

PEGMATITE MINERALS OF ONTARIO AND QUEBEC

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INTRODUCTORY

Pegmatites occur over wide areas in Canada, and are of various types. They may be roughly classified according to their characteristic component minerals. A certain type may have a wide distribution, while another type may be distinctly regional. Thus, normal granite pegmatites (with minor modifications due to structure and mineral composition *e.g.* graphic granite, soda-rich feldspar dykes, potash-rich feldspar dykes, dykes either rich or poor in mica, etc.) occur abundantly throughout practically the entire region of the Pre-Cambrian crystalline rocks of eastern Canada, from Hudson strait and Labrador, in the east, to the Rainy river district, in western Ontario.

South of the St. Lawrence river, in Nova Scotia and New Brunswick, there occur what are probably small and strictly local distributions of tin- and tungsten-bearing pegmatites.

In the Ottawa region, throughout a broad belt stretching from the Lièvre river, in Quebec, nearly to Kingston, on Lake Ontario, is found an abundant series of dark-coloured, basic pyroxenite-pegmatites, which have been extensively mined for apatite and phlogopite mica.

In Renfrew and Haliburton counties, Ont., as well as at scattered outlying localities in the same general region, there occurs a series of molybdenite-bearing pegmatites (in part, pegmatitic quartz veins), which are probably of a distinct type.

In the Bancroft-Haliburton district, Ont., there is a local development of syenite pegmatites, which are characterized by a most interesting assemblage of minerals.

Further west, in southeastern Manitoba, there has lately been discovered an extensive series of lithium pegmatites, similar in their general character to those of the Black Hills, in South Dakota.

In British Columbia, throughout a belt known to extend from Fort Grahame, on the Finlay river, to the Big Bend of the Columbia river, a distance of over 300 miles, there is an extensive de-

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velopment of muscovite-bearing pegmatites, some of which have been worked in a small way for their mica content.

The above-mentioned pegmatites comprise some of the more distinct types recognized and will suffice to show the variety that exists. This paper is concerned only with (A) the normal granite pegmatites of Ontario and Quebec, upon which considerable mining has been done over a long period for either the feldspar or mica that they carry, and (B) the syenite pegmatites of the Wilberforce district, Ont. In an Appendix, however, there are also enumerated briefly the minerals that have been recorded from three of the other four types of pegmatites cited above.

Into Group A fall the greater number of the dykes, comprising the abundant, reddish feldspar-pegmatites of eastern Ontario and the adjacent portion of western Quebec; the less common, white or buff feldspar dykes of the same region and of eastern Quebec, north of the St. Lawrence river; and a few that may be styled freakish pegmatites, such as the lepidolite-bearing dyke in Wakefield township, Que., the peristerite-microcline dykes in Ville-neuve and West Portland townships, Que., and the beryl pegmatite in Lyndoch township, Ont. These latter are of individual or strictly local occurrence.

Group B comprises the quartz-free dykes of the Bancroft-Wilberforce district, Ont., which are lithologically distinct from the normal granite pegmatites, and which, on account of their unusual and peculiar mineralization, it is convenient and desirable to consider as a distinct type.

The apatite-bearing pyroxene-feldspar dykes of Sebastopol and Brudenell townships, Ont., appear to be intermediate in type between acid pegmatites and the basic pyroxenite-pegmatites of the Ottawa district, but they probably are more akin to the latter and accordingly have not been included in this paper. They are famous for the large zircons, titanites and apatites with basal plane development that they have yielded.

It might, perhaps, be possible to sub-divide group A on the basis of certain more or less defined lithological differences, due, possibly, to differences in age, but such a division is beyond the scope of this paper. To be effective, also, such a classification would need to be supported by detailed microscopical examination and chemical analyses of the feldspars, coupled with close observation of the field relationships.

A. NORMAL GRANITE PEGMATITES

DESCRIPTION

The pegmatites examined by the writer occur throughout a region extending from a point on the north shore of the Gulf of St. Lawrence, north of Anticosti Island, in Quebec, to Sudbury, in Ontario, a distance of about 800 miles.

Various types of granite pegmatite occur throughout this region, and within limits, it may be said that certain types are peculiar to a district. That is to say, once one is familiar with the deposits, it is not difficult to identify, with a fair degree of accuracy, specimens of feldspar from the different major districts. It would not be so easy, however, to describe in words in what the identifying differences consist, these being largely a matter of experience.

