward-trending branch.	1/2	60		20				20		Trace.		Trace.							Beryl.	4 crystals.	1/2

[1] Cleavelandite

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size	Mineral	Per-cent	Size	Mineral	Per-cent	Size (inches)
106	Tonalite.		Crosscutting.	Lenticular-branching.	One unit.	1/4	72		8				20		<1		Trace.							Beryl.	2 crystals.	1/8-1/4
107	do.			do.	do.	1/8	67		8				25		Trace.									Magnetite.	1 crystal.	
108	do.			Lenticular.	do.	1/16-1/8	71		3				25		Trace.									Chlorite.	2	
109	do.			do.	do.	1/4	70		10				20		<1		Trace.									
110	do.		Not exposed.	Lenticular-branching.	do.	1/8	71		4				25		<1		Trace.		Trace.							
111	do.		do.	Lenticular.	do.	1/8-1/4	70		5				25		<1		Trace.									
112	Hornblende gneiss.		do.	Lenticular-branching.	do.	1/8-1/4	75		5				20		<1		<1							Beryl.	13 crystals.	1/8-1/4
113	Hornblende gneiss and coarse-grained granite.		do.	do.	do.	1/8-1/4	74		8				18		<1		Trace.									
114	Hornblende gneiss.		do.	Lenticular.	do.	1/8-1/4	70		10				20		<1		<1							Beryl.	2 crystals.	1/8
115	Hornblende gneiss and granite.		do.	Lenticular-branching.	do.	1/8	73		5				22		<1		Trace.									
116	Hornblende gneiss.		Crosscutting.	Irregular.	do.	1/8-1/4	65		15				20		<1		Trace.							Beryl.	2 crystals.	1/4-3/4
117	Tonalite and granite.		Not exposed.	Lenticular.	do.	1/4-1/2	65		15				20		<1		Trace.							do.	3 crystals.	1/8-1/4
118	Coarse-grained granite.	None.		Lenticular-branching.	do.	1/16	81		4				15		<1		Trace.									
119	do.		Not exposed.	do.	do.	1/8-1/4	67		8				25		Trace.		Trace.									
120	Tonalite.		Crosscutting.	do.	do.	1/32-1/16	80		2				18		Trace.		Trace.									
121	do.		do.	do.	do.	1/16-1/8	76		4				20		Trace.		Trace.							Beryl.	5 crystals.	1/8-1/2
122	Not exposed.		Not exposed.	Irregular.	do.	1/8-1/4	65		15		5		20		<1		Trace.									
123	do.		do.	do.	do.	1/8-1/4	62		18				20		<1		<1									
124	Fine-grained granite.		do.	Lenticular-branching.	do.	1/8-1/4	70		10		2		20		<1		Trace.									
125	Tonalite.			Lenticular.	do.	1/8	75		5				20		Trace.		Trace.							Beryl.	1 crystal.	5/8
126	do.		Not exposed.		do.	1/8-1/4	75		10				15		Trace.		Trace.							do.	1 crystal.	1/8
127	Hornblende gneiss.		do.		do.	1/8-1/4	70		10				20		<1		Trace.									
128	do.		do.		do.	1/8-1/4	73		7				20		<1		Trace.							Beryl.	2 crystals.	1/8
129	Tonalite.		Crosscutting.	Lenticular-branching.	do.	1/8	76		4				20		Trace.		Trace.							do.	1 crystal.	1/8

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Mineral	Percent	Size	Mineral	Percent	Size (inches)
130	Tonalite.		Crosscutting.	Lenticular-branching.	One unit.	1/8-1/4	75		5				20		<1		Trace.							Beryl.	3 crystals.	1/8
131	do.		do.	do.	do.	1/4	65		8				27		Trace.		Trace.							do.	2 crystals.	1/8
132	do.		do.	do.	do.	1/8	77		5				18		<1		Trace.							do.	2 crystals.	3/4
133	Hornblende gneiss.		Not exposed.	do.	do.	1/4-1/2	56		4				40		<1		Trace.							do.	2 crystals.	1/4
134	do.		do.	Irregular.	do.	1/8-1/4	73		2				25		<1		Trace.							do.	2 crystals.	1/4
135	do.		do.	Lenticular.	do.	1/8-1/4	70		10				20		<1		Trace.							do.	1 crystal.	1/8
136	Tonalite.	None.		Irregular.	do.	1/8-3/4	70		8				22		<1		Trace.							do.	11 crystals.	1/4-1½
137	Hornblende gneiss.			Lenticular-branching.	do.	1/4	75		10				15		<1		Trace.							do.	4 crystals.	1/4
138	Hornblende gneiss and granite.	None.		do.	do.	1/8	72		8				20		<1		Trace.									
139	Hornblende gneiss.	do.		Lenticular.	do.	1/4	65		15				20		<1		Trace.		Trace.					Beryl.	1 crystal.	1/2
140	Coarse-grained granite.	do.		Lenticular-branching.	do.	1/2-3/4	60		30				10		<1		Trace.									
141	Tonalite and granite.	do.	Crosscutting.	do.	do.	1/4	72		10				18				Trace.									
142	Tonalite.			Lenticular.	do.	1/4	72		3				25				Trace.									
143	do.			Irregular.	do.	1/8	73		2				25		Trace.		Trace.							Beryl.	1 crystal.	3/16
144	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/2	40		35				20													
145	do.		do.	do.	do.	1/16-1/8	81		4				15				Trace.									
146		None.	Crosscutting.	Lenticular-branching.	do.	1/2	55		25				20		<1		Trace.									
147	Tonalite.	None.		Lenticular.	do.	1/4	70		Trace.				30											Beryl.	3 crystals.	1/8-1/4
148	do.	do.		do.	do.	1/8-1/4	73		2				25		<1		Trace.							do.	1 crystal.	1/8
149	do.			do.	do.	1/8	72		3				25				Trace.									
150	Tonalite and coarse-grained granite.	None.		Lenticular-branching.	do.	1/8-1/4	65		15				20		Trace.		<1							Beryl.	2 crystals.	1/4
151	do.			Lenticular.	do.	1/4	70		15				15													
152	Coarse-grained granite.		Not exposed.	do.	do.	1/8	70		15				15				Trace.									
153	Coarse-grained granite and hornblende gneiss.	None.	Crosscutting.	Lenticular-branching.	do.	1/4-1/2	63		15				22		<1		Trace.									

Table 20.--Mineralogy of pegmatites.--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Mineral	Percent	Size	Mineral	Percent	Size (inches)
154	Not exposed.		Not exposed.	Irregular.	One unit.	1/8	73		7				20		<1		Trace.									
155	Hornblende gneiss and coarse-grained granite.		do.	Lenticular.	do.	1/8	72		8				20		Trace.											
156	do.		do.	do.	do.	1/16-1/8	80		4				16		Trace.									Biotite. Martite.	Trace. Trace.	
157	Tonalite.		do.	do.	do.	1/8	70		10				20		Trace.		Trace.									
158	Hornblende gneiss.			do.	do.	1/2	55		20				25		Trace.		Trace.									
159	do.		Not exposed.	do.	do.	1/2	55		20				25				Trace.									
160	Coarse-grained granite.			do.	do.	1/16-1/8	80		5				15		Trace.		Trace.							Martite.	3 crystals.	
161	do.	None.		Lenticular-branching.	do.	1/8	75		5				20		Trace.		<1									
162	Tonalite and coarse-grained granite.	do.		do.	do.	1/8-1/4	70		10				20		Trace.		<1							Beryl.	8 crystals.	1/8-1/4
163	do.		Crosscutting.	do.	do.	1/4-1/2	65		20				15				<1							Beryl. Biotite. Martite.	1 crystal. Trace. Trace.	1/8
164	Coarse-grained granite.		Not exposed.	do.	do.	1/8-1/4	60		25				15		Trace.		Trace.									
165	Tonalite and coarse-grained granite.	None.		Lenticular.	do.	1/8-1/4	70		10				20		<1											
166	do.	do.		do.	do.	1/8-1/4	65		15				20		<1											
167	Tonalite.		Not exposed.	Irregular.	do.	1/4-1/2	60		20				20				Trace.									
168	Hornblende gneiss and granite.	None.		Lenticular.	do.	1/32-1/16	75		1				25													
169	Coarse-grained granite.	do.		Lenticular-branching.	do.	1/4-1/2	63		25				12		<1		<1									
170	Tonalite and granite.	do.		Lenticular.	do.	1/4	60		15				25		<1		Trace.									
171	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1/8	65		20				15				<1									
172	do.		do.	Lenticular.	do.	1/8-1/4	65		12				23				Trace.							Beryl. Martite.	3 crystals. 1 crystal.	1/8-1/4
173	do.		do.	do.	do.	1/8	73		7				20		Trace.		Trace.							Beryl.	5 crystals.	1/8-1/4
174	Hornblende gneiss and granite.	None.		Lenticular-branching.	Wall zone. Core.	1/8-1/4 1 - 2	70 20		10 40				20 40		Trace.		Trace.							Martite. Beryl.	Trace. 1 crystal.	1/16

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size	Mineral	Per-cent	Size	Mineral	Per-cent	Size (inches)
175	Coarse-grained granite.	None.		Lenticular-branching.	Wall zone. Core.	1/4	65		15				20 100		Trace.											
176	Tonalite and coarse-grained granite.	do.		Lenticular.	Wall zone. Core.	1/16-1/8 6	83 10		2 20				15 70		Trace.											
177	Tonalite and granite.		Not exposed.	Lenticular.	One unit.	1/8-1/4	65		15				20				<1									
178	Coarse-grained granite.	None.		do.	do.	1/8	75		5				20				Trace.							Martite.	Trace.	
179	Tonalite.		Not exposed.	do.	do.	1/8	73		7				20				Trace.							Magnetite.	Trace.	
180	do.			Lenticular-branching.	do.	1/2	45		25				30				Trace.									
181	Tonalite and granite.	None.	Crosscutting.	do.	do.	1/4	72		20				8		Trace.		Trace.							Magnetite.	Trace.	
182	do.	do.	do.	Lenticular.	do.	1/16	66		25				8		Trace.		<1									
183	do.	do.	do.	do.	do.	1/16-1/8	70		5				20		Trace.		<1									
184	do.		Not exposed.	do.	do.	1/8	70		20				10				Trace.							Beryl.	2 crystals.	1/16
185	do.	None.	Crosscutting.	do.	do.	1/2	65		25				15		Trace.		Trace.									
186	do.	do.	do.	Lenticular-branching.	do.	1/4	71		20				8		1		Trace.							Martite. Beryl.	Trace. 1 crystal.	 1/8
187	do.	do.		Lenticular.	do.	1/4-1/2	50		32				18		1		<1									
188	do.	do.	Crosscutting.	Lenticular-branching.	do.	1/8-1/4	73		22				5				Trace.							Magnetite. Beryl.	Trace. 2 crystals.	 1/8
189	do.	do.	do.	do.	do.	1/4-1/2	45		30				25				Trace.									
190	Tonalite.	do.	do.	do.	do.	1/16-1/8	69		6				25											Beryl.	2 crystals.	1/8
191	do.		do.	do.	do.	1/16	75		5				20				Trace.									
192	Tonalite and granite.	None.		Lenticular.	Wall zone. Core.	1/32 6	83 3		2 37				15 60													
193	Tonalite.	do.		Lenticular-branching.	One unit.	1/16	76		4				20				<1							Magnetite.	Trace.	
194	do.	do.		Lenticular.	do.	1/16	78		2				20				Trace.							do.	Trace.	
195	Tonalite and granite.		Not exposed.	Lenticular-branching.	do.	1	33		45				22		<1		<1									
196	do.			do.	do.	1/4	70		10				20		Trace.		Trace.							Beryl.	2 crystals.	1/16-3/4
197	Tonalite.	None.		Lenticular.	do.	1/8	67		8				25		<1									do.	5 crystals.	1/4

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
198	Tonalite.		Not exposed.	Lenticular.	One unit.	1/4-1/2	50		35				15		<1									Beryl.	1 crystal.	1/4
199	Fine-grained granite.			Oval.	do.	1/2-3/4	66		4				30		<1											
200	do.			Irregular.	Wall zone. Core.	1/8 6	80 15		10 43				10 42		<1 <1											
201	do.			Lenticular.	One unit.	1/8-1/4	77		8				15		<1		Trace.							Beryl.	1 crystal.	1/2
202	Hornblende gneiss and fine-grained granite.	None.		Irregular.	do.	1/2-3/4	74		5				20		1											
203	Fine-grained granite.			do.	do.	3/4	58		20				20		2											
204	do.		Not exposed.	Lenticular.	do.	1/2	45		35				20		<1		Trace.									
205	Hornblende gneiss.	None.		Irregular.	Wall zone. Core.	1/8 4 - 5	77 20		3 30				20 50		<1 1		Trace.		1 crystal.					Gahnite. Columbite-tantalite	1 crystal. 2 crystals.	
206	do.		Not exposed.	Lenticular.	One unit.	3/4	44		25				30		1											
207	Tonalite.		do.	do.	do.	1/4	59		7				30		4		Trace.									
208	Fine-grained granite.		do.	do.	Wall zone. Core.	1/4 3	62 [1]39		5 15				30 45		3 1											
209 Opportunity Dike No. 10	Fine-grained granite and hornblende gneiss.		Crosscutting.	Lenticular-branching.	Northern branches. Main southern body.	1/8-1/4 2	60 [1]70		20 10				20 20		Trace. <1											
210 Opportunity Dike No. 9	do.		Not exposed.	Lenticular.	One unit.	1	[1]58		20				20		2											
211 Opportunity Dike No. 7	do.		do.	do.	do.	1/8	78		7				15		Trace.		Trace.									
212 Opportunity Dike No. 6	do.		do.	do.	do.	1/8-1/4	74		5				20		Trace.		Trace.		1							
213 Opportunity Dike No. 5	do.		do.	do.	Wall zone. Core.	1 6	[1]70 [1]20		12 40				18 40		<1 <1				<1					Beryl.	Several.	Up to 3.
214 Opportunity Dike No. 4.	do.		do.	do.	North and south ends. Central section.	3 - 5 3/4	[1]15 65		2 15				81 20		2 <1				 Trace.							
215 Opportunity Dike No. 3	do.		do.	Lenticular-branching.	Small stringers. Albite-quartz-perthite pegmatite.	1/4	65		15				20		<1									Beryl.	1 crystal.	1/4

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size	Quartz: Percent	Quartz: Size	Muscovite: Percent	Muscovite: Size	Garnet: Percent	Garnet: Size	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
215 Opportunity Dike No. 3--(Continued)	Fine-grained granite and hornblende gneiss.		Not exposed.	Lenticular-branching.	Central part. Cleavelandite-quartz pegmatite.	1	[1]69		8				20		2		Trace.	Up to 1/2	1	1/4-1	Lepidolite.	< 1	1/4-1	Topaz. Monazite. Columbite-tantalite. Microlite. Beryl.	< 0.5 2 crystals. 5 crystals. < 1 20 crystals.	Up to 36 1 1/2 1/32-1/4 3/4-1½
					South-central unit. Perthite-cleavelandite-quartz pegmatite.	2 - 3	[1]20		60	8			20		<1		Trace.		<1							
					Pod. Quartz-albite pegmatite.	3 - 4	20		2				75		3				<1							
216 Opportunity Dike No. 2	do.		do.	do.	North-trending branches.	1/8-1/4	72		10				18		<1											
					Northeast branch.	1-1/2	[1]73		5				20		2		<1							Microlite. Beryl.	2 crystals. 5 crystals.	1/8 1/4-4
					Central and southwestern branch.	4	[1]8		64	12-36			25		3	1/2-3/4								do.	3 crystals.	1 - 3
217 Opportunity Dike No. 1	Fine-grained granite.		do.	Oval.	One unit.	4 - 8	5		10				84		1				< 1							
218 Opportunity Dike No. 8	Fine-grained granite and hornblende gneiss.		do.	Lenticular.	do.	2	[1]55		30				15		<1				Trace.							
219	Coarse-grained granite.	None.		Irregular.	do.	1/8	75						20											Biotite. Chlorite.	< 1 5	
220	do.			Lenticular.	do.	1/4	75		3				20											do.	2	
221	Fine-grained granite.		Not exposed.	do.	do.	1/4	65		15				20		<1		Trace.									
222	Covered.		do.	Lenticular-branching.	do.	1/8-1/4	56		5				35											Chlorite.	4	
223	Fine-grained gneissic granite.	None.	Conformable.	do.	do.	1/4	55		25				20		<1		Trace.							Beryl.	1 crystal.	1/4
224	do.	do.	do.	Lenticular.	do.	1/8	77		3				20				Trace.									
225	Fine-grained granite.		Not exposed.	do.	do.	1/8	72		8				20				Trace.		Trace.					Magnetite.	Trace.	
226	Fine-grained granite and hornblende gneiss.			do.	do.	1/4	65		15				20		Trace.		Trace.		Trace.					Beryl. Magnetite.	5 crystals. Trace.	Up to 1/2

[1] Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Percent	Size	Mineral	Percent	Size	Mineral	Percent	Size (inches)
227	Fine-grained granite and hornblende gneiss.	None.	Conformable.	Lenticular.	One unit.	1/4	70		10				20		Trace.		Trace.							Biotite.	Trace.	
228	do.		Not exposed.	do.	do.	1/8-1/4	70		10				20				Trace.									
229	Fine-grained granite and tonalite.		do.	Lenticular-branching.	do.	1/8	77		8				15		<1		Trace.		Trace.					Martite.	Trace.	
230	Tonalite.			do.	Wall zone. Core.	1/4 4 - 6	70 10		10 30				20 60		Trace. 1		<1 <1							Beryl.	6 crystals.	Up to 1/2
231	Tonalite and granite.		Not exposed.	Lenticular.	Wall zone. Core.	1/8-1/4 6	80 10		5 40				15 49		<1 1		<1		 <1					Beryl.	3 crystals.	
232	Tonalite.			Oval.	One unit.	1/8	74		3				22		<1		1	<1/16-1/2								
233	Fine-grained granite.		Not exposed.	Lenticular.	do.	1/8-1/4	70		10				20		<1		Trace.							Beryl.	1 crystal.	1/4
234	Hornblende gneiss.		do.	do.	do.	1/4	69		5				25		1		Trace.									
235	Fine-grained granite.		do.	do.	do.	1/4	60		15				25		Trace.											
236	Fine and coarse-grained granite.	None.	Conformable.	do.	do.	1/4	65		15				20		Trace.									Biotite.	Trace.	
237	Fine-grained granite.	do.		Lenticular-branching.	do.	1/4	60		20				20		<1		Trace.							Beryl.	2 crystals.	3/8
238	do.	do.		Lenticular.	do.	1/2-3/4	54		20				25		1		Trace.		Trace.					do.	3 crystals.	1/4
239	Hornblende gneiss.		Not exposed.	Oval.	do.	1/8-1/4	70		10				20		Trace.		Trace.							do.	1 crystal.	1/4
240	do.		do.	Lenticular.	do.	1/4	70		15				15		Trace.		Trace.							do.	1 crystal.	1/2
241	Gneissic granite.		do.	Oval.	do.	1/2-3/4	41		40				18		<1		Trace.		Trace.							
242	Fine-grained granite.	None.		do.	do.	1/2	50		30				20		1		Trace.									
243	do.	do.	Crosscutting.	Lenticular-branching.	do.	1/4	70		10				20				Trace.							Martite.	Trace.	
244	do.	do.		Lenticular.	do.	1/4	65		10				25		<1		Trace.							Beryl.	4 crystals.	1/8-1/4
245	Hornblende gneiss, tonalite and granite.	do.	Crosscutting.	Irregular.	North half. Wall zone.	8	57		20		25	24-36	20		3		Trace.							do.	1 crystal.	3/4 by 2
					South half. Wall zone.	1/8	85		3				12		<1		Trace.							do. Columbite-tantalite	2 crystals. 3 crystals.	1/2 1/4
					Core pods.	1 - 2	49		20				30		1											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Mineral	Percent	Size	Mineral	Percent	Size (inches)
246	Hornblende gneiss.	None.	Crosscutting.	Irregular.	Wall zone.	3/4	65		8				25		2											
					Core pods.	2-1/2	25		35				40		<1		Trace.									
247	do.			do.	One unit.	1/2	84		4		5		12		<1											
248	do.			Lenticular.	do.	3/4	64		8				25		3		Trace.									
249	do.		Crosscutting.	Lenticular-branching.	do.	1-1/2	53		20		20		25		2		Trace.									
250 Opportunity 2A and 3A	do.	None.	do.	do.	Wall zone.	4	33	1/4-1/2	40	2 - 36	10-15	12-36	25	1/4-1/2	2	1/4-1/2	Trace.							Beryl. Monazite.	1 crystal. 1 crystal.	2-1/2 1/8
					Core pods.	6 - 8	5		30				65		<1									Biotite. Beryl.	<1 1 crystal.	 6 by 10
251	do.		Not exposed.	do.	Wall zone.	1/4-1/2	70		10				20		<1		Trace.							Beryl.	2 crystals.	1/4-1
					Core.	8	10		51				35		4				Trace.					do. Monazite. Columbite-tantalite.	4 crystals. 5 crystals. 2 crystals.	1/8-1-1/2 Up to 1 1/32-1/4
252	Tonalite.		do.	do.	One unit.	1/8-1/4	80		5				15		<1		Trace.							Biotite.	Trace.	
253	do.		do.	do.	do.	1/8-1/4	75		10				15		<1		Trace.									
254	Hornblende gneiss.		do.	Lenticular.	do.	1/4	70		15				15		<1		Trace.									
255	Tonalite.		do.	Lenticular-branching.	do.	1/4	57		8				35		<1		Trace.									
256	Hornblende gneiss.		do.	Lenticular.	do.	1/4	60		15				25		<1		Trace.									
257	do.		do.	do.	do.	1/8-1/4	76		4				20		<1		Trace.									
258	do.		do.	Lenticular-branching.	do.	1/4	69		10				20		1		Trace.									
259	do.		do.	Irregular.	do.	1/4	53		22				25		Trace.		Trace.							Beryl.	{14 crystals. {1 crystal.	1/8-1/2 3/4
260	Hornblende gneiss and fine-grained granite.		do.	Lenticular.	do.	1/4	55		20				25		<1											
261	Fine-grained granite.		do.	do.	do.	1/4	55		25				20		<1											
262	Hornblende gneiss.		do.	do.	do.	1/8-1/4	73		15				12		<1		Trace.									
263	Fine-grained granite.			Irregular.	do.	1/2	50		30				20		<1											
264	do.			Lenticular.	do.	1/4	72		8				20		<1											
265	Hornblende gneiss.		Not exposed.	do.	Wall zone.	1/16-1/8	85		5				10		<1		<1									
					Core.	1	44		30				25		1											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size	Mineral	Percent	Size (inches)
266	Fine-grained granite.		Not exposed.	Lenticular.	Wall zone.	1/4	70		10				20		<1		Trace.									
					Core.	1 - 2	45		25				30		<1									Columbite-tantalite.	1 crystal.	
267	Hornblende gneiss.		do.	Oval.	Wall zone.	1/8-1/4	69		3				25		3		Trace.									
					Core.	3 - 4	24		30				45		1											
268	Hornblende gneiss and fine-grained granite.		do.	Lenticular.	One unit.	1/4	67		3				30		<1											
269	Fine-grained granite.		do.	do.	do.	1/4	61		4				35		<1											
270	Hornblende gneiss.	None.		Irregular.	Hanging wall. layer.	3/4-1	44		25				30		1											
					Middle layer.	6	25		30				45		<1	1-2								Beryl.	1 crystal.	1 by 5
					Footwall layer.	1/16	81		3				15		1		<1									
271	Tonalite.	do.		Lenticular.	One unit.	3/4	40		35				25		<1		Trace.									
272	Hornblende gneiss.	do.		Irregular.	do.	1/8	80		5				15		<1		<1									
273	do.	do.		do.	Wall zone.	1/8	76		8				15		1		Trace.									
					Core pods.	2	40		25				35		<1											
274	do.		Crosscutting.	Lenticular-branching.	Hanging wall layer.	3/4	45	1/8-1/4	30	1-4			25		<1		Trace.							Martite.	Trace.	1/2
					Foot wall layer.	1/16	81		3				15		1		<1									
					Core.	2	25		40				35		<1											
275	do.			Irregular.	Wall zone.	1/8-1/4	58		3				35		4											
					Core pods.	2	44		20				35		1											
276	do.	None.		Lenticular-branching.	One unit.	1/4	74		5				20		1											
277	Hornblende gneiss and granite.	do.	Crosscutting.	Irregular.	Wall zone.	1/8-1/4	71		8				20		1											
					Core.	2	30		54				15		1											
278	do.	do.		Lenticular.	One unit.	1/4	64		7				27		2		Trace.									
279	Hornblende gneiss.			Lenticular-branching.	Wall zone.	1/4	65		15				20		<1		Trace.							Biotite.	Trace.	
					Core.	3	30	1/8-1/4	30				39		1	1/4-3/4	<1							Beryl.	35 crystals.	1/8-3/8
																								Gahnite.	Trace.	1/64
																								Samarskite(?)	1 crystal.	1/2
280	do.			Lenticular.	One unit.	1/8	73		12				15		<1		Trace.							Martite.	Trace.	
281	do.			do.	do.	1/8	75		10				15		Trace.		Trace.							Beryl.	3 crystals.	1/8-1/4
282	do.			Lenticular-branching.	do.	1/4	65		20				15		Trace.		Trace.							Biotite.	Trace.	
283	do.		Not exposed.	Lenticular.	do.	1/2-3/4	60		15	3 - 6			25		<1		<1							Beryl.	1 crystal.	1/4

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size	Mineral	Percent	Size (inches)
284	Fine-grained granite.	None.		Lenticular.	One unit.	1/8	70		8				22				Trace.									
285	do.	do.	Conformable.	do.	do.	1/8	70		15				15				<1									
286	do.			do.	do.	1/2	55		25				20		<1		Trace.									
287	Hornblende gneiss.			Lenticular-branching.	do.	1/4	75		15				10		Trace.		Trace.									
288	do.		Not exposed.	Lenticular.	Wall zone.	1/4	63		3				30		4		<1		1 crystal.							
					Core.	3	[1]60		<1				40		<1									Beryl.	3 crystals.	1
289	do.		do.	do.	Wall zone.	1/2	[1]42		25	2 - 3			30		3		Trace.		1 crystal.							
					Core.	1-1/2	[1]60		5				35		<1				1 crystal.					Beryl. Columbite-tantalite.	1 crystal. 1 crystal.	2
290	Hornblende gneiss and granite.	None.		Lenticular-branching.	Hanging wall layer.	1/8	79		2				15		4		Trace.							Biotite.	Trace.	
					Center layer.	4 - 6	20		50				30		<1		Trace.		Trace.					Beryl.	1 crystal.	
					Footwall layer.	3/4	37		42				20		1		Trace.							Biotite. Columbite-tantalite. Monazite.	Trace. 1 crystal. 1 crystal.	
291	Fine-grained granite.		Crosscutting.	Lenticular.	One unit.	1/2	55		20				25		<1		Trace.									
292	Tonalite.		do.	Lenticular-branching.	Hanging wall layer.	3/4	54		25				20		1											
					Footwall layer.	1/16	86		3				10		1											
293	do.			Oval.	Wall zone.	1/8	78		2				20		<1											
					Core.	3	15		42				42		1											
294	Hornblende gneiss.			Irregular.	One unit.	1/8	66		3				30		1											
295	do.	None.		do.	do.	1/4	70		10				20		<1		Trace.									
296	do.		Not exposed.	Lenticular.	North and south ends.	4	25		43				30		2											
					Center unit.	1/16	83						15		2		<1									
297	Hornblende gneiss and granite.	None.	Crosscutting.	Irregular.	Wall zone.	1/2	74		5				20		1											
					Core.	6-8	14		43				43		<1											
298	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/2	65		10				25		Trace.											
299	Covered.		do.	Lenticular-branching.	do.	3/4	65		20				25		<1									Beryl.	8 crystals.	1/16-1/4
300	Hornblende gneiss.		do.	do.	do.	3/4	53		22	3-6			25		<1		Trace.							do. Martite.	8 crystals. Trace.	1/4 1/8-1
301	do.		do.	Irregular.	do.	1/4	66		3				30		1		<1							Beryl.	2 crystals.	1/2

[1] Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
302	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Wall zone.	1/2	70		10				20		<1		Trace.							Beryl.	2 crystals.	1/2-1
					Core.	1-1/2	15		40				45		<1											
303	do.		do.	Lenticular.	One unit.	1/8	80		8				12		<1		<1									
304	do.		do.	Oval.	do.	1/2	54		20				25		1		<1									
305	Hornblende gneiss and fine-grained granite.	None.		Irregular.	Wall zone.	1/8	80		5		1		15		<1		<1							Beryl. Chlorite.	3 crystals. Trace.	1/16
					Core.				✓				✓													
306 Opportunity No. 4	Hornblende gneiss.		Not exposed.	Lenticular.	East layer	1/4	65		10	3			22		3		Trace.		<1							
					West layer	1-1/2	[1]79	1-3					15		1				<1		Lepidolite.	4-5	<1/16-1/2	Microlite.	2 crystals.	1/10
307 Opportunity No. 4	do.		do.	Irregular.	One unit.	1/2	47		30		5-10		20		3		<1		Trace.							
308	do.		do.	Lenticular.	Wall zone.	1/2	59		15		10-20		25		1		Trace.							Beryl.	1 crystal.	
					Core.	3			✓				✓													
309	do.		do.	Irregular.	Hanging wall layer.	1/4	64		20				15		1		<1									
					Footwall layer.	4-6	5		75		>50		20		<1											
310	do.		do.	do.	One unit.	1/4	35		45		5-10		20		1											
311	do.		do.	Lenticular.	do.	3/4	44		35		30		20		1		<1		Trace.					Beryl.	2 crystals.	1/4
312	do.		do.	Irregular.	do.	2-3	25		54		75		20		1		Trace.		Trace.							
313	Granite gneiss.		do.	Oval.	do.		15		64		75		20		1											
314	Hornblende gneiss and granite gneiss.		do.	Lenticular.	do.	1	38		40		50		20		2											
315	Tonalite and granite.	None.	Crosscutting.	Lenticular-branching.	do.	1/2-3/4	75		5				20		<1											
316	Tonalite.	do.	do.	Irregular.	Wall zone.	1/4	66		5				25				4									
					Core.	8	10		25		5		64		1	2								Beryl.	1 crystal.	3/4
317	do.		Not exposed.	Lenticular-branching.	Wall zone.	1/4-1/2	58		15				25		2		Trace.									
					Core.	4	15		35				48		2											
318	do.		do.	Lenticular.	One unit.	1/4	69		1				30		<1											
319	Hornblende gneiss.		do.	do.	do.	3/4	44		30				20		6											
320	do.		do.	Lenticular-branching.	do.	1/2	61		1				35		3											
321	Tonalite.	None.	Conformable.	Lenticular.	Wall zone.	1/8	70						30													
					Intermediate zone.	1/2	84		2				10		4											
					Core.								100													

[1] Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
322	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4-1/2	62		10				25		3											
323	Tonalite.	None.	Crosscutting.	Oval.	Wall zone. Core.	1/2-3/4 2	69 40		10				20 59		1 1											
324	do.	do.	do.	Irregular.	One unit.	1/4	68		10				20		2											
325	do.	do.	do.	do.	do.	1/8-1/4	84		10	1			5	1/4-1/2	1-2	1/2	<1							Beryl.	1 crystal.	
326	do.		Not exposed.	Oval.	do.	1	40		40				20		<1											
327	do.		do.	do.	do.	1/2	52		30	6			18		<1											
328	do.		do.	Lenticular.	do.	1/8	80		5	2			15													
329	do.		do.	Lenticular-branching.	do.	1/4	54		30	6			15		1		<1									
330	Tonalite and fine-grained granite.		do.	do.	do.	1/4	60		19				20		1		Trace.							Beryl. Biotite. Magnetite.	3 crystals. Trace. 2 crystals.	1/2
331	Tonalite.		do.	Lenticular.	do.	3/4	45		35				25		<1											
332	Fine-grained granite.			Lenticular-branching.	do.	1/2	35		40				25		Trace.		Trace.									
333	Tonalite.		Not exposed.	Lenticular.	do.	1/4-1/2	50		30				20		<1		<1							Magnetite.	<1	
334	Hornblende gniess and granite.	None.	Crosscutting.	Irregular.	do.	1/16	73		7				20		Trace.		Trace.							do.	Trace.	
335	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/8	75		10				15				Trace.									
336	do.		do.	do.	do.	1/4	55		25				20		<1		Trace.							Beryl.	1 crystal.	1/8
337	Hornblende gneiss and granite.	None.	Crosscutting.	do.	do.	1/4	60		25				15		<1		<1									
338	Tonalite.		Not exposed.	Lenticular-branching.	do.	1/4-1/2	55		20				25		<1		Trace.							Beryl.	2 crystals.	1/4
339	do.		do.	do.	do.	1/4-1/2	55		25				20		<1		Trace.							Epidote.	Trace.	
340	do.		do.	Lenticular.	Wall zone. Core.	1/4 4	67 10		10 5				20 84		3		<1 1									
341	do.		Crosscutting.	Lenticular-branching.	One unit.	1/8-1/4	63		15				22				<1									
342	do.		Not exposed.	Lenticular.	do.	1/8-1/4	70		10				20		<1		Trace.							Beryl.	2 crystals.	1/4
343	do.		do.	do.	do.	1/16	78		2				20				Trace.									
344	Tonalite and granite.		do.	do.	do.	1/8-1/4	55		25				20		Trace.		Trace.									
345	do.	None.	Crosscutting.	Lenticular-branching.	do.	1/8-1/4	65		15				20		<1		Trace.									
346	do.	do.		Lenticular.	do.	1/8-1/4	65		15				20		<1		Trace.									

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
347	Tonalite.		Not exposed.	Lenticular-branching.	One unit.	1/4	60		20				20		Trace.		Trace.							Beryl.	2 crystals.	1/16
348	do.		do.	do.	do.	1/4-1/2	50		25				25				Trace.							do.	1 crystal.	1/4
349	do.		do.	Lenticular.	do.	1/2	40		25				35				Trace.									
350	Tonalite and granite.		do.	do.	do.	1/8-1/4	65		15				20		Trace.		Trace.							Magnetite.	<1	
351	Granite.			do.	do.	1/8	65		15				20		Trace.		Trace.							Biotite. Magnetite.	Trace. Trace.	
352	Tonalite and granite.	None.		Lenticular-branching.	do.	1/8-1/4	55		30				15		Trace.		Trace.							do.	<1	
353	do.	do.	Crosscutting.	Lenticular.	do.	1/4	55		25				20		<1		Trace.							Biotite.	Trace.	
354	do.	do.	do.	Lenticular-branching.	do.	1/8	70		15				15		Trace.		Trace.							do.	Trace.	
355	do.	do.	do.	do.	do.	1/2-3/4	58		25				15		2		Trace.									
356	do.		Not exposed.	do.	do.	1/4	65		15				20		Trace.		Trace.							Biotite. Magnetite. Beryl.	Trace. Trace. 3 crystals.	 1/8-1/4
357	Tonalite.		do.	Irregular.	Wall zone. Core.	1/64 ?	85		 <1				15 100													
358	Hornblende gneiss.		do.	Lenticular.	One unit.	1/4	60		20				20		Trace.		Trace.							Beryl.	10 crystals.	1/2-3/4
359	do.		do.	do.	do.	1/4	60		20				20		<1		Trace.							do. Columbite-tantalite.	4 crystals. 1 crystal.	1 < 1/4
360	Coarse-grained granite.	None.		Irregular.	do.	3/4	45		40				15		Trace.		Trace.							Biotite. Beryl.	Trace. 1 crystal.	 1/2
361	Tonalite.		Not exposed.	Lenticular-branching.	do.	1/2-3/4	45		30				25		<1		Trace.									
362	do.		do.	Lenticular.	do.	1/4	65		15				20		<1		Trace.									
363	do.		do.	Lenticular-branching.	do.	1/2	55		25				20		<1		Trace.							Beryl.	4 crystals.	1/2
364	do.		do.	Lenticular.	do.	1/4-1/2	50		25				25		<1		Trace.							do.	10 crystals.	1/8-1/4
365	do.		do.	do.	do.	1/4	60		20				20		<1		Trace.							do.	1 crystal.	1/4
366	do.		do.	Lenticular-branching.	do.	1/8-1/4	72		8				20		<1		<1							do.	6 crystals.	1/8-1
367	do.		do.	do.	do.	1/4-1/2	53		25				20		2		Trace.							do.	1 crystal.	1/4
368	Tonalite.		do.	do.	do.	1/8	72		3				25		Trace.		Trace.									
369	do.		do.	Lenticular.	do.	1/4	65		15				20		Trace.		Trace.									
370	do.		do.	do.	do.	1/8-1/4	69		10				20		1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
371	Tonalite.		Not exposed.	Lenticular.	One unit.	1/8-1/4	64		15				20		1		<1									
372	do.		do.	do.	do.	1/8-1/4	67		12				20		1		Trace.									
373	do.		do.	do.	do.	1/4-1/2	54		25				20		1		<1									
374	do.		do.	do.	do.	1/8	70		5				25		Trace.											
375	do.		do.	Lenticular-branching.	do.	1/8-1/4	70		10				20		<1		Trace.									
376	do.		do.	Lenticular.	do.	1/4	50		30				20		<1		Trace.									
377	do.		do.	do.	do.	1/8-1/4	70		10				20		<1		Trace.							Beryl.	1 crystal.	1/4
378	do.		do.	do.	do.	1/4	59		20				20		<1		1							do.	9 crystals.	1/4
379	Tonalite and fine-grained granite.		do.	do.	do.	1/8	73		5				22		<1		<1							do.	1 crystal.	1/16
380	Tonalite.		do.	Lenticular-branching.	do.	1/4	68		12				20				Trace.									
381	do.		do.	Lenticular.	do.	1/4	65		15				20		Trace.		Trace.									
382	do.		do.	Lenticular-branching.	do.	1/8-1/4	70		10				20		<1		<1							Beryl.	4 crystals.	3/4
383	do.		do.	do.	do.	1/8-1/4	65		15				20		<1		<1							Martite.	Trace.	
384	do.		do.	do.	do.	1/4-1/2	60		20				20		<1		<1							Beryl.	1 crystal.	1/2
385	do.		do.	Lenticular.	do.	6-8	7		53		33		40		Trace.									Biotite. Columbite-tantalite.	Trace. 2 crystals.	 1/2
386	do.		do.	do.	do.	1/8	72		8				20		<1		Trace.									
387	Coarse-grained granite.	None.		do.	do.	1/4	60		25				15				<1									
388	do.	do.		do.	do.	1/8	75		10				15				<1									
389	Tonalite.	do.	Crosscutting.	Lenticular-branching.	do.	1/8	73		7				20		Trace.											
390	Tonalite and granite.	do.		Lenticular.	do.	1/8-1/4	70		10				20		<1		<1							Beryl.	1 crystal.	1/4
391	Tonalite.	do.	Crosscutting.	Lenticular-branching.	Wall zone. Core.	<1/64 4-8	75 15				✓		25 85		Trace.				 Trace.							
392	Covered.		Not exposed.	do.	One unit.	1-2	40		40				20		<1		Trace.									
393	do.		do.	Oval.	do.	1	40		35				25		<1											
394	do.		do.	Irregular.	do.	1/4	63		7				25		5		Trace.									
395	do.		do.	Lenticular.	do.	1/8-1/4	57		15				25		3											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
396	Covered.		Not exposed.	Lenticular-branching.	One unit.	1-2	49		40		✓		10		1											
397	do.		do.	Lenticular.	do.	1/8-1/4	70		5				25		Trace.		Trace.									
398	do.		do.	do.	do.	1-2	38		45		20		15		2											
399	do.		do.	Irregular.	do.	1-2	50		30		✓		20		<1		Trace.							Biotite.	<1	
400	do.		do.	Lenticular.	do.	3/4	50		30				20		<1		Trace.									
401	do.		do.	Irregular.	do.	1/8-1/4	70		10				20											Biotite. Magnetite.	Trace. Trace.	
402	do.		do.	Lenticular.	do.	3/4	40		45				15		Trace.		Trace.									
403	do.		do.	do.	do.	3/4	50		35				15		<1		Trace.									
404	do.		do.	do.	do.	3/4	45		30				25		<1		Trace.									
405	Tonalite.	None.		Lenticular-branching.	do.	3/4	55		15				30													
406	do.		do.	Lenticular.	do.	1/2	47		30	6			20		3											
407	Hornblende gneiss.		do.	do.	do.	3/4	50		20	4			30		<1											
408	do.		do.	Lenticular-branching.	do.	1/2	60		10				30		<1											
409	do.		do.	Lenticular.	do.	3/8	70						30		<1											
410	do.		do.	do.	Wall zone. Core.	1/8 4-5	85		 15	 4			15 85		 <1											
411	Quartzite.		do.	do.	Wall zone. Core.	1/4 6	85 30		 39	 4-10			15 30		<1 1											
412	Hornblende gneiss.		do.	do.	One unit.	3	53	1/8	35	10			10		2									Beryl.	0.3	
413	do.		do.	do.	Wall zone. Core.	1/8 6	72 15		5 44				15 40		8 <1									 Beryl.	 <0.05	
414	do.		do.	do.	One unit.	1/2	44		20				35		1											
415	do.		do.	do.	do.	1	57		8	3			35				<1	3								
416	do.		do.	do.	do	3/8	55		35				10		<1		Trace.							Beryl.	4 crystals.	3/4
417	do.		do.	Irregular.	Wall zone. Core.	1/8 3	55 42		5 45	 4-6			35 8		5 5									do. do.	1 crystal. 0.2	3/4 1/8-2
418	do.		do.	Lenticular.	One unit.	1/4	61		15				20		4									do.	1 crystal.	1/4
419	do.		do.	Lenticular-branching.	do.	1/2	75		15				10		<1		Trace.									
420	do.		do.	Lenticular.	do.	3/8	75		10				15				Trace.							Beryl.	2 crystals.	1/4
421 Ben-Kauf No. 4	do.		do.	do.	do.	1/2	44		20				35		1											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
422 Ben-Kauf No. 1	Tonalite.		Not exposed.	Lenticular-branching.	Hanging wall layer.	3	22		35				35		8											
					Central unit.	1/2	[1]81		15				2								Lepidolite.	2		Microlite. Apatite.	0.01 1 crystal.	 1/4
					Footwall layer.	1/4	50		2				40		8											
423	Hornblende gneiss.		do.	Lenticular.	One unit.	1/2	49		35				15		1											
424 Bazooka	Tonalite.		do.	do.	Wall zone.	1/2	[1]82						10								Lepidolite.	8				
					Core.	1-2	[1]15						85													
					do.	4	[1]20						60								Lepidolite. Spodumene. Amblygonite.	2 12 6		Microlite.	1 crystal.	
425	Hornblende gneiss.		do.	do.	One unit.	1/4	60		15				25											Beryl.	3 crystals.	3/4
426	do.		do.	do.	do.	3/8	54	1/8	10	4			35		1											
427	do.		do.	do.	do.	1	30		40				30													
428	do.		do.	do.	do.	1	30		40				30		<1									Beryl.	2 crystals.	1/2
429	do.		do.	do.	do.	1/2	70		15	8			15		<1											
430	Hornblende gneiss.		do.	Oval.	One unit.	1/2	55	<1/8	20	2			25		Trace.											
431	do.		do.	Lenticular-branching.	Hanging wall layer.	4	30		45				25		<1									Beryl.	<0.05	1
					Footwall layer.	1/4-1/2	65		20				15		Trace.											
432	do.		do.	do.	Border zone.	1/8	92		5				3											Beryl.	0.1	1/4-3/4
					Hanging wall layer.	2	46		30				20		4		Trace.							do.	0.05	1/4-3/4
					Footwall layer.	1/4	62	1/8	2				35		1									do.	1 crystal.	
433	do.	None.	Conformable.	Lenticular.	Hanging wall layer.	1/2	44		20	4			35		1		Trace.							do.	<0.05	1-1/2
					Footwall layer.	1/8	64						35		1											
434	do.		Not exposed.	do.	One unit.	1/4	54		8				35		3	1/4								Beryl.	1 crystal.	6
435	do.		do.	do.	Hanging wall layer.	1	40		35				15		2									do.	4 crystals.	
					Footwall layer.	1/8	65						35		<1											
436	do.		do.	do.	Wall zone.	1/4	65	1/8	5	3			30		<1											
					Core.	4	5		80				15		<1									Beryl.	1 crystal.	1
437	do.		do.	do.	One unit.	1/4	46	1/8	20	8			32		2									do.	1 crystal.	1/2
438	do.		do.	do.	do.	1/4	55	1/8	15	6			30		<1									do.	1 crystal.	3/4

