



alidade at a scale of 1:600. Underground workings were map-

cent plagioclase, and 10 percent quartz. The accessory

Pertbite-plagioclase-quartz-muscovite pegmatite. - The larg-

matite forms a shell surrounding the quartz core in the east

the dip is 34° NE. Both contacts are approximately parallel to schistosity and bedding of the country rock. Crosscutting relations are best displayed at the west end of the pegmatite. Many small rolls and a few large ones are exposed along the entire length of the pegmatite. The direction of plunge of the axes of the rolls ranges from N. 38° E. to N. 57° E., and the angle of plunge ranges from 25° to 39°. The general plunge of the pegmatite is probably about 38° N. 40° E. A normal fault along the south flank of the pegmatite outcrop cuts both schist and pegmatite. The fault dips 58° S. and strikes N. 77° W., nearly parallel to the strike of the pegmatite. The best exposure is in the south entrance of the open cut, where the fault zone has a thickness of about 10 feet. The position of the pegmatite contact and zonal contacts on the two sides of the fault indicates that the south side has been downthrown about 20 feet and offset about 5 feet to the southeast.

ped by tape and Brunton compass.

The Triangle A claim was first located by the Galesburg Mica Company sometime before 1908 (Sterrett, 1908, p. 395-396). The ownership of the mine from 1908 to 1935 is unknown. After 1935 the property was held successively by Elizabeth Ainsworth, Lewis Collingwood, Amos V. Burnside, Harry Stephens, and Peter Stark, all of Custer, S. Dak. In 1947 the property was operated by Monarch Mines, Inc., which owned the property jointly with Harry Stephens and C. C. Nelson.

Virtually no production records exist. It is clear, however, that this mine has produced several thousand pounds of block mica, at least a thousand tons of feldspar, and probably a few tons of beryl.

The Triangle A pegmatite is mined by open-cut and underground workings. The underground workings consist of a 40-foot shaft inclined at 45 degrees near the east end of the pegmatite. A 153-foot drift at the 20-foot level extends west along the hanging-wall side of the pegmatite. Two stopes extending over about 800 square feet have been mined to recover mica from the wall zone. During the mapping, feldspar and beryl were being mined near the center of the pegmatite exposure in an open cut that was 180 feet long, 20 feet deep, and as much as 30 feet wide.

GEOLOGY

METAMORPHIC ROCKS

The Precambrian metamorphic rocks in the area of the Triangle A pegmatite consist of interbedded quartz-mica-silli-

minerals include chlorite, magnetite, and apatite. The hornblende occurs as elongate parallel crystals up to one millimeter in length in a fine-grained groundmass of plagioclase, quartz, and accessory minerals. Granulite.-The schist near the pegmatite contact has been locally altered to a granulite. It is a light-colored, finegrained rock with a granulitic texture in which the original structure of the schist has been partially preserved. The thickness of the granulite ranges from one-eighth inch to 6 inches and therefore is not shown on the map. The granulite is of variable composition; it generally contains quartz, feldspar, muscovite, and accessory tourmaline, biotite, and apatite. Quartz is the most abundant mineral and commonly makes up about 50 percent of the rock.

PEGMATITE

The Triangle A pegmatite crops out as a lenticular body that measures 1,020 feet in length and has an average thickness of 50 feet. The predominant units of the pegmatite are plagioclase-quartz-muscovite pegmatite of the border and wall zones and perthite-plagioclase-quartz-muscovite pegmatite of the first intermediate zone. In the western part of the pegmatite these units are followed by a quartz-perthite core. In the eastern part of the pegmatite, however, the succession is cleavelandite-quartz-perthite pegmatite, cleavelandite-quartz pegmatite, and a quartz core.

Plagioclase-quartz-muscovite pegmatite (border and wall zones).-The border and wall zones consist of plagioclasecurs as two irregularly lenticular masses that are 55 and quartz-muscovite pegmatite. The border zone, averaging

est unit is the perthite-plagioclase-quartz-muscovite intermediate zone containing 30 percent perthite, 30 percent plagioclase, 25 percent quartz, 10 percent muscovite, and 5 percent garnet, tourmaline, beryl, apatite, and zircon. Coarse perthite and graphic-granite masses as much as 20 feet long are surrounded by finer grained plagioclase, quartz, and muscovite. This zone is about 760 feet in length and averages 30 feet in thickness. The average grain size of the matrix is about an inch, although crystals of plagioclase and quartz are as much as 4 inches in diameter. The matrix is similar in mineralogy to the wall zone but is coarser grained. Garnet occurs as darkbrown crystals that range from one-eighth inch to one inch in diameter. White to light-green beryl crystals averaging 11/2 inches in diameter are unevenly scattered throughout the zone. Perthite occurs as white to pink crystals averaging about

6 feet in diameter. About two-thirds of the perthite contains graphic quartz. The quartz rods range from one-eighth inch to 6 inches in diameter. Inclusions of tourmaline and garnet are common in the perthite. Micarich aggregates having an average diameter of 4 feet were observed chiefly in the open cut. These contain 45 percent muscovite, 30 percent quartz, 20 percent plagioclase, and 5 percent garnet, beryl, and apatite. The grain size is about half an inch. Ouartz-perthite pegmatite. - Quartz-perthite pegmatite is exposed inside the perthite-plagioclase-quartz-muscovite zone along the crest of the outcrop west of the open cut. It ocpart of the pegmatite. The outer part of the zone grades into the cleavelandite-quartz-perthite pegmatite, and the inner margin has a sharp contact with the quartz core. The average thickness of the zone is 2 feet, but the thickness ranges from 0.5 foot to 7 feet.