In the great majority of instances, the dykes are found cutting gneiss, usually a rusty-weathering biotite gneiss, and this is often fairly heavily impregnated with small red garnets along the contacts. More rarely, the gneiss is tourmalinized with closely-packed, acicular crystals of schörl. The dykes usually exhibit tightly frozen contacts with the gneiss, though in some cases, a thin gouge selvage occurs and this then generally shows evidence of rock movement in the form of smooth, slickensided surfaces.

In only a few instances have quarries been opened on dykes cutting crystalline limestone. The feldspar of such dykes is usually white or grey-white, and lacks the fresh lustre of the more common pink or reddish microcline of the dykes cutting gneiss. It is also often characterized by a strong foetid odor of sulphuretted hydrogen, though this is not an invariable feature.

All the pegmatites are of Pre-Cambrian age, though in view of the rather wide dissimilarity in colour of feldspar, presence or absence of mica, tourmaline and other accessory minerals, it is probable that they were not all strictly contemporaneous. Studies on the age of the dykes, by the aid of determinations of the lead-uranium ratio in their radioactive minerals, have been made by Walker (22) and Ellsworth (8) (19) (23), the results indicating ages ranging from 120 to 1,293 millions of years. From these studies, the pegmatites of the Hybla district, Ont., appear to be among the youngest, while those of the Parry Sound district, Ont., the Villeneuve dyke, in Villeneuve township, Que., and the syenite pegmatites of the Wilberforce district, Ont., are among

the oldest. In spite of these indicated wide age discrepancies, the writer has noted no instance of a dyke of one type cutting or intruding a dyke of another type, and therefore no grouping of the pegmatites on the basis of their relative age has been attempted. It may be noted, however, that the mica-apatite, pyroxenite-pegmatites of the Ottawa region are often cut by narrow stringers of granite pegmatite, which are thus indisputably younger than the basic dykes.

Broadly speaking, the dykes may be roughly classified according to the colour and character of their feldspar. The most common type is that in which the feldspar is microcline of a reddish cast, the colour ranging from a pale salmon-pink to brick red. This type of feldspar is widely distributed throughout the entire region from the Laurentian mountains to Georgian Bay, and constitutes the bulk of the commercial spar mined. Characteristic of these dykes is the extremely coarse crystallization of the feldspar, single individuals often measuring many feet, and forming large benches or ledges from which a large tonnage of spar can be won. In Sabine township, Ont., there occurs a remarkable example of such a dyke, in which the feldspar crystals, separated by quartz, attain a length of 30 feet and extend almost from wall to wall.

Dykes of white feldspar are less common. The individual crystals are usually much smaller than in the red dykes. The feldspar is usually microcline, though rarely it is albite or oligoclase, as in the case of a pegmatite in Aylwin township, Que. The white pegmatite at the Villeneuve mine, on the Lièvre river, Que., is composed of a coarse intergrowth of albite and white microcline.

There is a local development, also on the Lièvre river, Que., of dykes composed of a medium-textured buff microcline. This type of feldspar has not been noted elsewhere.

A few instances are known of dykes in which the feldspar is principally pale-coloured amazonite, as in Hull and Bouchette townships, Que. Local patches of amazonite also sometimes occur in the red pegmatites, as in Monteagle township, Ont., and in the beryl pegmatite in Lyndoch, Ont.

Most of the so-called microcline of the pegmatites is really perthite, the soda content seldom being much under 2 per cent and usually between 2 and 3 per cent. The perthitic structure is generally fairly coarse and easily discernible by the unaided eye.

Most of the pegmatites contain much quartz, usually in large, irregular masses between the feldspar and sometimes also in graphic intergrowth with the spar.

Vugs, or miarolitic cavities, are comparatively rare in the dykes, the constituent minerals of which are generally tightly frozen. Free, well-formed crystals of quartz, feldspar and other minerals characteristic of drusy pegmatites are therefore rather uncommon.

The dykes have yielded a considerable variety of the rare element minerals, including a number of new species. The Hybla district, in Ontario, is particularly rich in such minerals, other notable localities being the Mattawa, Sudbury and Parry Sound districts, also in Ontario, and the region north of the St. Lawrence, below Montreal, in Quebec.

The productive mica and feldspar pegmatites and their associated minerals have been described in a general way in three publications of the Mines Branch (18) (35).

ALBITE

(Oligoclase-Albite—Oligoclase.)