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
439	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	55		15				30		<1									Beryl.	2 crystals.	1/4
440	do.		do.	Oval.	Hanging wall layer.	3	25		40	12			25		10									do. Apalite.	2 crystals. Trace.	
					Footwall layer.	1/4	52		15				26		7											
441	do.		do.	Irregular.	Wall zone. Core.	1/4 8-12	65 2		30 8	1			5 90		Trace.											
442	do.		do.	Lenticular.	One unit.	1/8	45		15				35		5											
443	do.		do.	do.	do.	1/8	38		35				25		2											
444	do.		do.	do.	do.	1/4	50	1/8	15				35													
445	do.		do.	do.	do.	8	35	1/8	5				60	1												
446	do.		do.	do.	do.	1/4	53	1/8	7	2			40	1	<1		Trace.									
447	do.		do.	do.	do.	1/4	40		35				25		<1											
448	do.		do.	do.	do.	1/4	58		2				40													
449	do.		do.	Irregular.	do.	1	40	1/8					57	2	2		Trace.			1						
450	do.		do.	Lenticular.	do.	1	34	1/4					65	1	1											
451	do.		do.	do.	do.	1	40		40	4	5-10		20													
452 Brown Derby No. 1	do.	None.	Crosscutting.	Lenticular-branching.	West branch wall zone. Quartz-cleaveland-ite pegmatite.	4-6	[1]45						52		3		<1		<1		Curved lepidolite.	<1				
					West branch Core. Albite-monazite-columbite pegmatite.	1/8-1/4	86	1/8-1/4					5	1/8			<1	1/4-1/2	<1	1/4-1/2				Gahnite. Biotite. Monazite. Columbite-tantalite. Fluorite. Betafite.	1 4 2.2 1.4 Trace. Trace.	1/16 1/16 1/4-1-1/2 1/4-21
					Hanging wall layer. Perthite-albite-quartz pegmatite.	12	30		40				20		10				Trace.					Beryl.	0.1	1/2 by 1/4 2 by 2
					Hanging wall. Quartz pod.	24	[1]25						70								Lepidolite.	5	3-4			
					Curved lepidolite layer.	4-5	[1]44						40		<1				<1	1/2-3	Curved lepidolite.	15	1/4-2	Topaz. Apatite.	1 5 crystals.	4-8 1/4
					Lepidolite-microlite	1	[1]43						15								Lepidolite.	40	1/32-1/8	Microlite. Topaz. Beryl.	0.35 2 1 crystal.	1/64-1/4 4-6 1/2

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
452 Brown Derby No. 1--(Continued)	Hornblende gneiss.	None.	Crosscutting.	Lenticular-branching.	Quartz-cleavelandite-lepidolite topaz layer.	4-6	[1]25	1/2-3					55	1-10	1	1/2-1½			<1		Lepidolite.	10	1-7	Topaz. Beryl.	10 <0.1	Up to 7 across by 42 long. 1-4
					Footwall layer. Albite pegmatite.	1/4	90						8		Trace.		<1		2					Biotite.	Trace.	
453 Brown Derby No. 2	do.	do.	do.	Lenticular.	Wall zone.	1/4-1/2	62						30		7		<1							Biotite. Topaz.	1 <1	
					Core.	1	[1]53						40				<1		1		Lepidolite.	5		do. Microlite.	1.1 1 crystal.	4-8
454 Brown Derby No. 3	do.	do.	do.	Lenticular-branching.	North end.	12-24	10		74	12-24	75		15		1											
					South end wall zone.	1/2-3/4	37		2				55	1-2	4	1-3	<1		<1					Biotite. Beryl.	2 2 crystals.	 1/2
					South end core.	5-6	[1]47		1				38		4		<1		3		Lepidolite.	7		Topaz. Microlite. Columbite-tantalite. Beryl.	<1 Trace. 1 crystal. 4 crystals.	 1-3
455 Brown Derby Dike No. 4	Hornblende gneiss and biotite schist.	do.	do.	Lenticular.	Southern and northern ends.	1/8	82		10				8		<1		<1									
					Southern part core.	24-36	10		80				10		Trace.									Beryl.	3 crystals.	3-12
					Central section.	24-36			5				95													
456 Brown Derby Dike No. 5	Hornblende gneiss.		Not exposed.	do.	Wall zone.	1/2	[1]65		20				15		<1		<1									
					Core.	8	56						45		1									Microlite.	1 crystal.	1/4
457 Brown Derby Dike No. 6	do.		do.	Lenticular-branching.	Wall zone.	1/4	72		5				20				<1		<1		Curved lepidolite.	3		Beryl.	1 crystal.	1/4
					Core.	3	[1]64		5				30		5		<1				Curved lepidolite.	1				
458 Brown Derby Dike No. 7	do.		do.	Lenticular.	Hanging wall layer.	6	10		70	Up to 18			20		4									Beryl.	1 crystal.	2
					Footwall layer.	1/4	68		10				20		2		<1									
459 Brown Derby Dike No. 8	Hornblende gneiss and biotite schist.	None.	Crosscutting.	Lenticular-branching.	Wall zone.	3	42		35	4-12	2		20		3		<1		Trace.					Gahnite.	Trace.	
					Pod.	4	[1]67						20		1						Lepidolite.	2		Beryl. Topaz.	4 crystals. 10	1/4-7
460 Brown Derby Dike No. 9	Biotite schist.	do.	do.	Lenticular.	One unit.	2	45		44	Up to 6			10		1											
461 Brown Derby Dike No. 10	Biotite schist and hornblende gneiss.	do.	do.	Lenticular-branching.	do.	3	44		35	Up to 12			20		1		Trace.		Trace.					Beryl.	8 crystals.	1/2-3
462	Hornblende gneiss.	do.	Conformable.	Lenticular.	Wall zone.	1/8-1/4	71		5				20		2		2	1/16	<1	1/4-1/2				Biotite.	<1	
					Core.	3	[1]92						8		<1		<1		<1					Lepidolite. Microlite.	<1 5 crystals.	1/16-3 1/8-1/4

[1] Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																						
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture	Mineralogy																		
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
463	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	3	25		52				20		3		<1							Beryl.	1 crystal.	1/4
					Footwall layer.	1/4	71		8				20		1		<1									
464	do.		do.	do.	Wall zone.	1/4-1/2	45		10				40		5											
					Core.	2	10		55				25		5									Biotite.	<1	
465	do.		do.	do.	Wall zone.	1/4	70		15	Up to 3			15		<1									do.	Trace.	
					Core.	12	5		20				75													
466	do.		do.	do.	One unit.	1/2	65		20				15													
467	do.	None.		do.	Hanging wall layer.	4	30		40				30		<1		Trace.									
					Footwall layer.	1/4	65		15				20													
					Fracture filling.								100													
468	Coarse-grained granite.	do.		do.	Wall zone.	3/4-1	3		77		30		20													
					Core.	3-4			60				40		<1											
469	do.	do.		do.	One unit.	3/4-1	3		72				25		Trace.		Trace.							Biotite.	Trace.	
470	do.			do.	do.	1-2	5		75				20		<1											
471	do.			Lenticular-branching.	do.	1/4-1/2	25		49		10-15		25		1											
472	do.	None		do.	do.	2-3	4		69		30		25		2		Trace.									
473	do.			Lenticular.	do.	3/4	30		44		25		25		1		Trace.									
474	do.	None.		Lenticular-branching.	do.	3/4	3		77		30		20		<1		Trace.									
475	do.	do.		Lenticular.	do.	1-2	1		78		20		20		1											
476	do.	do.		Lenticular-branching.	do.	1-1/2	2		78		30		20		Trace.		Trace.							Biotite.	Trace.	
477	do.	do.		do.	do.	1/4-1/2	50		25				25		<1		Trace.							Beryl.	21 crystals.	1/8-1/2
																								Magnetite.	<1	
478	do.	do.		Lenticular.	do.	3-4	1		73		90		25		1											
479	do.			Lenticular-branching.	do.	1	2		77		50		20		1		Trace.									
480	do.			Lenticular.	do.	1-2	5		75		70		20				Trace.							Magnetite.	Trace.	
481	do.			do.	do.	1-2	2		78		60		20		<1		Trace.									
482	do.			do.	do.	1-2	1		79		75		20		<1											
483	do.			do.	do.	1/2-3/4	15		65		30		20		Trace.									Beryl.	1 crystal.	1/4
																								Biotite.	Trace.	
484	do.	None.		do.	Wall zone.	1-2	2		78		90	4	20	1/8										Magnetite.	Trace.	
					Core.	3			30				70													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
485	Coarse-grained granite.	None.		Lenticular.	Main unit. Fracture filling.	3-4 6	5		75 ✓		85		20 ✓											Biotite.	Trace.	
486	do.	do.		Lenticular-branching.	Main unit. Fracture filling.	3-4 6	5 Trace.		75 5		85		20 95		Trace.		Trace. Trace.							Biotite. do.	Trace. Trace.	
487	do.			Oval.	One unit.	3-4	10		70		70		20													
488	do.			Lenticular.	Main unit. Fracture filling.	3-4 6	15		70 ✓		80		15 ✓		Trace.		Trace.		Trace.							
489	do.	None.		Lenticular-branching.	One unit.	4	3		82		90		15				Trace.							Magnetite. Biotite.	Trace. Trace.	
490	do.			Lenticular.	do.	2-3	3		77		90		20											Magnetite.	Trace.	
491	do.			do.	do.	3	2		78		95		20				Trace.							do.	Trace.	
492	do.			Lenticular-branching.	Main unit. Fracture filling.	3-4 5-6	1		79 35		95		20 65											do.	<1	
493	do.	None.		do.	One unit.	4-5	Trace.		80		95		20				Trace.							Magnetite.	Trace.	
494	do.	do.		do.	do.	4	3		77		95		20				Trace.							Biotite. Magnetite.	Trace. Trace.	
495	do.			do.	do.	1	5		75		80		20				<1							Biotite.	Trace.	
496	do.	None.		do.	do.	3-4	15		55		✓		30													
497	do.	do.		Irregular.	do.	3	10		65		✓		25				Trace.									
498	do.	None.		do.	Main unit. Fracture filling.	1-2 ?	35		35		✓		30 100													
499	do.			Lenticular.	One unit.	5	23		47		✓		30		Trace.											
500	do.			Lenticular-branching.	do.	2	30		45		✓		25		Trace.											
501	do.			Lenticular.	do.	5	8		50		✓		30		2											
502	do.			do.	Wall zone. Core.	1/4 ?	10		60		✓		30 100				Trace.									
503	do.			Lenticular-branching.	One unit.	6	7		65	Up to 12			25		3	3/4										
504	do.			Oval.	Main unit. Fracture filling.	2 ?	30		40	Up to 3			25 100		5											
505	do.			Irregular.	Main unit. Fracture filling.	2 ?	30		45	4	40		25 100													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Pegmatite: Shape	Pegmatite: Internal structure	Pegmatite: Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
506	Coarse-grained granite.	None.		Lenticular-branching.	One unit.	4	15		55		85		30		Trace.		Trace.									
507	do.	do.		Oval.	Main unit. Fracture filling.	2 ?	20		55		80		25 100		<1											
508	do.	do.		Irregular.	Main unit. Fracture filling.	1-2 ?	20		60				20 100		Trace.											
509	do.	do.		do.	Main unit. Fracture filling.	1/2 ?	40		30		✓		30 100		<1		Trace.									
510	do.		Not exposed.	Lenticular.	Main unit. Fracture filling.	1/4 ?	70		5				25 100													
511	do.	None.		do.	Main unit. Fracture filling.	1/2-1 6	30		40 10		✓		30 90													
512	do.	do.		Irregular.	One unit.	1/2	30		39		50		30		1											
513	do.		Not exposed.	do.	do.	1/4	33		35		50	1/2	30		2											
514	Hornblende gneiss and granite.		do.	Lentiuclar.	do.	4	15		50		85		35													
515	Hornblende gneiss.		do.	Irregular.	do.	4	15		50		85		35													
516	Hornblende gneiss and granite.		do.	Lenticular.	do.	2	34		35		✓		30		1											
517	Hornblende gneiss.		do.	Irregular.	Main unit. Fracture filling.	2-3 ?	45		25				30 100		<1											
518	do.		do.	do.	One unit.	1-2	20		50		40		30													
519	do.		do.	Lenticular.	do.	1/4	55		15				30											Biotite.	Trace.	
520	do.		do.	Irregular.	Wall zone. Core.	1/4 6	50		20 10		✓		30 90		Trace.		Trace.									
521	do.		do.	Lenticular.	One unit.	1/4	65		5				30													
522	do.		do.	do.	do.	3/8	80						20													
523	do.		do.	Lenticular-branching.	do.	2	50		30	Up to 2	✓		20													
524	do.		do.	Lenticular.	Wall zone. Core.	3/4	10 ✓		65		✓		25 ✓													
525	do.		do.	do.	One unit.	1/4	57		25				18													
526	Dacite.	None.		do.	do.	1/4	55		20	Up to 2			25		<1											

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
527	Dacite.	None.		Lenticular.	One unit.	1-1/2	20		50				30													
528	Hornblende gneiss.		Not exposed.	Oval.	do.	1/4	65		25	3/4			10				<1									
529	do.		do.	Lenticular.	do.	4			✓		85		✓													
530	Hornblende gneiss and granite.		do.	Lenticular-branching.	Main unit.	1-2	20		45				35													
					Fracture filling.	?							100													
531	Coarse-grained granite.		do.	Irregular.	One unit.	1	25		40				35													
532	do.		do.	Lenticular.	Main unit.	1/4	50		25	Up to 2			25				Trace.									
					Fracture filling.	?							100													
533	Dacite.	None.		do.	Wall zone.	1/4	53		25	Up to 4			20		2	3/4										
					Core.	?							100													
534	Hornblende gneiss.	do.		Irregular.	Wall zone.	1/8-1/4	58		15				25		2											
					Core.	4-12	7		62				30		1									Beryl.	1 crystal.	4
					Fracture filling.	6	7		62				30		1											
535 Brown Derby No. 5	Tonalite.	do.		do.	Wall zone.	1/8-1/4	61		10				25		4		Trace.		<1		Lepidolite.	Trace.		Beryl.	<.05	0.6-1.1
					Intermediate zone.	4	[1]35		4				55		1		<1	Up to 1-1/2	<1		do.	5		Apatite.	Trace.	1/2
																								Columbite-tantalite.	1 crystal.	1/64 by 3/4
																								Microlite.	13 crystals.	1/8-1/4
																								Topaz.	<1	4-6
					Core.	6	20		39				40		1						Lepidolite.	Trace.		Beryl.	<0.1	1/2-3-1/2
																								Columbite-tantalite.	2 crystals.	1/16-1-1/2
																								Beryl.	1 crystal.	4 by 6
536	Hornblende gneiss.	do.		do.	Wall zone.	1/4-1/2	45		10	Up to 2			40		5											
					Core.	24-36	10	1/4	55				25		5									Biotite.	5	8
					Fracture filling.				25				75													
537	do.		Not exposed.	do.	Wall zone.	1/4	58		5				35		2											
					Core.	8-10	10		65				20		5									Beryl.	0.3	1/4-3
538	do.		do.	do.	Wall zone.	1/4	57		10	Up to 6			25		8											
					Core.	4	15		32				50		3	1/4								Beryl.	0.5	1/64-6
539	do.		do.	Lenticular.	Hanging wall layer.	6	8		80				12													
					Footwall layer.	1/8	69		7				20		4											
540	do.		do.	do.	One unit.	1/4	62	1/8	15	Up to 4			20	1/8	3	1/4										

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
541	Hornblende gneiss.	None.		Lenticular.	Wall zone.	1/4	60		10				25		5		<1									
					Core.	6	5		25				70											Beryl.	Several pieces.	3/4
542	do.		Not exposed.	Irregular.	Wall zone.	1/4	60		30				10		<1											
					Core.	6	53		5				92		<1											
543	do.		do.	do.	Wall zone.	1/2	55		10				30		5									Beryl.	1 crystal.	1-1/2
					Core.	?							100													
544	do.		do.	Lenticular.	One unit.	1/8	68		10				20		2											
545	do.		do.	do.	Wall zone.	1/8-1/4	69		10				20		1		<1									
					Core.	1	20		48				30		2											
546	do.		do.	do.	Wall zone.	1/4	55		25				20		<1											
					Core.	5	5		3				92		<1									Biotite.	Trace.	
547	do.		do.	do.	One unit.	6	25		30				43		2											
548	do.	None.	Crosscutting.	Lenticular-branching.	Hanging wall layer.	10	15		50				33		2									Beryl.	3 crystals.	3-4
					Footwall layer.	1/8	74		3				20		3											
					Consolidated.	1/4-1/2	63		15				20		2											
549	do.			Lenticular.	Wall zone.	1/4	58		15				25		2											
					Core.	8	10		20				66		4											
550	do.		Not exposed.	Irregular.	One unit.	1/4	53	1/8	20				25		2									Monazite.	1 crystal.	3/4
551	do.		do.	Lenticular.	do.	1/2	54		25	Up to 6			20		1									Beryl.	4 crystals.	1/2
552	do.		do.	do.	do.	1/8	60		10				30		<1											
553	do.		do.	do.	Wall zone.	1/8	70		15				14		1											
					Core.	?																				
554	do.		do.	do.	One unit.	1/2-3/4	50	1/8	25	Up to 8			25		<1											
555	do.		do.	do.	Hanging wall layer.	4	25		60				15		<1		Trace.									
					Footwall layer.	1/8	70		15				15													
556	do.			Irregular.	Main unit.	1/4	70		15	2			15													
					Fracture filling.	2	20		55	Up to 5			25													
557	do.			Lenticular.	Wall zone.	1/4-1/2	49		20	Up to 5			30		1											
					Core.	8	10		60	5			30													
558	do.		Not exposed.	Lenticular-branching.	Main unit.	1/8-1/4	59		20	Up to 5			20		1		Trace.									
					Fracture filling.	6-12	5		64				30		1											
559	do.		do.	Lenticular.	Main unit.	1/4	65	1/8	6	Up to 4			25		4	1/4										
					Fracture filling.	4			✓				✓													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
560	Hornblende gneiss and granite.	None.		Irregular.	Wall zone.	1/8	60		4				36		<1		Trace.									
					Main core.	4	20	1/8	50				30		Trace.											
					Small pod.	12-24	5		75				20											Beryl.	0.45	1-1/2-5
561	Hornblende gneiss.			Lenticular.	North end.	1/4	60		20				20													
					South end.	1	30		45				25		Trace.		Trace.									
562	Coarse-grained granite.		Not exposed.	Irregular.	Wall zone.	1/8	93		1				6		<1											
					Core.	1	20		35	Up to 8			45		<1		Trace.									
563	Hornblende gneiss.			Lenticular.	One unit.	3/4	45		40	Up to 3			15													
564	do.		Not exposed.	Irregular.	Main unit.	1/4	60		20	Up to 8	✓		19		1		Trace.									
					Fracture filling.				50				50													
					do.								100													
565	do.		do.	Lenticular-branching.	Wall zone.	1/8	70		5				25		Trace.		Trace.									
					Core.	5	35		35				30													
566	do.		do.	Irregular.	Main unit.	1/4	50		20		✓		30													
					Fracture filling.								100													
567	do.	None.		do.	Wall zone.	1/8	78		2				20		Trace.											
					Pod.								100													
568	do.	do.		do.	Main unit.	1/8	67		7	1/2-4			25		<1											
					Fracture filling.	2-8			50				50													
569	do.		Not exposed.	Oval.	One unit.	1/8	50		20				30		Trace.											
570	do.	None.		Lenticular.	do.	1/8	67		8	Up to 6			25		<1		Trace.									
571	do.		Not exposed.	Irregular.	do.	1/8-1/4	73		5				20		1		1									
572	do.		do.	do.	Wall zone.	1/4	65		10				25		<1		<1									
					Core.	12			9				90		1											
573	do.	None.		do.	Main unit.	1/4	64		15				20		1		Trace.									
					Fracture filling.				50				50													
574	do.	do.		do.	Main unit.	1/8-1/4	54		15				30		1		<1									
					Fracture filling.				50				50													
					do.	?							100													
575	do.		Not exposed.	Lenticular.	Wall zone.	1/8	60		15				25		<1											
					Core.	?							100													
576	do.		do.	Oval.	Wall zone.	1/8	73		2				25		Trace.		<1									
					Core.	5-6	20		45				35		<1											
577	do.		do.	do.	Main unit.	1/8-1/4	66		5				25		3		1									
					Fracture filling.				50				50													
					do.	?							100													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																						
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																		
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
578	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/8-1/4	61		1				35		3		Trace.									
579	do.		do.	Irregular.	Main unit.	1/8	75		7				15		3		Trace.									
					Fracture filling.	?							100													
580	do.		do.	Oval.	One unit.	1/8	80		15				5		<1		Trace.									
581	do.		do.	Irregular.	do.	1/8-1/4	63		8				27		2		Trace.									
582	do.		do.	Oval.	Wall zone.	1/8	70		10				20		Trace.		<1									
					Core.	8			10				90													
583	do.		do.	Lenticular.	One unit.	1/2	40	1/8	30	4-6			30		<1		Trace.									
584	do.		do.	Irregular.	do.	3/4	37		25				35		3		Trace.									
585	do.		do.	Lenticular.	do.	1/2	30		39	Up to 4			30		1											
586	do.		do.	do.	do.	3/4	25		45				30		<1											
587	do.		do.	Irregular.	do.	1	49	1/8	20	2-6			30	2-6	1		Trace.									
588	do.		do.	Lenticular.	do.	1/4	53		20	Up to 5			25		2											
589	do.		do.	do.	do.	1/4	32		35	1-2			30		3									Beryl.	Several crystals.	1/4-3/4
590 Beryl and Rare Minerals Lode	do.		do.	do.	Wall zone.	1/4	55		20				25		<1											
					Intermediate zone.	36	<1		50	12-60			20		30	Up to 8	<1							Beryl. Columbite-tantalite. Gahnite. Unknown.	0.2 <0.05 Trace. Trace.	1/2-8 1/4-2 <1/32 1/4
					Core.	?							100													
591	do.		do.	Oval.	One unit.	1/8	60		19				20		1											
592	do.		do.	Lenticular-branching.	Wall zone.	1/8	45		20	1/2			30	1/8	5	1/8-1/2										
					Core.	2			70				30													
593	do.		do.	Lenticular.	One unit.	1/4-1/2	28		30				40		2											
594	Tonalite.	None.		do.	do.	1/2	56		18				25		1		<1									
595	do.	do.		do.	Hanging wall layer.	1-2	40		37				20		3		<1									
					Footwall layer.	1/8-1/4	84		1				15		<1											
596	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1/4	30		39	Up to 6			25		1											
597	do.		do.	Oval.	do.	1/2	25		39	Up to 6			35		1											
598	Quartzite.	None.	Crosscutting.	Lenticular.	do.	1/2-1	39		38				20		3		Trace.							Beryl.	1 crystal.	3/16
599	Hornblende gneiss.			Lenticular-branching.	do.	1/4	44		30				25		1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
600	Hornblende gneiss.		Not exposed.	Oval.	One unit.	1/8	75		9				15		1											
601	do.		do.	do.	do.	1/16	70		14				15		1											
602	do.		do.	Lenticular.	Wall zone.	1/8	64	1/16	20	2			15		1	1/8										
					Core pod.	1/2	30		50	3-4			20		<1	1			Trace.					Beryl.	1 crystal.	1
603	do.		do.	Oval.	One unit.	1/32	79		5				15		1											
636 White Spar No. 1	do.	None.	Crosscutting.	Irregular.	Wall zone.	1	45		32	18			20		3	1-1/2										
					Intermediate zone.	2	[1]55		15	10			25								Lepidolite.	5	2	Topaz. Beryl. Columbite-tantalite. Microlite.	<1 0.1 Trace. Trace.	Up to 5
					Core.	4			40	24			60													
					Small pod.	1/32							10								Lepidolite.	90	1/32	Microlite.	0.1	
605	Tonalite.		Not exposed.	Lenticular.	One unit.	1/4	54		25	30			18		1	1/8					Lepidolite.	2				
606	Hornblende gneiss.	None.	Crosscutting.	do.	do.	1/8	70		15	3			15		<1	1/2										
607	Tonalite.		Not exposed.	Lenticular-branching.	Main unit.	1/32	75		9	3/4			15		1	1/16										
					Fracture filling.	1/8	50		23	4			25								Lepidolite.	2	1/8			
608	do.		do.	Lenticular.	One unit.	1/16	70		14	4			15		1	1/16										
609	Hornblende gneiss.		do.	Lenticular-branching.	do.	1/32	70		9	3			20		1	1/16										
610	do.	None.	Crosscutting.	Lenticular.	do.	1/4	42		38	2			20		<1	1/32										
611	do.		Not exposed.	do.	do.	1/2	40		40	8			20		<1	1/8										
612	do.	None.	Crosscutting.	Lenticular-branching.	Hanging wall layer.	1/4	41		37	4			20		2	1/8										
					Footwall layer.	1/32	78		5	1			15		2	1/16										
613	do.		Not exposed.	Lenticular.	Hanging wall layer.	1/8	55		25	2			20		<1	1/16										
					Footwall layer.	1/32	80						20		<1	1/32										
614	Biotite schist.	None.	Crosscutting.	do.	One unit.	1/8	65		19	3-1/2			15		1	1/16										
615	Hornblende gneiss.	do.	Conformable.	do.	do.	1/8	70		15	2-1/2			15		<1	1/8										
616	do.		Not exposed.	Irregular.	Hanging wall layer.	1/4	50		30	4			20		<1											
					Footwall layer.	1/32	75		10	5			15		<1	1/16	Trace.									
617	do.		do.	Lenticular.	Hanging wall layer.	1/2	30		60	5			10		<1	1/16										
					Footwall layer.	1/16	64		20	4			15		1	1/16	Trace.									

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
618	Hornblende gneiss.	None.	Crosscutting.	Irregular.	Hanging wall layer.	1/2	54		25	5			20		1	1/16	Trace.									
					Footwall layer.	1/16	74		10	3			15		1	1/16										
619	do.		Not exposed.	Lenticular.	One unit.	1/8	65		20	4			15													
620	do.		do.	do.	do.	1/8	70		15	1			15		<1	1/16										
621	do.		do.	do.	do.	1/4	60		25	3			15		<1	1/16										
622	do.		do.	do.	do.	1/8	65		25	2			10		<1	1/16										
623	do.		do.	do.	do.	1/4	40		40	2			20		<1	1/8										
624	do.	None.		Irregular.	do.	1/16	60		15	2			24		1	1/32										
625	do.	do.		Lenticular.	do.	1/16	65		9	2-5			25		1	1/16										
626	do.		Crosscutting.	do.	do.	1/16	70		15	3-9			15		<1	1/16										
627	do.		do.	do.	Wall zone.	1/16	60		20	1-2			20		<1	1/16										
					Core.	1/4	30		50	2-4			20		<1											
628	do.		do.	do.	Hanging wall layer.	1	44		35	4-7			20		1	1/4										
					Footwall layer.	1/32	70		10	1-2			19		1	1/16										
629	do.		Not exposed.	do.	One unit.	1/4	50		29	2-4			20		1	1/8										
630	do.	None.	Crosscutting.	do.	do.	1/4	64		20	3-6			15		1	1/16										
631	do.		Not exposed.	do.	do.	1/16	69		15	3-6			15		1	1/16	Trace.									
632	do.		do.	do.	do.	1/4	45		35	2-4			20		<1	1/16										
633	do.		do.	do.	do.	1/32	65		20				14		1		Trace.									
634	do.		do.	do.	do.	1/64	65		20				13		2											
635	Tonalite.		do.	do.	do.	1/16	60		19				20		1											
604 White Spar No. 2	Hornblende gneiss.	None.	Crosscutting.	do.	Wall zone.	1/4	45		30	1-1/2-2-1/2			20		5						Lepidolite.	<1	1/8			
					Core.	1/32	45		10	4-6			35				<1				Lepidolite.	10	1/32	Fluorite.	Trace.	
																								Microlite.	<0.01	1/32
																								Beryl.	2 crystals.	5/8
																								Chrysacolla.	Trace.	
637	do.	do.		do.	Wall zone.	1/4	40[1]		38				20		2		Trace.									
					Core pod.	1	20[1]		35	8-12			40		5						Lepidolite.	Trace.		Columbite-tantalite.	1 crystal.	
					Fracture filling.	1/4	50[1]		5	4-10			30		15						Lepidolite.	Trace.		Beryl.	1 crystal.	2
																								Microlite.	.01	1/8
638	do.		Not exposed.	do.	Hanging wall layer.	1/4	30		5				50		15											
					Central layer.	3	70						30													
					Footwall layer.	1/8	64		5				30		1											

[1]Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																						
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																		
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
639	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	1/4	59		20	3-4			20		0.5	1/2										
					Core pod.	1	10		20	8-15			67		3											
640	do.		do.	do.	One unit.	1/8	50		30	4-7			19		1	1/2										
641	do.		do.	Irregular.	do.	1/16	65		14	3-6			20		1	1/8										
642	do.	None.		do.	do.	1/16	55		23				20		2		Trace.									
643	Hornblende gneiss and biotite schist.	do.	Crosscutting.	do.	Wall zone.	1/8	72		7				20		1		Trace.									
					Core pod.	1/4	20		55				15		4		1							Beryl.	2 crystals.	1/2
					do.	1/4	19		60				20		1											
644	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	43		40	10-12			15		2	1/2	Trace.									
645	do.	None.	Crosscutting.	Irregular.	Wall zone.	3/16	55		24	1-1-1/2			20		1		0.5									
					Core.	3	19		40	2-3			40		1	2										
					Small pods.	1			18	2-3			80		2	3-4										
646	do.		Not exposed.	Lenticular.	Wall zone.	1/8	49		20	1-2			30		1											
					Core pod.	1	8		50	Up to 10			40		2	1										
647	do.		do.	do.	Wall zone.	1/64	75		13	4-7			10		2	1/4			Trace.							
					Core pod.	3	5		80	9-14			10		5	1										
648	do.		do.	Irregular.	One unit.	1/16	75		8	5-7			15	2		1/4	Trace.									
649	Hornblende gneiss, mica schist, and quartzite.		do.	Lenticular.	Wall zone.	1/32	54		10				35		1	1/8	Trace.									
					Core pod.	1	30		47	6-8			20		3	1/2-3/4										
650	Hornblende gneiss.		do.	Irregular.	One unit.	1/8	69		10	4-6			20		1	1/8										
651	do.		do.	do.	do.	1/8	69		10	2-1/2-3			20		1	1/8										
652	do.		do.	Lenticular.	Hanging wall layer.	1/8	40		20	12-14			40													
					Footwall layer.	1/16	70		9	2-3			20		1	1/8	Trace.									
653	do.	None.		Lenticular-branching.	One unit.	1/16	60		20	5-9			20		0.5	Up to 1/4	Trace.									
654	do.		Not exposed.	Oval.	do.	1/16	60		10	3-5-1/2			29		1	1/16	Trace.									
655	do.	None.		Irregular.	Wall zone.	1/4	45		35	8-12			19		1	Up to 2										
					Core.	2	10		52				35		3	1-1-1/2	0.5									Up to 3
656	do.			Lenticular.	One unit.	1/16	60		18	2-4			20		2	1/8										
657	do.	None.		Irregular.	Wall zone.	1/16	31		40	4-10			25		4	3/8										
					Core pod.	1/8	65		15				20													
658	do.	do.		Lenticular.	One unit.	1/16	50		19	3-4			30		1											
659 Buckhorn and Feldspar lodes.	Hornblende gneiss and tonalite.	do.	Crosscutting.	Irregular.	Wall zone.	1/4-1/2	59		20	1-3			20		1		Trace.							Biotite.	Trace.	
					Intermediate zone.	12			50				10		40	4-12								Beryl.	Several	crystals.
																								Columbite-tantalite.	Several crystals.	1/4
																								Monazite.	Several	crystals.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
659 Buckhorn and Feldspar lodes--(Continued)	Hornblende gneiss and tonalite.	None.	Crosscutting.	Irregular.	Core, Buckhorn claim.	24			91				7		1	1								Beryl.	0.7	1/2-4
					Core pods, on ridge.	8-12	1		53				45		1	1/2-2								do.	0.5	1/2-2
660	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	1/16	70		9				20		1	1/8										
					Core pods.	2	30		40	3-6			30			1/4										
661	do.			Irregular.	Wall zone.	1/8	70		10	2-4			18		2	1/8										
					Intermediate zone.	1/2	20		49				20		10									Beryl.	0.8	1/2-2-1/2
					Core.	1			40				50		10											
662	do.		do.	Oval.	One unit.	1/8	78		4	Up to 6			15		3		<1									
663	do.		do.	Irregular.	Wall zone.	1/4	53		20				25		2											
					Core.	6	10		65				25													
664	do.		do.	do.	Wall zone.	1/4	70		8	Up to 4			20		2		Trace.									
					Core.	1-1/2	30	1/4-1/2	30				40		<1											
665	do.		do.	Oval.	One unit.	1/8	87		2	Up to 4			10	Up to 4	<1		1									
666	do.		do.	do.	Wall zone.	1/8	76		2				25		2		<1									
					Core.	4	25		35				40													
667	do.		do.	Lenticular.	Wall zone.	1/8	80		5				15		Trace.		<1									
					Core.	?			10				90													
668	do.		do.	Lenticular-branching.	Main unit.	1/8-1/4	72		8				20		<1		Trace.									
					Fracture filling.	2-3	15		15				70		<1											
669	do.		do.	Irregular.	One unit.	1/4-1/2	60		10				30		<1											
670	do.	None.	do.	do.	do.	1/4	60		15	1-4			25		<1		Trace.									
671	do.		Not exposed.	do.	Main unit.	1/2	56		19				25		1		Trace.									
					Fracture filling.	?			50				50													
					do.	?							100													
672	do.		do.	Lenticular.	One unit.	1/8	71		8				20		1		Trace.									
673	do.		do.	do.	do.	1/4	40		25				35		<1											
674	do.			Irregular.	Wall zone.	1/8	65		10				25		<1		<1									
					Core.	4	15		45				35		5	Up to 3								Columbite-tantalite.	Trace.	
675	do.		Not exposed.	Oval.	Main unit.	1/8-1/4	70		15	Up to 8			15		<1		Trace.									
					Fracture filling.	6			50				50													
676	do.			Irregular.	Main unit.	1/8	70		10				20		<1		<1									
					Fracture filling.	4	3						95		2											

Table 20.--Mineralogy of pegmatites—Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
677	Hornblende gneiss.		Not exposed.	Oval.	Main unit.	1/8-1/4	60		15	Up to 2			25		<1									Biotite.	Trace.	
					Fracture filling.	?							100													
678	do.		do.	Irregular.	Main unit.	1-1/2	40	1/4	35	3-4			25	3-4	<1		Trace.									
					Fracture filling.	?							100													
					do.	6-8	15		55				30													
679	do.			Lenticular-branching.	Wall zone.	1/8	72		12				15		1		Trace.									
					Core.	4-8	15		40				45		<1											
680	do.		Crosscutting.	Irregular.	Main unit.	1/8	74		5				20		1		<1									
					Fracture filling.	?							100													
681	do.			do.	One unit.	1/16	70		9				20		1		Trace.									
682	do.		Crosscutting.	Irregular.	Wall zone.	1/32	70		14	3-5			15		1	1/4	Trace.									
					Core pod.	3/4	15		54	6-10			30		1	1/2										
683	do.		Not exposed.	Lenticular.	One unit.	1/16	70		9	4-5			20		1	1/32										
684	do.	None.	Conformable.	Irregular.	Hanging wall layer.	1	45		38				15		2											
					Footwall layer.	1/32	75		14				15		1		Trace.									
685	do.			Lenticular.	Hanging wall layer.	1/2	30		48	4-6			20		2	1/2										
					Footwall layer.	1/32	65		19	2-3			15		1	1/8	Trace.									
686	do.		Not exposed.	Oval.	One unit.	1/4	60		20	5-7			19		1	1-1/2	Trace.									
687	do.		do.	Lenticular.	do.	1/4	50		39				10		1											
688	do.		do.	Irregular.	do.	1/32	70		14	2-4			15		1	3/4										
689	do.		do.	Oval.	Hanging wall layer.	1/2	30		55	6-12			15		<1	1/2										
					Footwall layer.	1/16	45		33	2-3			20		2	1/2										
690	do.		do.	do.	One unit.	1/32	60		23	5-7			15		2	1/4										
691	do.		do.	do.	do.	1/4	65		20	3-4			13		2	1/2										
692	do.		do.	do.	do.	1/4	40		40				19		1											
693	do.				Wall zone.	1/16	60		24				15		1											
					Core.	1/2	20		19				60.		1											
694	do.			Irregular.	One unit.	1/64	74		10		✓		15		1											
695	do.		Not exposed.	Lenticular.	One unit.	1/4	50		30				20													
696	do.		do.	do.	do.	1/8	60		20				20													
697	do.		do.	Irregular.	do.	1/8	30		54				15		1											

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
698	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1/16	60		19.5				20		0.5											
699	do.		do.	do.	do.	1/8	50		30		30	8	20		Trace.		Trace.	1/16						Biotite.	Trace.	1/8
700	do.		do.	do.	do.	1/4	55		30		30	5	15											Magnetite. Biotite.	Trace. Trace.	1/16 1/16
701	do.		do.	do.	do.	1	20		50		✓	10	30				Trace.	1/16						do.	Trace.	1/4
702	do.		do.	Lenticular.	do.	2	35		50		40	10	15				Trace.	1/32						Magnetite.	Trace.	1/16
703	do.		do.	Oval.	do.	1/4	50		30		✓		20				Trace.							Biotite.	Trace.	
704	do.		do.	Irregular.	do.	1/8	50		35		30		15													
705	do.		do.	Lenticular.	do.	1/16	65		15				20											Biotite.	Trace.	
706	do.		do.	do.	do.	1/8	40		30				30													
707	do.		do.	Oval.	do.	1/16	70		5				25													
708	do.		do.	Lenticular.	do.	2	10		65		80		25													
709	do.		do.	do.	do.	2	10		65		80		25													
710	do.		do.	do.	do.	1	30		40				30													
711	do.		do.	do.	do.	3	10		70		80		20													
712	do.		do.	Oval.	do.	3	10		60		✓		30													
713	do.		do.	Irregular.	do.	3	10		60				30													
714	do.		do.	Lenticular.	do.	3	10		60		80		30													
715	do.		do.	Irregular.	Wall zone.	2	10		60				30													
					Intermediate zone.								50		50	3/4										
					Core.								100													
716	do.		do.	Lenticular.	One unit.	3	10		70				20				Trace.									
717	do.		do.	do.	do.	2	10		70				20													
718	do.		do.	do.	do.	3	10		70		80		20													
719	do.		do.	Oval.	do.	1/2	60		10	8			30				Trace.									
720	do.		do.	Lenticular.	do.	1/4	70		10				20													
721	do.		do.	Oval.	do.	1	10		60				30				Trace.									
722	do.		do.	Lenticular.	do.	1/8	70		10				20													
723	Hornblende gneiss and coarse-grained granite.		do.	do.	do.	1/4	50		30				20				Trace.							Biotite.	Trace.	
724	Hornblende gneiss.		do.	do.	do.	1/4	60		10				30													
725	do.		do.	do.	do.	1/4	50		20				30													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
726	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	50		30				20													
727	do.		do.	do.	do.	1/4	60		10				30													
728	do.		do.	Lenticular-branching.	Wall zone.	1	10		65		75		25													
					Intermediate zone.	1/4	[1]67						30		3	2								Beryl.	1 crystal.	3/8
					Core.	1/2			80				20													
729	do.		do.	Lenticular.	Wall zone.	1/4	70		10				20													
					Intermediate zone.	2			40				60													
					Core.	4			20				80													
730	do.		do.	do.	One unit.	1/16	60		10				30											Biotite.	Trace.	
731	do.		do.	do.	do.	1/8	30		50		✓		20													
732	do.		do.	Oval.	do.	1/32	80		15				5													
733	do.		do.	Lenticular.	do.	2	20		60		60		20													
734	do.		do.	do.	do.	1/16	60		10				30													
735	do.		do.	Lenticular-branching.	do.	2	10		70		50		20													
736	do.		do.	do.	do.	1/4	70		10				20													
737	do.		do.	Lenticular.	do.	1	10		70		50		20													
738	do.		do.	do.	do.	2	10		70		60		20													
739	do.		do.	Lenticular-branching.	Wall zone.	1/4	60		20				20													
					Core.	1/2	✓		80				20													
740	do.		do.	do.	Wall zone.	1/4	30		50				20				Trace.									
					Intermediate zone.	4			70				30													
					Core.								100													
					Southwest dike.	1/4	80						20													
741	Hornblende gneiss and granite.	None		Lenticular.	One unit.	1/32	70						30											Biotite.	Trace.	
742	Hornblende gneiss.		Not exposed.	Oval.	do.	1	10		60		✓		30				Trace.									
743	do.		do.	Lenticular.	do.	2	10		70		60		20													
744	do.		do.	Lenticular-branching.	Wall zone.	1/16	70		10				20													
					Intermediate zone.	1/16	35						60		5	2										
					Core.	1/4	30		50				20													
745	do.		do.	Oval.	One unit.	2	10		70		70		20													
746	Granite.		do.	Lenticular.	do.	2	10		70		70		20													

[1] Cleavelandite.