This zone consists of 90 percent cleavelandite, 8 percent quartz, and 2 percent muscovite, beryl, tourmaline, and apatite. The cleavelandite crystals, ranging in size from 0.5 inch to 6 inches, are oriented perpendicular to the contact of the quartz core. Beryl occurs at the inner edge of the zone in crystals as much as 5 inches long and 2 inches in diameter; the average length is about 2 inches. Black tourmaline crystals as much as a foot in length and 3 inches in diameter occur in this zone near the east end of the pegmatite. Cleavelandite-quartz pegmatite also occurs as thin shells surrounding four unmapped pipelike masses of white to lightpink quartz that are surrounded by perthite-plagioclase-quartzmuscovite pegmatite. These masses range from 1 to 8 feet in diameter. The shells range from 2 inches to 1 foot in thickness. Cleavelandite is by far the most abundant mineral in these shells; accessory minerals include muscovite, beryl, apatite, and columbite-tantalite. The cleavelandite occurs in bladed crystals oriented perpendicular to the contact with

quartz. Quartz pegmatite (core). - The quartz core is divided into two lenticular segments on either side of the fault that cuts the south edge of the pegmatite. These segments are 40 and 120 feet long, and range from 3 to 11 feet in thickness. This unit consists of 98 percent quartz, and 2 percent muscovite, apatite, and spodumene. The quartz is massive, milky white

MINERAL DEPOSITS

The minerals of economic value in the Triangle A pegmatite are potash feldspar, muscovite, and beryl. The only minable potash feldspar-bearing zone is the first intermediate zone of perthite-plagioclase-quartz-muscovite pegmatite. Bervl is recovered from the matrix of this same zone. It also occurs in very small quantities in the cleavelandite-quartz pegmatite. Muscovite has been mined from underground workings in the hanging-wall part of the plagioclase-quartz-muscovite wall zone. Minable quantities of muscovite are not known in the footwall part of the wall zone. Scrap mica has been obtained as a byproduct of potash feldspar from the first intermediate zone.

Potash feldspar occurs as white to light-pink perthite that forms about 30 percent of the first intermediate zone. Approximately two-thirds of the potash feldspar is graphic granite that has a low market value. Tourmaline and garnet occur in small quantities as inclusions in the potash feldspar. The perthite crystals are subhedral and as much as 20 feet long, 14 feet wide, and 12 feet high; the average length is 6 feet. Small quantities of potash feldspar occur in the wall zone. Where the wall zone is thick, feldspar crystals are as much as 3 feet long and could be recovered by hand cobbing. The potash-feldspar content of the wall zone does not exceed 4 percent.

Muscovite mica is mined from the plagioclase-quartz-muscovite wall zone. The overall mica content of the wall zone is visually estimated at about 10 percent. The richest micabearing pegmatite is in the outer 1.5 feet of the wall zone on the hanging-wall side of the pegmatite. Many of the mica books are large-as much as 2 feet in diameter-and thus the recovery of punch and sheet mica is large. The mica is colorless to brownish. Much of it is of low quality. The mica is wedged and reeved, has "A" and herringbone structure, and contains minor inclusions of quartz, feldspar, tourmaline, and small particles of a clavlike material. Scrap mica has been mined as a byproduct from the first intermediate zone, and a few colorless sheet-bearing mica books as much as 4 inches in diameter have been recovered. The mica occurs in the fine-grained plagioclase-quartz-muscovite matrix.

MICA

Beryl is visually estimated to form 0.1 percent of the first intermediate zone. It occurs as white to light-green subhedral to euhedral crystals as much as 1.4 feet in cross section, but the average size is about an inch and a half. Only a small proportion of the beryl is too fine grained to recover by hand cobbing. Beryl from this zone contains a few microscopic inclusions of guartz and muscovite. The index of refraction of the ordinary ray in four crystals ranged from 1.582 to 1.590. According to an unpublished graph by W. T. Schaller, these crystals would contain 11.9 to 12.9 percent BeO.

Beryl also forms about 0.1 percent of the quartz-cleavelandite zone. Most of the beryl in this unit is in light-green euhedral crystals that range from 0.5 inch to 5 inches in length and 0.5 inch to 2 inches in diameter. The index of refraction of the ordinary ray of five crystals ranged from 1.585 to 1.592. These crystals would contain 11.6 to 12.5 percent BeO.

LITERATURE CITED

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