Small amounts of white or pale coloured, soda-rich feldspar are often encountered in the normal pink or reddish microcline pegmatites, usually as scattered crystals in the contact zones. Sometimes, the dykes carry a narrow band of such feldspar, a few inches wide, along the walls, as at the Gunter mine in Sabine township, Ont. At this locality, practically all of the visible mineral impurities in the dykes, in the shape of biotite and other dark, ferro-magnesian minerals, are confined to this wall zone, the dyke mass proper consisting of clean, pink microcline and quartz.

On the basis of chemical analysis of a number of such soda-rich feldspars from various pegmatites, it is apparent that many of them carry an important percentage of lime, and are therefore to be placed in the oligoclase-albite or oligoclase class. For the purposes of convenience, however, and since no microscopical examination of them has been made by the writer, the soda-rich feldspars have been included here under the general heading of albite. The following analyses of a number of such feldspars will serve to show the range of their lime-soda-potash ratio:

Locality	CaO	Na ₂ O	K ₂ O
McDougall township, Ont.	3.60	8.21	0.58
Monteagle " "	2.40	8.82	2.12
" " "	1.23	9.74	1.50
Conger " "	6.20	6.99	1.64
Bedford " "	4.20	8.26	2.42
Aylwin township, Que.	4.40	8.48	0.33
" " "	3.40	8.81	1.64
West Portland " "	1.60	8.90	1.68
" " " "	1.59	10.65	0.10
Villeneuve " "	1.20	9.87	1.08
Charlevoix county "	3.85	9.41	1.09

At the old Villeneuve mine, in Villeneuve township, Que., as well as at a small mine in the adjacent township of West Portland, a large portion of the dyke mass consists of white, lustrous albite of the peristerite variety, which exhibits a beautiful, light-blue schillerization. Through the albite are scattered irregularly masses of light cream-coloured microcline, for which the mine was formerly worked and which was in high demand for "dental spar." The dyke carries large amounts of black tourmaline, in stout prisms, and muscovite mica, as well as spessartite garnet, blue-grey apatite, gummite, occasional small zircons, uraninite and monazite. All these accessory minerals occur in the albite and seldom, if ever, in the microcline, the whole mineral association being in accord with the theory of Hess and Schaller (1) that such minerals have formed during albitization of an original microcline-pegmatite. The albite individuals are usually of small to medium size—seldom over 3 to 4 inches across—and often possess obscure crystal form. This type of dyke is of strictly local occurrence, and is confined to the area in question, only three or four outcrops being known.

Many of the normal pink or red microcline dykes of western Quebec and eastern Ontario probably carry minor amounts of soda-rich feldspar, particularly where such dykes contain appreciable quantities of mica, tourmaline or rare-earth minerals. It is often only by close examination of the feldspar surrounding such minerals that the twinning lines characteristic of the plagioclase feldspars can be distinguished in the field.

The platy, cleavelandite variety of albite is rare in the pegmatites of Ontario and Quebec, but certain of the dykes of the

Lake St. John district, in Quebec, contain it in quantity, as does also the beryl pegmatite in Lyndoch township, Ont.

Pale red peristerite occurs in some of the dykes of the Hybla district, Ont., and is very abundant in a pegmatite in Portland township, Ont.; the iridescence of the mineral from the last-named locality is often unusual, lively and attractive. The Hybla peristerite has been used by Parsons in a study of the cause of iridescence (12).

ALLANITE

Allanite is a not uncommon constituent of Canadian pegmatites, and some of the dykes contain it in fair abundance. It has been observed by the writer in quantity in certain of the red microcline dykes of the Parry Sound district, notably in the townships of Conger and McDougall; also in the township of Calvin, near Eau Claire; and at the McDonald mine in the township of Monteagle, near Hybla, all in Ontario.

At the last-named locality, it occurs locally in the dyke in very large masses, some of them weighing several hundred pounds. The Hybla allanite is black and coarsely-granular, with streaks of more massive, dense material running through it. In Conger, it forms large, platy crystals, 12 inches or more in length and up to 1 inch thick. In McDougall, the crystals are stouter and smaller. The Calvin allanite resembles that from Conger, is of a brown colour and is rather severely altered: it is associated with euxenite (polycrase?). Altered allanite is also found in some quantity in a dyke in the township of Henvey, Ont., where it occurs in small masses without crystal outline.

Walker and Parsons have described (5) allanite from Monteith township, Ont., and East Portland township, Que. Ellsworth mentions (13) its occurrence at the Wallingford mine, in Derry township, Que., where it is associated with uraninite, thucholite and cyrtolite, and also in a number of dykes in Butt township, Nipissing district, Ont. (19). In concession 6 of Butt, he observed allanite crystals up to 10 inches long. Obalski records (26) it in a mica-bearing dyke in Taché township, Lake St. John district, Que.