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
747	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	1/8	30		50				20													
					Intermediate zone.	3/8	20						70		10	1-1/4										
					Core.								100													
748	do.		do.	do.	Wall zone.	1/8	70		10				20													
					Intermediate zone.	3/8	50						45		5	1-1/2										
					Core.								100													
749	do.		do.	do.	One unit.	2	10		70		60		20													
750	do.		do.	do.	Wall zone.	1/8	70		2	5			25													
					Intermediate zone.	3/8	50						45		5	1-1/2										
					Core.								100													
751	do.		do.	do.	One unit.	1/8	30		50				20													
752	do.		do.	do.	Wall zone.	2	10		70		70		20													
					Intermediate zone.	3/8	10						75		15	1										
					Core.								100													
753	do.		do.	do.	One unit.	1/8	60		10				30				Trace.									
754	do.		do.	do.	do.	1/8	40		20				30				Trace.									
755	do.		do.	do.	do.	1/16	50		10				40													
756	do.		do.	do.	do.	1/16	65		15	5			20													
757	do.		do.	do.	do.	1/8	60		15				25													
758	do.		do.	do.	do.	3/8	10		60				30													
759	do.		do.	do.	do.	1/32	60		10				30				Trace.									
760	do.		do.	do.	do.	1/32	60		25				15				Trace.									
761	do.		do.	do.	do.	1/4	70		10				20													
762	do.		do.	do.	do.	1/8	60		10				30													
763	do.		do.	do.	do.	1/4	70		10				20				Trace.									
764	do.		do.	do.	do.	1/32	70		5				25				Trace.									
765	do.		do.	do.	do.	1/32	70		5				25				Trace.									
766	do.		do.	Oval.	do.	1/4	70		10				20													
767	do.		do.	Lenticular.	do.	1/4	20		50		60		30													
768	do.		do.	Oval.	do.	3/8	10		70				20													
769	do.		do.	do.	do.	1/8	35		35				30											Biotite.	Trace.	
770	do.		do.	Lenticular.	do.	1/8	30		40		50		30											do.	<1	
771	do.		do.	do.	do.	1/4	30		50		50		20													

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
772	Hornblende gneiss.		Not exposed.	Oval.	One unit.	1/4	40		20		10		20													
773	do.		do.	Lenticular.	do.	1/8	50		20		15		30											Biotite.	Trace.	
774	Coarse-grained granite.	None.		Lenticular-branching.	Wall zone.	3	25		60		50	8	15											Magnetite.	Trace.	
																								Biotite.	Trace.	1/4
					Core.	4			49.5	12			50											do.	0.5	4
775	do.	do.		Lenticular.	One unit.	1	50		30	3	10	5	20				Trace.	1/16						do. Martite.	Trace. Trace.	1/4 1/2
776	do.	do.		do.	do.	1	10		69.5		✓		20				Trace.							Biotite.	0.5	1/32
777	do.	do.		do.	One unit.	1	50		30		40		20				Trace.							Biotite. Magnetite.	Trace. Trace.	
778	Coarse-grained granite and hornblende gneiss.	do.		Irregular.	Hanging wall layer.	18	10		70		70	24	20											Biotite.	1	
					Footwall layer.	2	70	1/2	10	1	5		17		Trace.	1/8	Trace.	2						do.	3	2
					Core.	12			60				40											Martite. Biotite. Beryl.	Trace. Trace. Trace.	2 3
779	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	5	50		15		35	8	35				1									
780	do.		do.	do.	Hanging wall layer.	5	10		60	3	70	8	30											Biotite. Martite.	Trace. <1	
					Footwall layer.	1	70		5		10	3	25											Biotite.	Trace.	
781	do.		do.	do.	Wall zone.	1-1/2	5		65	3	75	5	30		Trace.									Martite.	<1	
					Core.	10			10				89		1	2										
782	do.		do.	Irregular.	Wall zone.	3/4	4.5		60	3	75	5	35				Trace.							Martite.	0.5	
					Core.	9			19				80		1	1										
783	Coarse-grained granite and hornblende gneiss.	None.	Crosscutting.	do.	Wall zone.	1	30		50		60		20				Trace.							Biotite. Martite.	Trace. Trace.	
					Core.	3			65				30		5									Beryl.	2 crystals.	2-1/2
784	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1	25		55		70		20				Trace.							Martite.	Trace.	
785	do.		do.	do.	do.	1/16	40		35	3	40		25				Trace.									
786	do.		do.	Lenticular-branching.	do.	1	10		70		60		20													
787	do.		do.	Lenticular.	do.	2	10		65		20		25				Trace.									
788	do.		do.	do.	do.	3	10		75				15													
789	do.		do.	do.	do.	3	10		75				15													
790	do.		do.	Lenticular-branching.	do.	3	10		65		20		25		Trace.		Trace.									
791	do.		do.	Oval.	do.	2	10		65		20		25													
792	Granite.			Lenticular.	do.	1/2	60		20		20	6	20											Biotite.	Trace.	

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Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl.II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
793	Granite.			Lenticular.	One unit.	1	10		65		80		25													
794	do.			do.	do.	1/2	50		30		40	6	20											Biotite.	Trace.	
795	do.			do.	do.	1/2	35		45		40		20													
796	do.			do.	do.	1	20		55		60		25													
797	do.			Lenticular-branching.	One unit.	1	10		70		60	6	20													
798	do.			Lenticular.	do.	2	10		70		60		20													
799	do.			do.	do.	2	10		60		50		30													
800	do.			do.	do.	2	10		60		50		30													
801	do.			do.	do.	1-1/2	15		60		50		25				Trace.									
802	do.			do.	do.	1/4	40		40		30		20													
803	do.			do.	do.	1/16	30		50		40		20													
804	do.	None.		Lenticular-branching.	do.	1/4	30		55		45		15													
805	do.	do.		Lenticular.	do.	1/4	20		60		50		20				Trace.									
806	do.	do.		do.	do.	1	10		70		60		20											Biotite.	Trace.	
807	do.			do.	do.	2	10		65		55		25													
808	do.			Lenticular-branching.	do.	1	10		65		55		25											Magnetite.	Trace.	
809	do.			do.	do.	2	10		75		65		15													
810	do.			Oval.	do.	1/2	15		60		50		25													
811	do.			Lenticular.	do.	1/4	10		60		50		30													
812	do.	None.		Lenticular-branching.	do.	1/2	20		55		45		25													
813	do.			Lenticular.	do.	1/4	20		60		50		20											Biotite.	Trace.	
814	do.	None.		Lenticular-branching.	do.	1/4	15		65		55		20													
815	do.			Lenticular.	do.	1/16	35		40				25				Trace.									
816	do.			do.	do.	1/8	50		25		✓		25													
817	do.			Irregular.	do.	1/8	30		45	7	10		25				Trace.									
818	do.			Oval.	do.	1/2	30		50		40		20				Trace.									
819	do.			Lenticular.	do.	1	10		70		60		20				Trace.							Biotite.	Trace.	
820	do.			do.	do.	1	10		70		60		20				Trace.							do.	Trace.	

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite				Mineralogy																			
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
821	Granite.			Lenticular.	One unit.	1/4	25		55				20													
822	do.			Oval.	do.	1/32	50		30				20													
823	do.			Irregular.	do.	1/4	45		35	1	25	7	20													
824	do.			Oval.	do.	2	10		60		50		30													
825	do.	None.		Lenticular.	do.	1	10		65		55		25													
826	do.	do.		do.	Wall zone. Core.	1/4 3	30 10	1/16 1	50 55	2 2	40	6 12	20 20		<1 15	1/2								Monazite.	Trace.	1/2
827	do.	do.		do.	One unit.	1/2	35	1/4	45	5	20	5	20		<1	1/8	Trace.							Monazite.	Trace.	1/4
828	do.	do.		do.	do.	1/4	50		30		20	6	20											do.	Trace.	1/4
829	do.	do.		Irregular.	do.	1/4	50		30	5	20	8	20				Trace.							Biotite.	Trace.	
830	do.	do.		Lenticular.	do.	1/2	25		55		10		20													
831	do.	do.		do.	do.	3/4	35	1/16	45	3		8	20		Trace.		Trace.									
832	do.	do.		Oval.	do.	3/4	10		65	2	40	6	25				Trace.							Biotite. Magnetite.	Trace. Trace.	
833	do.			do.	do.	1/16	60		24	5			15		1	2										
834	do.	None.		Lenticular-branching.	do.	1/2	30		55		40		15		Trace.		Trace.							Biotite.	Trace.	
835	do.	do.		do.	do.	1/2	30		50	4	40	4	20				Trace.							do.	Trace.	
836	do.	do.		do.	do.	1/4	50		30				20				Trace.									
837	do.			Irregular.	do.	1/4	20		65		55	16	15													
838	do.	None.		Lenticular.	do.	1/8	45		40		30	8	15													
839	do.	do.		Lenticular-branching.	do.	1/8	65		20		10	10	15													
840	do.			Lenticular.	do.	2	10		70		60	6	20													
841	do.			Oval.	do.	1/8	65		20	1			15		Trace.									Martite.	Trace.	
842	do.			do.	do.	1/4	65		15				20		Trace.											
843	do.			do.	do.	1/8	35		50		40		15											Biotite.	Trace.	
844	do.			Irregular.	do.	1/8	70		15	2			15													
845	Covered with glacial till.			do.	do.	2	30		44				20		0.5	1	0.5	1/32								
846	do.			do.	do.	1	33.5		45		35	8	20		0.5	3/4	1	1/16								

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
847 Black Wonder	Hornblende gneiss, coarse-grained granite, and quartzite.	None.	Crosscutting.	Irregular.	Wall zone, south and west parts.	3	24		60		50	8	15				Trace.							Martite. Biotite.	1 <1	
					Wall zone, north and east parts.	1-1/2	55		30		less than 10	6	15				<1							Martite.	Trace.	
					Intermediate zone.	2	79		5				10		5	1/4-5	1	1/4-2						Beryl.	0.2	1/2-1-1/4
					Intermediate zone.	6	55						15		30	Up to 8								Monazite. Columbite-tantalite.	17 crystals. 3 crystals.	3/4 1/8
					Core.								100													
					do.				✓				✓													
					do.				✓				✓											Allanite.	Trace.	1/4
848	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	2	55		25				20											Magnetite.	Trace.	
849	do.		do.	do.	do.	1	49		30		20		20													
850	do.		do.	Irregular.	do.	2	25		54		40		20				1									
851	do.		do.	Lenticular-branching.	do.	1	35		45		35		20				<1									
852	do.		do.	Lenticular.	do.	3/4	35		45	7	35	6	20				Trace.							Biotite. Magnetite.	Trace. Trace.	
853	do.		do.	do.	do.	1	35		45	3	35	6	20				Trace.	1/32								
854	do.		do.	Oval.	do.	3/4	40		45		35		15				<1							Biotite.	Trace.	
855	do.		Crosscutting.	Irregular.	do.	3	15		65		55		20											Magnetite.	Trace.	
856	do.		Not exposed.	do.	Wall zone.	3/4	10		70	2	60	5	20		Trace.									do.	Trace.	
					Core.	5			50	6			50													
857	do.		do.	Oval.	One unit.	3	20		60	3	55	6	20											Magnetite.	Trace.	1/16
858	Hornblende gneiss and granite.	None.		Lenticular.	do.	3	35	1/16	40	3	30	8	25											do.	Trace.	1/16
859	Hornblende gneiss.		Not exposed.	do.	do.	2	35		45	3	25	6	20				Trace.	1/2								
860	do.		do.	Irregular.	do.	1	30		50	8	45	3	20				Trace.							Biotite. Magnetite.	Trace. Trace.	
861	do.		do.	Oval.	do.	1/2	70		10		5		20													
862	do.		do.	Lenticular.	do.	1/4	60		20				20													
863	do.		do.	do.	do.	1/16	70		10				20													
864	do.		do.	do.	do.	1/2	50		30		20		20													
865	do.		do.	do.	do.	1/2	20		50		40		30													
866	do.		do.	do.	do.	1/2	50		30		20		20													
867	do.		do.	do.	do.	1/4	60		20				20											Magnetite.	Trace.	
868	do.		do.	do.	do.	1/8	60		10				30				Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Per-cent	Size (inches)	Other minerals: Mineral	Per-cent	Size (inches)
869	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/16	70		5				85				Trace.									
870	do.		do.	Oval.	do.	1/16	60		20				20													
871	do.		do.	do.	do.	1/4	65		15		10		20				Trace.									
872	do.		do.	Lenticular-branching.	do.	1/16	70		10		✓		20													
873	do.		do.	Lenticular.	do.	1/4	55		20		10		25													
874	do.		do.	do.	do.	1	30		50		40		20				Trace.									
875	do.		do.	do.	do.	1/2	50		30		20		20				Trace.									
876	do.		do.	do.	do.	1/2	40		40		30		20				Trace.							Biotite.	Trace.	
877	do.		do.	do.	do.	1/4	60		20		10		20				Trace.									
878	do.		do.	do.	do.	1/8	50		30		20		20				Trace.							Biotite.	Trace.	
879	Hornblende gneiss and granite.	None.		do.	do.	1/2	50		30		20		20				Trace.									
880	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/2	40		40		30		20													
881	do.		do.	do.	do.	1/8	60		10				30													
882	do.		do.	do.	do.	1/8	40		30				30											Biotite.	Trace.	
883	do.		do.	Oval.	do.	1/8	50		20		10		30													
884	do.		do.	Lenticular.	do.	1/8	60		10				30											Biotite.	Trace.	
885	do.		do.	do.	do.	1/8	50		20		10		30		Trace.											
886	do.		do.	do.	do.	1/8	50		20		10		30		Trace.											
887	do.		do.	do.	do.	1/8	60		20		10		20													
888	do.		do.	do.	do.	1/8	50		20		10		30		Trace.											
889	do.		do.	do.	do.	1/2	30		50		40		20													
890	do.		do.	do.	do.	1/8	50		20		10		30													
891	do.		do.	do.	do.	1/8	50		20		10		30													
892	do.		do.	do.	do.	1/2	30		50		40		20													
893	do.		do.	Oval.	do.	1/8	50		20		10		30													
894	do.		do.	Lenticular.	do.	3/8	40		28				30		2											
895	do.		do.	do.	Hanging wall layer.	1/4	50		17				30		3											
					Footwall layer.	1/32	60		20				19		1											

Table 20.--Mineralogy of pegmatites—Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
896	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	1/4	55		25				20		Trace.											
					Footwall layer.	1/32	75		5				20		Trace.											
897	do.		do.	do.	Hanging wall layer.	1/4	40		30				28		2											
					Footwall layer.	1/32	60		20				19		1											
898	do.		do.	do.	One unit.	1/2	35		45	3			20		<1											
899	do.		Crosscutting.	do.	do.	1	30		50	3			20		Trace.	1/4										
900	do.		Not exposed.	do.	Hanging wall layer.	3/4	40		40	2			19.5		0.5	1/4										
					Footwall layer.	3/8	70		10	3/4			19.5		0.5	1/4										
901	do.		do.	do.	Hanging wall layer.	1	20		64.5	2			15		0.5											
					Footwall layer.	1/4	50		40	1/2			10		<1											
902	do.		do.	do.	One unit.	3/4	48		30	3			20		2	1/4	Trace.									
903	Hornblende gneiss and granite.		do.	do.	do.	3/4	35		50	3			15		<1											
904	do.	None.	Crosscutting.	do.	do.	1/2	30		50	3/4			20													
905	do.		Not exposed.	do.	Hanging wall layer.	1	25		55	4			19.5		0.5	1/8										
					Footwall layer.	1/4	50		30	1½			20		Trace.											
					Core.								100											Beryl.	Trace.	1/4-3/4
906	Hornblende gneiss.		do.	do.	Hanging wall layer.	1½	15		65	3			20		Trace.	1/4	Trace.									
					Footwall layer.	1/4	60		20	2			20		Trace.	1/16	Trace.									
907	Hornblende gneiss and granite.	None.	do.	do.	One unit.	1/4	30		60	1/2			10													
908	Hornblende gneiss.		do.	do.	Wall zone.	3/4	20		65	4			15		<1											
					Intermediate zone.	3/8	25		40	3/4			28.5		5	3/8	Trace.							Beryl.	1.5	1/16-1
					Core.				40				60													
909	Hornblende gneiss and granite.	None.		do.	One unit.	3/4	20		50	1			30		Trace.	1/4										
910	Coarse-grained granite.	do.		do.	Hanging wall layer.	3/4	5		80	2	10	3	15											Biotite. Magnetite.	Trace. Trace.	
					Footwall layer.	1/4	55		35	1/2			10		<1		Trace.									
911	Hornblende gneiss.		Not exposed.	do.	Hanging wall layer.	3/4	15		69.5	2	3	3	15		0.5											
					Footwall layer.	1/4	45		40	1/2			15		Trace.											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
912	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	3/4	25		60	2			15		<1		Trace.									
913	do.		do.	do.	Hanging wall layer.	3/4	15	1/64	65	2			20		Trace.	1/16										
					Footwall layer.	1/8	75		5	1			20		Trace.	1/32	Trace.									
914	do.		do.	do.	One unit.	1/2	55		25	1			20		Trace.	1/8										
915	do.		do.	do.	do.	1/2	30		50	1-1/2			20		<1											
916	do.		do.	do.	Hanging wall layer.	1/4	30		39	3			30		1	1/2										
					Footwall layer.	1/64	60		10				30				Trace.									
917	do.		do.	do.	Hanging wall layer.	1/4	26		40				30		3									Biotite.	1	
					Footwall layer.	1/32	50		20				30				Trace.									
918	do.		do.	do.	Hanging wall layer.	1/4	50		20				20		10	1										
					Footwall layer.	1/2	10		60	3			30		Trace.									Biotite.	Trace.	
919	do.		do.	do.	One unit.	1/4	28		40	2			30		2	1										
920	do.		do.	do.	Wall zone.	1/64	70		10				20				Trace.									
					Intermediate zone.	1/4	45		20				30		5	1										
					Core.	1	5		59				34		1											
921	do.		do.	do.	Hanging wall layer.	1/4	8		70	3	✓		20		2											
					Footwall layer.	1/32	60		20				20				Trace.									
922	do.		do.	do.	Hanging wall layer.	1/8	50						40		10	1/2	Trace.									
					Footwall layer.	1/32	70		20				10													
923	do.		do.	do.	Hanging wall layer.	1/4	48		20	4			20		2	1										
					Footwall layer.	1/4	55		14				30		1											
924	do.		do.	do.	Hanging wall layer.	1/8	8		60	3			30		2											
					Footwall layer.	1/32	19		40				40		1											
925	do.		do.	do.	Hanging wall layer.	1/8	30		50				20		1											
					Intermediate zone.	3/4	15						60		25	1/2										
					Core.	1			80	5			20													
					Footwall layer.	1/32	60		20				20													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
926	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/8	65		10				24		1	1/2	Trace.							Monazite.	1 crystal.	1/2
927	Hornblende gneiss and coarse-grained granite.		do.	Irregular.	Hanging wall layer.	1/2	10		65	1			15		<1		Trace.									
					Footwall layer.	1/8	80		5	1/2			15				<1							Biotite.	Trace.	
928	Hornblende gneiss.		do.	Lenticular.	One unit.	1/4	40		30	2			38		2	1/2										
929	do.		do.	do.	Hanging wall layer.	1/4	15		50	4			30		5	1/2										
					Footwall layer.	1/64	60		14				25		1											
930	do.		do.	do.	Hanging wall layer.	1/4	30		10				50		10	1										
					Footwall layer.	1/32	75						25				Trace.									
931	do.		do.	Lenticular-branching.	Hanging wall layer.	1/4	30		40				20		10	1								Monazite.	1 crystal.	1/4
					Footwall layer.	1/32	60		10				29.5		0.5		Trace.									
932	do.		do.	Lenticular.	Hanging wall layer.	1/4	30		50				17		3	1/2	Trace.									
					Footwall layer.	1/8	60		15				24		1											
933	do.		do.	do.	Hanging wall layer.	1/8	10		60	3			29		1											
					Footwall layer.	1/64	60						40				Trace.									
934	do.		do.	do.	Hanging wall layer.	1/4	30		40	4			28		2	1										
					Footwall layer.	1/64	60		10				28		2											
935	do.		do.	do.	Hanging wall layer.	1/8	30		40	3			25		5	1-1/4										
					Footwall layer.	1/64	60						40				Trace.									
936	Fine-grained granite and hornblende gneiss.	None.		Lenticular-branching.	One unit.	1/4	63		20	4			15		2	1/4	Trace.	1/16						Beryl.	1 crystal.	1/4
937	Granite.	do.		Lenticular.	Hanging wall layer.	1-1/2	20	1/32	65	3			15		0.1	1/2										
					Footwall layer.	1/2	65	1/64	15	1			20		Trace.											
938	Hornblende gneiss.		Not exposed.	do.	One unit.	1/2	25		65	2	2	5	10		<1											
939	do.		do.	do.	Hanging wall layer.	3/4	40		38	2	10	4	20		2	1/2	Trace.									
					Footwall layer.	1/2	67	1/64	15	2	5	1	15		Trace.	1/32	3									
940	do.		do.	do.	One unit.	1/2	25		60	2-1/2			14		1											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
941	Granite and hornblende gneiss.	None.		Lenticular.	One unit.	1	15		55		5	5	30		Trace.		Trace.									
942	do.	do.		do.	do.	3/4	10		65	3			25													
943	Gneissic granite.	do.	Crosscutting.	do.	do.	1/2	30	1/32	50	2			18		2	1/4										
944	Granite and hornblende gneiss.		Not exposed.	do.	Hanging wall layer.	3/4	20		15	4			15		15	1/8	Trace.									
					Footwall layer.	1/4	50	1/32	10	2			20	1/4	20	1/4	0.1									
945	do.	None.		do.	Hanging wall layer.	1-1/2	15	1/32	60	3			15		10	1/2										
					Footwall layer.	1/8	50		10				20													
946	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Hanging wall layer.	3/4	30		20	2-1/2			50		Trace.											
					Footwall layer.	1/2	50		40				10		<1		Trace.									
947	Granite.	None.		Lenticular.	Hanging wall layer.	3/4	30		50	2			20		Trace.											
					Footwall layer.	1/2	60	1/32	20	1			20													
948	Hornblende gneiss.		Not exposed.	do.	Hanging wall layer.	1/4	55		15				28		2											
					Footwall layer.	1/16	60		10				30		Trace.											
949	do.		do.	do.	Hanging wall layer.	1/16	35		35				28		2											
					Footwall layer.	1/32	60		9				30		1											
950	do.		do.	do.	Hanging wall layer.	1/4	40		30				28		2											
					Footwall layer.	1/32	60		9				30		1		Trace.									
951	do.		do.	do.	Hanging wall layer.	1/8	40		40				17		3											
					Footwall layer.	1/64	70		9				20		1		Trace.									
952	do.		do.	do.	Hanging wall layer.	3/8	40		39				20		1											
					Footwall layer.	1/32	60		19				20		1											
953	Hornblende gneiss.		do.	do.	Hanging wall layer.	3/8	45		25				28		2											
					Footwall layer.	1/64	60		5				34		1		Trace.									
954	do.		do.	do.	Hanging wall layer.	1/8	40		40				17		3											
					Footwall layer.	1/64	70		9				20		1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
955	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	1/16	63		20				15		2											
					Footwall layer.	1/32	70		10				19		1											
956	do.		do.	do.	Hanging wall layer.	1/4	58		20				20		2											
					Footwall layer.	1/32	74		9				15		1											
957	do.		do.	do.	Hanging wall layer.	1/4	50		30				19		1											
					Footwall layer.	1/32	70						30													
958	Hornblende gneiss and granite.		do.	do.	Hanging wall layer.	1/2	20		65	2-1/2			15													
					Footwall layer.	1/2	45		40	1			15				Trace.							Biotite.	Trace.	
959	Hornblende gneiss.		do.	do.	Hanging wall layer.	1	30	1/8	50	4			20		<1	1/4										
					Footwall layer.	1/4	70	1/32	10	1			20		Trace.											
960	do.		do.	do.	One unit.	3/4	45		40	2			15		<1											
961	do.		do.	do.	do.	1/2	55	1/16	25	3			19.5		0.5	1/4										
962	do.	None.	Crosscutting.	do.	do.	1	30		50	4			19		1	1/2										
963	do.		Not exposed.	do.	Hanging wall layer.	1/4	48		20				30		2									Monazite.	1 crystal.	1/4
					Footwall layer.	1/32	70		4				25		1											
964	do.		do.	do.	One unit.	1/16	50		20				30													
965	Coarse-grained granite and hornblende gneiss.	None.		Lenticular-branching.	do.	1/8	50		20		✓		30													
966	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/4	20		60		50		20													
967	do.		do.	do.	do.	1/4	30		50		40		20													
968	do.		do.	Oval.	do.	1/32	60		10				29				1									
969	do.		do.	Lenticular.	Hanging wall layer.	1/4	10		60		2		28													
					Footwall layer.	1/4	40		27				30		3											
970	do.		do.	do.	One unit.	1/64	80						20													
971	do.		do.	do.	Hanging wall layer.	1/4	10		60				30													
					Footwall layer.	1/64	60		5				30		5											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
972	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	1/16	10		60				28		2											
					Footwall layer.	1/16	55		10				25		10											
973	do.		do.	do.	Wall zone.	1/64	70		9				20		1											
					Core.	1/4	60		8				30		2											
974	do.		do.	do.	One unit.	1/32	60		13				25		2											
975	do.		do.	do.	Hanging wall layer.	1/2	50		19				30		1	2										
					Footwall layer.	1/64	80						20													
976	do.		do.	do.	One unit.	1/64	75						25													
977	do.		do.	do.	do.	1/16	75						20		5											
978	do.		do.	do.	Hanging wall layer.	1/64	10		60				30													
					Footwall layer.	1/16	50		20				22		3											
979	do.		do.	do.	Hanging wall layer.	3/8	10		65				24		1											
					Footwall layer.	1/4	50		15				30		5											
980	do.		do.	do.	Hanging wall layer.	1/2			70				28		2											
					Footwall layer.	1/64	70		2				25		3											
981	do.		do.	do.	Hanging wall layer.	1/8	10		60				30													
					Footwall layer.	1/64	60		6				30		4											
982	do.		do.	do.	Hanging wall layer.	1/2	5		70				24		1											
					Footwall layer.	1/64	70						28		2											
983	do.		do.	do.	Hanging wall layer.	3/8	20		60				18		2											
					Footwall layer.	1/32	70		4				25		1											
984	do.		do.	Lenticular-branching.	Hanging wall layer.	1/4	10		60				27		3											
					Footwall layer.	1/4	30		10				45		15											
985	Hornblende gneiss and fine-grained granite.		do.	do.	Hanging wall layer.	1	20		50	5			20		10	3/4	Trace.	1/64						Beryl.	1 crystal.	1/2
					Footwall layer.	1/2	49.2		30	5			15		5	1/16	0.5	1/64						do. Monazite.	0.3 3 crystals.	1/16-1/2 1/4-1/2
986	do.		do.	Lenticular.	One unit.	2	15		50	12	✓	5	19.5		15	3/4	0.5	1/32								

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
987	Hornblende gneiss and fine-grained granite.		Not exposed.	Lenticular-branching.	Hanging wall layer.	3/4	45		40	4			15		10	1/4	Trace.	1/16								
					Footwall layer.	1/4	64		15	2			15		5	1/8	1	1/64								
988	do.		do.	do.	Hanging wall layer.	2	20		50	5			20		10	3/4	Trace.	1/64								
					Footwall layer.	1/16	60		15	1			15		10	1/16	Trace.	1/64								
989	do.		do.	do.	Wall zone.	1/64	75		10	1			15		Trace.	1/8	<1	1/128								
					Core.	1/4	40		29	4			20		1	1								Beryl.	2 crystals.	1/4-3/8
990	do.		do.	Lenticular.	One unit.	1/8	45		35	2			20		Trace.	1/4										
991	Hornblende gneiss.		do.	do.	do.	3/8	54		30	4			15		1	1/16	<1	1/128								
992	Hornblende gneiss and fine-grained granite.	None.	Not exposed.	Lenticular-branching.	Hanging wall layer.	1/4	40		30	2			20		10	1/4										
					Footwall layer.	1/32	73		10	1			15		2	1/32	Trace.	1/128								
993	do.	do.	do.	Lenticular.	One unit.	1/8	64		20	1-1/2			15		1	1/16	Trace.	1/64								
994	Hornblende gneiss.		do.	do.	do.	1/4	65		20	3			15		Trace.	1/8	<1	1/128								
995	do.		do.	do.	do.	3/8	45		40	3			15		Trace.	1/8								Beryl.	3 crystals.	1/4-1/2
996	do.		do.	do.	do.	1/4	35		45	3			15		Trace.	1/8	<1	1/128								
997	do.		do.	do.	Hanging wall layer.	3/4	20		45	5	5	3	25		10	1/2										
					Footwall layer.	1/4	75		15				10		<1									Monazite.	1 crystal.	1/2
998	Fine-grained granite and hornblende gneiss.	None.		do.	One unit.	1/8	55		25	2			20		Trace.	1/32								Beryl.	4 crystals.	1/4-1
999	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1/8-1/4	55		25				20		<1		Trace.							do.	1 crystal.	1/4
1000	Fine-grained granite and hornblende gneiss.	None.		Lenticular.	Wall zone.	1/8	63		20		10	5	15		2	1/16	<1	1/128								
					Core.	1	20		50	4			20		10	3/8	Trace.	1/32								
1001	do.		Not exposed.	do.	One unit.	1/2	35		45	3			20		Trace.	1/4	Trace.	1/64						Beryl.	1 crystal.	1
1002	Hornblende gneiss.		do.	do.	Wall zone.	1/64	78		5				15		Trace.	1/8	2	1/64								
					Core.	1/2	29		50				20		1	1/4	Trace.	1/32						Beryl.	3 crystals.	1/32-1/8
																								Columbite-tantalite.	1 crystal.	1/16
1003	Granite and hornblende gneiss.	None.		do.	Hanging wall layer.	3/4	20		55	2			25		<1									Beryl.	1 crystal.	1/4
					Footwall layer.	1/8	50		35	1			15		<1											
1004	do.	do.	Crosscutting.	do.	Hanging wall layer.	3/4	30		45	2			20		5	1/4										
					Footwall layer.	1/4	68		10	1			20		2	1/8	<1									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1004--(Continued)	Granite and hornblende gneiss.	None.	Crosscutting.	Lenticular.	Core.	2			30				70				<1							Beryl.	5 crystals.	1/16-3/4
1005	do.	do.		Lenticular-branching.	One unit.	1/8-1/4	65		15				20		<1		Trace.							do.	1 crystal.	1/4
1006	Hornblende gneiss.		Not exposed.	do.	do.	1/8	58		20	2			20		2	1/8								do.	9 crystals.	1/32-1/4
1007	do.		do.	Lenticular.	do.	1/8-1/4	54		20				25		1		Trace.									
1008	Hornblende gneiss and fine-grained granite.		do.	Lenticular-branching.	do.	1/8-1/4	55		15				30		<1		Trace.									
1009	do.	None.		Lenticular.	do.	1/4-1/2	47		33				20		Trace.		Trace.							Beryl.	2 crystals.	1/4-1/2
1010	do.		Not exposed.	Lenticular-branching.	do.	3/16	55		30	2			15		Trace.	1/16								do.	6 crystals.	1/16-1/4
1011	Hornblende gneiss, fine-grained granite, and coarse-grained granite.	None.		do.	do.	1/4	45		35				20		<1		Trace.							do.	1 crystal.	1/4
1012	Hornblende gneiss and fine-grained granite.		Not exposed.	Lenticular.	do.	1/4	50		30				20		<1		Trace.							do.	2 crystals.	1/4
1013	Hornblende gneiss and coarse-grained granite.	None.		Lenticular-branching.	do.	1/4	50		29				20		1		Trace.									
1014	Hornblende gneiss, fine-grained granite, and coarse-grained granite.	do.	Not exposed.	Lenticular.	do.	1/8-1/4	55		25				20		<1		Trace.							Beryl.	2 crystals.	3/4
1015	do.	do.		do.	do.	1/8-1/4	60		20				20		<1		Trace.							do.	5 crystals.	1/4-1/2
1016	Hornblende gneiss.		Not exposed.	do.	do.	3/16	53		25	3			20		2	1/8	Trace.	1/128						do.	1 crystal.	1/8
1017	do.		do.	Lenticular-branching.	do.	1/8	57.5		20	2			20		2	1/8	0.5	1/64								
1018	do.		do.	Lenticular.	do.	1/8	45		30	3			20		5	1/4	0.1	1/16								
1019	Hornblende gneiss and fine-grained granite.		do.	Lenticular-branching.	do.	1/8	42		30	2	20	3	15		8	1/8	Trace.	1/64								
1020	do.	None.		Lenticular.	do.	1/4	30		40	3	30	3	20		10											
1021	do.		Not exposed.	do.	do.	1/8	50		25	3	10		20		5	1/8	Trace.	1/32								
1022	Hornblende gneiss.		do.	do.	Wall zone. Core.	1/16 2	50 10	1/32	20 49	 3			28 30		2 1									Biotite.	Trace.	
1023	do.		do.	do.	Wall zone. Core.	1/8 1-1/2-3	60		19 50	 3			20 50		1											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Per cent	Plagioclase: Size	Perthite: Per cent	Perthite: Size (inches)	Graphic granite: Per cent	Graphic granite: Size (inches)	Quartz: Per cent	Quartz: Size (inches)	Muscovite: Per cent	Muscovite: Size (inches)	Garnet: Per cent	Garnet: Size (inches)	Tourmaline: Per cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per cent	Other minerals: Size (inches)
1024	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	1/2	40		28				30		2											
					Core.	3/4-2-1/2	20		55	2-1/2			25													
1025	do.		do.	do.	Wall zone.	1/8	55		10				30		5											
					Core.	1/8	30		37				30		3											
1026	Fine-grained granite and hornblende gneiss.	None.		do.	Wall zone.	3/8	45		25	5	15		20		10	3/8	Trace.	1/32								
					Core.	2			20				80													
1027	do.	do.		do.	Wall zone.	1/16	60		20	3			15		5	1/2	Trace.	1/16								
					Core.	4	10		35				45		10	3/4								Beryl.	2 crystals.	1/4-3/8
1028	Hornblende gneiss, fine-grained granite and coarse-grained granite.	do.		Lenticular-branching.	Wall zone.	1/8	63		10	1			15		5	1/8	2	1/64								
					Core.	2	15		30	4			50		5	1								Beryl.	1 crystal.	3/8
1029	Hornblende gneiss and fine-grained granite.	do.		do.	One unit.	1/2	40		30	4			20		10	1/2	Trace.	1/16								
1030	do.	do.		do.	do.	3/4	35		35	5			20		10	1/2	Trace.	1/16								
1031	do.		Not exposed.	Lenticular.	do.	1/8	49		30	3			20		Trace.	1/16	1	1/64						Beryl.	1 crystal.	3/16
1032	do.		do.	do.	do.	1/4	53		25	4			20		2	1/2	Trace.	1/16						do.	1 crystal.	3/16
1033	Hornblende gneiss.		do.	do.	do.	3/8	49		25	4			20		5	1/4	1	1/64						do.	2 crystals.	1/16-1/8
1034	do.		do.	Lenticular-branching.	do.	3/16	39.5		30	3			20		10	1/4	0.5	1/64						do.	1 crystal.	3/16
1035	Hornblende gneiss and fine-grained granite.		do.	Lenticular.	do.	1/16	61		20	3			15		2	1/8	2	1/64						Columbite-tantalite.	1 crystal.	3/8
1036	do.		do.	do.	do.	1/4	43.5		25				20		10	1/2	0.5	1/128						Cleaveland-ite.	1	
																								Biotite.	Trace.	3/8
																								Columbite-tantalite.	1 crystal.	1/8
																								Beryl.	2 crystals.	1/16-1/8
1037	do.		do.	do.	do.	3/8	34.5		35				20		10	1/8	0.5	1/128								
1038	Hornblende gneiss, fine-grained granite, and coarse-grained granite.	None.		Lenticular-branching.	do.	1/2	40		30	3			20		10	3/4	Trace.	1/16								
1039	Hornblende gneiss and fine-grained granite.		Not exposed.	Lenticular.	do.	1/8	60		15	3			20		5	1/4	Trace.	1/128						Beryl.	1 crystal.	3/8
																								Biotite.	Trace.	1/4
1040	Hornblende gneiss, fine-grained granite, and coarse-grained granite.	None.		Lenticular-branching.	Hanging wall layer.	1/4	40		40	4			15		5	1/4	Trace.	1/16								
					Footwall layer.	1/32	78		5	1/2			15		Trace.	1/16	2	1/128						Beryl.	1 crystal.	3/8

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1041	Hornblende gneiss and fine-grained granite.	None.		Lenticular-branching.	One unit.	3/8	42		35	4			20		3	1/8	Trace.	1/64						Biotite. Chlorite. Beryl.	Trace. Trace. 4 crystals.	1/4 1/8 1/16-1/2
1042	do.	do.		do.	do.	1/8	58.5		20	3			20		1	3/16	0.5	1/64						do.	7 crystals.	1/32-1/4
1043	do.		Not exposed.	Lenticular.	Hanging wall layer.	1/8	53.9		35				15		0.5	1/8	Trace.	1/64						Biotite. Beryl.	Trace. 0.6	1/4 1/16-3/8
					Footwall layer.	1/128	85						15				<1							do.	1 crystal.	1/8
1044	Hornblende gneiss.		do.	Lenticular-branching.	Wall zone.	1/64	78		5	1/4			15				2									
					Core.	3/8	35		35	3	5		15		10	1/2	Trace.	1/32						Beryl. Biotite.	3 crystals. Trace.	1/8-3/16 1/4
1045	do.		do.	Lenticular.	One unit.	1/16	58		20	1			15		5	1/8	2	1/128						Beryl.	3 crystals.	3/8-1/2
1046	Hornblende gneiss and fine-grained granite.		do.	do.	do.	1/16	62		15	3			20		3	1/4	<1	1/32						do.	3 crystals.	1/16-3/32
1047	Hornblende gneiss.		Not exposed.	Lenticular-branching.	One unit.	1/4	49		30	4			20		1	3/16	Trace.	1/32						Beryl.	2 crystals.	1/8-1/4
1048	Hornblende gneiss and fine-grained granite.	None.		Lenticular.	do.	1/16	57		20	4			20		3	1/8	Trace.	1/32						do.	1 crystal.	1/8
1049	Hornblende gneiss.		Not exposed.	do.	do.	1/16	56		20	3			20		4	1/8	Trace.	1/32						Columbite-tantalite.	1 crystal.	3/16
1050	do.		do.	do.	do.	1/8	49.5		30	3			20		0.5	1/2	<1	1/32						Biotite.	Trace.	1/8
1051	do.		do.	do.	do.	1/8	45		35	2			15		5	1/8	<1	1/64								
1052	Hornblende gneiss and fine-grained granite.	None.		Lenticular-branching.	do.	1/4	45		30	4			20		5	1/8	<1	1/16						Beryl.	1 crystal.	1/4
1053	Fine-grained granite.	do.		Lenticular.	do.	1/8	49.5		30	3			20		0.5	1/16	Trace.	1/64						do. Biotite.	5 crystals. Trace.	3/32-3/16 1/64
1054	Hornblende gneiss.		Not exposed.	do.	do.	1/4	43		30	3			20		7	3/16	Trace.	1/32						do.	Trace.	1/4
1055	do.		do.	do.	do.	1/8	55		20	3			20		5	1/4	<1	1/64								
1056	do.		do.	do.	do.	1/4	45		30				25		<1											
1057	Hornblende gneiss, fine-grained granite, and quartzite.	None.		Lenticular-branching.	do.	1/4-1/2	30		44				25		1		Trace.									
1058	Fine-grained granite.	do.		do.	do.	1/4	49		30				20		1		Trace.									
1059	Hornblende gneiss and quartzite.	do.		do.	do.	1/4-1/2	43		37				20		<1		Trace.									
1060	Hornblende gneiss.		Not exposed.	do.	do.	1/8-1/4	60		15				25		Trace.		<1									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
1061	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/8-1/4	55		25				20		<1		Trace.									
1062	do.		do.	do.	do.	1/4	45		35				20		<1		Trace.							Magnetite.	Trace.	
1063	do.		do.	do.	do.	1/2	30		50				20		<1		Trace.							Biotite.	Trace.	
1064	Hornblende gneiss, fine-grained granite, and quartzite.	None.		do.	do.	1/4	49		25				25		1		Trace.							Beryl. 1 Columbite-tantalite.	crystal. 1 crystal.	7/8 1/4
1065	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1/4-1/2	45		35				20		<1		Trace.							Beryl. 1	crystal.	1-1/4
1066	Hornblende gneiss and fine-grained granite.	None.		do.	do.	1/2	42		37				20		1		Trace.									
1067	Hornblende gneiss, fine-grained granite, and quarzite.	do.		Lenticular.	do.	1/8-1/4	60		20				20		<1		Trace.									
1068	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Wall zone. Core.	1/8-1/4 3	51 1		25 40				20 58		4 1		<1							Beryl. 17 do. 3 Columbite-tantalite.	crystals. crystals. 1 crystal.	1/8-5/8
1069	Hornblende gneiss and fine-grained granite.	None.		Lenticular.	One unit.	1/4-1/2	42		37				20		1		<1							Beryl. 4	crystals.	3/16-5/8
1070	Hornblende gneiss.		Not exposed.	Irregular.	do.	1/8-1/4	69		10				20		1		<1							Beryl. 5	crystals.	1/16-3/4
1071	do.		do.	Lenticular.	Wall zone. Core.	1/2 6	40 1		35 38				25 60		<1 1		<1							do. 23 Biotite.	crystals. Trace.	1/8-1/2
1072	do.		do.	do.	One unit.	1/2-3/4	35		40				25		<1		Trace.							Beryl. 26	crystals.	1/16-1/2
1073	Hornblende gneiss and fine-grained granite.	None.		do.	do.	1/4-1/2	44		35				20		1		Trace.									
1074	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	3/4	35		45				20		Trace.		Trace.							Biotite.	Trace.	
1075	Hornblende gneiss and coarse-grained granite.	None.		do.	do.	1/4	45		34				20		1		<1							Beryl. 3	crystals.	3/16
1076	Hornblende gneiss and fine-grained granite.		Not exposed.	Lenticular.	Wall zone. Core.	1/2 1	30 10		50 50				20 40		Trace.		Trace.							Biotite. Martite. Beryl. 2 Biotite.	Trace. Trace. crystals. Trace.	 1/16-1/2
1077	Hornblende gneiss.		do.	Lenticular-branching.	Wall zone. Core.	1/4-1/2 5	45 <1		35 7				20 93		<1		Trace.									
1078	do.		do.	do.	One unit.	1/8-1/4	50		30				20		<1		Trace.									
1079	do.		do.	Lenticular.	do.	1/4	45		30				25		<1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
1080	Hornblende gneiss and fine-grained granite.	None.		Lenticular-branching.	One unit.	1/8-1/4	55		25				20		<1		Trace.									
1081	do.	do.		do.	do.	1/8	54		25				20		1		<1							Beryl. Martite.	1 crystal. Trace.	1/8
1082	do.	do.		do.	do.	1/4-1/2	49		30				20		1		<1							do.	Trace.	
1083	do.	do.		Lenticular.	do.	1/4	60		20				20		<1		<1							Beryl.	6 crystals.	1/8-3/8
1084	do.	do.		do.	do.	1/8-1/4	59		20				20		1		<1							do.	5 crystals.	1/8-1/4
1085	Hornblende gneiss.		Not exposed.	do.	do.	1/2-3/4	43		30				25		2		Trace.							do.	3 crystals.	3/16-3/4
1086	do.		do.	Lenticular-branching.	do.	1/8-1/4	49		30				20		1		Trace.							do.	1 crystal.	3/16
1087	do.		do.	do.	do.	1/8-1/4	60		20				20		<1		Trace.									
1088	Hornblende gneiss and fine-grained granite.	None.		do.	do.	1/4	44		35				20		1		<1							Biotite. Beryl.	Trace. 3 crystals.	 3/16
1089	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/8-1/4	49		30				20		1		<1									
1090	do.		do.	do.	do.	1/4	55		25				20		<1		<1							Biotite.	Trace.	
1091	do.		do.	do.	do.	1/2	39		40				20		1		Trace.							Beryl.	1 crystal.	1/4
1092	do.		do.	do.	Wall zone. Core.	1/8-1/4 4-5	55 1		25 25				20 74		<1 <1		<1							do.	1 crystal.	1/4
1093	do.		do.	do.	One unit.	1/4-1/2	40		35				25		<1		Trace.							Beryl.	2 crystals.	1/4
1094	do.		do.	do.	do.	1/2	35		40				25		<1		Trace.							do.	4 crystals.	1/8-1/2
1095	do.		do.	do.	do.	1/4	45		30				25		<1		Trace.							do.	2 crystals.	1/8
1096	do.		do.	do.	Wall zone. Core.	1/2 4	35 1		45 25				20 74		<1		Trace. Trace.									
1097	do.		do.	do.	One unit.	3/4	15		65		15		20		<1		Trace.									
1098	do.		do.	do.	do.	1/4	44		35				20		1		Trace.									
1099	do.		do.	do.	do.	1/2-3/4	40		39				20		1		Trace.									
1100	do.		do.	Lenticular-branching.	do.	1/4	44		30				25		1		Trace.							Beryl.	2 crystals.	1/4
1101	do.		do.	Lenticular.	do.	1/4	45		30				25		<1		Trace.							Epidote.	Trace.	
1102	do.		do.	do.	do.	1/4	49		30				20		1		Trace.							Beryl.	1 crystal.	3/16
1103	do.		do.	Lenticular-branching.	do.	1/4	44		35				20		1											
1104	do.		do.	Lenticular.	do.	1/8	46.5		30				20		3		0.5									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium Percent	Lithium Size (inches)	Other minerals: Mineral	Other Percent	Other Size (inches)
1105	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	3/4	30		45	4			15		10	3/4	Trace.	1/64								
					Footwall layer.	1/16	67.5		15	2			15		2	1/4	0.5	1/128						Beryl.	1 crystal.	1/16
1106	do.		do.	do.	One unit.	1/4	49		35	3			15		1	1/8	Trace.	1/64								
1107	Fine-grained granite and hornblende gneiss.	None.		do.	Hanging wall layer.	1/4	50		30	3			15		5	1/8	Trace.	1/16								
					Footwall layer.	1/32	72		10	1/2			15		1	1/16	2	1/64								
1108	do.	do.		Lenticular-branching.	One unit.	1/8	44.5		30	2			20		5	1/4	0.5	1/128								
1109	do.	do.		do.	do.	1/16	73		10	1			15		2	1/4										
1110	do.	do.		Lenticular.	do.	1/16	68		15				15		2											
1111	do.	do.		Lenticular-branching.	do.	1/8	45		30	2			20		5	1/2										
1112	Hornblende gneiss.		Not exposed.	do.	do.	1/8	50		25	1	15	4	15		2	1/8										
1113	Hornblende gneiss and fine-grained granite.	None.		Lenticular.	do.	1/2	39		45	3			15		1	1/4	Trace.	1/64								
1114	do.	do.		Lenticular-branching.	do.	1/32	74		10	3/4			15		1	1/16	<1	1/64								
1115	do.	do.		Lenticular.	do.	1/16	72		10				15		3	1/8										
1116	do.	do.		do.	Hanging wall layer.	3/8	20		60	3/4			15		5	1/4										
					Footwall layer.	1/64	84						15		1	1/64										
1117	Hornblende gneiss.		Not exposed.	do.	Hanging wall layer.	1/2	15		40	1-1/2			40		5	1/8										
					Footwall layer.	1/64	85						15		Trace.	1/64	<1	1/64								
1118	Hornblende gneiss and fine-grained granite.	None.		Lenticular-branching.	One unit.	1/16	78		5				15		2	1/8	Trace.	1/64								
1119	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	3/8	8		60	3/4			25		7	1/4										
					Footwall layer.	1/32	83						15		2	1/64										
1120	do.		do.	Oval.	One unit.	3/8	39		45	1			15		1	1/4	<1	1/8								
1121	do.		do.	Lenticular-branching.	do.	3/8	59		20	1-1/2			20		1	1/4										
1122	do.		do.	Lenticular.	Hanging wall layer.	1/8	20		60				19		1											
					Footwall layer.	1/16	40		28				30		2											

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. 11)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1123	Hornblende gneiss.		Not exposed.	Lenticular.	Hanging wall layer.	1/4	60		10				27		3											
					Footwall layer.	1/64	75		5				18		2											
1124	do.		do.	do.	One unit.	1/32	45		24	4			30		1											
1125	do.		do.	do.	Hanging wall layer.	1/4	17		50				30		3	3/4										
					Footwall layer.	1/64	60		19				20		1											
1126	do.		do.	do.	Hanging wall layer.	1/2	15		50				30		5	1										
					Footwall layer.	1/32	60		8				30		2											
1127	do.		do.	do.	One unit.	3/8	30		30				30		10											
1128	do.		do.	do.	do.	1/16	70		4				25		1											
1129	do.		do.	do.	Hanging wall layer.	1/8	10		60				27		3											
					Footwall layer.	1/32	60						38		2											
1130	do.		do.	do.	Hanging wall layer.	1/4	30		50				28		2											
					Footwall layer.	1/32	70		4				25		1											
1131	do.		do.	do.	Hanging wall layer.	1/8	10		60				27		3											
					Footwall layer.	1/32	70		4				25		1											
1132	do.		do.	do.	Hanging wall layer.	1/4	10		50				40		<1											
					Footwall layer.	1/32	60		10				25		5											
1133	do.		do.	do.	Wall zone.	1/64	80						20													
					Core.	1/32	30		20				49		1											
1134	do.		do.	Oval.	One unit.	1/16	60		10				30													
1135	do.		do.	Lenticular.	do.	1/8	50		20				30		Trace.											
1136	do.		do.	do.	do.	1/8	44.5		30	5			15		0.5	1/8	<1	1/84								
1137	Hornblende gneiss and fine-grained granite.	None.	do.	Irregular.	One unit.	1/4	48		30				20		2	1/4										
1138	do.	do.	do.	Lenticular.	do.	1/8	60		20	5			20				Trace.	1/64						Biotite.	Trace.	1/4
1139	Hornblende gneiss.		do.	Irregular.	do.	1/16	75		10	3			15													
1140	do.		do.	do.	do.	1/4	58		25	4			15		2	3/8										
1141	do.		do.	Oval.	do.	1/4	75		10	2			15													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1142	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/2	50		35	2			15													
1143	do.		do.	Oval.	do.	1-1/2	45		35		15	8	20													
1144	do.		do.	Irregular.	do.	1/4	75		10	2			15		5	1/4										
1145	do.		do.	Lenticular-branching.	do.	1/4	50		25		15	6	15		10	1/4										
1146	do.		do.	Lenticular.	do.	1/8	50		20	3	10	5	20		10	1/4										
1147	do.		do.	Lenticular-branching.	do.	1/4	56		25		15	6	15		3	1/8	1	1/128								
1148	do.		do.	do.	Wall zone.	1/8	58.5		25	2			15		1	1/8	0.5	1/64								
					Core.	3/4	10		5	1/2			30		55	1										
1149	do.		do.	Lenticular.	One unit.	1/16	72		10	2			15		3	1/4										
1150	do.		do.	do.	Wall zone.	1/8	40		30	3			20		10	1/4										
					Core.	4	10		30	6			55		5	1								Beryl.	2 crystals.	1-1/2-3-1/4
1151	Coarse-grained granite and hornblende gneiss.	None.		do.	One unit.	1/8	45		35	3			15		5	1/4	Trace.	1/128								
1152	do.	do.		do.	Hanging wall layer.	1/8	40		40	3			15		5	1/4										
					Footwall layer.	1/64			84				15				1	1/128								
1153	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Hanging wall layer.	1/8	40		40	1			15		5	3/8	Trace.	1/128								
					Footwall layer.	1/64	84						15				1	1/128								
1154	Fine-grained granite and hornblende gneiss.	None.		Lenticular.	Hanging wall layer.	1/8	40		43.5	1-1/2			15		1	1/2	0.5	1/128								
					Footwall layer.	1/64	80		5	1/2			15				Trace.	1/128								
1155	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Hanging wall layer.	3/8	25		45	2			20		10	3/4										
					Footwall layer.	1/64	79		5	1/4			15				1	1/128								
1156	do.		do.	Lenticular.	Hanging wall layer.	1/16	48.5		35	2	25	5	15		1	1/4	0.5	1/128								
					Footwall layer.	1/64	84						15				1	1/128								
1157	do.		do.	Lenticular-branching.	One unit.	1/2	15		50		40	5	20		15	1/4	<1	1/32								
1158	do.		do.	Lenticular.	do.	1/4	55		20	2			25													
1159	do.		do.	do.	do.	1/8	65		15	3			20		Trace.	1/16										
1160	do.		do.	Lenticular-branching.	do.	1/8	59		25	3			15		1	1/8	Trace.	1/8								

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1161	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	65		10	4			25													
1162	do.		do.	do.	do.	3/8	60		10	1-1/2			30													
1163	do.		do.	do.	do.	1/8	70		15	1			15				Trace.	1/64								
1164	do.		do.	Lenticular-branching.	Hanging wall zone.	1/2	30		50	1			20		5	1/4										
					Footwall layer.	1/64	75		10	3/4			15		Trace.	1/32	Trace.	1/128								
1165	do.		do.	Lenticular.	Wall zone.	1/16	60		20	2			15		5	1/16										
					Core.	3	15		38				45		2	1										
1166	Hornblende gneiss and granite.	None.	do.	do.	One unit.	1/8	62		20	2			15		3	1/4	Trace.	1/128								
1167	Fine-grained granite and hornblende gneiss.	do.		do.	do.	1/8	50		25	3			20		5	1/4										
1168	do.	do.		do.	do.	1/16	69		10	1			20		1	1/16										
1169	do.	do.		Lenticular-branching.	Wall zone.	1/4	53		25	1	15	5	20		2	1/8										
					Core.	3			10	4			80		10	3/4										
1170	Hornblende gneiss.		Not exposed.	do.	One unit.	1/8	50		20	3			20		10	1/4										
1171	Hornblende gneiss and fine-grained granite.	None.		Lenticular.	do.	1/2	30		50	8			15		5	3/8	<1	1/64								
1172	do.	do.		Lenticular-branching.	Hanging wall layer.	1/4	35		40	5			15		10	1/4	<1	1/64								
					Footwall layer.	1/64	75						15		10	1/64	Trace.									
					Core.	3			45	5			45		10	3/4								Beryl.	1 crystal.	1
1173	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/8	69.5		15	2			15		0.5	1/4	<1	1/32								
1174	do.		do.	Lenticular-branching.	Wall zone.	1/8	60		20				20		<1		Trace.									
					Core.	2	7		50				43		<1									Beryl.	8 crystals.	1/4-1
1175	do.		do.	Lenticular.	One unit.	1/4-1/2	54		25				20		1		Trace.									
1176	do.		do.	do.	do.	1/4-1/2	44		35				20		1											
1177	do.		do.	Irregular.	Wall zone.	1/2	53		25				20		2		<1									
					Core.	8	1		30				66		3											
1178	do.		do.	do.	Wall zone.	1/2	35		41				20		4		<1									
					Core.	1	<1		15				85		<1											
1179	do.		do.	do.	One unit.	1/2	40		40		10		19		1		<1									
					Fracture filling.	3	2		58				40		<1									Beryl.	8 crystals.	1/4-1/2
1180	do.		do.	Lenticular.	One unit.	1/8-1/4	49		20				30		1		<1									
1181	Hornblende gneiss and fine-grained granite.	None.		Lenticular-branching.	do	1/8-1/4	45		33				20		2		Trace.									

Table 20.--Mineralogy of pegmatites --Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1182	Hornblende gneiss.		Not exposed.	Lenticular-branching.	Wall zone.	1/8-1/4	40		40				20		< 1											
					Core.	6-8	2		5				93											Beryl.	2 crystals.	1-6
1183	do.		do.	Irregular.	One unit.	3/4	25		45				30				< 1									
1184	do.		do.	Lenticular-branching.	do.	1/4	43		35				20		2		Trace.									
1185	Hornblende gneiss and fine-grained granite.	None.	do.	do.	do.	1/4	43		35		Trace.		20		2		Trace.									
1186	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/4-1/2	15		57				25		3		< 1									
1187	do.		do.	do.	Wall zone.	1/2	10		68		5		20		2		< 1									
					Core.	6-8			15				85													
1188	Hornblende gneiss and fine-grained granite.	None.		Irregular.	Wall zone.	1/16	62		20				15		3		1									
					Intermediate zone.	1/8	35		30				25		20		Trace.									
					Core.								100													
1189	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	1/4-1/2	44		35				20		1		< 1									
					Core.	4-5	< 1		40				60		< 1									Beryl.	1 crystal.	3/4
1190	Coarse-grained granite and hornblende gneiss.	None.		do.	One unit.	1/2	30		50				20		< 1		Trace.									
1191	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1/2	42		37				20		1		Trace.									
1192	do.		do.	do.	do.	1/2	35		44				20		1		Trace.							Beryl.	22 crystals.	1/8-1/2
1193	Hornblende gneiss, fine-grained granite, and coarse-grained granite.	None.		do.	Wall zone.	3/8	50		20	5			20		10	1/2	Trace.	1/64								
					Intermediate zone.	1	15		25	5	10		35											Hematite.	Trace.	
					Core.	8			20				80											Beryl.	3 crystals.	1-1-1/2
1194	Hornblende gneiss.		do.	Lenticular.	One unit.	3/16	48		30				20		2		Trace.							do.	2 crystals.	1/32-1/16
1195	do.		do.	do.	do.	1/8	42		30	3			20		3	1/8	Trace.	1/32								
1196	do.		do.	do.	Wall zone.	1/8	59.5		20	3			20		0.5	1/8	Trace.	1/64								
					Core.	8			60	8			40													
1197	Hornblende gneiss and fine-grained granite.	None.		do.	Wall zone.	1/8	60		25	2			15		Trace.	1/16	Trace.	1/64						Biotite.	Trace.	1/2
					Core.	8			40	8			60		Trace.	1/4										
1198	do.	do.		do.	Wall zone.	1/8	59		20	2			20		0.5	1/4	0.5	1/32								
					Core.	3	10		50	5			35		5	1/2	Trace.	1/32								
1199	do.	do.		Lenticular-branching.	Wall zone.	1/2	48		30	5			20		2	1/4	< 1	1/32								
					Intermediate zone.	1	40		10	5			30		20	2	Trace.	1/32								
					Core.	8			10	8			90													
1200	do.	do.		do.	One unit.	1/4	62		15	1			20		3	1/8	Trace.	1/32								

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
1201	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	3/8	39		40	4			20		1	1/4	<1	1/64						Beryl.	1 crystal.	1/2
																								Biotite.	Trace.	1/4
1202	do.		do.	Lenticular.	Wall zone	1/4	50		30	1-1/2			20		Trace.	1/4	Trace.	1/64						do.	Trace.	1/4
					Core.	5	5		35				60		Trace.									Beryl.	4 crystals.	5/16-1/2
1203	do.		do.	do.	One unit.	1/4	40		35	1			25		Trace.	1/4	Trace.	1/64								
1204	do.		do.	do.	do.	1/16	56.5		20	3			20		3	1/8	0.5	1/64						Magnetite.	Trace.	1/4
1205	do.		do.	do.	do.	1/16	55		20	3/4			20		5	1/8	<1									
1206	do.		do.	Lenticular-branching.	Wall zone.	1/4	50		25	3			20		5	1/8	<1	1/64								
					Intermediate zone.	1/4	48		10	5			20		20	1	2	1/4								
					Core.	8			40				60													
1207	do.		do.	Lenticular.	One unit.	3/16	40		30	5			20		10	1/4	<1	1/64								
1208	Hornblende gneiss and fine-grained granite.	None.		do.	Wall zone.	1/8	44.5		30	5			20		5	1/8	0.5	1/32								
					Intermediate zone.	3/4	25		10	3			35		30	1										
					Core.	8	20		40	8			35		5	1/4										
1209	Hornblende gneiss.		Not exposed.	do.	Wall zone.	1/8	45		25	3			20		10	1/4	Trace.	1/32								
					Core.								100													
1210	do.		do.	Lenticular-branching.	One unit.	1/4	53		25	4			20		2	1/4	Trace.	1/16								
1211	do.		do.	Lenticular.	Wall zone.	1/4-1/2	15		59				25		1		<1									
					Core.	6-8	2		30				68		<1											
1212	do.		do.	do.	Wall zone.	1/2	30		40	5			20		10	1/2	Trace.	1/32								
					Core.								100													
1213	Hornblende gneiss and fine-grained granite.	None.		do.	One unit.	1/4	60		25		15	5	15											Biotite.	Trace.	1/4
1214	Hornblende gneiss.		Not exposed.	do.	do.	3/8	45		40		20		15											Chlorite.	Trace.	1/4
1215	do.		do.	do.	do.	3/8	40		35	4			25											Magnetite.	Trace.	1/16
1216	Hornblende gneiss and granite.		do.	do.	do.	3/8	45		30		3		24.5				0.5	1/64						do.	Trace.	
																								Hematite.	Trace.	
1217	Hornblende gneiss.		do.	do.	Wall zone.	1/16	75						25													
					Core.	1/2	45		30	3			25											Magnetite.	Trace.	1/16
1218	do.		do.	do.	One unit.	1/4	40		40		10		20											Martite.	Trace.	
1219	do.		do.	do.	Wall zone.	1/2	15		60		10		25											do.	<1	
					Core.				2				98											Biotite.	Trace.	
1220	do.		do.	Lenticular-branching.	One unit.	2-3	15		65				20											Magnetite.	Trace.	
1221	do.		do.	Lenticular.	do.	1/4-1/2	35		40				25				<1							Martite.	Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1222	Quartz monzonite.	None.		Lenticular-branching.	One unit.	1/8	60		20				20		Trace.		Trace.							Magnetite.	Trace.	
1223	do.			do.	do.	1/4	40		40				20				<1							do.	<1	
1224	do.			do.	do.	1/4	55		25				20		Trace.		Trace.							do.	Trace.	
1225	do.			Lenticular.	do.	3/4	20		55		10		25				Trace.							Martite. Biotite.	Trace. Trace.	
1226	do.	None.		Lenticular-branching.	Wall zone. Core.	3/4-1	10		70		15		20 100				Trace.							Martite. Biotite.	Trace. Trace.	
1227	do.			Lenticular.	One unit.	3/4	25		50		20		25											Martite.	Trace.	
1228	do.			Lenticular-branching.	do.	1/2-3/4	25		55				20				Trace.							do. Biotite.	Trace. Trace.	
1229	Quartz monzonite and hornblende gneiss.	None.		do.	do.	1/4-1/2	20		55				25				<1							Magnetite.	<1	
1230	Quartz monzonite.			do.	do.	3/4	50		25				25											do. Biotite.	<1 Trace.	
1231	do.	None.		Irregular.	do.	1/4-1/2	35		45				20		<1		Trace.							do. Magnetite.	Trace. Trace.	
1232	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1/8-1/4	50		30				20				Trace.							do. Biotite.	Trace. Trace.	
1233	Quartz monzonite.			Lenticular.	do.	1/4-1/2	30		55				15		<1		<1							Martite.	<1	
1234	do.	None.		Irregular.	Wall zone. Core.	1/2	15		60				25 100				<1							do. Columbite-tantalite.	<1 10 crystals.	
1235	do.	do.		do.	One unit.	1/4	20		55				25											Martite.	<1	
1236	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/8	60		15				25				<1							Magnetite. Biotite.	Trace. <1	
1237	do.		do.	do.	do.	1/32	88		5	1/2			15											do.	2	1/16
1238	do.		do.	Irregular.	Wall zone. Core.	1/32 6	80 10		5 30	1			15 60		Trace.	1/16	Trace.	3/8	Trace.	1-1/2				do. do. Beryl. Samarskite.	Trace. Trace. 3 crystals. 2 crystals.	1/64 1/16 3/4-1-1/2 1/8
1239	do.		do.	do.	One unit.	1/64	78		5	5			15											Biotite.	2	1/64
1240	do.		do.	do.	do.	1/32	75		10				15											do. Columbite-tantalite.	<1 1 crystal.	1/32 1/8
1241	do.		do.	Lenticular.	do.	1/2	30		55		35	3	15						Trace.	1/8				Biotite.	<1	1/32
1242	do.		do.	Irregular.	Wall zone. Core.	1/32 3	50 60		30				20 40											do. Samarskite.	Trace. 1 crystal.	1/16 1/8

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																								
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																				
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1243	Hornblende gneiss.		Not exposed.	Irregular.	Wall zone. Core.	1/16	75		5				20 100						Trace.	1/8				Biotite.	Trace.	
1244	do.		do.	Lenticular-branching.	South end. North end. Core.	1/2 1/64 2-1/2	60 84 60		20	3			20 15 40				Trace.	1/64						Magnetite. Biotite.	Trace. 1	1/4 1/64
1245	do.		do.	Lenticular.	One unit.	1/64	84						15											Biotite.	1	1/32
1246	do.		do.	do.	do.	1/8	70		15		5	3	15				<1	1/64								
1247	do.		do.	Irregular.	do.	1/16	80		5	1			15											Biotite. Martite.	<1 Trace.	1/8 1/16
1248	do.		do.	do.	Wall zone. Core.	1/8	65		20		10	8	15 100		 Trace.	 1/64	<1	1/16						Biotite.	Trace.	1/2
1249	do.		do.	Lenticular.	One unit.	1/4	70		15	6			15		Trace.	1/4	Trace.	1/64								
1250	do.		do.	do.	do.	1/16	75		15		5	5	10		Trace.	1/16	<1	1/64								
1251	do.		do.	do.	do.	1/16	80		5	1/2			15				<1	1/64						Biotite.	<1	1/32
1252	do.		do.	do.	do.	1/32	75		10	3			15				<1	1/64								
1253	do.		do.	do.	Wall zone. Intermediate zone. Core.	1/16 1	75 30		10 50 25	 3	5	3	15 20 75		 Trace.	 1/8	Trace.	1/16						 Biotite. do.	 Trace. Trace.	 1/2 2
1254	Coarse-grained granite and hornblende gneiss.	None.		do.	One unit.	1/16	75		10	2			15											do. Magnetite.	<1 Trace.	1/32 1/32
1255	Hornblende gneiss.		Not exposed.	do.	do.	1/8	55		30	3			15		Trace.	1/16	Trace.	1/64								
1256	do.		do.	do.	do.	1/4	55		30		20	5	15				<1	1/64						Martite.	<1	1/64
1257	Coarse-grained granite and hornblende gneiss.	None.		Oval.	do.	1/8	65		20		10	5	15		Trace.	1/16								Biotite.	Trace.	1/16
1258	do.	do.		Irregular.	do.	1/16	70		15	1			15		Trace.	1/16	<1	1/64								
1259	do.	do.		do.	do.	1/8	55		30		20	5	15		1	1/8	Trace.	1/64								
1260	do.	do.		Lenticular-branching.	do.	1/16	70		15	3			15				<1	1/32								
1261	do.	do.		Irregular.	do.	1/8	65		20		10	5	15		Trace.	1/8	Trace.	1/32								
1262	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone. Core.	1/8 1-1/2	70 75		15 5	1 2			15 20		Trace. Trace.	1/32 1/16	<1 Trace.	1/64 1/32								
1263	do.		do.	do.	One unit.	1/8	70		10	1-1/2			20				<1	1/64								
1264	do.		do.	Lenticular-branching.	do.	1/8	50		30	3			20				<1	1/16								
1265	do.		do.	Lenticular.	do.	1/8	50		30	5	5		20				<1	1/64						Biotite.	Trace.	3/8

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1266	Fine-grained granite and hornblende gneiss.	None.		Lenticular.	One unit.	1/8	62		20	2			15		3	1/4	Trace.	1/128								
1267	Coarse-grained granite and hornblende gneiss.	do.		do.	Wall zone.	3	33		50		30	3	15		2	1/4										
					Intermediate zone.	1-1/2	30		20	8			30		20	3	Trace.	1/16								
					Core.	3			15				85													
1268	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1/4	45		40		30	5	15											Biotite. Magnetite.	<1 Trace.	1/4 1/8
1269	Hornblende gneiss and granite.	None.	Crosscutting.	do.	do.	1/8	60		15	3			85				<1	1/32						do.	<1	1/8
1270	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/4	35		50				15		<1		<1									
1271	do.		do.	Irregular.	do.	3/4	49		30				20		<1		Trace.									
1272	do.		do.	Lenticular.	do.	1/4	63		15				20		2		<1									
1273	do.		do.	Lenticular-branching.	do.	3/4	49		30				20		1		Trace.									
1274	do.		do.	do.	do.	1/4-1/2	58		20				20		2		<1		Trace.					Martite.	Trace.	
1275	do.		do.	do.	do.	1/8-1/4	65		15				20		<1		<1									
1276	do.		do.	Lenticular.	do.	1/8-1/4	65		15				20		<1		<1									
1277	do.		do.	do.	do.	1/4	54		25				20		<1		<1		Trace.					Martite. Biotite.	<1 Trace.	
1278	do.		do.	Lenticular-branching.	do.	1/4	45		35				20		Trace.		Trace.		Trace.					Martite.	<1	
1279	Hornblende gneiss and fine-grained granite.	None.		Lenticular.	do.	1/8-1/4	90		5				5											Biotite.	<1	
1280	Hornblende gneiss and quartz monzonite.	do.		do.	do.	1/4-1/2	40		35				25		<1		Trace.									
1281	do.	do.		Irregular.	do.	1/2-3/4	35		40				25				Trace.							Martite.	<1	
1282	do.	do.		Lenticular.	do.	1/2	15		65		5		20				Trace.							Biotite. Magnetite.	<1 <1	
1283	do.	do.		Irregular.	do.	1/4	35		45		5		20		Trace.		Trace.							do.	Trace.	
1284	Hornblende gneiss.		Not exposed.	Lenticular.	do.	12-24	20		60		70		20											Biotite. Magnetite.	Trace. <1	
1285	Hornblende gneiss and quartz monzonite.	None.		Lenticular-branching.	Wall zone.	8-12	30		50		60		20				Trace.							Samarskite. (?) Biotite. Magnetite.	Trace. <1 <1	
					Core.	6	1		15				84		<1		Trace.							Biotite. Magnetite.	Trace. Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1286	Hornblende gneiss and quartz monzonite.	None.		Lenticular-branching.	Northeast branch.	4-6	15		65		80		20											Magnetite. Biotite.	<1 <1	
					Southwest branch, wall zone.	1/4-1/2	45		35				20		<1		<1							Magnetite. Biotite.	Trace. Trace.	
					Southwest branch core.	12-24	1		30				69													
1287	Quartz monzonite.	do.		do.	One unit.	1/2-3/4	45		35				20		Trace.		<1							Biotite.	<1	
1288	do.	do.		Lenticular.	do.	1/4	20		55				25											do. Martite.	<1 <1	
1289	do.	do.		Lenticular-branching.	do.	1/2	15		65				20											Biotite. Martite.	<1 Trace.	
1290	do.	do.		Lenticular.	do.	1/4	30		45				25				Trace.							Biotite. Martite.	Trace. Trace.	
1291	do.	do.		do.	do.	1/8-1/4	38		42				20				Trace.							Biotite. Magnetite.	Trace. Trace.	
1292	Hornblende gneiss.		Not exposed.	do.	do.	3/8	49.5		30		85		20		Trace.		0.5							Biotite.	Trace.	
1293	do.		do.	do.	do.	3/8	60		25		40		15		Trace.		Trace.							do.	Trace.	
1294	do.		do.	do.	do.	3/16	59		21		20		20				Trace.							Magnetite.	Trace.	
1295	do.		do.	Lenticular-branching.	do.	3/16	53		25				20		2		Trace.									
1296	do.		do.	Lenticular.	do.	1/4	52.5		25				20		2		0.5									
1297	do.		do.	do.	do.	1/8	48.5		30				20		1		0.5							Martite. Biotite.	Trace. Trace.	
1298	do.		do.	Lenticular-branching.	do.	3/8	54.5		30		Trace.		15		0.5		Trace.									
1299	Quartz monzonite.			Irregular.	do.	1	40		45		35	12	15											Magnetite. Biotite.	<1 Trace.	1/16 1/4
1300	do.			Lenticular.	do.	1/2	55		25		15	5	20				<1	1/32						do.	Trace.	1/4
1301	do.	None.		Oval.	do.	2	65		15		5	8	20											do. Magnetite.	Trace. Trace.	1/4 1/32
1302	do.	do.		Irregular.	do.	1	55		25		15	8	20											do. Biotite.	Trace. Trace.	1/2 1/16
1303	do.	do.		Lenticular.	do.	1/2	55		25	3			20											Magnetite. Biotite.	Trace. Trace.	1/2 1/4
1304	do.			do.	do.	1/4	60		20	3			20											Magnetite. Biotite.	Trace. Trace.	1/4 1/16
1305	do.			do.	do.	1	50		30		20	12	20											do.	Trace.	1/32
1306	do.			do.	do.	1/4	65		20		10	8	15											Magnetite.	Trace.	1/16

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl.II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1307	Quartz monzonite.	None.		Lenticular.	One unit.	1/16	75		10	4			15											Magnetite.	<1	1/16
1308	do.			Lenticular-branching.	do.	1/2	40		35	3	5		15											do. Biotite.	<1 Trace.	1/16 1/2
1309	do.			Lenticular.	do.	1	35		50	3			15											Magnetite.	<1	1/8
1310	do.	None.		Irregular.	do.	1/2	20		62				15											do. Biotite.	<1 3	1/16 1/16
1311	do.	do.		Oval.	do.	3/4	45		35	4			20											Magnetite. Biotite.	<1 Trace.	1/16 1/8
1312	do.	do.		Lenticular-branching.	do.	2	50		35		25	8	15											Magnetite. Biotite.	Trace. Trace.	1/4 1/4
1313	do.	do.		Oval.	do.	3	32		50		40	12	15											do. Magnetite.	3 Trace.	1/8 1/8
1314	do.			Irregular.	Wall zone. Core.	3	40		45		35	12	15 100											do. Biotite.	Trace. Trace.	1/16 1/8
1315	do.			Lenticular.	Wall zone. Core.	3	45		40		30		14.5 100											Biotite.	0.5	1
1316	do.	None.		Irregular.	One unit.	4	60		35		25	10	15											Biotite.	<1	2
1317	do.	do.		do.	do.	3	60		25		10	8	15											Martite. Biotite.	<1 <1	1/4 2
1318	Quartz monzonite.			Oval.	do.	4	55		30		20	8	15											Biotite. Chlorite.	Trace. Trace.	1/16
1319	do.	None.		Irregular.	Eastern part.	5	20		40	6			30		10	1	<1									
					Western part.	6	60		25		15	8	15											Biotite.	Trace.	1/2
1320	do.			Lenticular-branching.	One unit.	4	50		30		20	10	19											Magnetite. Biotite.	0.5 0.5	1/2 1
1321	do.			Lenticular.	do.	2	60		25		10	8	15											Magnetite. Biotite.	Trace. Trace.	1/2 1/2
1322	Hornblende gneiss and quartz monzonite.	None.		Irregular.	Wall zone.	2	55		30		20	8	15											Biotite. Magnetite.	Trace. Trace.	 1/2
					Core. do.	2	25		40				35 100		10	4	Trace.	1/4	Trace.	2				Beryl.	5 crystals.	1/2-3/4
1323	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	3	43		40		30		15											Biotite. Magnetite. Chlorite.	1 1 Trace.	
					Core.								100											Beryl.	3 crystals.	2-1/2-8
1324	do.		do.	do.	One unit.	4	60		35		25		15											Biotite. Magnetite.	Trace. Trace.	
1325	do.		do.	do.	do.	3	65		20		10		15											do.	Trace.	
1326	do.		do.	do.	do.	2	65		20		2		15											Biotite.	Trace.	1/2

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1327	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	5	47		30		20		20		Trace.	1/16	3	3/8						Martite.	<1	1
1328	do.		do.	Lenticular-branching.	do.	2	59.5		18	4	10	6	20				2							Magnetite.	0.5	
1329	do.		do.	Lenticular.	do.	6	43		35		25	10	20				Trace.	1/4						do.	2	1/2
1330	do.		do.	Irregular.	do.	1	64.5		20		10	12	15				0.5	1/8						Biotite.	Trace.	1/4
1331	do.		do.	do.	do.	1	59.5		20	5	2		15				5	1/4						Magnetite.	0.5	1/2
1332	do.		do.	do.	do.	3	60		25				15											do.	Trace.	
1333	do.		do.	do.	Hanging wall layer.	5	40		45				15													
					Footwall layer.	1/4	79		5				15											Biotite.	1	1/8
1334	do.		do.	Lenticular.	One unit.	4	60		25		15		15				Trace.							Magnetite.	Trace.	
1335	do.		do.	Oval.	do.	2	44		40		30		15				Trace.	1/8						do.	1	1/8
1336	do.		do.	Lenticular.	do.	2	53		30		15		15				Trace.	1/16						do.	2	1/4
1337	do.		do.	Lenticular-branching.	do.	1	60		25		15		15											do.	Trace.	
1338	do.		do.	Lenticular.	do.	2	50		20				30				<1							do.	Trace.	
1339	do.		do.	Irregular.	do.	1/4	45		35		25		20				Trace.									
1340	do.		do.	Lenticular-branching.	do.	3	45		40		30		15											Magnetite.	Trace.	
1341	do.		do.	Lenticular.	Hanging wall layer.	3/4	35		45		10		20				Trace.							Biotite.	Trace.	
					Footwall layer.	1/4	25		20				55				Trace.							do.	Trace.	
1342	do.		do.	Lenticular-branching.	One unit.	2	50		30		10	8	20				<1	1/32						Magnetite.	Trace.	1/16
1343	do.		do.	Lenticular.	do.	2	50		30		20		20											Biotite. Magnetite.	Trace. Trace.	
1344	do.		do.	Irregular.	do.	1	65		20				15											do.	Trace.	
1345	do.		do.	Lenticular.	do.	4	30		50		5		20				Trace.							Biotite.	Trace.	
1346	do.		do.	do.	do.	2	50		30		10		20											Magnetite.	Trace.	
1347	do.		do.	Irregular.	do.	3	55		30		20	8	15											Biotite. Magnetite.	Trace. <1	1/2 1/2
1348	do.		do.	Oval.	do.	4	60		25		15	12	15											do.	<1	1
1349	do.		do.	Lenticular.	do.	1	20		45		20	8	35		Trace.		Trace.							do.	Trace.	
1350	do.		do.	Irregular.	do.	2	75		10				15				Trace.							do.	Trace.	
1351	do.		do.	Lenticular.	do.	4	45		40		20	8	15				Trace.	1/8								

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1352	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	4	64		20		5	6	15											Magnetite.	1	1/2
1353	do.	None.	Crosscutting.	Lenticular.	do.	2	60		20		2		20											do. Biotite.	Trace. Trace.	1/16 1-1/4
1354	do.		Not exposed.	do.	do.	4	70		15		5	8	15				Trace.	3/4						Magnetite.	Trace.	1/4
1355	do.		do.	Irregular.	Wall zone. Core. Core.	4	50		35		25	10	15 100 100				<1							Biotite. Magnetite.	<1 <1	
1356	do.		do.	do.	One unit.	4	43		40		30	12	15											Biotite.	2	1
1357	Hornblende gneiss and quartz monzonite.		Crosscutting.	do.	do.	2	60		25		15		15											Magnetite. Biotite.	<1 Trace.	1/16 1/8
1358	Hornblende gneiss.		do.	do.	do.	1-1/2	75		10	5	1	8	15				<1	1/32						Magnetite.	Trace.	1/8
1359	do.		do.	Lenticular.	do.	1-1/2	55		25		1	4	20											do.	<1	1/4
1360	do.		Not exposed.	Oval.	do.	1-1/2	75		10	4	2		15											Magnetite. Biotite.	Trace. Trace.	1/4 3/8
1361	do.	None.	Crosscutting.	Lenticular.	do.	1-1/2	55		20		1		25				Trace.							Magnetite. Epidote.	Trace. Trace.	1/8
1362	Quartz monzonite.	do.		do.	do.	3	45		35		10	6	20				Trace.	1/64						Magnetite.	Trace.	1/4
1363	Hornblende gneiss.		Not exposed.	do.	Hanging wall layer.	2	65		20		10	12	15											Biotite.	Trace.	1-1/2
					Footwall layer.	3	25		60				15											Magnetite. Biotite.	Trace. Trace.	
1364	do.		do.	One unit.	One unit.	1	74.5		10				15											do. Magnetite.	0.5 Trace.	
1365	do.		do.	Oval.	do.	5	55		35		25	8	15											do.	Trace.	1/32
1366	do.		do.	do.	do.	1-1/2	55		30		20	8	15											Biotite.	Trace.	1/32
1367	do.		Crosscutting.	Irregular.	do.	2	65		20		5	12	15											Magnetite. Biotite.	Trace. Trace.	1/32 1/4
1368	Quartz monzonite.	do.		Lenticular.	do.	2	40		45		25	10	15											Magnetite. Biotite.	< 1 Trace.	1/16 3/8
1369	do.	do.		do.	Wall zone. Core.	3	60		25		10	12	14.5 100											do. Magnetite.	0.5 Trace.	1/8 1/8
1370	do.	do.		Lenticular-branching.	One unit.	1	70		15		5		15											do. Biotite.	Trace. Trace.	1/32 1/32
1371	do.			Lenticular.	do.	2	55		30		20	12	15				Trace.	1/4						Magnetite. Biotite.	Trace. Trace.	1/4 1/4
1372	do.	None.		do.	do.	2	65		25		15	8	15				Trace.	1/4						Magnetite. Biotite.	Trace. Trace.	1/4 1/4
1373	do.			do.	do.	1	65		20		5	5	15											Magnetite. Biotite. Chlorite.	Trace. Trace. Trace.	1/4 1/16
1374	do.			do.	do.	1	55		23		2		20				2	1/16						Magnetite.	Trace.	1/2

Table .--Mineralogy of pegmatites

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1375	Quartz monzonite.	None.		Lenticular.	One unit.	1-1/2	65		20		5		15				Trace.	1/8						Magnetite.	Trace.	1/4
1376	do.	do.		Lenticular-branching.	Wall zone. Core.	2-1/2	30		50		30	12	20 100				Trace.	2						Biotite.	<1	1/2
1377	do.	do.		Irregular.	One unit.	3/4	75		10		5		15											Magnetite.	Trace.	1/8
1378	do.	do.		Oval.	do.	1-1/2	65		20		10	8	15				Trace.	1/64						Biotite. do. Magnetite.	Trace. Trace. Trace.	3/8 1/4 1/16
1379	do.	do.		Lenticular.	do.	1-1/2	65		20		5		15											do.	Trace.	1/32
1380	do.			do.	do.	3/8	69		15				15				1	1/16								
1381	do.			do.	do.	1	70		15		5		15				Trace.	1/16						Martite.	<1	1/8
1382	do.			Lenticular-branching.	do.	1-1/2	60		25	7	5		15				Trace.	1/32						Biotite. Magnetite.	Trace. Trace.	1/2 1/4
1383	do.	None.		Irregular.	do.	2	60		25	3	20	8	15											Biotite. Martite.	Trace. <1	1/4 1/16
1384	do.	do.		Lenticular.	do.	1	70		15		2		15											Magnetite.	Trace.	1/16
1385	do.			do.	do.	2	70	5	15		5		15											do.	Trace.	1/32
1386	do.	None.		do.	do.	2-1/2	20		55		30		25											Martite.	Trace.	1/4
1387	do.	do.		do.	do.	2-1/2	20		55		10		25											do.	Trace.	3/8
1388	do.			Irregular.	do.	1	65		20		10	12	15											do. Biotite.	Trace. Trace.	1/4 1/2
1389	do.	do.		do.	do.	3/4	75		10		3	5	15											do. Magnetite.	Trace. Trace.	1/8 1/32
1390	do.			do.	Wall zone. Core.	2-1/2	45		35		20	12	20 100											Biotite. Magnetite.	Trace. Trace.	2 1/2
1391	do.			Lenticular.	One unit.	1/2	70		15		1		15											do.	Trace.	1/16
1392	do.			Lenticular-branching.	do.	1/2	55		30		5		15											do.	<1	1/4
1393	do.			Lenticular.	do.	1-1/2	30		55	5	30		15											do. Biotite.	<1 Trace.	3/8 1/16
1394	do.			do.	do.	3	30		50		40	12	20											do. Magnetite.	<1 Trace.	1/32 1/32
1395	do.			do.	do.	3/4	60		25		5		15											do.	<1	1/8
1396	do.	None.		Lenticular-branching.	Wall zone. Core.	3	60		25		12		15 100											do. Biotite.	<1 Trace.	1/8 1/8
1397	do.	do.		Irregular.	Wall zone. Core.	2	50		30		20	15	20 100											Magnetite. Biotite.	<1 Trace.	1/2 1/4