A highly-altered (chloritized), platy and loose-textured mineral, which accompanies the thucholite of a dyke in Henvey township Ont., and which is often impregnated with carbon, may be the pyrrorthite variety of allanite.

AMAZONITE
(See microcline)
APATITE

Apatite is quite rare in the normal granite pegmatites of Ontario and Quebec. It occurs in minor amount as small greyish-blue crystals in the albite of the Villeneuve mine, Que., and is also reported from one or two of the old mica mines north of the St. Lawrence, below Montreal.

In a foetid feldspar dyke cutting crystalline limestone, near Perth, Ont., small pale-blue apatite prisms occur with titanite and emerald-green diopside. Ellsworth (23) mentions small (up to 2 inch) crystals of brown apatite in a dyke near Hybla, Ont. Small crystals, up to 3 inches long, of lustrous, green apatite also occur sparingly in a red feldspar dyke at the Purdy mine, in Calvin township, Ont.; the crystals are doubly-terminated and exhibit prominent development of the basal plane.

Apatite is stated (3) to occur in quartz pegmatites in Lacorne and Malartic townships, Abitibi district, Que., associated with molybdenite, fluorite, etc.

BERYL

Occasional small crystals of beryl are sometimes encountered in mica or feldspar mines in eastern Canada, but the mineral is in the nature of a rarity. At most of the recorded localities, the dykes are composed chiefly of white or light-coloured feldspar, and the writer has observed beryl in very few instances in dykes worked for red spar.

A little beryl, in small scattered crystals, has been reported from the old Villeneuve mine, on the Lièvre river, Que., and also from some of the old mica mines in Jonquière, Brassard and de Maisonneuve townships, north of the St. Lawrence, below Montreal (28) (29). In pegmatites opened up for molybdenite on the Kewagama river, in the Abitibi region of Quebec, beryl crystals up to 4 inches across are reported to have been found (30) (34).

There is only one recorded locality in eastern Canada where beryl occurs in quantity in a pegmatite dyke. This is in Lyndoch township, Ont., near the village of Quadville. The locality is an old one and has been described by Miller (2), Walker (3) and Ellsworth (10). The dyke, which is only about 10 feet wide, con-

sists mainly of medium-textured, pale cleavelandite and peristerite, in which beryl crystals are abundantly distributed. The crystals range from thin, pencil-like prisms to individuals up to 5 inches across. The beryl is blue-green in colour, and is mostly flawed and cloudy, though the larger crystals sometimes yield small clear pieces of gem (aquamarine) quality. Small amounts of columbite, euxenite (var. lyndochite), fluorite, and amazonite accompany the beryl.

Beryl crystals up to 5 pounds in weight are stated (31) to have been found at old mica mines in Calvin township, near Mattawa, Ont.

BIOTITE

Biotite is one of the commonest minerals encountered in the pegmatites and is particularly abundant in those of the Parry Sound district, where few dykes are completely free of it. In this region, it commonly occurs in thin plates, often of large size, and is generally rather severely altered. Well-formed biotite crystals also occur in Dill township, near Sudbury, Ont.

In the dykes of the lower St. Lawrence, biotite and muscovite often occur in parallel intergrowth. Very interesting examples of such intergrowth are found at the Pied des Monts mica mine, near Murray Bay, Que., where crystals of muscovite sometimes enclose an inner crystal of biotite. From other crystals, sheets can be split that are half muscovite and half biotite, the line of demarcation being sharp and running diagonally across the sheet, while in others, biotite and muscovite occur in alternate layers. Kerr-Lawson has described (6) interesting pleochroic haloes in the biotite of this mine.

BISMUTHINITE

This mineral has been reported from the Lyndoch beryl pegmatite, in Ontario (10), where it is associated with small amounts of bismite, (55) and bismutite (53). It is also stated (32) to have been found in foliated, massive form in a dyke in Jonquièrè township, Chicoutimi county, Que.

Bismuthinite occurs in considerable quantity in the molybdenite-bearing quartz pegmatites of Lacorne and Malartic townships and the Kewagama lake region, Abitibi district, Que. (3) (30) (52).

CALCIOSAMARSKITE

A rare, lime-rich samarskite found originally at the Woodcox mine, near Hybla, Ont., and later in Conger township, near Parry Sound, Ont. (16).

The Hybla material occurred in a large mass in a dyke that has yielded an interesting variety of minerals including hatchettolite and columbite.