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Per-cent	Plagioclase: Size (inches)	Perthite: Per-cent	Perthite: Size (inches)	Graphic granite: Per-cent	Graphic granite: Size (inches)	Quartz: Per-cent	Quartz: Size (inches)	Muscovite: Per-cent	Muscovite: Size (inches)	Garnet: Per-cent	Garnet: Size (inches)	Tourmaline: Per-cent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
1398	Quartz monzonite.	None.		Oval.	One unit.	1/32	10		72				15											Biotite.	3	1/32
1399	do.	do.		Irregular.	do.	1/32	20		65				15											Magnetite. Biotite.	<1 Trace.	1/16 1/16
1400	do.	do.		do.	do.	3/4	70		15		10	12	15											Magnetite.	Trace.	1/32
1401	do.	do.		do.	do.	1/8	75		10				15											do.	Trace.	1/16
1402 Trio No. 1	do.	do.		do.	Wall zone.	1/4	50		25	1	10	12	15											Biotite. Magnetite.	Trace. Trace.	1/16 1/8
					Intermediate zone.	6	34	2	30	18			35				0.5	1/2	Trace.	2				Biotite. Beryl.	0.5 6 crystals.	1/2 1/2-8
					do. Core.	1	25	3					60 100		15	1	<1	1/2								
1403	do.	do.		Lenticular-branching.	One unit.	1/4	55		25				20											Magnetite.	Trace.	1/16
1404	do.			Irregular.	Wall zone. Core.	1/32 1/2	60 45		20 40				20 15											do. do.	<1 Trace.	1/16 1/8
1405	do.			do.	One unit.	1/2	45		15	2			40											do. Biotite.	Trace. Trace.	1/16 1/32
1406	do.			Oval.	Wall zone. Core.	1/64 1/4	79 55		5 30				15 15		 Trace.	 1/64								do. do.	1 Trace.	1/64 1/8
1407	do.	None.		Lenticular-branching.	Wall zone. Core.	1/32 1/4	79.5 55		5 30	 2			15 15		 Trace.									do. do.	0.5 Trace.	
1408	do.	do.		Irregular.	One unit.	3/8	65		15				20											Magnetite.	<1	1/16
1409	do.			do.	do.	1/2	55		30	1			15											Biotite. Magnetite.	Trace. <1	1/16 1/4
1410	do.	None.		Lenticular.	do.	1/8	70		15	2			15											Biotite.	<1	1/8
1411	do.	do.		do.	do.	1/2	65		75	2			20											Biotite. Magnetite.	<1 Trace.	1/8 1/8
1412	do.	do.		Irregular.	do.	2	30		50		40	8	20											Biotite.	Trace.	1/4
1413	do.	do.		Lenticular.	do.	3/4	35		50		40	5	15											Magnetite.	Trace.	1/4
1414 Snowshoe	do.	do.		Irregular.	Wall zone.	3	30		50		40		20											do. Biotite.	<1 Trace.	1/4 1/2
					Core.								100													
1415	do.	do.		do.	One unit.	3	30		50		40	8	20											Magnetite. Biotite.	Trace. Trace.	1/8 1/2
1416	do.	do.		Lenticular.	do.	1	55		15		5		30											Magnetite.	Trace.	1/16
1417	do.	do.		Irregular.	do.	1/2	30		20	3			50											do.	Trace.	1/16
1418	do.	do.		do.	do.	1/4	10		65				25											Martite. Biotite.	Trace. Trace.	
1419	do.	do.		Lenticular.	Wall zone. Core.	3/4	35		45		5		20 100											Martite.	Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Per-cent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Per-cent	Other minerals: Size (inches)
1420	Quartz monzonite.	None.		Irregular.	One unit.	1/4	20		55		15		25											Biotite. Magnetite.	Trace. <1	 1-1/2
1421	do.	do.		Lenticular.	do.	1/2	30		20		20		50											Kartite.	<1	
1422	do.			do.	do.	1	25		55		25		20											do.	Trace.	
1423	do.	None.		do.	Wall zone. Core.	2-3 8	30		50 40		70		20 60											do. do.	Trace. <1	
1424	do.			Irregular.	Wall zone. Core.	2-3	15		60		50		25 100											Magnetite. Biotite.	<1 Trace.	
1425	do.			Lenticular.	One unit.	3/4	30		50				20											Martite.	<1	
1426	do.			Irregular.	Wall zone. Core.	3/4	15		70		10		15 100											do.	<1	
1427	do.	None.		do.	One unit.	3/4	35		40		15		25											Martite. Biotite.	<1 Trace.	
1428	Quartz monzonite and hornblende gneiss.	do.	Crosscutting.	Lenticular-branching.	Wall zone. Core.	1	15		65		40		20 100				Trace.							Magnetite.	<1	
1429	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone. Core.	2	35		45		70		20 100				Trace.							Martite.	<1	
1430	Hornblende gneiss and quartz monzonite.	None.		Irregular.	Wall zone. Core.	1/4 24	70		5 20				15 80											Magnetite.	Trace.	1/16
1431	Quartz monzonite.			Lenticular.	One unit.	1/16	70		10	1/4			20											Biotite.	Trace.	1/64
1432	do.	None.		Irregular.	do.	1/16	70		15		10	12	15											do.	Trace.	1/4
1433	do.	do.		Lenticular-branching.	Main branch. North branch.	2-1/2 1/16	45 85		40		30	12	15 15											Magnetite. Biotite. Magnetite.	<1 <1 <1	1/8 1
1434	do.			Lenticular.	One unit.	3/8	70		15	2			15											Biotite.	Trace.	1/16
1435	do.			do.	One unit.	1/4	65		20		5	3	15											do. Magnetite.	Trace. <1	1/64 1/8
1436	do.	None.		Lenticular-branching.	do.	1/2	55		30		20	5	15											Biotite. Magnetite.	<1 Trace.	1/2 1/4
1437	do.			Irregular.	do.	1/2	65		20				15											Biotite. Magnetite.	Trace. Trace.	1/4 1/64
1438	Hornblende gneiss.		Not exposed.	do.	do.	1-1/2	50		35		25	12	15											do.	Trace.	1/4
1439	do.		do.	do.	do.	1/8	65		20		10	5	15											do. Biotite.	<1 Trace.	1/32 1
1440	do.		do.	do.	do.	1/8	70		15		5	3	15				<1	1/64								
1441	do.		do.	Lenticular.	do.	1/4	70		15		5	5	15											Magnetite.	Trace.	1/8

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
1442	Hornblende gneiss.		Not exposed.	Lenticular-branching.	One unit.	3/4	55		30		20	10	15				Trace.	1/8						Magnetite.	Trace.	1/8
1443	do.		do.	Lenticular.	do.	1/8	65		20		5		15											do.	Trace.	1/16
1444	Quartz monzonite.			Lenticular-branching.	Wall zone.	4	25		55				20											do. Biotite.	Trace. Trace.	1 1/4
					Core.	12			10				90											do.	Trace.	3
1445	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1/8	70		15	2			15				<1	1/64						Magnetite. Biotite.	<1 Trace.	1/4 1/4
1446	do.		do.	Lenticular.	do.	3/8	55		30				15											Magnetite.	Trace.	1/8
1447	do.		do.	do.	do.	1/2	50		35		5	8	15				<1	1/128						Biotite.	Trace.	1/16
1448	do.		do.	Irregular.	do.	1/16	68		15		5		15											do.	2	1/2
1449	do.		do.	Lenticular.	do.	1/16	75		10	1/2			15				Trace.	1/64						do.	Trace.	1/16
1450	Quartz monzonite.			do.	do.	1/4	65		20				15											Magnetite. Biotite.	Trace. Trace.	1/4 1/4
1451	Hornblende gneiss.	None.	Not exposed.	Irregular.	do.	1/8	75		10	1			15											do. Magnetite.	Trace. Trace.	1/16 3/8
1452	do.	do.	do.	Lenticular.	do.	1/8	45		40		10	8	15											do.	Trace.	1/8
1453	Quartz monzonite.	do.		Irregular.	do.	2	65		20				15											do.	Trace.	1/8
1454	do.			Lenticular.	Wall zone.	3	40		35		25		25											do. Biotite.	Trace. Trace.	1/4 1/2
					Core.	12			10				90													
1455	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	4	53		30		20	8	15											Biotite. Magnetite.	2 Trace.	1/16 1/32
1456	Quartz monzonite.	None.		Lenticular.	Wall zone.	1/4	74		10				15											Biotite. Magnetite.	1 Trace.	1/8 1/8
					Core.	2	25		55	5			20		Trace.											
1457	do.	do.		do.	One unit.	1/2	75		10	2			15											do. Biotite.	Trace. Trace.	1/8 1/16
1458	do.	do.		do.	do.	1	60		20	5			20											Magnetite. Biotite.	Trace. Trace.	1/16 1/32
1459	Hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	3	65		20	10	8		15											Magnetite.	Trace.	1/16
1460	Quartz monzonite.			Lenticular.	Wall zone.	8	25		40	20	12		35											Biotite. Magnetite.	Trace. Trace.	3/4 3/4
					Core.	12			40				60											Biotite.	Trace.	3
1461	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1-1/2	60		25		15	8	15											Biotite. Magnetite.	Trace. Trace.	1/4 1/16
1462	do.		do.	do.	do.	2	55		30		20	12	15											Biotite. Magnetite.	Trace. Trace.	1/8 1/16
1463	do.		do.	do.	do.	3	50		35		25	12	15				Trace.	1/32						Biotite.	Trace.	1/16

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1464	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	4	30		55		45	12	15											Biotite. Magnetite.	Trace. Trace.	1/16 1/32
1465	do.		do.	Oval.	do.	2	55		25				20											do. Biotite.	Trace. Trace.	1/8 1/8
1466	do.		do.	Lenticular.	do.	3-1/2	35		50		40	8	15											Magnetite. Biotite.	Trace. Trace.	1/4 1/8
1467	do.		do.	Irregular.	do.	2	65		20		10	12	15											Magnetite. Biotite.	Trace. Trace.	1/32 1/4
1468	do.		do.	do.	do.	2-1/2	42		37.5		30	12	15											do. Magnetite.	2 0.5	1/4 1/32
1469	do.		do.	Lenticular.	do.	1-1/2	55		30		20	3	15											do.	Trace.	1/32
1470	do.		do.	Irregular.	do.	2	55		30		20	8	15		Trace.	1/8								do. Biotite.	Trace. Trace.	1/2 1/8
1471	do.		do.	Oval.	do.	1	65		20		10	5	15											do.	Trace.	1/32
1472	do.		do.	Lenticular.	do.	1/2	70		15		5	5	15				Trace.	1/32						Magnetite.	Trace.	1/32
1473	do.		do.	Oval.	do.	1-1/2	45		40		30	8	15				Trace.	1/32						do. Biotite.	Trace. Trace.	1/32 1/32
1474	do.		do.	Irregular.	do.	2-1/2	55		30				15											do. Magnetite.	Trace. Trace.	1/16 1/32
1475	do.		do.	Lenticular.	do.	1	42.5		40		30	6	15											Biotite. Magnetite.	2 0.5	 1/4
1476	do.		do.	do.	do.	2	45		40				15		Trace.	1/32	Trace.	3/16						do.	Trace.	1/4
1477	do.	None.	Crosscutting.	do.	do.	2-1/2	45		40		30	8	15				Trace.	1/16						do.	Trace.	1/4
1478	do.	do.	do.	Lenticular-branching.	do.	1	50		30	3			20				Trace.	1/32						Biotite. Magnetite.	Trace. Trace.	1/8 1/16
1479	do.		Not exposed.	Lenticular.	do.	1	60		25		15	8	15				Trace.	1/64								
1480	do.		do.	Lenticular-branching.	do.	3/4	70		15	4			15				Trace.	1/64						Biotite.	Trace.	1/8
1481	do.		do.	Lenticular.	do.	1/2	60		25		2		15				Trace.	1/64						do.	Trace.	1/4
1482	do.		do.	do.	do.	3/4	60		25	3			15				Trace.	1/64						Magnetite.	Trace.	1/64
1483	do.		do.	do.	do.	1	49.5		30		5		20				0.5	1/32						do. Biotite.	Trace. Trace.	1/8 1/8
1484	do.		do.	do.	do.	2	63.5		20		10	8	15											Magnetite. Biotite.	1 0.5	1/16 1/2
1485	do.		do.	do.	do.	1	49.5		30		20	12	15											do. Magnetite.	5 0.5	1/4 1/8
1486	do.		do.	do.	do.	2-1/2	36		45		35	12	15											Biotite. Magnetite.	3 1	1/4 1/16

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1487	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	2	47		35		25	8	15											Biotite.	3	1/16
1488	do.		do.	do.	do.	1	65		20		10	8	14											do. Magnetite.	1 Trace.	1/16 1/8
1489	do.		do.	do.	Wall zone. Core.	2-1/2 6	44		35 80				20 20				Trace.	1/4						Biotite.	1	1/4
1490	do.		do.	Oval.	One unit.	1	60		25		20	5	15				Trace.	1/64						Biotite.	Trace.	1/8
1491	do.		do.	Lenticular.	do.	3/4	40		35		10		25											Magnetite.	<1	
1492	do.		do.	do.	do.	1-1/2	65		15		5		20		Trace.											
1493	do.		do.	Lenticular-branching.	do.	3	45		35	4	25	8	20				Trace.	1/16						Biotite. Magnetite.	<1 Trace.	2 1/32
1494	do.		do.	Lenticular.	do.	3	48.5		30		20	10	20		1	1/4	Trace.							do.	0.5	1/2
1495	do.		do.	Irregular.	Hanging wall layer.	4	25		45	8	5		30		Trace.	1/4	Trace.	1/16						do.	Trace.	1/32
					Footwall layer.	2	55		30		10	8	15				Trace.	1/16						do. Biotite.	Trace. Trace.	1/32 1/2
1496	do.		do.	Lenticular-branching.	One unit.	1/2	35		45		10		20		Trace.		Trace.									
1497	do.		do.	Lenticular.	Wall zone.	3/4	55		20		3	10	20		5											
					Intermediate zone.	2			20				60		20	3										
					Core.								100													
1498	do.		do.	Lenticular-branching.	Wall zone.	1	55		30		20		15											Magnetite. Biotite.	Trace. Trace.	
					Core.								100													
1499	do.		do.	Lenticular.	Wall zone. Core.	1/2 8	45		20 50				35 50		Trace.											
1500	do.		do.	Lenticular-branching.	One unit.	3/4	50		30				20		Trace.									Magnetite. Biotite.	Trace. Trace.	
1501	do.		do.	Irregular.	Hanging wall layer.	3	30		60		20		10											Magnetite.	Trace.	
					Footwall layer.	1/4	50		20				30											do.	Trace.	
1502	do.		do.	Lenticular.	One unit.	2	55		25		15		20	2	Trace.									do.	Trace.	
1503	do.		do.	do.	do.	4	35		50		40		15		Trace.	1/4	Trace.									
1504	do.		do.	do.	do.	2	10		60		60		30		Trace.									Magnetite.	Trace.	
1505	do.		do.	do.	do.	1	50		30		40		20		Trace.									do.	Trace.	
1506	do.		do.	do.	Hanging wall layer.	3	20		50				30											do.	Trace.	
					Footwall layer.	1/2	50		30				20											do.	Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																									
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																					
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1507	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone. Core.	1-1/2 4	55		30 40		20	8	15 60				Trace.							Biotite.	Trace.	1/4
1508	do.		do.	Irregular.	Hanging wall layer.	5	20		50		20		30		Trace.		Trace.							Magnetite.	<1	
					Footwall layer.	1/4	40		30				30		Trace.									do.	Trace.	
1509	do.		do.	do.	One unit.	2	39		48				15		2		Trace.									
1510	do.		do.	Lenticular.	do.	1/2	58		25				15		2											
1511	do.		do.	do.	do.	2	45		35		25		20		<1	1/4	Trace.	1/32								
1512	do.		do.	do.	do.	1	65		20		15	10	15		<1	2										
1513	do.		do.	do.	do.	1-1/2	55		25		20	5	20		<1	1/4	Trace.							Biotite.	Trace.	1/2
1514	do.		do.	do.	do.	3	40		45	10	35	24	15				Trace.	1/16						Magnetite.	Trace.	1
1515	do.		do.	do.	do.	1	35		40		30	12	25		Trace.	1/8	<1							do.	Trace.	1/32
1516	do.		do.	Oval.	Wall zone. Core.	3/4	55		30	5	20	8	15 100				Trace.							do.	Trace.	
1517	do.		do.	Lenticular.	One unit.	4			10				90											Monazite.	1 crystal.	1/2
1518	do.		do.	Irregular.	Wall zone. Core.	3/4	55		30				15 100											Monazite.	1 crystal.	3/8
1519	do.		do.	Lenticular.	One unit.	2	60		20				20		<1		Trace.									
1520	do.		do.	do.	do.	3/4	55		25		15	3	20		<1	1								Biotite.	<1	1/4
1521	do.		do.	do.	do.	1-1/2	45		35	5	5	5	20				Trace.									
1522	do.		do.	do.	do.	1	40		25		15		24											Biotite.	1	
1523	do.		do.	Irregular.	Wall zone. Core.	1-1/2	50		30		20	12	20 100											Magnetite. Biotite.	Trace. Trace.	1 2
1524	do.		do.	Lenticular.	One unit.	3/4	65		20		15		15				<1									
1525	do.		do.	do.	do.	1/4	60		20				20		<1		Trace.							Biotite.	Trace.	
1526	do.		do.	do.	do.	3/4	65		20	3	5	8	15				<1	1/32						do.	Trace.	1/16
1527	do.		do.	Lenticular-branching.	do.	3/4	65		15		5	8	20				Trace.	1/64						do. Magnetite.	Trace. Trace.	1/8 1/16
1528	do.		do.	Irregular.	do.	1-1/2	50		35		25		15				Trace.	1/64						Biotite.	Trace.	1/16
1529	do.		do.	do.	do.	1-1/2	50		30		20	8	20				Trace.	1/64						do.	Trace.	1/8
1530	do.		do.	Lenticular.	do.	1/2	65		20				15				Trace.	1/64						do.	Trace.	1/16
1531	do.		do.	do.	do.	1-1/2	55		30		20	8	15				Trace.	1/64						do.	Trace.	1/8
1532	do.		do.	do.	do.	3/8	49		35		25	5	15				1	1/8								
1533	do.		do.	do.	do.	1/8	70		15				15				<1	1/16						Magnetite. Biotite.	Trace. Trace.	1/8 1/8

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
1534 The Trio Beryl Knob	Hornblende gneiss.		Not exposed.	Irregular.	Wall zone.	1/2	50		35		30	10	15				<1	1/16						Biotite. Magnetite.	Trace. Trace.	1/8 1/4
					Intermediate zone.	3	20		50				10		20	2										
					Core.	36			20				80													
					Intermediate zone.	3/4	50		33.5				15		Trace.	1/4	Trace.	1/4						Biotite.	1	1/4
					Core.	10			50				30		10	1/2								Magnetite.	Trace.	1/8
1535	do.		do.	Lenticular-branching.	Wall zone. Core.	1/4 2	60		25 4	5	Trace.		15 95		 1	 1/4								Magnetite.	Trace.	1/8
1536	do.		do.	Lenticular.	One unit.	1/4	65		20	5	2		15				<1	1/16						Biotite.	Trace.	1/8
1537	do.		do.	Lenticular-branching.	Wall zone. Core.	3/8 3	50		35 10		5		15 89		 1	 1/2	<1	1/8								
1538	do.		do.	do.	One unit.	1	53		20				25		2											
1539	Covered by alluvium.		do.	Irregular.	Hanging wall zone.	3	20		65	18	40	12	15		<1	1/4	<1	1/16								
					Footwall layer. Core.	1/64 4	80		5 40				15 60		Trace.	1/8										
1540	Hornblende gneiss.		Crosscutting.	do.	Wall zone. Core.	2 15	45		33 30	 18	25	18	20 60		2 10	1/4 8								Gahnite.	<1	1-1/2
1541	do.	None.	do.	do.	One unit.	3/4	45		30	2			20		5	1/8	Trace.									
1542	do.	do.	do.	do.	Wall zone. Core.	1/16-1/8 8-12	83 7		2 55				15 37		<1 1		Trace.									
1543	do.	do.	do.	Lenticular.	Wall zone. Core.	1/8 6-8	65 4		15 35		Trace.		20 60		<1 1		Trace. Trace.									
1544	do.		Not exposed.	Irregular.	Wall zone. Core.	3-4 3-4	29 8		50 55		60		20 37		1 1		Trace.									
1545	do.		do.	Lenticular.	One unit.	1/4	64		15		10		20		1		<1									
1546	do.		do.	do.	do.	1/2	35		55				10		<1		Trace.									
1547	do.		do.	do.	do.	4	20		35				45													
1548	do.		do.	do.	do.	1/2-1	30		49		45		20		1		Trace.									
1549	do.		do.	do.	do.	1/8-1/4	59		20		10		20		1		<1									
1550			do.	Irregular.	do.	1/4-1/2	50		15				35		<1		Trace.									
1551	do.		do.	do.	North part. South part. Core.	8 1/2 6	25 50		63 30 65	 4 12			10 15 25		2 5 10	1/8 1	<1 <1									
1552	do.		do.	Lenticular.	Wall zone. Core.	1/2	75		5	1			20 100				Trace.									
1553	do.		do.	Irregular.	One unit.	1/4	69.5	1/4	5	1/2			20		5	1/8	0.5	1/32								
1554	do.		do.	Lenticular.	do.	1/2	44		35				20		1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1555	Hornblende gneiss.		Not exposed.	Irregular.	One unit.	1-2	20		64	75			15		1		<1									
1556	do.		do.	do.	do.	1/2-3/4	35		44		15		20		1		Trace.							Biotite.	Trace.	
1557	do.	None.		do.	Wall zone.	1/2	30		49		10		20		1		Trace.									
					Core.	8	1		8				91		<1									Columbite-tantalite.	1 crystal.	1/2
1558	do.		do.	Lenticular.	Wall zone.	2-3	1		78		90		20		1											
					Core.	8	<1		20				80		<1									Columbite-tantalite.	1 crystal.	1/4
1559	do.		do.	Lenticular-branching.	One unit.	2-3	10		75		75		15		<1		Trace.									
1560 Flood No. 1 and No. 2	do.		do.	Irregular.	do.	1/2-1	30		49		5		20		1		Trace.									
					Fracture filling.	8	✓		✓				✓		✓									Beryl.	1 crystal.	2
1561	do.		do.	Lenticular.	One unit.	1	20		55		5		20		5		Trace.									
1562	do.		do.	Irregular.	do.	1	10		66		5		20		4		Trace.									
1563	do.	None.	Crosscutting.	Lenticular.	Wall zone.	1/2-3/4	50		35				15		<1		<1									
					Core.	6-8	3		50				47													
1564	do.		Not exposed.	do.	Wall zone.	1/4	55		30				15		<1		Trace.							Biotite.	Trace.	
					Core.	6	5		70				25		<1		1							Magnetite.	<1	
1565	do.		do.	do.	One unit.	1-2	15		65		35		20		<1		Trace.									
1566	do.		do.	Irregular.	do.	1/4-1/2	49		30		5		20		1		<1									
					Fracture filling.		✓		✓				✓		✓											
1567	do.		do.	do.	One unit.	3/4-1	15		64		20		20		1		Trace.							Martite.	Trace.	
																								Biotite.	Trace.	
1568	do.		do.	do.	Wall zone.	3-4	<1		80		85		20		<1											
					Core.	8	2						98		<1											
1569	do.		do.	do.	One unit.	1/4-1/2	15		63		10		20		2											
1570	do.		do.	do.	Wall zone.	1/4-1/2	20		59		5		20		1		<1									
					Core.		1		4				93		2											
1571	do.		do.	Lenticular.	One unit.	1/8	72		7				20		1		<1									
1572	do.		do.	do.	do.	1/2	69		3	2			20		7	1/8	1	1/32								
1573	do.		do.	Lenticular-branching.	Wall zone.	1/2-3/4	10		60				30		<1											
					Core.	8	8		17				75											Beryl.	1 crystal.	1
1574 Bucky Goldie South Slope	Hornblende gneiss and quartzite.	None.	Crosscutting.	Irregular.	Wall zone.	1/4	60		20				16		4		Trace.									
					Graphic granite intermediate zone.	5	3		77				20											Biotite.	<1	6
					Quartz-albite intermediate zone.	1/2	40		3	1-4			56		1	1/4-3/4	<1									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1574 Bucky Goldie South Slope--Continued.	Hornblende gneiss and quartzite.	None.	Crosscutting.	Irregular.	Muscovite-feldspar-quartz-beryl intermediate zone.	8	5		26				20		40		6							Gahnite. Beryl. Columbite-tantalite. Monazite. Unknown. Phosphates. Lepidolite.	<1 8.9 .11 .003 .003 Trace. Trace.	1/8-1 8 1/2-6 1/4-3/4 1/2-4 3 1/64-1/8
					Perthite intermediate zone.	60	<1		93	60			7		<1									Topaz. Beryl.	<1 <1	1-3
					Core pods.	?							100													
					Fracture filling.	36			50				50													
1575	Hornblende gneiss.		Not exposed.	Oval.	One unit.	4			2				98													
1576 Camp Robber	do.		do.	do.	Wall zone. Core.	1	15		60		15		25 100				Trace.									
1577	do.		do.	Irregular.	One unit.	1-1-1/2	35		45		20		20		<1		Trace.									
1578	do.		do.	do.	do.	3/4	35		49		20		15		1		Trace.									
1579	do.		do.	do.	do.	1-2	15		65		80		20				Trace.							Martite.	1 crystal.	
1580	do.		do.	do.	do.	2-3	15		70		80		15		<1		Trace.									
1581	do.		do.	do.	do.	2	35		50		50		15		<1		Trace.									
1582	do.		do.	do.	do.	1/2	40		40		5		20		<1		Trace.									
1583	do.		do.	Lenticular.	do.	1/4	30		45				25		<1		<1									
1584	do.		do.	do.	do.	1/2-3/4	25		55		35		20		<1		<1									
1585	do.		do.	Irregular.	do.	1/4-1/2	5		75		75		20		<1		Trace									
1586	do.		do.	do.	do.	3/4-1	30		53		10		25		2		Trace.									
1587	do.		do.	Lenticular.	do.	3-4	15		65		70		20		<1											
1588	do.		do.	do.	do.	1	40		40		20		20		<1		Trace.									
1589	Hornblende gneiss and quartzite.			Irregular.	do.	1/4-1/2	21		59		5		20		1		<1							Magnetite.	Trace.	
1590 Windy Knob	Hornblende gneiss.		Not exposed.	do.	Wall zone.	1/4	65		20				15				<1							do.	Trace.	
					Intermediate zone. Core.	6	15		69	18			10 100		3	1-1/2	3	1/2								
1591	do.		do.	Lenticular.	Wall zone. Core.	1/2 4	70 10		15 60				15 29		<1 1		Trace. Trace.									
1592	do.	None.		Lenticular-branching.	One unit.	1/2	50		30	5			20				<1	1/16						Magnetite.	Trace.	1/8
1593	do.		Not exposed.	Oval.	do.	1/2	40		40		10		2		<1		Trace.									

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium Percent	Lithium Size (inches)	Other minerals: Mineral	Other Percent	Other Size (inches)
1594	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/2-3/4	35		45		15		20		Trace.		Trace.									
1595	do.			Irregular.	Wall zone. Core.	1	25		55		65		20 100		<1		Trace.							Martite.	Trace.	
1596	do.		Not exposed.	Lenticular.	One unit.	8	25		54		30		20		1		Trace.							Martite.	Trace.	
1597	do.		do.	do.	do.	1/8	65		15				20				<1									
1598	do.	None.		do.	do.	1/8	25		55				20		Trace.		<1									
1599	do.	do.	Crosscutting.	do.	do.	1/16	70		15				15				<1									
1600	do.		Not exposed.	Irregular.	do.	1-1/2	45		40		30		15											Magnetite.	Trace.	1/32
1601	do.		do.	Lenticular.	do.	1/4	75		10		5	8	15											Magnetite.	Trace.	1/8
1602	do.		do.	Lenticular-branching.	do.	1/8	70		15		5	3	15											do.	Trace.	1/16
1603	do.		do.	Lenticular.	do.	1/8	58		25				15				2	1/32								
1604	do.		do.	do.	do.	1/8	75		10				15				<1	1/16								
1605	do.	None.	Crosscutting.	do.	do.	1/8	55		30		5		15				<1	1/64								
1606	do.		Not exposed.	do.	do.	1/8	50		30				20				<1	1/16								
1607	do.		do.	do.	do.	1/2	35		50				15				<1	1/32								
1608	do.		do.	do.	do.	1/8	75		10				15				Trace.	1/32								
1609	do.		do.	do.	do.	3/4	15		25				60		Trace.		<1							Biotite.	Trace.	
1610	do.		do.	Irregular.	Wall zone. Core pods.	4-6 ?	35		55		50		20 100		<1		<1							do.	Trace.	
1611	do.		do.	Lenticular.	Wall zone. Core.	3-4 ?	20		50 3		40		30 97		Trace.											
1612	do.		do.	Lenticular branching.	Wall zone. Core.	2-3 ?	20		55 1				25 99		<1									Martite.	Trace.	
1613	Hornblende gneiss and quartzite.		do.	do.	One unit.	3-4	30		45		30		25		Trace.		Trace.									
1614	do.		do.	Lenticular.	do.	1-2	50		30		5		20		Trace.		Trace.									
1615	Quartzite.		do.	do.	do.	1-2	40		40		5		20		<1		Trace.									
1616	Hornblende gneiss.		do.	do.	do.	1/4	50		25				25				<1							Magnetite.	<1	
1617	do.		do.	Irregular.	do.	3/4	20		60		15		20				Trace.							Biotite. Magnetite.	Trace. Trace.	
1618	Quartz-biotite-schist.	None.	Crosscutting.	do.	do.	2-3	20		55		55		25				Trace.							Martite.	<1	
1619	Hornblende gneiss and quartz-biotite schist.		Not exposed.	do.	do.	4-6	15		60		55		25											do. Biotite.	Trace. Trace.	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1620	Covered.		Not exposed.	Lenticular.	One unit.	1/4-1/2	50		30				20				<1							Biotite. Martite.	Trace. Trace.	
1621	Hornblende gneiss.		do.	do.	do.	1/4-1/2	45		35				20				<1	Up to 1/4						Biotite.	<1	
1622	do.		do.	do.	do.	1/4-1/2	35		45				20				Trace.		Trace.					do.	<1	
1623	do.		do.	Lenticular-branching.	do.	1	15		50				35				<1							do.	Tracel	
1624	do.		do.	Irregular.	do.	2	1		33				65		1		<1							do.	Trace.	
1625	do.		do.	Lenticular.	do.	1-2	15		60				25				<1									
1626	do.		Crosscutting.	do.	do.	3/4	30		45				25		<1		<1							Biotite.	Trace.	
1627	do.	None.		Irregular.	do.	1-1/2	[1]55		7				35		3				Trace.		Lepidolite.	Trace.				
1628	do.		Not exposed.	Lenticular.	do.	1/4-1/2	35		45				20		Trace.		<1									
1629	do.		do.	Lenticular-branching.	Wall zone.	1/2	40		40				20		Trace.									Biotite. Magnetite.	Trace. Trace.	
					Core.	12			10				90		<1											
1630	do.	None.		do.	Wall zone.	1/4	20		55				25		<1		<1							Magnetite. Monazite.	Trace. 1 crystal.	
					Core.	3-6	1		5				94				Trace.									
1631	Tonalite.	do.		do.	Wall zone.	1/4	25		50				25				<1									
					Core.	3-4	<1		7				93													
1632	do.	do.		Irregular.	Wall zone.	1/8	30		40				30				Trace.							Biotite. Martite.	Trace. Trace.	
					Core.	3			5		1		95													
1633	do.	do.		do.	One unit.	1/2-3/4	25		50				25				Trace.							Biotite.	Trace.	
1634	Hornblende gneiss.		Not exposed.	Lenticular.	Wall zone.	3-4	15		65		40		20													
					Core.	?			Trace.				100		Trace.											
1635	do.		do.	Oval.	One unit.	1/4	25		50				25				Trace.							Biotite. Martite.	Trace. Trace.	
1636	do.		do.	Lenticular.	do.	1/8	35		44				30											Biotite. Martite.	1 <1	
1637	do.		do.	do.	do.	1/2	15		60				25											Biotite. Martite.	<1 <1	
1638	Covered.		do.	Irregular.	Wall zone.	2	20		55		60		25											Biotite. Martite.	Trace. Trace.	
					Core.	?							100													
1639	Hornblende gneiss	None.		Lenticular.	One unit.	1/2	40		35				25		<1		<1							Biotite.	Trace.	
1640	do.	do.		do.	do.	1	40		30				30		<1		<1									
1641	do.	do.		do.	do.	3/4	15		65				20		<1		<1									
1642	do.		Not exposed.	Irregular.	Wall zone.	1/2-3/4	35		40		5		25				<1							Biotite.	<1	Up to 2
					Core.	?							100													
1643	Hornblende gneiss and quartzite.		do.	do.	One unit.	1/2	20		55				25		Trace.		<1							Biotite.	Trace.	

[1] Cleavelandite

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																								
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
1644	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	20		55				25		Trace.		<1							Biotite.	<1	
1645	do.		do.	do.	do.	1/8-1/4	35		35				30				<1							do.	<1	
1646	do.		Crosscutting.	do.	do.	1-2	15		50				35				<1							do.	<1	
1647	do.		do.	Lenticular-branching.	do.	1/4-1/2	35		40				25		Trace.		<1							do. Magnetite.	Trace. Trace.	
1648	Hornblende gneiss and quartzite.	None.		do.	do.	1/4-1/2	30		35				35		Trace.		<1							Biotite.	Trace.	
1649	Hornblende gneiss.		Not exposed.	Lenticular.	do.	1/4-1/2	15		55				30				<1							do.	Trace.	
1650	do.		do.	do.	do.	1/2	40		40				20				Trace.							do.	Trace.	
1651	do.		do.	Irregular.	do.	1/4	35		40				25				Trace.							do.	Trace.	
1652	do.		do.	Lenticular-branching.	do.	1/2	30		50		5		20				Trace.							do.	Trace.	
1653	do.		do.	Lenticular.	do.	2-3	20		65		10		15											Magnetite.	<1	
1654	do.		do.	do.	do.	<1/8	19		55				25											Biotite.	1	
1655	do.		do.	Lenticular-branching.	do.	1/8-1/4	40		39				20											do.	1	
1656	do.		do.	do.	Wall zone. Core.	6-8	25		55		50		20 100		<1									do.	<1	
1657	do.		do.	Irregular.	One unit.	1	20		55		30		25											Biotite. Martite.	<1 <1	
1658	do.		do.	Oval.	do.	1-2	10		70		10		20											Biotite. Magnetite.	<1 <1	
1659	do.	None.		Lenticular-branching.	Wall zone.	1-2	30		45		30		25											Biotite. Martite.	<1 <1	
					Core.	12			15				85													
1660	do.		Not exposed.	Irregular.	One unit.	2-3	15		60		75		25											Biotite. Martite.	<1 <1	
1661	Quartz monzonite.	None.		do.	Wall zone.	4	10		70				20											Biotite. Magnetite.	<1 <1	
					Core.	?							100													
1662	do.	do.		do.	One unit.	2-3	40		40		15		20											Biotite. Martite.	<1 <1	
1663	do.	do.		do.	do.	1	20		25				55											Biotite.	Trace.	
1664	do.			Lenticular.	do.	1/4	30		50				20											do. Martite.	<1 <1	
1665	do.			do.	do.	1/8	20		55				25											Biotite. Martite.	<1 <1	
1666	Hornblende gneiss.	None.		Irregular.	Wall zone.	1/2	20		50		15		30											Biotite. Martite. Beryl.	<1 <1 1 crystal.	
					Core.	?							100													

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite																							
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy																			
							Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Percent	Size (inches)	Mineral	Percent	Size (inches)	Mineral	Percent	Size (inches)
1667	Quartz monzonite.			Irregular.	One unit.	1/8	10		55				35											Biotite. Martite.	<1 Trace.	
1668	do.			Lenticular-branching.	do.	1/16	72		2				25											Biotite.	1	
1669	do.	None.		Irregular.	do.	3/4-1	2		78		5		20											do. Magnetite.	Trace. <1	
1670	do.			Lenticular.	do.	4-6	20		80		85		20											do.	Trace.	
1671	Hornblende gneiss.		Not exposed.	do.	do.	1/8	55		20				25											Biotite. Martite.	<1 <1	
1672	do.		do.	do.	do.	2-3	30		45		25		25											do.	Trace.	
1673	do.		do.	Irregular.	do.	1/8-1/4	50		25				25				Trace.							Magnetite.	Trace.	
1674	do.		do.	Lenticular-branching.	do.	1/4	30		40				30		<1		<1									
1675	do.	None.		Irregular.	One unit.	1/2	5		70				25				<1							Biotite.	Trace.	
1676	do.	do.	Crosscutting.	do.	do.	1/8-1/4	60		15				25				Trace.							do.	<1	
1677	do.		Not exposed.	do.	do.	1/8-1/4	35		40				25				Trace.							do. Magnetite.	<1 Trace.	
1678	do.		do.	Lenticular.	do.	1/8	64		10				25											do. Biotite.	1 <1	
1679			do.	do.	do.	1/8-1/4	65		15				25											do.	Trace.	
1680	do.		do.	do.	do.	1/4	50		30				20											Magnetite.	Trace.	
1681	do.		do.	Irregular.	do.	1/4	35		40				25											do. Biotite.	<1 <1	
1682	Quartz monzonite.	None.		do.	do.	3/4	20		55				25											Magnetite.	<1	
1683	Hornblende gneiss		Not exposed.	do.	do.	1/8	60		15				25											Biotite. Magnetite.	<1 Trace.	
1684	do.		do.	do.	do.	1/2-3/4	15		55				30		Trace.		<1							Biotite.	<1	
1685	do.		do.	Lenticular.	do	1/4-1/2	3		61				35		<1		1									
1686	do.		do.	do.	do.	1/4-1/2	10		60				30				<1							Biotite.	<1	
1687	do.		do.	do.	do.	1/2	10		55				35				<1							do.	<1	
1688	do.		do.	do.	do.	1/4-1/2	7		63				30				<1									
1689	do.		do.	do.	do.	1/4-1/2	5		60				35				<1									
1690 Lazy Day	do.		do.	do.	do.	1/4	40		35				25		<1		<1							Biotite.	Trace.	
1691	do.		do.	do.	do.	1/4-1/2	20		55				25				<1							do.	Trace.	
1692	do.		do.	Irregular.	do.	1/4	12		63				25				<1							do.	<1	

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium Percent	Lithium Size (inches)	Other minerals: Mineral	Other Percent	Other Size (inches)
1693	Hornblende gneiss and quartz monzonite.		Not exposed.	Lenticular-branching.	One unit.	1/4-1/2	45		35		15		20													
1694	Hornblende gneiss.		do.	Lenticular.	do.	1-1/2	10		70		65		20													
1695	Hornblende gneiss and quartz monzonite.		do.	do.	do.	1	15		65		40	4	20											Magnetite.	Trace.	
1696	do.	None.		Lenticular-branching.	West part. East part.	1/4 1-1/2	60 20		15 60	2	<5 30		25 20		Trace.									Biotite. Magnetite.	Trace. <1	
1697	Hornblende gneiss.		Not exposed.	do.	One unit.	1	10		70		70		20													
1698	do.		do.	Lenticular.	do.	2	10		70		80		20											Magnetite.	Trace.	
1699	Quartz monzonite.			do.	do.	1	15		65		70		20											do.	Trace.	
1700	do.			do.	do.	2	5		75		85		20													
1701	Quartz monzonite and hornblende gneiss.		Not exposed.	Lenticular-branching.	do.	1-2	10		70		70		20													
1702	do.		do.	Lenticular.	do.	1	10		70		85		20											Magnetite.	Trace.	
1703	Hornblende gneiss.		do.	Lenticular-branching.	do.	2	15		65		70	Up to 8	20											Biotite.	Trace.	
1704	do.		do.	Lenticular.	do.	2	20		55		50	Up to 10	25													
1705	do.		do.	do.	do.	1/2-1	45		35		25		20													
1706	Hornblende gneiss and quartz monzonite.		do.	do.	do.	1-1/2	30		50		60		20											Magnetite.	Trace.	
1707	Hornblende gneiss.		do.	Lenticular-branching.	do.	1/4	60		25	Up to 2	1		15											Biotite. Magnetite.	Trace. <1	1/2
1708	do.		do.	Irregular.	do.	1/4-1/2	45		30	Up to 3	5		25											do.	Trace.	
1709	do.		do.	Lenticular.	do.	1/2-1	50		30	Up to 3	10		20											Biotite. Magnetite.	Trace. <1	1/4 1/2
1710	do.		do.	do.	do.	1/4-1/2	60		20		10		20				Trace.							do.	Trace.	
1711	do.		do.	do.	do.	1	35		45		40		25											do.	Trace.	
1712	do.		do.	Irregular.	do.	1/2-1	40		40		20		20											Biotite. Magnetite.	Trace. Trace.	
1713	do.		do.	Lenticular-branching.	do.	1/4	50		30				20		Trace.		Trace.							Biotite. Martite.	Trace. Trace.	
1714	do.		do.	do.	do.	1/2	45		35		5	6-10	20				Trace.							do.	Trace.	

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Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock		Pegmatite				Mineralogy																				
	Type and formation	Alteration	Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase		Perthite		Graphic granite		Quartz		Muscovite		Garnet		Tourmaline		Lithium minerals			Other minerals		
							Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)	Mineral	Per-cent	Size (inches)
1715	Hornblende gneiss.		Not exposed.	Lenticular.	One unit.	1/4	60	1/16-1/8	20	1/2-2			20				Trace.									
1716	do.		do.	do.	do.	1/4	60		20	1/2-1			20				Trace.									
1717	do.		do.	Lenticular-branching.	do.	1	35	1/8	45	1-3	20		20	1/8-1/4										Magnetite.	<1	1/4
1718	do.		do.	do.	do.	1	50		30	1/2-3	30		20											do.	<1	<1/2
1719	do.		do.	Irregular.	do.	1/4	60	1/8	20	1/2-1-1/2			10	1/4-1												
1720	Hornblende gneiss and quartz monzonite.	None.		do.	Northeast and Southwest ends.	1	1		79		10		20				Trace.							Martite.	<1	1/2
					Central part.	1/4-1/2	35		45				20				<1									
1721	Quartz monzonite.	do.		Lenticular.	One unit.	1/2-1	20	1/16-1/8	60	1/2-3	30	1-3	20	1/8-1/4	Trace.	1/8	Trace.	1/8						Magnetite. Biotite.	<1 Trace.	1/4-1/2 1
1722	Hornblende gneiss and quartz monzonite.	do.		Lenticular-branching.	do.	2	30		50		20		20				Trace.							do. Magnetite.	Trace. <1	 3/4
1723	do.			do.	do.	2	5		75		40		20				<1							Biotite. Martite.	Trace. <1	
1724	Hornblende gneiss.		Not exposed.	Lenticular.	do.	3	30		50		30		20				Trace.	1/32						Magnetite.	Trace.	1/8
1725	do.		do.	do.	do.	3/4	60		25		10	6	15											do.	Trace.	1/32
1726	do.		do.	do.	do.	1/4	50		30	3			20				<1	1/16						do.	<1	1/32-1/4
1727	do.		do.	do.	do.	3/4	35		45		10	5	20				Trace.	1/16								
1728	do.		do.	Irregular.	do.	4	39		50		60	10	20											Biotite.	Trace.	1/16
1729	Hornblende gneiss and quartz monzonite.		do.	Lenticular.	do.	1/2	45		35	3			20											Magnetite. do.	Trace. Trace.	1/8 1/32
1730	do.		do.	do.	do.	3	30		55		40	6	15											Biotite. Magnetite.	Trace. Trace.	1/8 1/32
1731	Hornblende gneiss.		do.	do.	do.	1/4	49.5		30	3			20				0.5	1/16						Biotite. Magnetite.	Trace. Trace.	1/4 1/32
1732	Hornblende gneiss and quartz monzonite.		do.	do.	do.	1/2	65	1/8	20		20	4	15											Biotite.	Trace.	1/8
1733	do.		do.	Lenticular-branching.	do.	1/4	45		35		20	4	20											Magnetite.	Trace.	1/16
1734	do.		do.	do.	do.	6	10		70		85		20		Trace.									Biotite. Martite. Samarskite	<1 <1 (?)	 3 crystals.
1735	Hornblende gneiss.		do.	do.	do.	1/2	55	1/32	30	4			15											Magnetite.	Trace.	1/16

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase: Percent	Plagioclase: Size (inches)	Perthite: Percent	Perthite: Size (inches)	Graphic granite: Percent	Graphic granite: Size (inches)	Quartz: Percent	Quartz: Size (inches)	Muscovite: Percent	Muscovite: Size (inches)	Garnet: Percent	Garnet: Size (inches)	Tourmaline: Percent	Tourmaline: Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1736	Hornblende gneiss and quartz monzonite.		Not exposed.	Lenticular.	One unit.	2	30		50	4	30	6	20											Martite.	Trace.	1/8
1737	do.		do.	do.	do.	1	50		30	3	15	4	20				<1	1/64						do.	Trace.	1/32
1738	do.		do.	Lenticular-branching.	do.	2	40		34.5		40	8	25				0.5	1/8						Magnetite.	Trace.	1/32-2
1739	Quartz monzonite.			Lenticular.	do.	1/2	30		50		50		20											do. Biotite.	Trace. Trace.	1/64 1/4
1740	Quartz monzonite and hornblende gneiss.		Not exposed.	do.	do.	2	50		35		50	8	15											do. Magnetite.	Trace. Trace.	1/16-1/4 1/16
1741	Quartz monzonite.			do.	do.	3	30		50		65	8	20											do.	Trace.	1/32
1742	do.			do.	do.	1-1/2	35		50		35	5	15													
1743	do.	None.		Irregular.	do.	2	40		45		30	5	15											Biotite.	Trace.	1/4
1744	do.			Lenticular.	do.	2	40		50		40	4	10											Magnetite. Biotite.	Trace. Trace.	1/8 1/8
1745	do.			do.	do.	1/2	60		25		20	5	15											Magnetite.	Trace.	1/16-1
1746	do.			do.	do.	3/4	50		30		30	5	20											do.	Trace.	1/16
1747	do.			do.	do.	5	25		65		70	8	15													
1748	do.			do.	do.	1	55		35	4	15	5	20				<1	1/64						Magnetite.	Trace.	1/16
1749	do.			do.	do.	2	30		55		40	8	15											do.	Trace.	1/16
1750	do.			do.	do.	1	35		45		20	8	20				Trace.	1/16						do. Biotite.	Trace. Trace.	1/32 1/32
1751	do.			do.	do.	4	20		60		60	8	20											Magnetite.	Trace.	1/16
1752	do.			Lenticular-branching.	do.	1/2	55		30	2			15											do.	Trace.	1/4
1753	do.			Lenticular.	do.	4	25		50		50	10	25											do.	Trace.	1/32
1754	do.			do.	do.	1	55		35	4	15	5	20				<1	1/64						do.	Trace.	1/16
1755	do.			do.	do.	2	30		50		50	5	20											do.	Trace.	1/8
1756	do.			do.	do.	4	25		60		60	6	15											Biotite. Magnetite.	Trace. Trace.	1/8 3/16
1757	do.			Lenticular-branching.	do.	5	30		55		50	8	15				Trace.	1/64						Biotite. Magnetite.	Trace. Trace.	1/32 1/32
1758	do.			Lenticular.	do.	4	30		55		50	10	15				Trace.	1/32						do.	<1	1/32
1759	do.			Irregular.	do.	3	20		65		70	8	15											do.	Trace.	1/8
1760	Quartz monzonite and hornblende gneiss.		Not exposed.	Lenticular.	do.	1-1/2	20		65		60		15											do.	Trace.	1/4

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Plagioclase Per-cent	Plagioclase Size (inches)	Perthite Per-cent	Perthite Size (inches)	Graphic granite Per-cent	Graphic granite Size (inches)	Quartz Per-cent	Quartz Size (inches)	Muscovite Per-cent	Muscovite Size (inches)	Garnet Per-cent	Garnet Size (inches)	Tourmaline Per-cent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals Per-cent	Lithium minerals Size (inches)	Other minerals: Mineral	Other minerals Per-cent	Other minerals Size (inches)
1761	Quartz monzonite.			Lenticular-branching.	One unit.	3	45		40		40	8	15											Magnetite.	Trace.	1/16
1762	do.			Lenticular.	do.	2	45		60		20	6	15				Trace.	1/32						do. Biotite.	Trace. Trace.	1/16 1/32
1763	do.			do.	do.	2	25		60		20	5	15				Trace.	1/32						Magnetite.	Trace.	1/16
1764	do.			do.	do.	3	30		55		50	8	15											do.	Trace.	1/8
1765	do.			do.	do.	2	30		55		40	5	15											do.	Trace.	1/32-1/2
1766	do.			do.	do.	1	45		40		10	5	15											do.	Trace.	1/16
1767	do.			do.	do.	3	20		65		60	12	15											do.	Trace.	1/16-1
1768	do.			Lenticular-branching.	do.	3	15		65		60	8	20											do.	Trace.	1/16
1769	do.			Lenticular.	do.	2	30		55		50	8	15											do.	Trace.	1/16
1770	do.			Lenticular-branching.	do.	2	30		55		50	5	15											do.	Trace.	1/32
1771	do.			Irregular.	do.	1/2	40		35		5		25											Martite.	<1	
1772	do.	None.		do.	do.	3	35		50		60	8	15											Magnetite.	Trace.	1/32
1773	do.			Lenticular-branching.	do.	1/2	40		40		10		20											Martite.	<1	
1774	do.			Lenticular.	do.	3	10		75		70		15											Magnetite.	Trace.	1/8
1775	do.			do.	do.	1/4	55		30	3	10	4	15											Biotite. Magnetite.	Trace. Trace.	1/16 1/8
1776	do.			do.	do.	2	25		55		30	6	20											do. Biotite.	Trace. Trace.	3/16 1/8
1777	do.			do.	do.	4	35		50		40	5	15											Magnetite.	Trace.	3/8
1778	do.			do.	do.	1	50		30		20	5	20											do.	Trace.	1/32
1779	do.			do.	do.	5	20		65		70	8	15											do.	Trace.	1/4
1780	do.			Lenticular-branching.	do.	1	30		55		20		15											do.	<1	1/4
1781	io.			Lenticular.	do.	1/2	25		60	3			15											do.	Trace.	1/8
1782	do.			do.	do.	2	25		50		10	5	25											do.	Trace.	1/4
1783	do.			do.	do.	3	40		40		40	8	20											do.	Trace.	1/8
1784	do.			do.	do.	1/4	70		15	3			15											do.	Trace.	3/16-1/2
1785	do.			do.	do.	3	30		50		40	8	20											Biotite. Magnetite.	Trace. Trace.	3/8 1/16
1786	do.			do.	do.	5	30		40		30		30											do.	<1	1/8-2

Table 20.--Mineralogy of pegmatites--Continued.

Number and name of pegmatite (Pl. II)	Wall rock: Type and formation	Wall rock: Alteration	Pegmatite: Relation to wall rock	Shape	Internal structure	Texture (inches)	Mineralogy: Plagioclase Percent	Plagioclase Size (inches)	Perthite Percent	Perthite Size (inches)	Graphic granite Percent	Graphic granite Size (inches)	Quartz Percent	Quartz Size (inches)	Muscovite Percent	Muscovite Size (inches)	Garnet Percent	Garnet Size (inches)	Tourmaline Percent	Tourmaline Size (inches)	Lithium minerals: Mineral	Lithium minerals: Percent	Lithium minerals: Size (inches)	Other minerals: Mineral	Other minerals: Percent	Other minerals: Size (inches)
1787	Quartz monzonite.			Lenticular-branching.	One unit.	2-3	10		70		80		20											Martite.	< 1	
1788	do.			Lenticular.	do.	1-2	30		50		45		20											Magnetite.	<1	
1789	do.			do.	do.	1-2	20		55		40		25											do.	< 1	
1790	do.			Lenticular-branching.	do.	1/8-1/4	55		25				20				<1							Martite.	Trace.	
1791	do.			Lenticular.	do.	1/8-1/4	70		10				20				<1									
1792	do.			do.	do.	1/2	45		35		20		20				Trace.							Martite.	<1	
1793	do.			do.	do.	3/4	35		40		2		25				<1							do.	Trace.	
1794	do.			Lenticular-branching.	do.	1/2	50		25		1		25				Trace.							do.	<1	
1795	do.			Lenticular.	do.	3/4	35		45		Trace.		20				Trace.							do.	Trace.	
1796	do.			Lenticular-branching.	do.	1/4	50		30		2		20				Trace.							Magnetite.	Trace.	
1797	do.			Lenticular.	do.	1	15		65		60		20											do.	1	
1798	do.			Lenticular-branching.	do.	2	25		55		30		20				<1							Biotite. Martite.	Trace. <1	
1799	Hornblende gneiss.	None.	Crosscutting.	Lenticular.	do.	1/2-3/4	30		40				30		Trace.											
1800	Quartz monzonite.	do.		Irregular.	do.	3/4	25		55		5		20											Biotite.	Trace.	
1801	Hornblende gneiss.	do.		do.	do.	1/8-1/4	63		8				27		2		Trace.							Martite.	< 1	1/8-1-1/2
1802	do.			Lenticular-branching.	do.	1/8-1/4	70		9				20		1		Trace.									
1803	do.			do.	do.	1	63		20				15		2											

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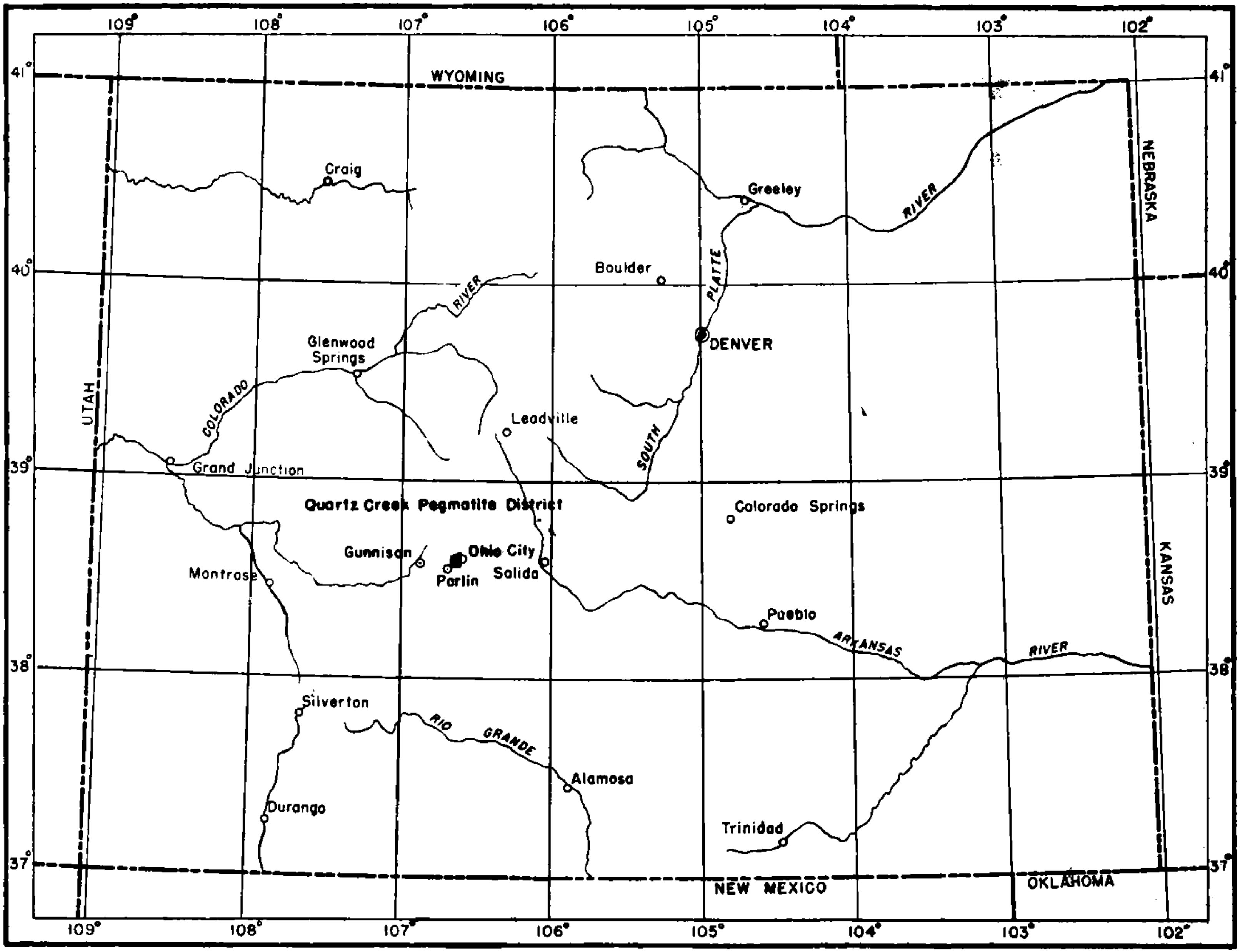

FIGURE I. INDEX MAP QUARTZ CREEK PEGMATITE DISTRICT, COLORADO

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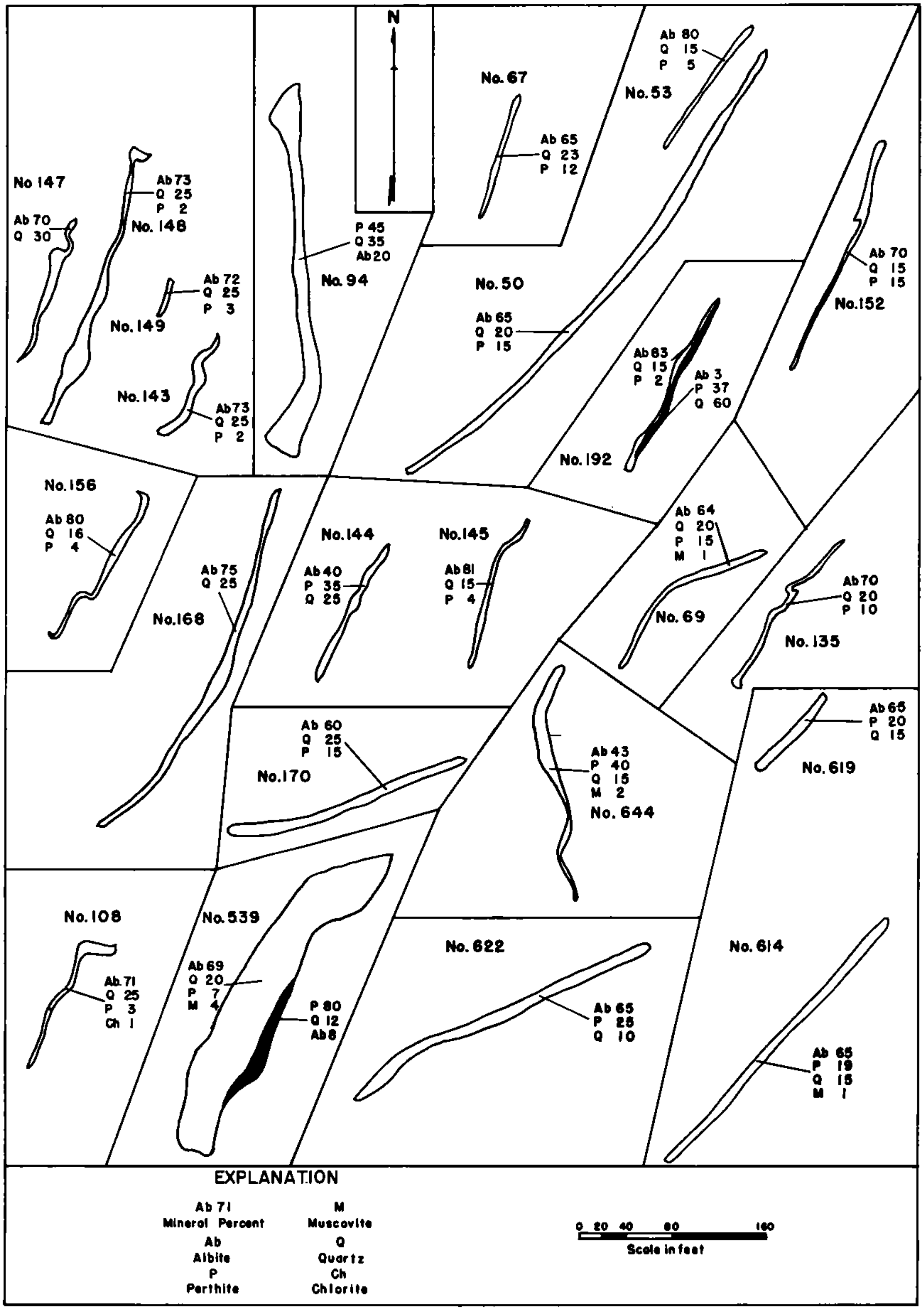


FIGURE 2. LENTICULAR PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT

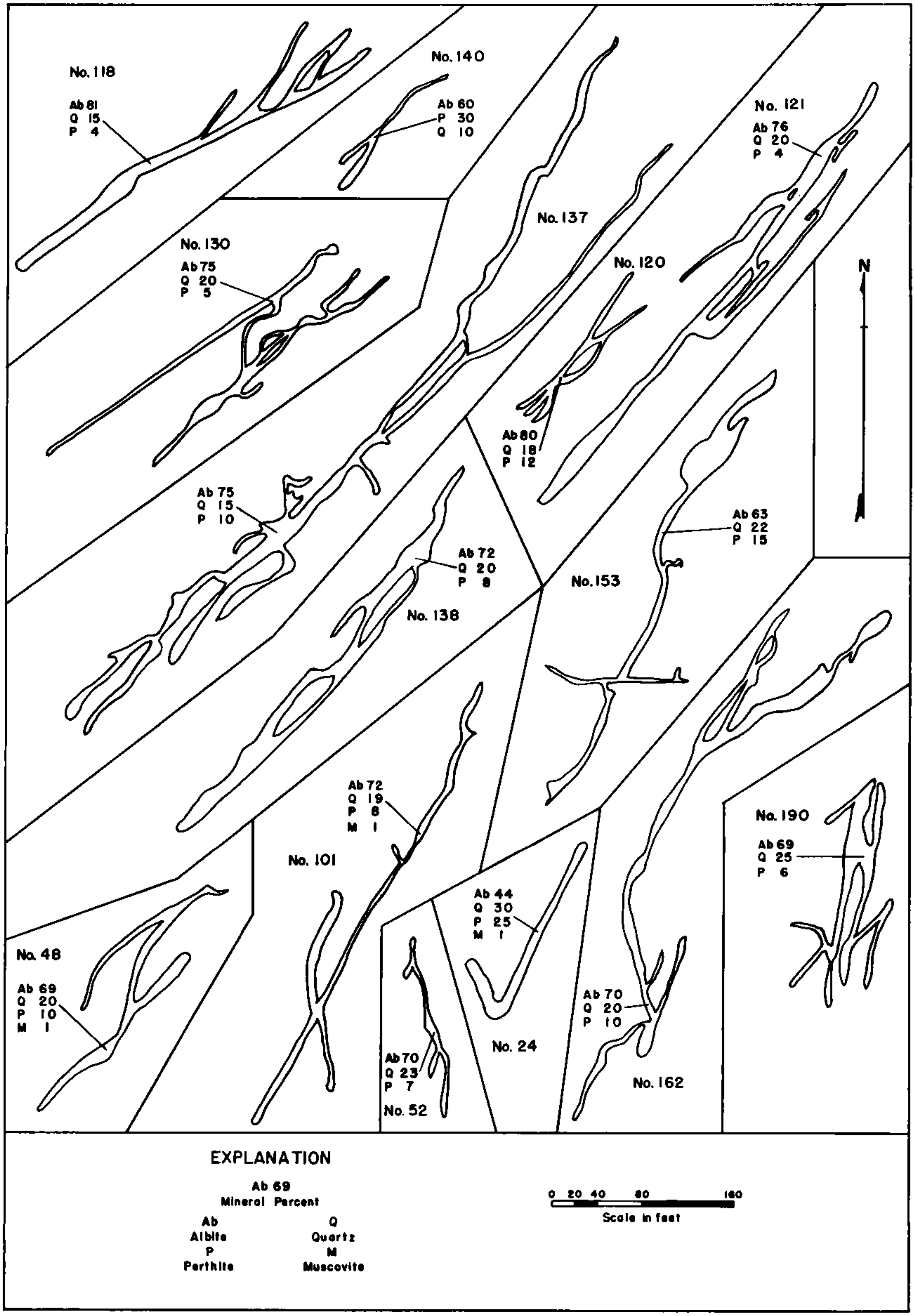
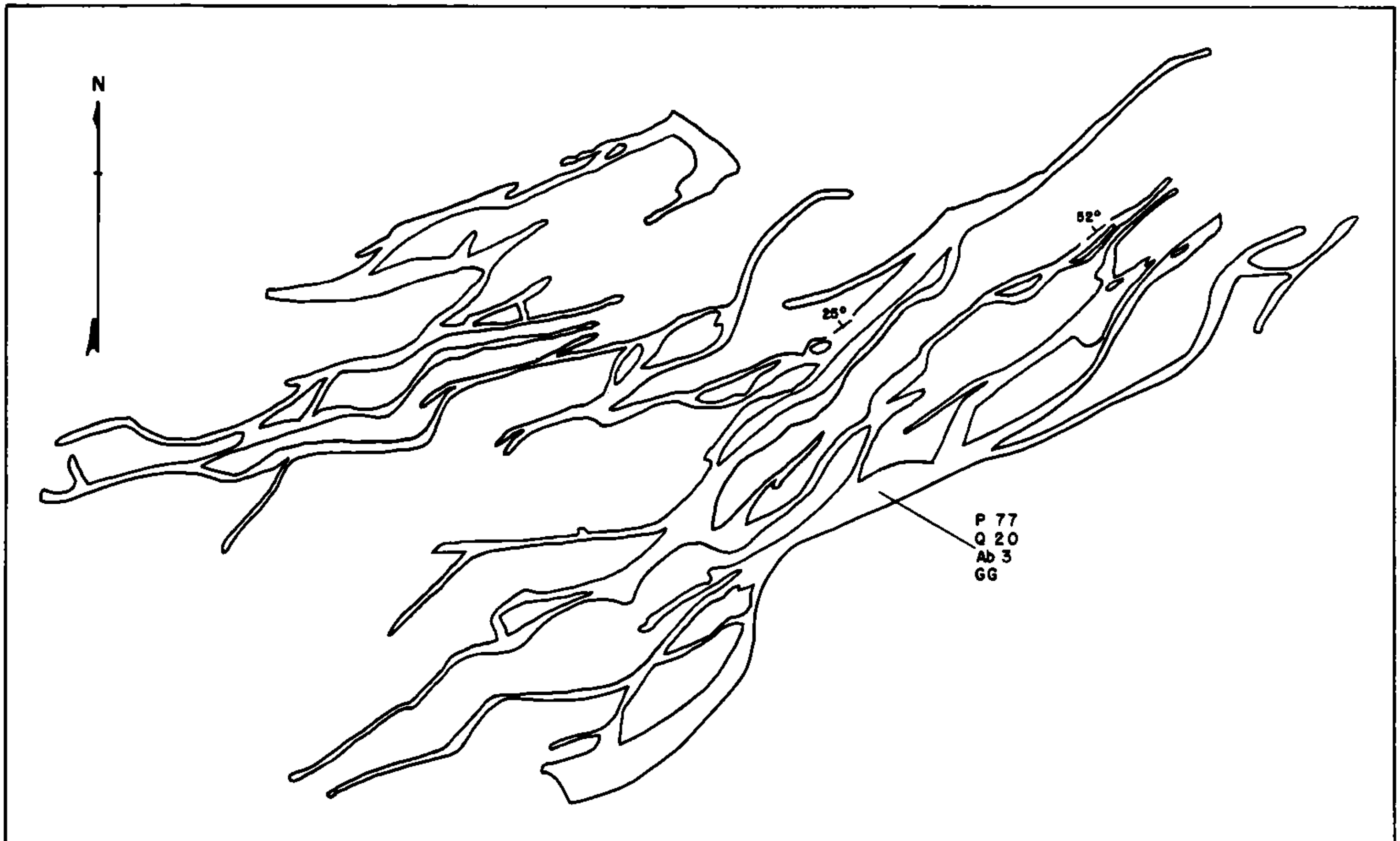


FIGURE 3. LENTICULAR AND BRANCHING PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT



EXPLANATION

P 77
Mineral Percent

Ab
Albite

Q
Quartz

P
Perthite

GG
Graphic Granite

25°
Strike and dip of pegmatite contact

0 50 100 200 400
Scale in feet

FIGURE 4. SHAPE OF PEGMATITE NO. 1294, QUARTZ CREEK PEGMATITE DISTRICT

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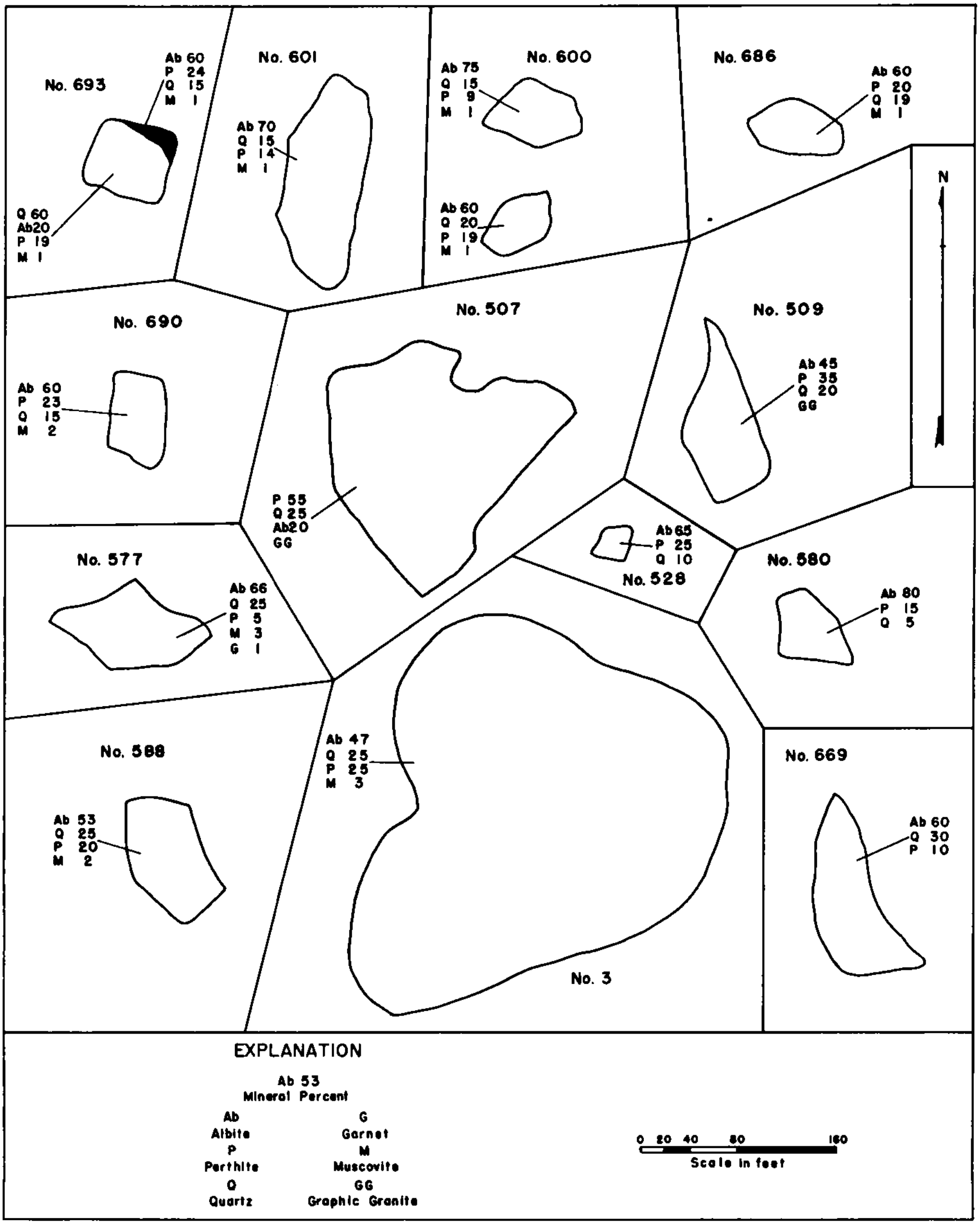


FIGURE 5. OVAL PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT

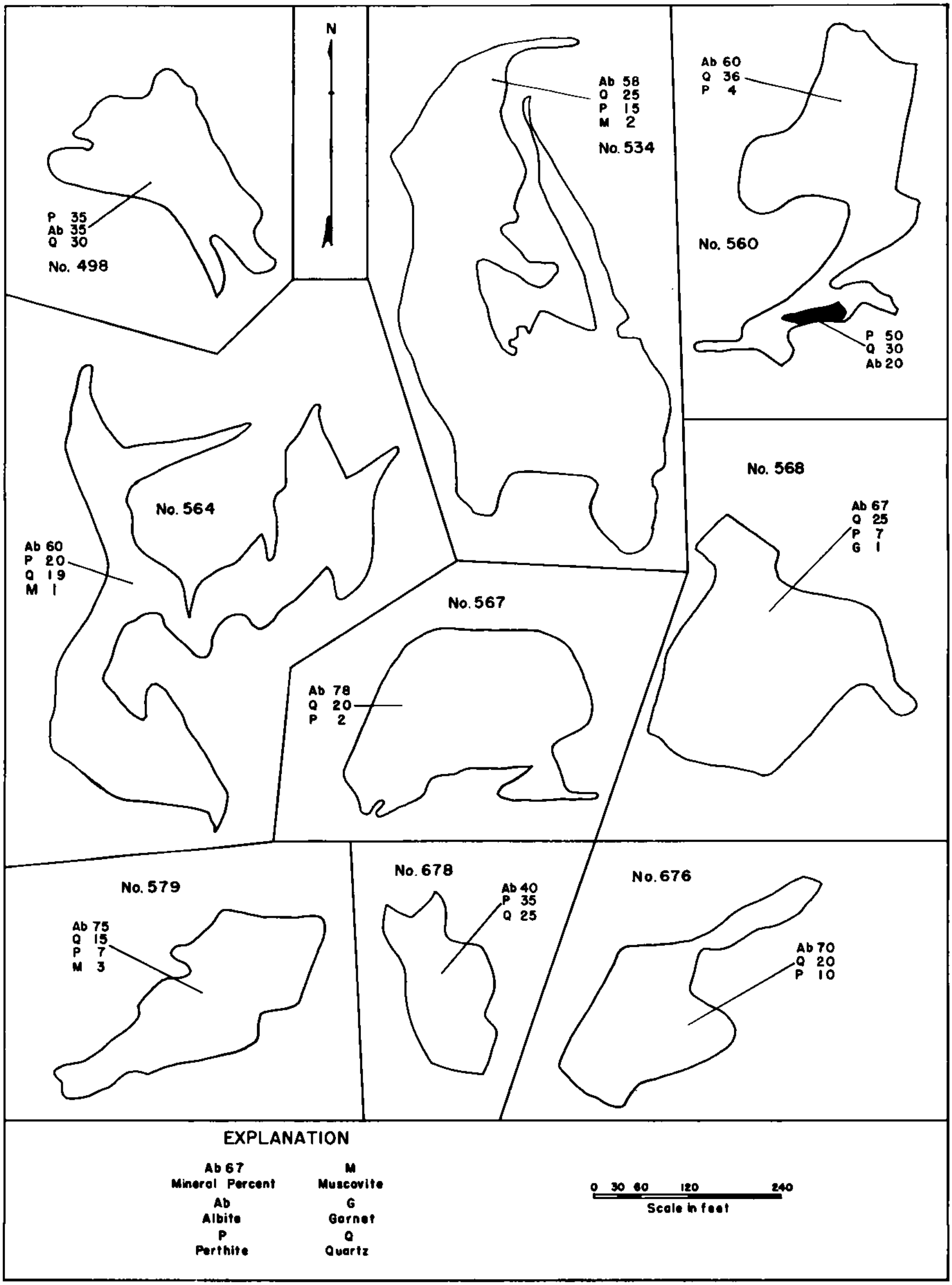
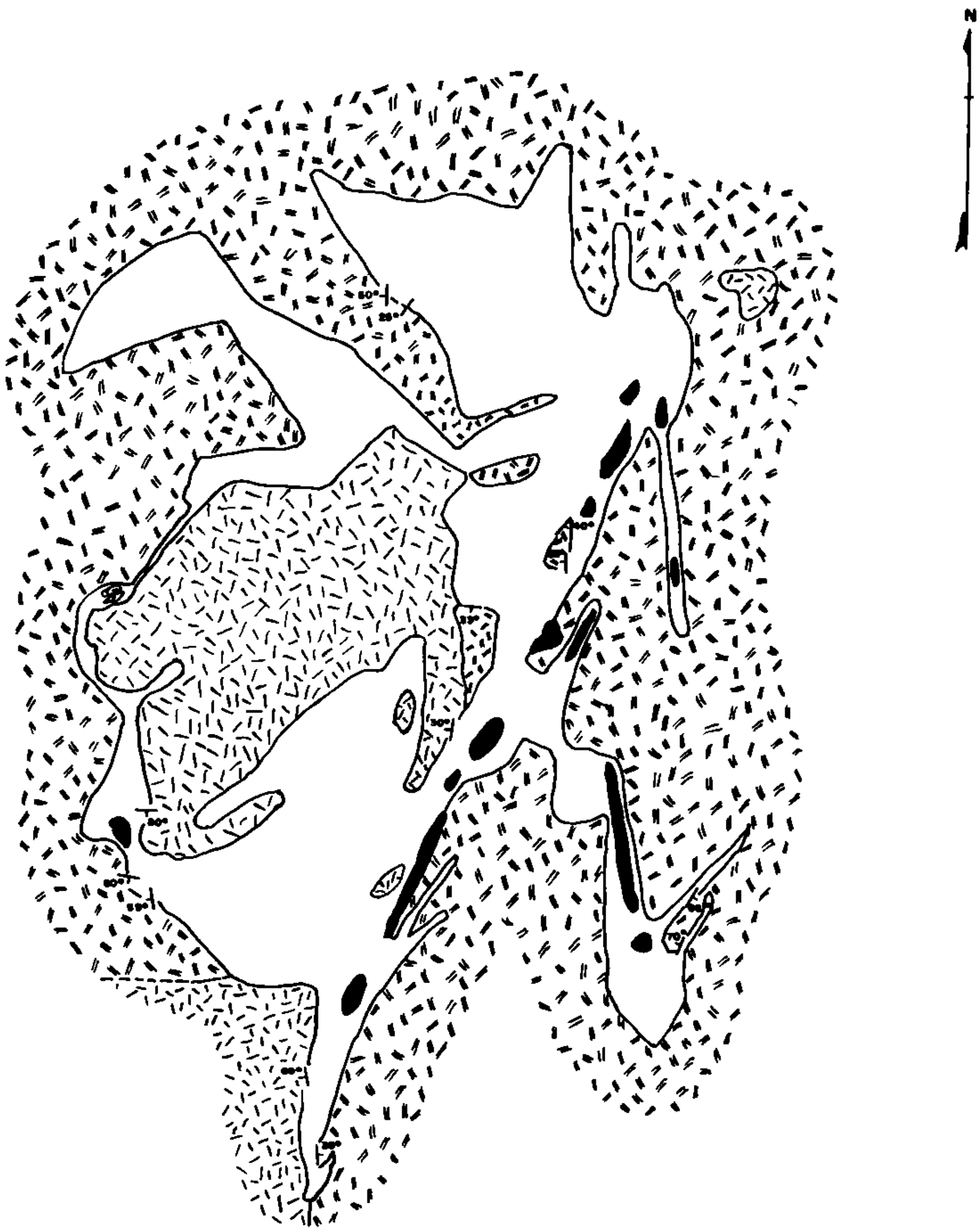


FIGURE 6. IRREGULAR PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT



EXPLANATION

Core
Quartz 43%, Perthite 43%, Albite 14%

Wall Zone
Albite 74%, Quartz 20%, Perthite 5%, Muscovite 1%

Granite

Hornblende gneiss

70°
Strike and dip of pegmatite contact

0 20 40 80 160 Feet
Scale

FIGURE 7 PEGMATITE NO. 297, QUARTZ CREEK PEGMATITE DISTRICT

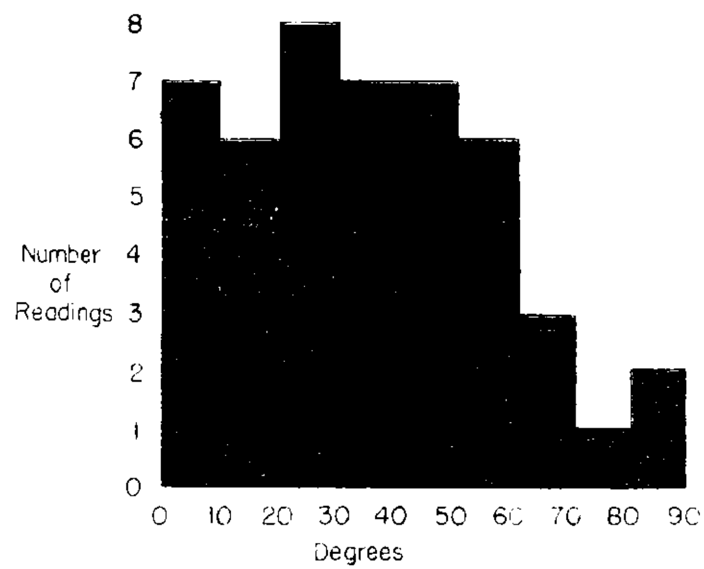


FIGURE 8. ANGLE BETWEEN PEGMATITE CONTACTS AND FOLIATION OF COUNTRY ROCK

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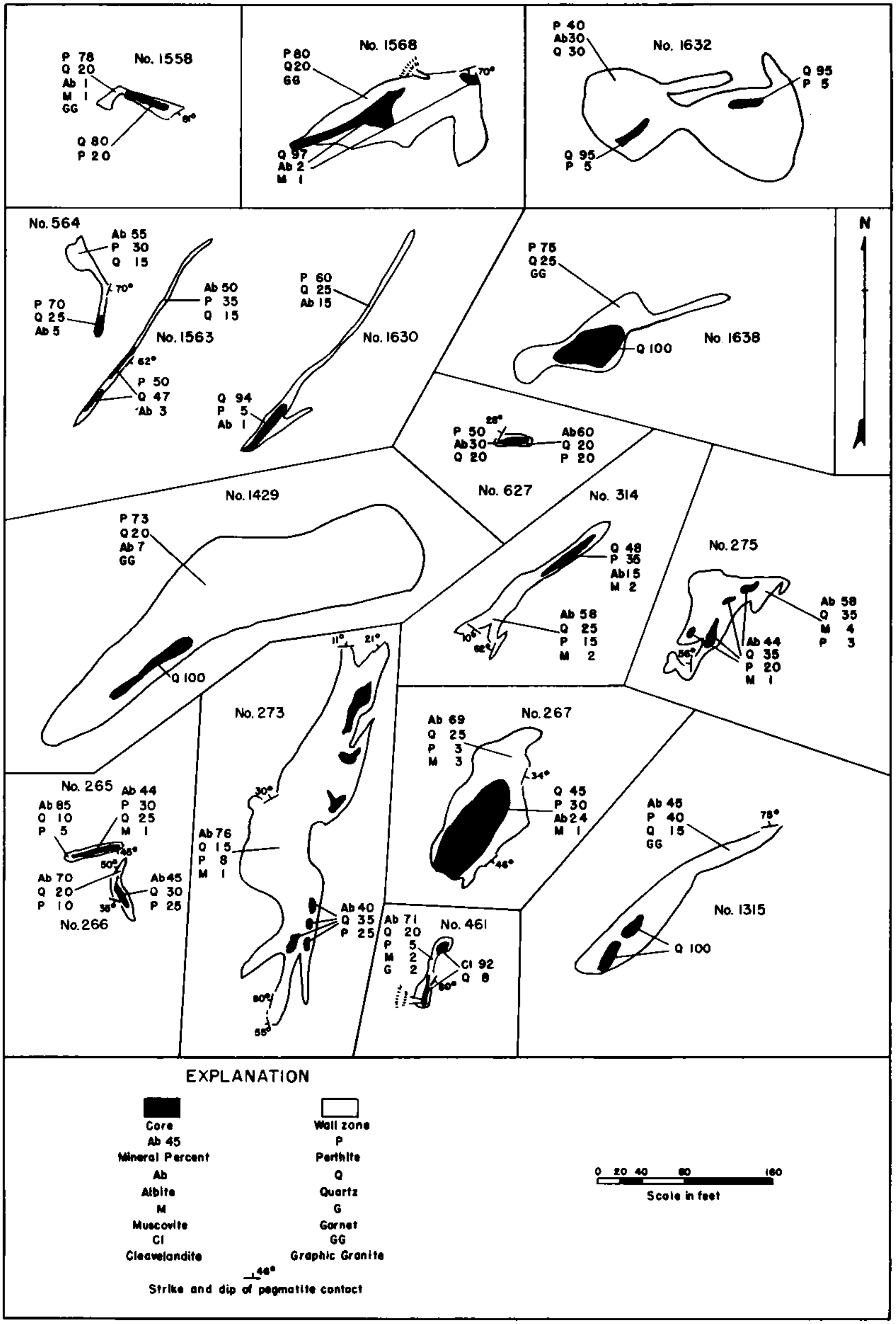