CALCITE

Calcite is not commonly regarded as a pegmatite mineral, but there seems to be little question that the calcite found in certain Canadian dykes is of primary origin (4) (23).

Calcite is not often found in the pegmatites, but at a few localities it is quite abundant. At the McDonald mine, near Hybla, Ont., a large mass of medium-grained, reddish calcite was encountered fairly near the surface and formed the matrix of disseminated ellsworthite, cyrtolite, titanite and smoky quartz. More remarkable still was the discovery, at about 80 feet below the surface, that the dyke, apparently over its entire width, changed into clean, massive calcite. This calcite is white to cream-coloured, breaks into large rhombohedral masses and is practically free of any admixed mineral. The normal pink microcline of the dyke gives way along the contact with the calcite mass to greenish-white albite. At several other spar mines in the vicinity of Hybla, small pocketty masses of calcite enclosed in microcline were observed, and in Portland township, north of Sydenham, Ont., calcite of an attractive reddish-orange colour occurs in a dyke containing large amounts of albite.

A white pegmatite cutting crystalline limestone in North Burgess township, Ont., also contains considerable calcite scattered through it (35).

CHRYSOBERYL

Evans has described (54) chrysoberyl from a pegmatite on the Post river, in Maskinonge county, Que. This is, apparently, the only recorded occurrence of the mineral in the granite pegmatites.

COLUMBITE

There are comparatively few recorded occurrences of columbite. It occurs probably in largest amount in the beryl pegmatite in

Lyndoch township, Ont., where it is found in thin, platy masses, often with hemispherical, radiating structure, in feldspar (2) (5). It also occurs massive in a narrow, pocketty veinlet in a pink feldspar dyke in Conger township, Ont., where it is associated with a brown, lustrous, resin-like mineral, not yet identified, that appears to be a decomposition product of the columbite. Walker and Parsons have described (5) fine-grained, massive columbite containing rutile from the Woodcox mine, near Hybla, Ont., and Ellsworth has described (9) a uranium-rich columbite occurring in small crystals and grains in a dyke in Dill township, Sudbury district, Ont., to which he has assigned the name toddite. What may be the same mineral was observed by the writer as a single, large, distorted crystal enclosed in a "book" of muscovite on a nearby lot in the same township.

Small amounts of a massive mineral resembling columbite have been noted by the writer in a dyke in West Portland township, Que., where it occurs with monazite and euxenite.

CYRTOLITE

(See zircon)

DIOPSIDE

Small amounts of diopside are occasionally found in the wall zones of pegmatites, particularly of dykes cutting crystalline limestone. It is evidently a contact mineral.

In a dyke cutting limestone in North Burgess township, near Perth, Ont., considerable diopside is present in stout prisms (35). The same dyke contains a small amount of a clear, emerald-green mineral, that is also possibly diopside; as well as small crystals of titanite, blue apatite, pyrite and pyrrhotite. Diopside also occurs in a dyke in Loughborough township, Ont. (4).

DUMORTIERITE

The only recorded occurrence of this mineral in a pegmatite is given by Walker, who describes it from a narrow dyke in Ashby township, Ont. (21). It is associated with cyanite, tourmaline and muscovite, and occurs in aggregates of slender prisms.

ELLSWORTHITE

Ellsworthite, a titanoniobate of uranium, lime and iron, is a distinctively Canadian mineral and was first described and named

by Walker and Parsons in 1923 (5). It was found originally at the McDonald mine, near Hybla, in Monteagle township, Ont., and has later also been described (15) from Cardiff township, some miles to the west. It has not been recorded elsewhere.

The Hybla mineral is massive, and ranges from dark brown to amber yellow, both colours often being associated. Its occurrence was confined principally to a mass of salmon-coloured calcite which was encountered in the upper workings of the mine, and in which the mineral occurred in small, irregular masses and pellets. It is associated with cyrtolite, titanite and smoky quartz.

The Cardiff ellsworthite occurs in small crystals of rounded octahedral habit, and is found disseminated through the calcite filling of a pegmatite cavity.

EUXENITE

After, possibly, allanite, euxenite is the commonest and most widely-distributed of the rare element minerals found in the pegmatites.

It was first recorded (7) (60) in 1917 from a dyke in South Sherbrooke township, Ont., and has since been found at a number of other scattered localities.

In the South Sherbrooke pegmatite, the mineral was found in some quantity in a rather localized zone, and a small shipment of the ore was sent to the Mines Branch at Ottawa in 1919, in the hope that it might prove possible to concentrate it (19). However, no attempt at commercial production was ever made. A new analysis of the euxenite from this locality was made by Ellsworth in 1927 (8).