FIGURE 10. ZONED PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT

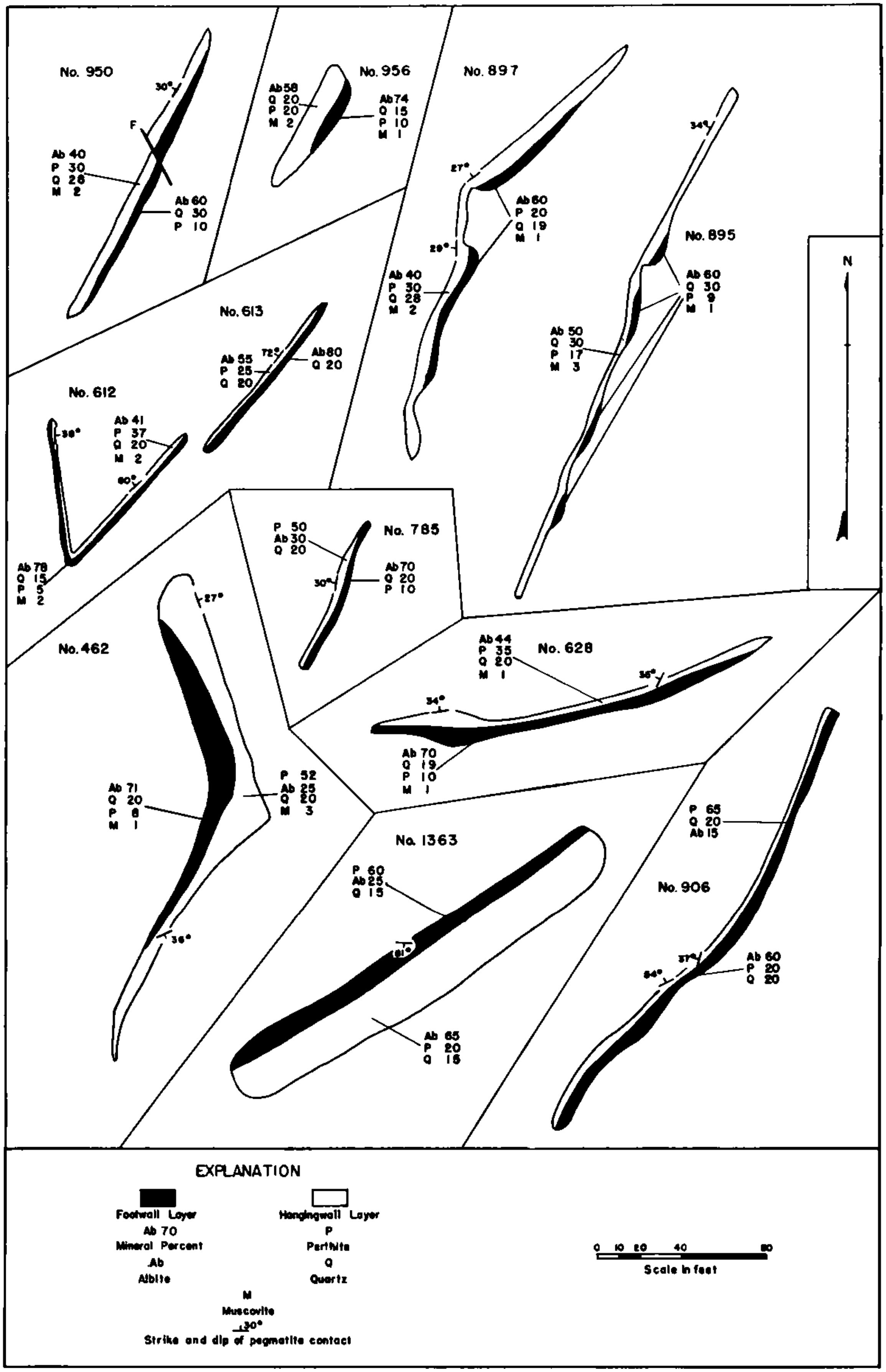

FIGURE 11. LAYERED PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT

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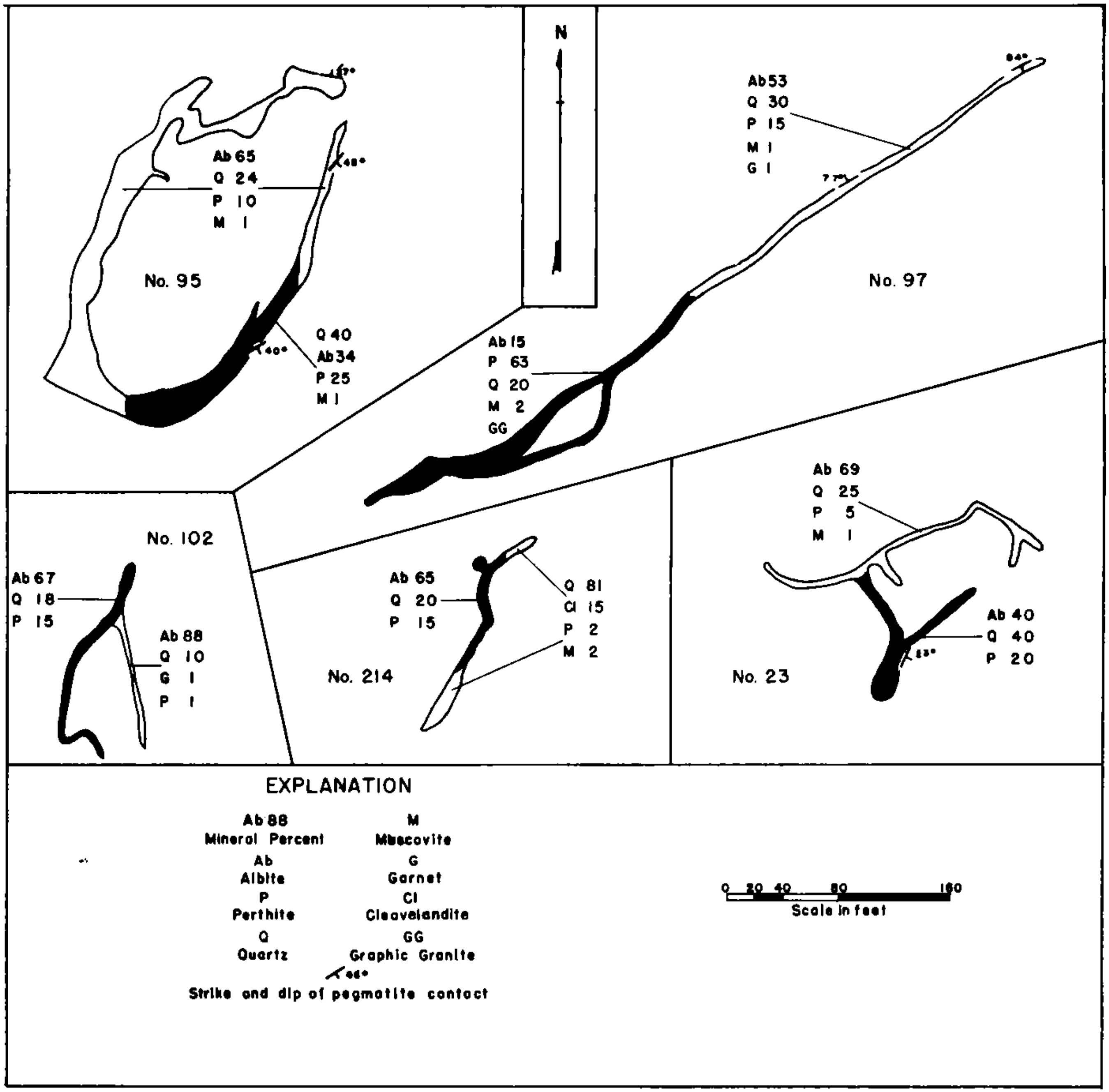

FIGURE 12. PEGMATITES SHOWING VARIATION IN COMPOSITION ALONG STRIKE
QUARTZ CREEK PEGMATITE DISTRICT

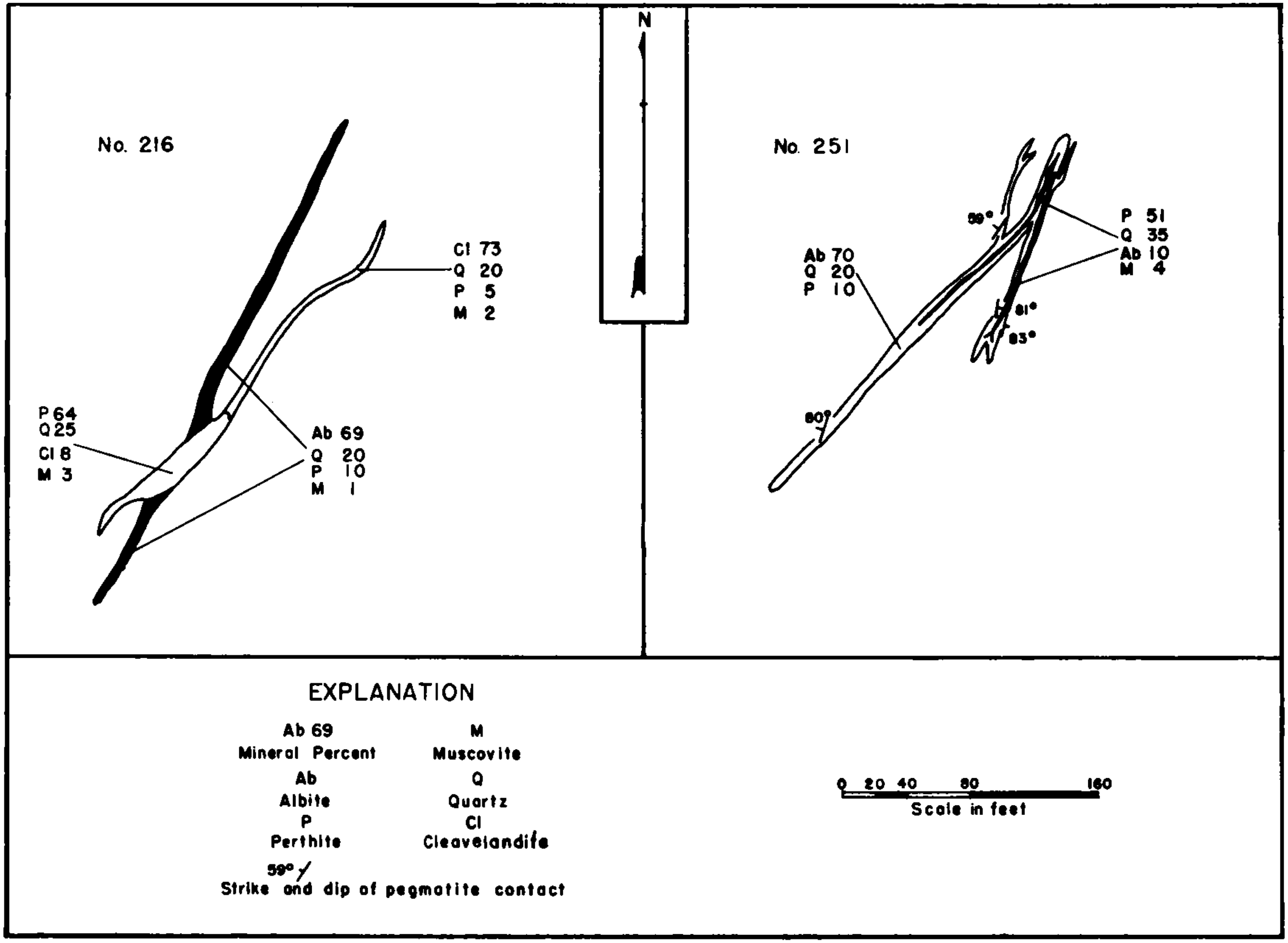

FIGURE 13. MULTIPLE PEGMATITES, QUARTZ CREEK PEGMATITE DISTRICT

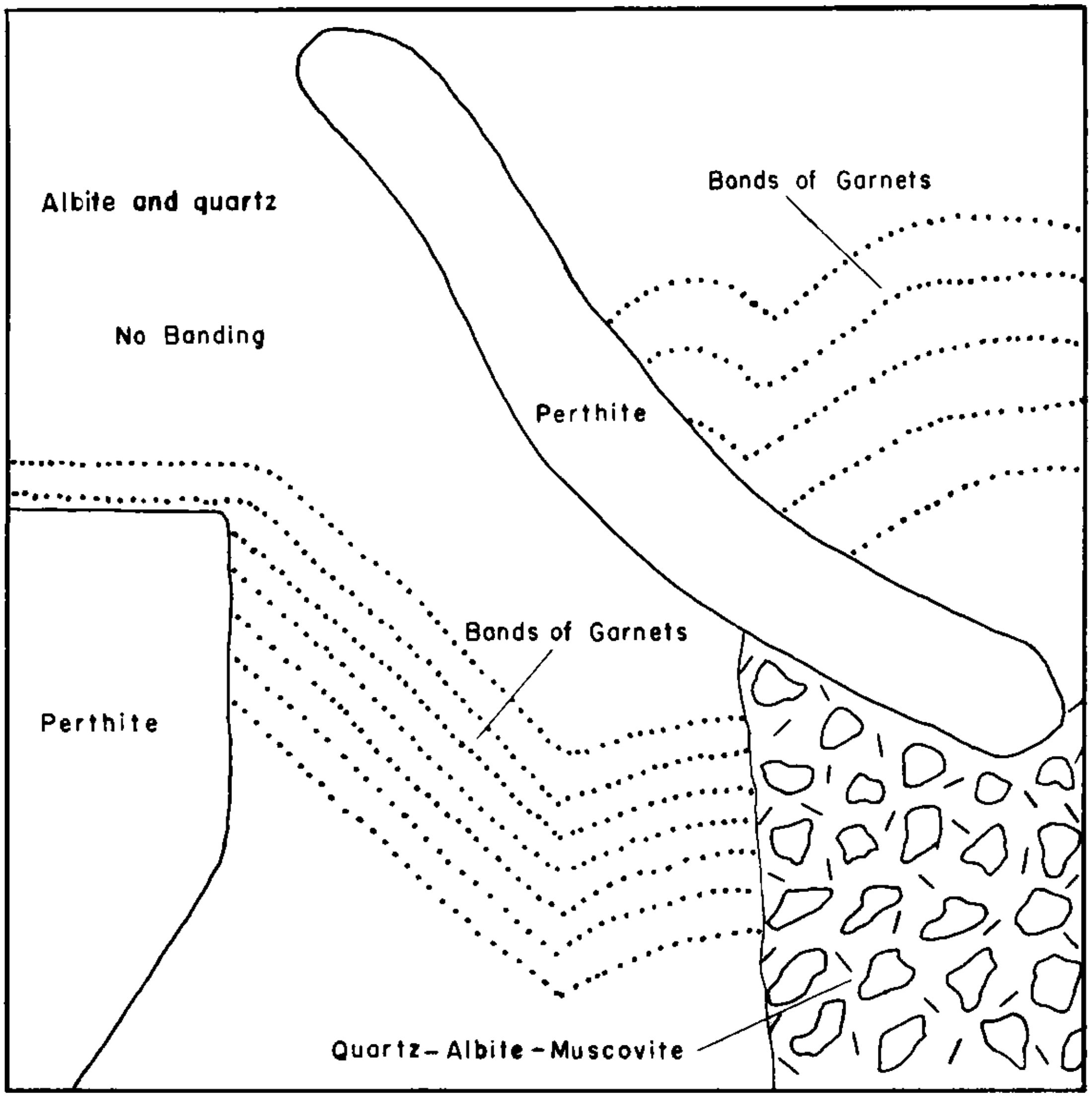

FIGURE 14. RELATION OF BANDING TO CRYSTALS OR NON-BANDED MINERAL AGGREGATES, PEGMATITE NO. 70

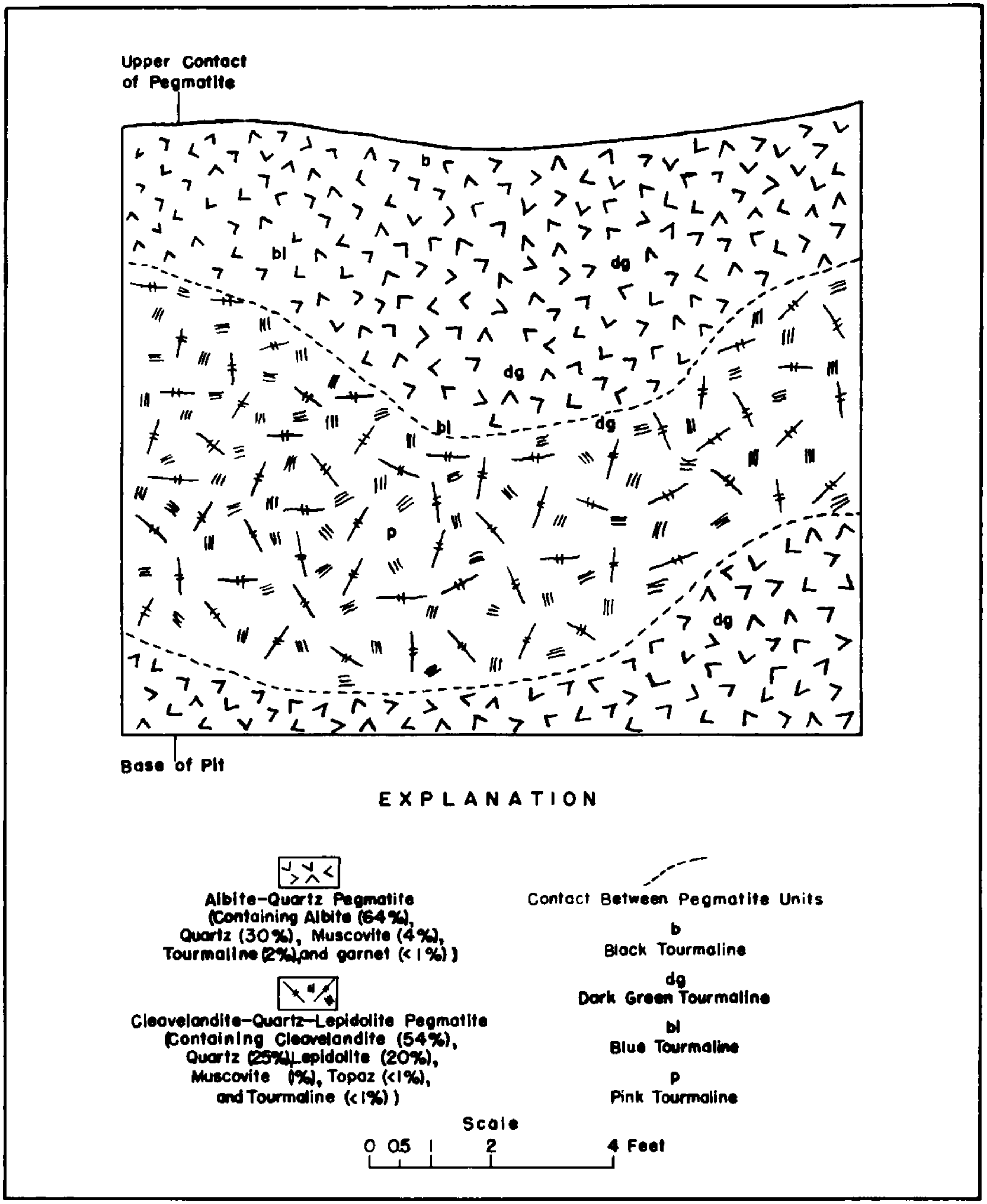

FIGURE 15. DISTRIBUTION OF TOURMALINE, FACE OF CUT IN PEGMATITE NO. 453

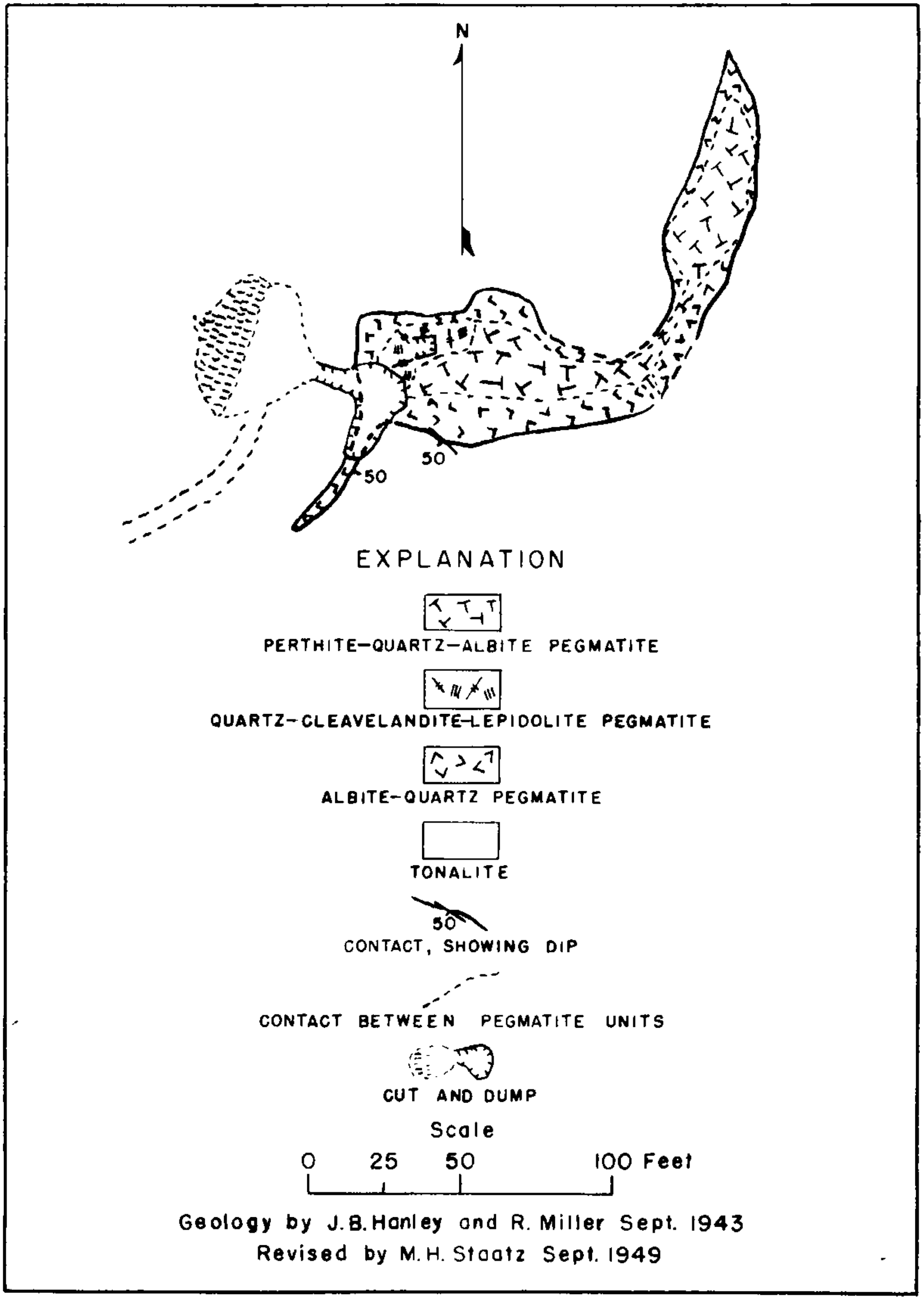

FIGURE 23. GEOLOGIC MAP, BROWN DERBY NO. 5 (NO. 535) PEGMATITE

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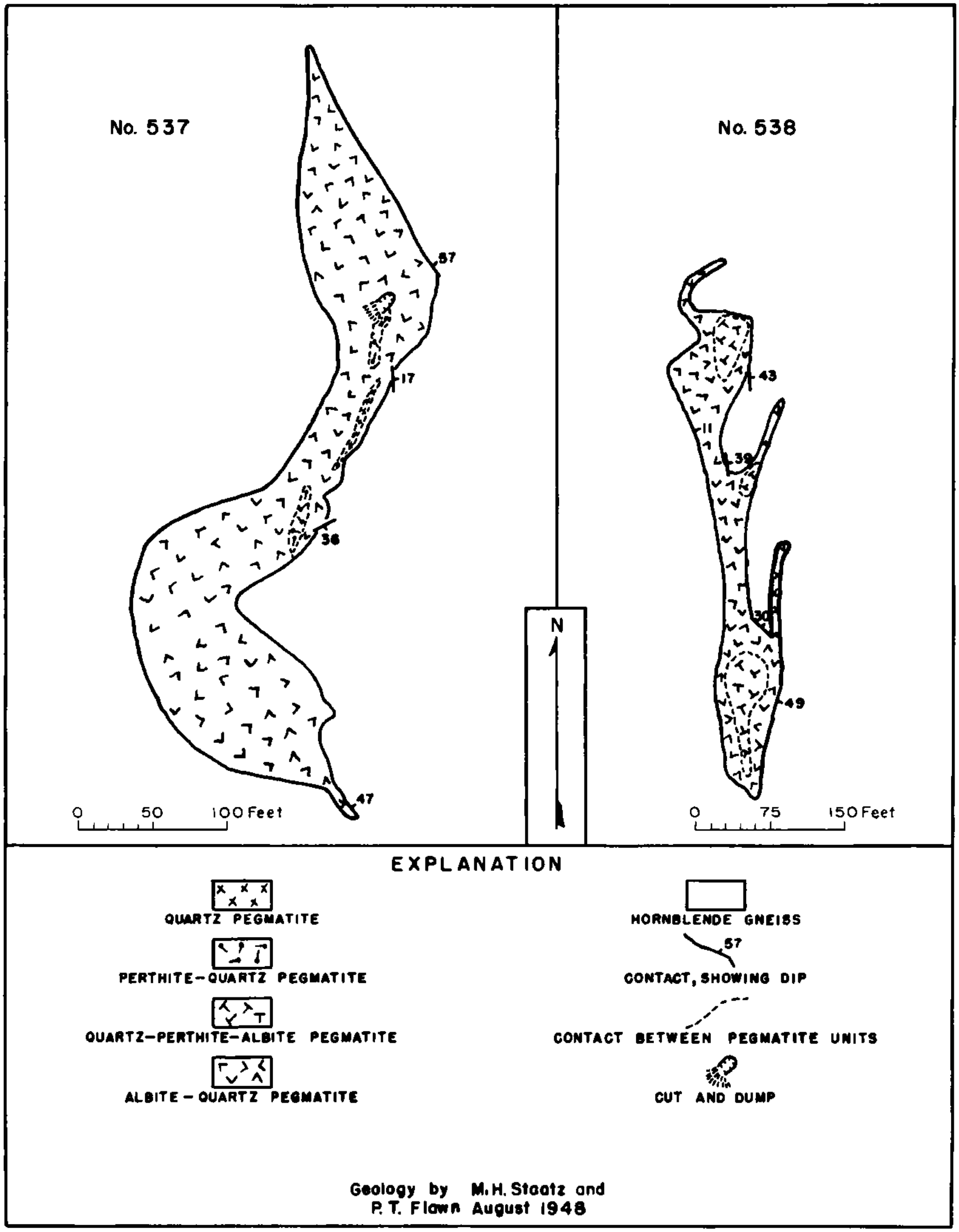

FIGURE 24. GEOLOGIC MAP OF PEGMATITES NO. 537 AND NO. 538

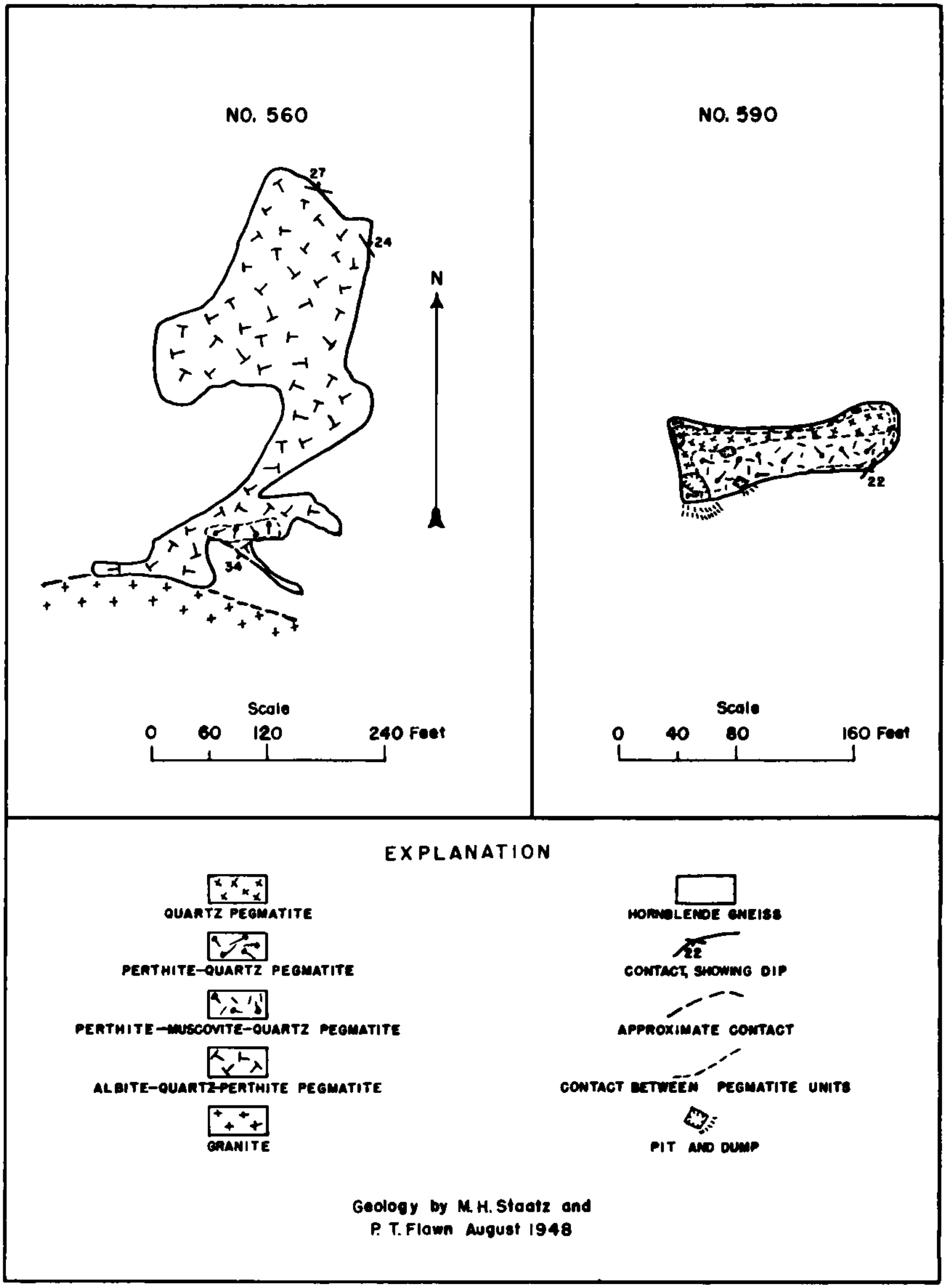

FIGURE 25. GEOLOGIC MAPS OF PEGMATITE 560
AND BERYL AND RARE MINERALS LODE (NO. 590)

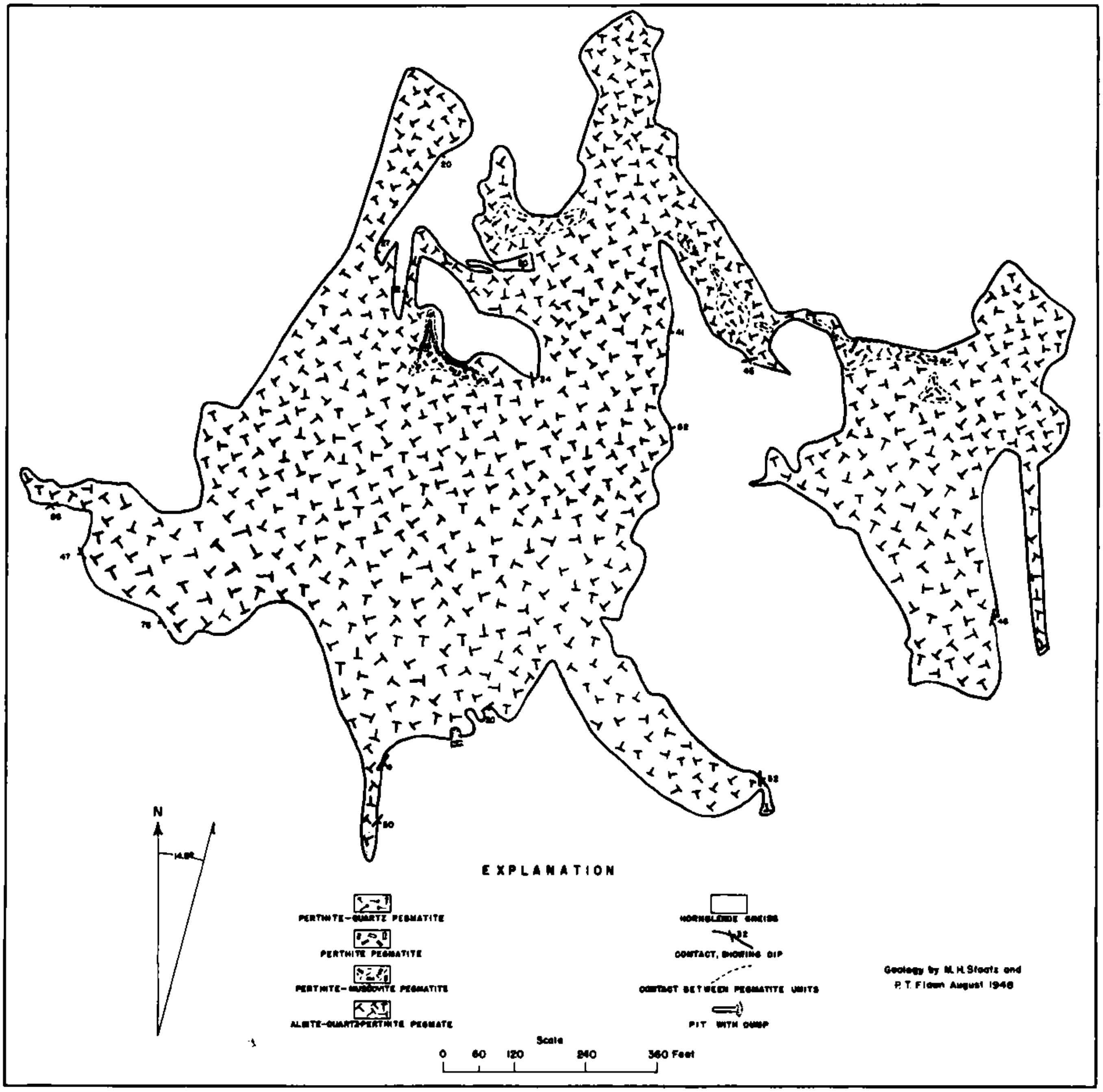

FIGURE 26. GEOLOGIC MAP, BUCKHORN (NO. 659) PEGMATITE

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CONTENTS

TABLES

METHOD OF CALCULATING PEGMATITE MINERAL RESOURCES

The resources of beryl, potassium feldspar, scrap mica, lepidolite, spodumene, amblygonite, columbite-tantalite, microlite, monazite, and topaz have been calculated on the basis of arbitrary cut-off points. These points were necessary to separate those pegmatites containing small quantities of industrial minerals from those deposits that have possibilities of becoming commercial deposits in the future.

Most of the beryl-bearing pegmatites contain only one or two small crystals of beryl. Beryl-bearing pegmatites that contain less than two square inches of exposed beryl are listed in table 21. This table gives the number of beryl crystals observed and their size range for each pegmatite. Pegmatites with an exposure of more than two square inches of beryl are listed in table 22, with the potential beryl resources of each unit.

The perthite and muscovite, which would help pay for mining the beryl, are calculated in each unit that contains over two square inches of beryl.

Potassium feldspar is found in a large proportion of the pegmatites. This mineral has a low unit price and, therefore, must be mined in large quantities by inexpensive methods in order to make a profit. To add to the cost of mining is the relatively high transportation costs. A narrow gauge railroad passes through Parlin but the cost of reloading at Salida to a standard gauge car makes it cheaper to truck the 58 miles directly to Salida. The usual method of separating the feldspar from the remainder of the pegmatite is by hand cobbing. In recent years, however, several mills have been erected. The closest mill to the Quartz Creek district is the mill of the Consolidated Feldspar Company at Parkdale, Colo. A separation is made between hand cobbing and milling feldspar with specifications for each. To be able to hand cob feldspar, the pegmatite must be sufficiently large to give sample tonnages, have crystals large enough to be easily hand cobbed, and be of sufficiently high tenor so as to profitably handle the rock. Limits on these three items are set low enough to anticipate a considerable improvement in mining, cheaper transportation, and a rise in the unit value. The resources of both hand cobbing and milling potash feldspar are given in table 22. The requirements for hand cobbing potash feldspar pegmatites are as follows: a maximum width of the pegmatite unit in excess of 40 feet and a minimum length of from 200 to 300 feet depending on the width; an average grain size of the potassium feldspar in excess of 12 inches; and the tenor of the rock to exceed 25 percent potassium feldspar. All pegmatites falling under this category also have beryl reserves in the Quartz Creek district.

In milling practice grain size is of little importance, and the feldspar resources of the graphic granite pegmatites are all calculated under this classification. By far the greater feldspar resources in the Quartz Creek district fall under this heading as graphic granite pegmatites are the more common throughout the area. Potash feldspar-bearing pegmatites must meet the following requirements to be considered as milling pegmatites: a maximum width of 40 feet and a length of at least 300 feet, and have a tenor in excess of 15 percent potassium feldspar.

No sheet mica is found in this district and there are only three pegmatite units which have scrap mica in excess of 15 percent. These all contain beryl. Scrap mica reserves are figured, therefore, as byproducts of beryl-bearing pegmatites.

The Quartz Creek district is noted for its rarer minerals. Many of these occur in small pods or as one or two crystals. Because of the interest these pegmatites have caused in the past, all pegmatites which contain lepidolite, spodumene, amblygonite, microlite, columbite-tantalite, monazite, or topaz are included in table 22.

RESOURCES

A section on reserves in Part I gives the district wide totals of the various economic minerals. Table 22 in Part II gives the reserves broken down to the various properties. Though the reserves of some properties can be published in Part I, the failure to get permission to publish on all properties does not permit a complete listing of properties that is given here. Some pegmatites have only one mineral of economic interest, such as feldspar, but many have several minerals. Reserves are calculated for various units on 134 pegmatites. Only 53 of the total pegmatites on which reserves were calculated were of one unit, 35 of these were feldspar-rich.

Table 21.—Beryl-bearing pegmatites with less than two square inches of exposed beryl

Pegmatite No.	No. of crystals	Size range in inches	Pegmatite No.	No. of crystals	Size range in inches
4	4	1/8 by 1/4	188	2	1/8
		to 3 by 3	190	2	1/8
21	1	1/4	196	2	1/16 to 3/4
22	1	4	197	5	1/4
24	1	1/2	198	1	1/4
55	1	1-1/2	201	1	1/2
68	2	—	223	1	1/4
78	2	1/4 to 2	226	5	1/8 to 1/2
80	2	1/8	230	6	1/8 to 1/2
81	1	1/8	231	3	—
84	2	1/8	233	1	1/4
86	2	—	237	2	3/8
88	1	1/4	238	3	1/4
102	2	1/4	239	1	1/4
105	4	1/2	240	1	1/2
106	2	1/8 to 1/4	244	4	1/8 to 1/4
112	13	1/8 to 1/4	245	3	1/2 to 1-1/4
114	2	1/8	259	15	1/8 to 1/2
116	2	1/4 to 3/4	279	35	1/8 to 3/8
117	3	1/8 to 1/4	281	3	1/8 to 1/4
121	5	1/8 to 1/2	283	1	1/4
125	1	5/8	290	1	1-1/2
126	1	1/8	299	8	1/16 to 1/4
128	2	1/8	300	8	1/4
129	1	1/8	301	2	1/2
130	3	1/8	302	2	1/2 to 1
131	2	1/8	305	3	1/16
132	2	3/4	308	1	—
133	2	1/4	311	2	1/4
134	2	1/4	316	1	3/4
135	1	1/8	325	1	—
137	4	1/4	330	3	1/2
139	1	1/2	336	1	1/8
143	1	3/16	338	2	1/4
147	3	1/8 to 1/4	342	2	1/4
148	1	1/8	347	2	1/16
150	2	1/4	348	1	1/4
162	8	1/8 to 1/4	356	3	1/8 to 1/4
163	1	1/8	360	1	1/2
172	3	1/8 to 1/4	363	4	1/2
173	5	1/8 to 1/4	364	10	1/8 to 1/4
174	1	1/16	365	1	1/4
184	2	1/16	366	6	1/8 to 1
186	1	1/8	367	1	1/4

Table 21.—Beryl-bearing pegmatites with less than two square inches of exposed beryl—Continued

Pegmatite No.	No. of crystals	Size range in inches	Pegmatite No.	No. of crystals	Size range in inches
377	1	1/4	1003	1	1/4
378	9	1/4	1004	5	1/16 to 3/4
379	1	1/16	1005	1	1/4
382	4	3/4	1006	9	1/32 to 1/4
384	1	1/2	1009	2	1/4 to 1/2
390	1	1/4	1010	6	1/16 to 1/4
413	2	—	1011	1	1/4
416	4	1/4 to 3/4	1012	2	1/4
418	1	1/4	1014	2	3/4
420	2	1/4	1015	5	1/4 to 1/2
425	3	3/4	1016	1	1/8
428	2	1/2	1027	2	1/4 to 3/8
431	2	1/8 to 1	1028	1	3/8
433	2 to 4	—	1031	1	3/16
435	4	—	1032	1	3/16
436	1	1	1033	2	1/16 to 1/8
437	1	1/2	1034	1	3/16
438	1	3/4	1036	2	1/16 to 1/8
439	2	1/4	1039	1	3/8
440	2	—	1040	1	3/8
457	1	1/4	1041	4	1/16 to 1/2
463	1	1/4	1042	7	1/32 to 1/4
477	21	1/8 to 1/2	1043	11	1/16 to 3/8
483	1	1/4	1044	3	1/8 to 3/16
541	4	1/4 to 1-1/2	1045	3	3/8 to 1/2
543	1	1-1/2	1046	3	1/16 to 3/32
551	4	1/2	1047	2	1/8 to 1/4
589	4	1/4 to 3/4	1048	1	1/8
598	1	3/16	1052	1	1/4
602	1	1	1053	5	3/32 to 3/16
643	2	1/4 to 3/4	1064	1	7/8
728	1	3/8	1065	1	1-1/4
778	3	—	1068	20	1/8 to 5/8
905	3	1/4 to 3/4	1069	4	3/16 to 5/8
908	9	1/16 to 3/4	1070	5	1/16 to 3/4
936	1	1/4	1071	23	1/8 to 1/2
985	22	1/8 to 3/8	1072	26	1/16 to 1/2
989	2	1/4 to 3/8	1075	3	3/16
995	3	1/4 to 1/2	1076	2	1/16 to 1/2
998	4	1/4 to 1	1081	1	1/8
999	1	1/4	1083	6	1/8 to 3/8
1001	1	1	1084	5	1/8 to 1/4
1002	3	1/32 to 1/8	1085	3	3/16 to 3/4

Table 21.--Beryl-bearing pegmatites with less than two square inches of exposed beryl--Continued

Pegmatite No.	No. of crystals	Size range in inches	Pegmatite No.	No. of crystals	Size range in inches
1086	1	3/16	1174	8	1/4 to 1
1088	3	3/16	1179	8	1/4 to 1/2
1091	1	1/4	1189	1	3/4
1092	1	1/4	1192	22	1/8 to 1/2
1093	2	1/4	1194	2	1/32 to 1/16
1094	4	1/8 to 1/2	1201	1	1/2
1095	2	1/8	1202	4	5/16 to 1/2
1100	2	1/4	1238	3	3/4 to 1/2
1102	1	3/16	1322	5	1/2 to 3/4
1105	1	1/16	1560	1	1-1/2
1172	1	1	1573	1	1

Table 22.--Pegmatite mineral resources
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
21	One unit.	Lenticular.	155	9																			Columbite-tantalite.	[1]3		
23	North branch core.	do.	165	2 to 4	25	1080	0.03	13.1	0.32	95	55		590	100	0	0			0	20	20	50	Monazite. Columbite-tantalite.	[1]3 [1]5		
64	West branch core.	do.	50	1 to 3																			Monazite. Columbite-tantalite.	[1]1 [1]3		
136	One unit.	Irregular.	195	20	25	7160	0.002	13.2	0.14	30	8		570	0												
205	Core.	Lenticular.	150	?																			Columbite-tantalite.	[1]2		
213 Opportunity No. 1	Wall zone.	do.	165	10	25	3580	0.08	13.0	2.8	95	12		430	50												
215 Opportunity No. 1	Central unit.	Lenticular-branching.	250	14	25	7500	0.1	13.3	7.0	90	8.0		600	50	0	0			0	150	150	0	Lepidolite. Topaz. Microlite. Columbite-tantalite. Monazite.	0.5 0.1 [2]1 [1]6 [1]4		35 7.0 0.4
215 Opportunity No. 1	South-central unit.	Irregular.	90	27	25	5170					60		3100	75												
216 Opportunity No. 1	Northeast branch.	Lenticular.	167	7	25	2580	0.01	13.5	0.26	75	5		130	50	0	0			0	50	50	5	Microlite.	[1]2		
216 Opportunity No. 1	Central and southwestern branch.	do.	106	12	25	2770	0.005	13.3	0.14	95	64		1770	100	0	0			0	80	80	0				
245	South half wall zone.	Irregular.	1250	450																			Columbite-tantalite.	[1]3		
250 Opportunity Nos. 2A and 3A	Wall zone.	Lenticular-branching.	1310	35			[1]1	13.0															Monazite.	[1]1		
250 Opportunity Nos. 2A and 3A	Core pods.	Lenticular.	248	11	20	4870	0.02	13.1	1.0	100	30		1460	80												
251	Core.	do.	120	0.6	20	125	0.03	13.0	0.04	50	51		64	80	0	0			0	5	5	10	Columbite-tantalite. Monazite.	[1]2 [1]5		
266	do.	do.	26	4																			Columbite-tantalite.	[1]1		
270	do.	do.	90	82	20	310	0.02	13.2	0.06	50	30		90	60												
288	do.	do.	20	2	10	35	0.1	13.1	0.035	80																

1/ Number of crystals observed.
2/ Pounds.