Other occurrences of euxenite in Ontario have been noted in Calvin, Mattawan, Sabine, Burwash, Henvey, Dill and Lyndoch townships.

The Mattawan mineral has been described by Ellsworth (9) as euxenite-polycrase.

The Lyndoch material, which occurs in well-formed crystals in contrast to the more usual massive form, has been described by Ellsworth (10) under the name of lyndochite. It is very much lower in uranium, and higher in columbium, than ordinary euxenite.

The Sabine euxenite has also been analyzed and described by Ellsworth (11).

In Henvey and Burwash, euxenite occurs in large, but rather rough, crystals. In Henvey, it is associated with cyrtolite.

Ellsworth has recorded (23) the occurrence in small amounts of a mineral of the euxenite family at the Watson mine, near Hybla, Ont.

In Quebec, traces of euxenite occur in several dykes in Hull township, and it also is found in some abundance in West Portland, where it is associated with monazite.

FERGUSONITE

Obalski mentions (26) (56) fergusonite as having been found at the old Maisonneuve mica mine, in Berthier county, Que. This appears to be the only recorded occurrence of the mineral in Canada.

FLUORITE

Fluorite is a comparatively rare mineral in all types of the granite pegmatites. Small amounts of finely-granular, purple fluorite occur in an amazonite dyke in Hull township, Que., and also at the Villeneuve mine, in Villeneuve township, Que., and the Leduc mine, in Wakefield township (25). Similar fluorite also occurs at the McDonald mine, near Hybla, Ont., and in the beryl pegmatite in Lyndoch township, Ont.

GADOLINITE

Gadolinite has not yet been identified with certainty from the Canadian pegmatites. A mineral resembling it occurs associated with cyrtolite in the Lyndoch beryl pegmatite, in Ontario, and the writer has also found small amounts of what may be gadolinite in a white, soda-rich feldspar dyke in Aylwin township, Que. Obalski mentions (26) the mineral as occurring at an old mica mine in Taché township, near Lake St. John, Que.

GALENA

Rare. A single mass, several pounds in weight, is stated to have been found in the McDonald dyke, near Hybla, Ont.

GARNET

Red almandite garnet is common, particularly in the wall zones of the dykes. Many of the pegmatites of the Mattawa-Sudbury region, Ont., contain an abundance of small, and often well-

formed, almandite crystals along their contacts. Crystals up to 1 inch in diameter have been secured from dykes near Mattawa. Large crystals also occur in the Lyndoch beryl pegmatite, in Renfrew county.

In Quebec, large, misshapen crystals of red garnet occur in the dykes of the Saguenay region often enclosed in muscovite. At the Villeneuve mine, in Papineau county, and also in a similar dyke in the adjoining township of West Portland, red garnet occurs abundantly in the albite of the dykes and also as flattened crystals between the plates of muscovite. This garnet has an attractive, reddish-yellow wine colour and is probably spessartite.

GUMMITE

Small amounts of gummite are found at the Villeneuve mine, Que., where it is closely associated with uraninite, or represents completely altered uraninite. It is found principally as small, pellets of a brilliant orange-scarlet or yellow, massive mineral, or, in an altered form, as a grey, powdery incrustation. Both forms are common in small pits in the faces of large tourmaline crystals. It also occurs sparingly in a similar dyke in the adjoining township of West Portland, and at the Leduc mine, in Wakefield township (25).

HATCHETTOLITE

This rare columbate has been recorded only from the Woodcox and McDonald mines, near Hybla, Ont.

At the Woodcox mine, it occurs in irregular masses, associated with cyrtolite, calciosamarskite, columbite, etc. (5). At the McDonald mine, nearby, it occurs in small, nodular masses, intimately intergrown with titanite, and associated with cyrtolite.

HORNBLLENDE

Hornblende crystals are often found in the wall zones of pegmatites cutting gneiss, and are sometimes of large size. They seldom possess good crystal outline and are difficult to free from the enclosing feldspar. Like the garnet and biotite often found in the feldspar and quartz of the dykes, adjacent to the walls, the hornblende is evidently a contact mineral, formed by action of the pegmatitic solutions on the country rock.

The hornblende is generally of a dark, greenish-black colour. The crystals often attain a length of 12 inches, or over, and may

be 6 inches or more in diameter. Such large crystals are common in several dykes in Bathurst township, near Perth, Ont., and also at the McDonald mine, near Hybla, Ont.

HYBLITE

An alteration product of the uranothorite from the McDonald mine, near Hybla, Ont. It occurs as a thin, white or yellow coating upon the thorite crystals, and has not been found in sufficient quantity for quantitative analysis. By microchemical tests, Ellsworth (8) has determined both the white and yellow material to be hydrous, basic sulfo-silicates of thorium, and has termed the white variety alpha-hyblite and the yellow, beta-hyblite.

IRON (NATIVE)

Hoffmann has recorded (32) the occurrence in a kaolinized perthite from a pegmatite dyke in Cameron township, near Mattawa, Ont., of minute spherulitic grains of native iron, associated with fine, granular magnetite. An analysis of the grains yielded 90.45 per cent metallic iron.

LEPIDOLITE

Lepidolite is known to occur only in the dyke of the Leduc mine, in Wakefield township, Que., where it is the only mica present. It occurs in the form of large wedge-shaped crystals, or pyramidal crystal groups, sometimes one foot or more in diameter, associated with green and red tourmaline. The mica has a brownish colour, is cloudy and will not split into sheets, having what is known in the trade as "tangle-sheet" structure, due to imperfect crystallization (18).

The dyke here is in the nature of a freak pegmatite, being the only one of its kind known in a district in which normal granite pegmatites are numerous.

LYNDOCHITE

(See euxenite)

MAGNETITE

Magnetite is a fairly frequent mineral, usually in small scattered grains and sometimes massive: it is seldom found in large crystals. In the beryl pegmatite, in Lyndoch, Ont., magnetite is present in considerable amount, and some of the dykes in the Verona district, Ont., contain it in the form of scattered crystals.

MARCASITE

Less common than pyrite, but sometimes present in small amount. Probably of secondary origin.

Small amounts of marcasite, associated with pyrite and calcite, occur in the form of small balls in the cavities of a fracture zone cutting across a dyke in Henvey township, Ont.

MARTITE

Much of the apparent magnetite of the pegmatites is probably martite.

In Sabine township, Ont., it occurs (11) in nodular crystals up to 1 inch in diameter, and it is very abundant in some of the dykes in Calvin township, Ont. It has also been noted in dykes in Burwash township, south of Sudbury, Ont.

MICROCLINE

The predominant feldspar of the pegmatites is microcline-perthite, the soda content of which is seldom below 2 per cent, and averages about 2.5 per cent. Perthitic structures are usually plainly visible to the unaided eye and are often quite coarse. The colour is most commonly reddish, ranging from pale salmon-pink to brick-red. Some of the dykes carry microcline of a brownish-buff shade, while in others, the mineral has a mottled pinkish-buff or pinkish-green colour. White microcline is less common. A very high grade of white microcline occurs in the Villeneuve dyke, in Villeneuve township, Que., and was formerly in great demand for "dental spar." The microcline of dykes cutting crystalline limestone is sometimes of a blue-grey tone and is then often strongly foetid, probably due to the presence of occluded sulphuretted hydrogen. Such foetid microcline occurs in a dyke in North Burgess township, Ont. (35), and has also been described by Sine (4) from a pegmatite in Loughborough township, Ont. Sine suggests that the odour of the Loughborough mineral may be due to selenium sulphide.

Coarseness of crystallization is very variable. As a rule, the reddish microclines are the most coarsely crystalline, the feldspar individuals often forming large benches or ledges that sometimes run almost from wall to wall of the dykes, as at a locality in Sabine township, Ont., where the crystals measure nearly 30 feet in length. Such ledges, however, are often interrupted by quartz masses or stringers. At the Pedneaud mine, in Buckingham township,

Que., well-formed, buff-coloured microcline individuals, up to 6 feet in length and 3 feet across, lie in a ground-mass of quartz, and very large crystals also occur similarly in a dyke in the adjoining township of Derry. From such large individuals, the crystals range in size down to those of dykes in which the average length is not much over a few inches, the rock then having the structure of an extremely coarse granite.

The microcline of different dykes varies considerably in its relative lustre and cleavability. The white varieties usually are comparatively dull and matt and do not break cleanly. Some of the



FIG. 1. Large crystal of red microcline from lot 1, concession 3, township of Burwash, Sudbury district, Ont.

buff microclines, and also the deeper red varieties, possess the best cleavage, breaking readily into blocks, and even into large, thin plates, with sharp edges. Some of these more brittle, glassy microclines (often termed 'crystal spar') make a large amount of quarry fines, due to shattering in mining. The buff-coloured, glassy microcline is often translucent in fairly thick plates and sometimes even transparent in plates up to $\frac{1}{8}$ -inch in thickness.