Table 22.—Pegmatite mineral resources—Continued.
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit					Beryl				Feldspar				Mica								Other minerals			
		Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Percent	Composition (Percent BeO)	Tons	Percent cobbable	Percent	Composition	Tons	Percent cobbable	Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Mineral	Percent	Composition	Tons
289	Core.	Lenticular.	90	2	10	150	0.02	13.2	0.03	80	5		7.5	60									Columbite-tantalite.	[1]1		
290	do.	do.	1-1/2	1-1/2																			Monazite.	[1]6		
290	do.	do.	20	?																			Columbite-tantalite.	[1]1		
306 Opportunity No. 4	West layer.	do.	24	3	10	60									0	0			0	0.6	0.6	0	Lepidolite. Microlite.	5 [1]2		3
358	One unit.	do.	95	12	25	2480	.002	13.1	0.05	0	20		500	5												
359	do.	do.	257	14	25	7820	0.0008	13.1	0.06	50	20		1560	5									Columbite-tantalite.	[1]1		
385	do.	do.	79	6																			do.	[1]2		
411	Core.	do.	60	30	25	3920	0.9		0.39	50	35		1370	80	0	0			0	200	200	0				
417	do.	Irregular.	360	2	25	1920	0.2	13.3	3.8	60	45		860	80	0	0			0	96	96	0				
422 Ben-Kauf No. 1	do.	Lenticular.	6	5	25	65					81		[3]52	80	0	0			0	9.8	0	0	Lepidolite. Microlite.	2 0.01		1.3 [2]73
424 Bazooka	Wall zone.	do.	228	10	25	4950					82		[3]4060	70									Lepidolite.	8		396
424 Bazooka	Core.	Oval.	20	20	25	800					20		[3]160	90									do. Microlite. Spodumene. Amblygonite.	2 [1]1 12 6		16 96 45
432	Hanging wall layer.	Lenticular.	660	6	25	8300	0.05	13.2	4.2	30	30		2490	60	0	0			0	330	330	0				
432	Foot wall layer.	do.					[1]2-4	13.4																		
434	One unit.	do.	32	7	20	390	0.1	13.4	0.4	100	8		30	20	0	0			0	10	10	0				
452 Brown Derby Dike No. 1	West branch core.	do.	20	0.5	8																		Columbite-tantalite. Monazite.	1.4 2.2		[2]179 [2]282
452 Brown Derby Dike No. 1 Perthite-quartz-albite pegmatite.	Hanging wall layer.	do.	785	8	140	76,450	0.1		76	95	40		30,580	100	0	0			0	7,600	7,600	0				
452 Brown Derby Dike No. 1	Curved lepidolite layer.	do.	190	2	140	4,630					44		[3]2040	90									Lepidolite. Topaz.	15 1		690 46
452 Brown Derby Dike No. 1	Lepidolite-microlite pod.	do.	50	6	10	260	[1]1																Lepidolite. Microlite. Topaz.	40 .03 [1]2		104 [2]57

[1] Number of crystals observed.
[2] Pounds.
[3] Soda spar.

Table 22.--Pegmatite mineral resources--Continued.
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition 5/ (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
452 Brown Derby Dike No. 1	Quartz-cleavelandite-lepidolite-topaz layer.	Lenticular.	319	2	140	7,770	[1]4				25		[3]1940	90									Lepidolite. Topaz.	10 10		777 777
453 Brown Derby Dike No. 2	Core.	do.	180	1.5	240	5,640					53		[3]2990	70									Lepidolite. Topaz. Microlite.	5 [1]1 [1]1		280 62
454 Brown Derby Dike No. 3	do.	do.	108	1	150	1410	0.3		4.2	95	1 47		[1]4 [3]660	100 80	0	0			0	56	56	0	Lepidolite. Columbite-tantalite. Microlite. Topaz.	5 [1]1 [1]4 <1		71
455 Brown Derby Dike No. 4	Southern part, core.	do.	342	8	25	5750	0.076	13.2	4.4	100	80		4600	100												
456 Brown Derby Dike No. 5	Core.	do.	50	1																			Microlite.	[1]1		
457 Brown Derby Dike No. 6	Wall zone.	do.	175	12	25	2600																	Lepidolite.	3		78
457 Brown Derby Dike No. 6	Core.	do.	120	4	25	1040																	do.	1		10
458 Brown Derby Dike No. 7	Hanging wall layer.	do.	95	5	25	1030	.007	13.2	0.07	80	70		720	70												
459 Brown Derby Dike No. 8	Wall zone.	Lenticular-branching.	700	65	25	86,200	.001	13.4	0.86	80	35		30,200	85	0	0			0	2590	2590	10				
459 Brown Derby Dike No. 8	Core pod.	Lenticular.	3	1	10	2.6					67		[3]1.7	80	0	0			0	0.08	0.08	10	Lepidolite. Topaz.	2 10		0.05 0.26
461 Brown Derby Dike No.10	One unit.	Lenticular-branching.	560	20	25	54,900	.0006	13.3	0.33	50	35		19,200	50	0	0			0	550	550	0				
462	Core.	Lenticular.	40	3																			Microlite. Lepidolite.	[1]5 <1		
497	One unit.	Irregular.	876	65	50	236,000					65		[4]153,000	10												
498	do.	do.	300	105	50	149,000					35		[4]52,000	20												
503	do.	Lenticular-branching.	390	40	50	64,000					65		[4]41,600	10	0	0			0	1920	1920	0				
505	Main unit.	Lenticular.	480	60	50	90,900					45		[4]40,900	10												
508	do.	Irregular.	1260	---	50	1,360,000					60		810,000	30												

1/ Number of crystals observed.
2/ Pounds.
3/ Soda feldspar.
4/ Mainly graphic granite.
5/ Composition of beryl determined by index of refraction according to a chart by W. T. Schaller (unpublished).

Table 22.--Pegmatite mineral resources
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition [5] (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
509	Main unit.	Irregular.	600	60	50	158,000					30		47,000	80												
512	One unit.	do.	780	85	50	246,000					39		[4]96,000	5	0	0			0	2500	2500	0				
516	do.	Lenticular.	480	48	50	77,000					35		[4]27,000	10	0	0			0	770	770	0				
517	Main unit.	do.	300	45	50	56,000					25		14,000	15												
534	Core.	do.					[1]1																			
535 Brown Derby No. 5	Wall zone.	Irregular.	207	---	25	6200	.01	13.3	0.62	30	10		620	10									Lepidolite.	Trace.		
535 Brown Derby No. 5	Intermediate zone.	Lenticular.	33	13	20	750	0.1	13.05	0.75	80	4 35		[3]30 260	90 70	0	0			0	7.5	7.5	20	Lepidolite. Topaz. Microlite. Columbite-tantalite.	5 <1 [1]13 [1]1		37
535 Brown Derby No. 5	Core.	Irregular.	175	13	20	4,000	.003		0.12	100	39		1560	95	0	0			0	40	40	10	Lepidolite. Columbite-tantalite.	Trace. [1]2		
537 Brown Derby No. 4	do.	Lenticular.	52	10	25	1125	0.31	13.4	3.4	65	66		745	80	0	0			0	45	45	5				
538	do.	Irregular.	128	35	25	4360	0.95	13.4	42	75	32		1400	80	0	0			0	131	131	0				
548	Hanging wall layer.	Lenticular.	125	7	25	1900	.016	13.4	0.30	95	50		950	30	0	0			0	38	38	0				
550	One unit.	do.	312	20																			Monazite.	[1]1		
557	Wall zone.	do.	1110	70	50	313,000					20		62,600	0	0	0			0	3130	3130	0				
558	Main unit.	Lenticular-branching.	1044	75	50	707,000					20		141,400	0	0	0			0	7070	7070	0				
560	Core pod.	Lenticular.	74	20	15	2120	0.45	13.4	9.5	100	55		1170	100												
564	Main unit.	Irregular.	600	---	50	374,000					20		74,800	0	0	0			0	3740	3740	0				
587	One unit.	do.	720	135	50	352,000					20		70,400	0	0	0			0	3520	3520	0				
590 Beryl and Rare Minerals Lode	Intermediate zone.	Lenticular.	155	41	3	1450	0.1		1.5	85	50		725	100	0	0			0	465	465	80	Columbite-tantalite.	.002		[2]50
596	One unit.	do.	520	50	50	113,000					40		45,200	50	0	0			0	1130	1130	0				
604 White Spar No. 1	Intermediate zone.	do.	90	6.5	25	1300	0.01		0.13	65	15 50		194 [3]650	85 50									Topaz. Lepidolite. Columbite-tantalite. Microlite.	.003 5 .0003 Trace.		[2]78 65 [2]7.8 [2]3
604 White Spar No. 1	Pod.	do.	7	3.3	1	2																	Lepidolite. Microlite.	90 0.1		1.8 [2]4

1/ Number of crystals observed.
2/ Pounds.
3/ Soda spar.
4/ Mainly graphic granite.
5/ Composition of beryl determined by index of refraction according to a chart by W. T. Schaller (unpublished).

Table 22.--Pegmatite mineral resources --Continued.
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
605	One unit.	Lenticular.	100	3	25	720					25		180	25	0	0			0	7.2	7.2	0	Lepidolite.	2		14.4
607	Fracture filling.		Small.								23			30									do.	2		
623	Pod.	Lenticular.	14	4	15	73	0.6		0.44	35	40		29	30												
636 White Spar No. 2	Wall zone.	Irregular.	130	4	25	2360																	Lepidolite.	< 1		
636 White Spar No. 2	Core.	Lenticular.	235	24	25	9820	[1]2				45 10		[3]4400 980	0 0									do. Microlite.	10 [1]3		980
637	do.	Irregular.	147	45																			Lepidolite. Columbite-tantalite.	Trace. [1]1		
637	Fracture filling.	Lenticular.	55	6			[1]1																Lepidolite. Microlite.	Trace. .01		
659 Buckhorn	Intermediate zone.	do.	145	---	1.5	600	[1]4			20	50		300	100	0	0			0	240	240	95	Columbite-tantalite. Monazite.	[1]4 [1]3		
659 Buckhorn	Core, Buckhorn claim.	do.	145	---	5.5	2200	0.7		15.4	98	91		2000	100	0	0			0	22	22	0				
659 Buckhorn	Core pods, ridge.	Irregular.	---	---	15	23,960	.002		0.50	70	53		12,700	100	0	0			0	240	240	0				
661	Core.	Lenticular.	10	1.5	10	13	8.5		1.1	85	42		5.5	95	0	0			0	1.3	1.3	0				
671	Main unit.	Irregular.	690	---	50	738,800					19		[4]140,400	0	0	0			0	7400	7400	0				
697	One unit.	Lenticular.	350	50	25	36,500					54		[4]19,700	0	0	0			0	365	365	0				
783	Wall zone.	Irregular.	2300	70	50	1,380,000					50		[4]690,000	0												
783	Core pod.	Lenticular.	8	2	10	14	1.2		0.17	100	65		9.1	100	0	0			0	0.6	0.6	0				
790	One unit.	do.	640	55	25	55,200					65		[4]35,900	0												
826	Wall zone.	do.	24	14																			Monazite.	Trace.		
827	One unit.	do.	30	10																			do.	Trace.		
828	do.	do.	24	4																			do.	Trace.		
837	do.	Irregular.	360	---	50	254,000					65		[4]165,000	0												
847 Black Wonder	Wall zone.	do.	13,600	---	350	643,400,000					35		[4]225,200,000	0												
847 Black Wonder	Intermediate zone.	Lenticular.	30	10	25	980	0.2	13.4	2.0	60	5		49	50	0	0			0	49	49	40				

1/ Number of crystals observed.
3/ Soda spar.
4/ Mainly graphic granite.

Table 22.--Pegmatite mineral resources --Continued.
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
847 Black Wonder	Intermediate zone.	Lenticular.	15	4	10	52									0	0			0	16	16	85	Monazite. Columbite-tantalite.	.007 [1]2		[2]93
852	One unit.	Irregular.	350	160	50	213,000					45		[4]95,850	10												
855	do.	do.	800	---	50	472,000					65		[4]306,800	5												
860	do.	do.	364	90	50	115,400					50		[4]57,700	10												
963	Hanging wall layer.	Lenticular.	165	4																			Monazite.	[1]1		
985	do.	do.	20	2																			do.	[1]3		
997	Foot wall layer.	do.	165	6																			do.	[1]1		
1002	Core.	do.	20	1																			Columbite-tantalite.	[1]1		
1035	One unit.	do.	22	2																			do.	[1]1		
1036	do.	do.	100	12																			do.	[1]1		
1049	do.	do.	40	2																			do.	[1]1		
1064	do.	do.	470	10																			do.	[1]1		
1068	Core.	do.	---	2																			do.	[1]1		
1140	One unit.	Irregular.	440	100	50	153,000					25		38,250	5	0	0			0	3060	3060	0				
1142	do.	Lenticular.	520	120	50	266,000					35		93,100	10												
1150	Core.	do.	3	1.5	3	1.2	2.8	13.4	0.03	100	30		0.4	80	0	0			0	0.06	0.06	0				
1182	do.	do.	50	1	25	109	0.46		0.50	100	5		5.5	90												
1193	do.	Oval.	6	4	5	10	0.12	13.3	0.01	80	20		2	90												
1234	Wall zone.	Lenticular.	176	14																			Columbite-tantalite.	[1]10		
1240	One unit.	Lenticular-branching.	50	11																			do.	[1]1		
1248	Wall zone.	Irregular.	2335	---	50	2,450,000					20		[4]490,000	0												
1256	One unit.	Lenticular.	500	35	25	37,400					30		[4]11,200	0												
1269	do.	Irregular.	410	140	50	240,000					25		60,000	0												
1316	do.	do.	360	65	50	108,500					35		[4]39,600	5												
1322	Wall zone.	Lenticular-branching.	2780	---	50	4,260,000					30		[4]1,278,000	0												
1323	Core.	Oval.	15	15	10	196	0.2		0.39	100																
1332	One unit.	Irregular.	568	65	50	252,000					25		63,000	30												

1/ Number of crystals observed.
2/ Pounds.
4/ Mainly graphic granite.

Table 22.—Pegmatite mineral resources
(in short tons)

Number and name of pegmatite (Pl. II)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
1341	Hanging wall layer.	Lenticular.	580	20	50	52,700					45		[4] 23,700	5												
1341	Foot wall layer.	do.	880	45	50	168,700					20		[4] 33,700	0												
1347	One unit.	Irregular.	314	38	25	39,000					30		[4] 11,700	10												
1355	Wall zone.	do.	3,450	---	90	7,826,000					35		[4] 2,739,000	15												
1357	One unit.	do.	535	60	50	185,000					25		[4] 46,200	0												
1402 Trio No. 1	Wall zone.	do.	644	---	50	290,000					25		[4] 72,500	0												
1402 Trio No. 1	Intermediate zone.	Lenticular.	96	5	20	860	0.91	13.2	7.8	95	30		258	100												
1426	Wall zone.	Oval.	330	115	50	135,500					70		94,900	5												
1428	do.	Lenticular-branching.	1150	---	50	262,000					65		[4] 170,000	0												
1429	do.	Irregular.	385	76	50	109,000					45		[4] 49,000	0												
1470	One unit.	do.	1,140	---	50	783,000					30		[4] 235,000	5												
1509	do.	do.	1,000	---	50	1,226,000					48		588,000	30	0	0			0	24,520	24,520	5				
1517	do.	Lenticular.	34	12																			Monazite.	[1] 1		
1518	do.	Lenticular-branching.	362	20																			do.	[1] 1		
1523	Wall zone.	Irregular.	600	---	50	379,000					30		[4] 113,700	5												
1534 The Trio	do.	do.	2,800	760	100	2,287,000					30		[4] 686,000	0												
1540	do.	do.	500	190	50	289,100					33		[4] 95,400	5	0	0			0	5,780	5,780					
1541	do.	do.	1,020	260	50	1,217,000					30		365,000	25	0	0			0	60,850	60,850	0				
1544	do.	do.	368	170	50	242,000					50		[4] 121,000	5	0	0			0	2,420	2,420	0				
1557	Core.	Lenticular.	24	6																			Columbite-tantalite.	[1] 1		
1558	do.	do.	44	1.5																			do.	[1] 1		
1566	One unit.	Irregular.	384	75	50	131,300					30		39,400	0	0	0			0	1,310	1,310	0				
1574 Bucky	Graphic granite, intermediate zone.	do.	1,350	650	200	16,870,000					80		[4] 13,500,000	0												
1574 Bucky	Muscovite-feldspar quartz-beryl intermediate zone.	Oval.	100	90	3	1,770	8.9	12.9	158	100	26		460	100	0	0			0	708	708	100	Lepidolite. Topaz. Columbite-tantalite. Monazite.	Trace. Trace. 0.11 0.003		 1.95 0.05

1/ Number of crystals observed.
4/ Mainly graphic granite.

Table 22.--Pegmatite mineral resources --Continued.
(in short tons)

Number and name of pegmatite (Pl.)	Internal structure	Size and shape of deposit: Shape	Average length (feet)	Average thickness (feet)	Depth (feet)	Tons	Beryl: Percent	Composition (Percent BeO)	Tons	Percent cobbable	Feldspar: Percent	Composition	Tons	Percent cobbable	Mica: Percent crude sheet and punch	Percent sheet and punch in crude	Size of sheet and punch	Quality of sheet and punch	Tons sheet and punch	Total tons of scrap	Total tons of mica	Percent cobbable	Other minerals: Mineral	Percent	Composition	Tons
1574 Bucky	Perthite intermediate zone.	Oval.	90	50	17	5200	<1		---		93		4800	100												
1584	One unit.	Lenticular.	450	70	50	120,500					55		[4]66,300	0												
1585	do.	do.	450	42	50	86,300					75		[4]64,700	0												
1589	do.	Irregular.	800	400	50	869,600					59		513,000	0	0	0			0	8700	8700	0				
1610	Wall zone.	do.	1110	120	50	646,700					55		[4]355,700	5												
1617	One unit.	do.	410	110	50	150,500					60		90,300	5												
1619	do.	do.	651	170	50	426,900					60		[4]256,000	0												
1627	do.	do.	173	89																			Lepidolite.	Trace.		
1630	Wall zone.	Lenticular-branching.	258	7																			Monazite.	[1]1		
1657	One unit.	Irregular.	732	55	50	198,100					55		[4]109,000	0												
1667	do.	do.	426	105	50	179,500					55		98,700	0												
1800	do.	do.	1820	350	50	2,767,000					55		1,522,000	5												

1/ Number of crystals observed.
4/ Mainly graphic granite.

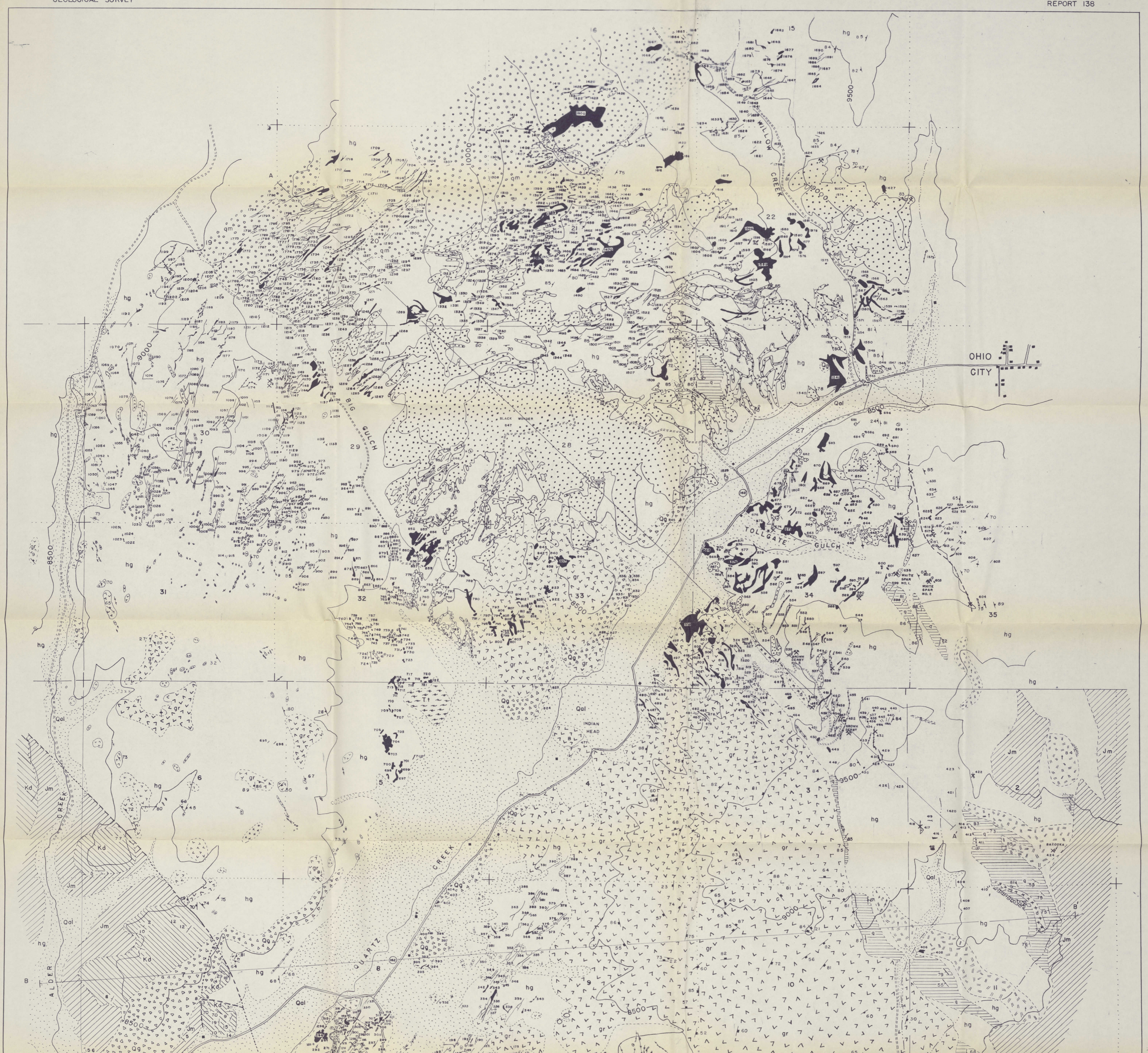
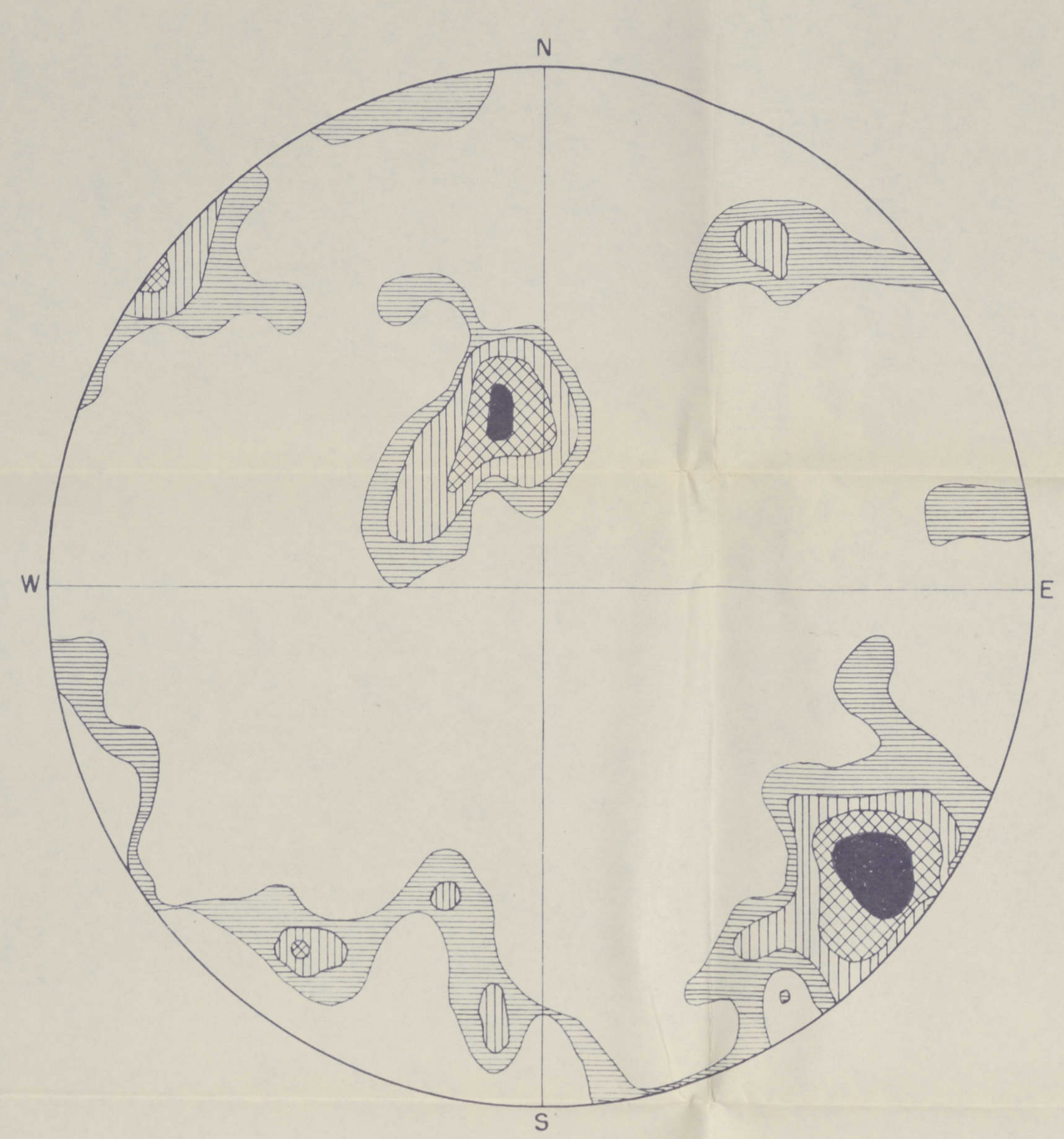
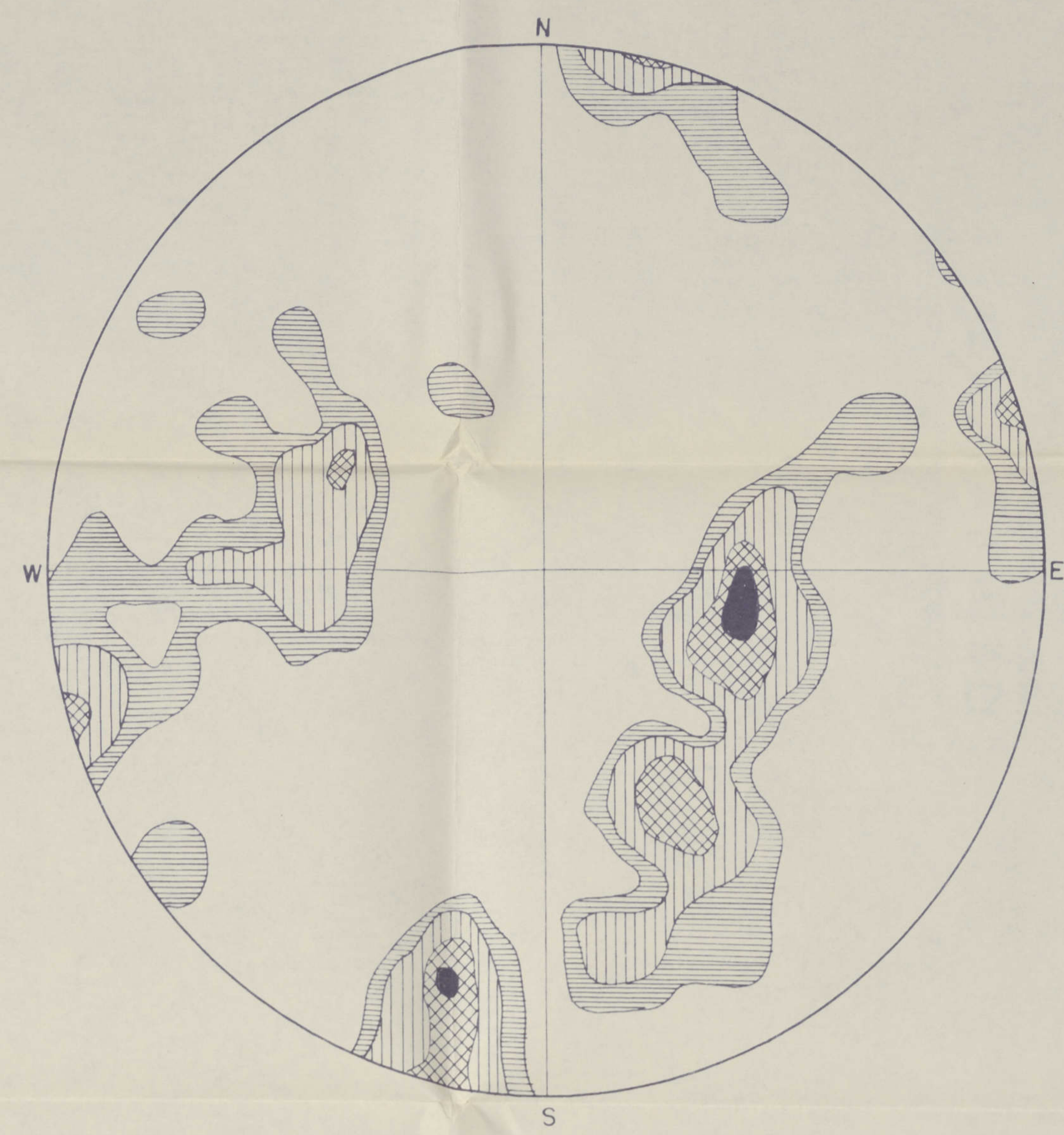


PLATE II. GEOLOGIC MAP AND SECTIONS OF THE QUARTZ CREEK PEGMATITE DISTRICT, GUNNISON COUNTY, COLORADO

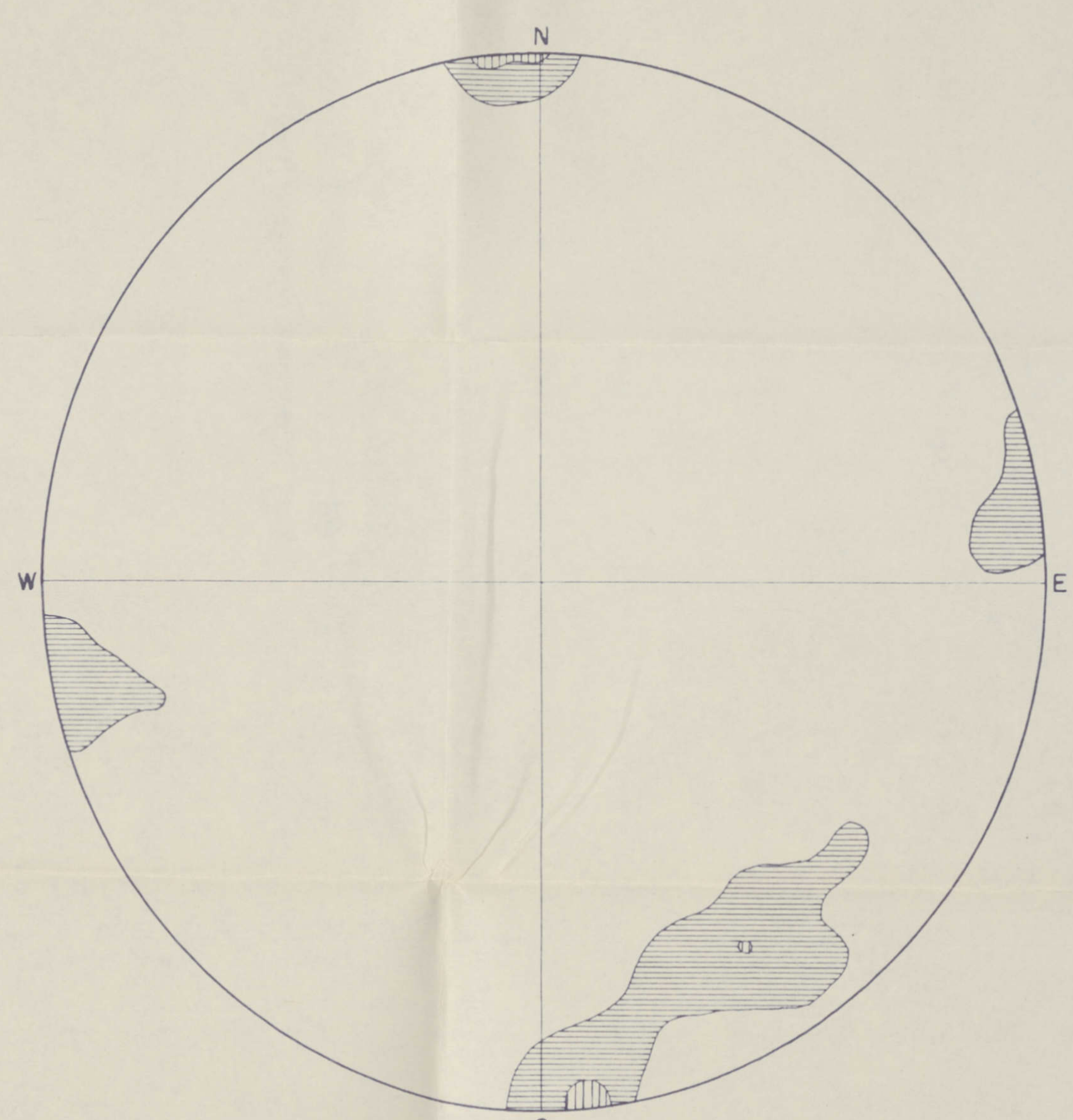


CONTOUR DIAGRAM OF 54 JOINTS AT LOCALITY A



CONTOUR DIAGRAM OF 59 JOINTS AT LOCALITY B

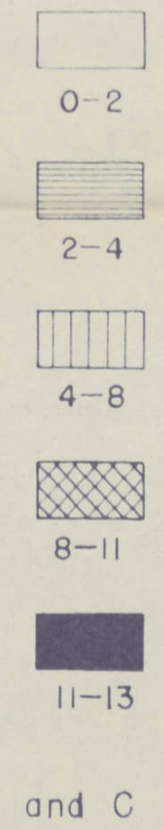
CONTOUR DIAGRAM OF 48 JOINTS AT LOCALITY C



CONTOUR DIAGRAM OF 638 JOINTS FROM ENTIRE GRANITE AREA ON THE EAST SIDE OF QUARTZ CREEK

EXPLANATION

PERCENTAGE OF JOINTS MEASURED



Localities A, B, and C Shown on Plate 2

FIGURE 9. CONTOUR DIAGRAM OF JOINTS IN GRANITE

FIGURE 16. DISTRIBUTION OF BERYL-BEARING PEGMATITES

FIGURE 17. DISTRIBUTION OF TOURMALINE- AND CURVED MUSCOVITE-BEARING PEGMATITES

FIGURE 18. DISTRIBUTION OF MAGNETITE AND BIOTITE-BEARING PEGMATITES

FIGURE 19. DISTRIBUTION OF COLUMBITE TANTALITE AND MONAZITE-BEARING PEGMATITES

FIGURE 20. DISTRIBUTION OF LEPIDOLITE, CLEAVELANDITE, TOPAZ AND MICROLITE-BEARING PEGMATITES

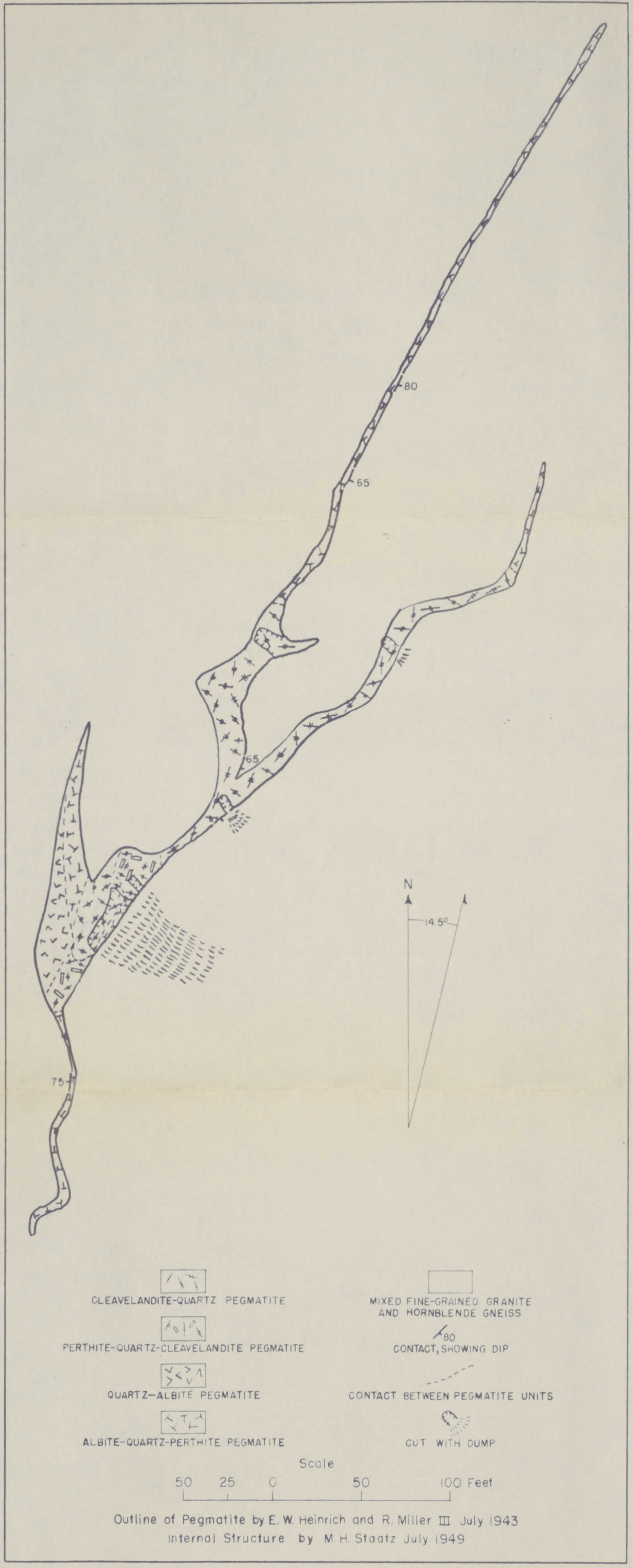


FIGURE 21. GEOLOGIC MAP, OPPORTUNITY NO. 1 (NO. 215) PEGMATITE

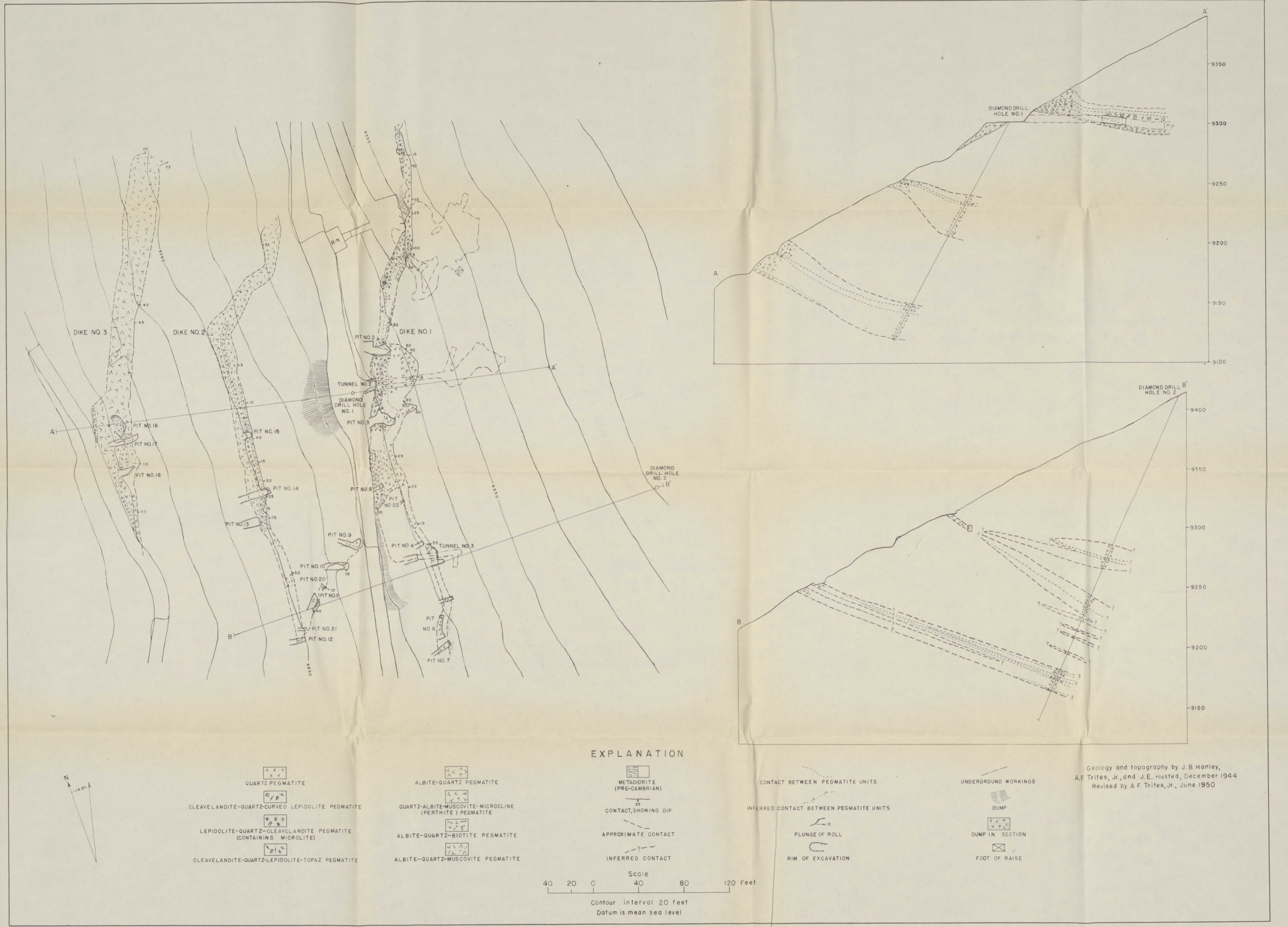


FIGURE 22. GEOLOGIC MAP AND SECTIONS OF BROWN DERBY MINE, SHOWING BUREAU OF MINES DIAMOND DRILLING

FIGURE 27. DETAILED MAP, BUCKY (NO. 1574) PEGMATITE

FIGURE 28. GEOLOGIC SECTIONS, BUCKY (No. 1574) PEGMATITE