The dykes being relatively free of vugs or cavities, well-formed microcline crystals are rare. Occasionally, however, large individuals having fairly good crystal outline have been observed

Such a crystal from a dyke in Burwash township, Ont., is illustrated in Fig. 1. In a pegmatite on the Hoffman property, in Portland township, Ont., there occurs an irregular, chimney-like, surface cavity, some 20 feet deep, the walls of which are lined with very large, partially-developed microcline crystals, some of which measure 2 feet in diameter (35).

Analyses by E. A. Thompson, Mines Branch Chemical Division, of three different, commercial microclines are given below:

	1	2	3
SiO ₂	64.00	64.80	64.60
Al ₂ O ₃	19.76	19.35	18.88
Fe ₂ O ₃	0.06	0.05	0.32
MgO	—	0.11	—
Na ₂ O	1.81	2.29	2.96
K ₂ O	14.19	13.32	13.02
	99.82	99.92	99.78

1. Buff microcline (dental grade), O'Brien mine, Derry township, Que.
2. White microcline, Cameron mine, range IX, lot 27, Buckingham township, Que.
3. Pink microcline, McDonald mine, Hybla, Ont.

Amazonite is not common in the pegmatites. It is, however, present locally in the beryl-pegmatite in Lyndoch township, Ont., and also at the Woodcox mine, near Hybla, Ont., both of which localities have yielded large, platy blocks of a rich green colour. It also occurs in the Leduc lepidolite-pegmatite, in Wakefield township, Que. Pale amazonite constitutes the greater part of the feldspar in a dyke in Hull township, Que., and a pegmatite in Bouchette township, Que., is largely made up of amazonite graphic granite (35).

MOLYBDENITE

Molybdenite is not common in the normal granite pegmatites worked for mica or feldspar. It seems to be more abundant in the dykes of the region along the north shore of the lower St. Lawrence than elsewhere, particularly in those of the more easterly section, below Anticosti island. It usually occurs in the contact zones of the dykes, rather than within them. Ellsworth has noted it in small amount in Conger township, Ont. (13).

In northern Quebec, in La Corne, Malartic and Preissac townships (3), and around Kewagama lake (30) (52), molybdenite occurs in a rock described as quartz-pegmatite, associated with apatite, tourmaline, columbite, beryl and fluorite. Attempts have been made to work the deposits for their molybdenite content.

Many of the occurrences of molybdenite in Ontario and Quebec described as in, or associated with, pegmatites are actually in pyroxenic rock bordering pegmatite or coarse granite, and usually where such rock cuts limestone. In some cases, molybdenite occurs to a limited extent in the dykes, but usually only in the contact zones or on joints. It would appear that such dykes may logically be assigned to a distinct class of their own.

MONAZITE

Until recently, this mineral has only been recorded from the Villeneuve mine, in Villeneuve township, Que., where a nodular mass weighing about 12 pounds is reported (20) to have been found many years ago.

The writer has lately found an interesting occurrence of monazite in the adjoining township of West Portland. Here, monazite occurs in considerable amount in the form of large, well-formed, tabular crystals, sometimes as much as 6 inches in length by 3 inches across, associated with euxenite, allanite and large tourmaline crystals. A yellow mineral with resinous lustre, that has not yet been identified, is also present in small amount. The monazite possesses a brick-red colour, has a specific gravity of 5.12 and contains 23.75 P_2O_5 .

MUSCOVITE

Many of the pegmatites carry muscovite mica, sometimes in large sheets, while others are practically free of it. In general, muscovite occurs in greatest quantity in the dykes composed of white or light-coloured feldspar, the red dykes usually carrying biotite, or being mica-free. However, some of the reddish pegmatites of the Sudbury district, Ont., contain large quantities of muscovite, and it also occurs in the dykes of the Parry Sound district.

Muscovite mica is not now mined in eastern Canada to any extent. Some thirty years ago, muscovite mining was carried on north of the St. Lawrence, in Quebec; in Villeneuve township,

Que., and also at scattered localities in Ontario. The amount of merchantable mica recovered, however, did not prove sufficient to render mining profitable and operations have been abandoned (18). A little scrap muscovite is sometimes recovered at feldspar mines and sold for grinding purposes.

The Villeneuve mine formerly yielded very large sheets of muscovite, most of it stained and spotted, as is most of the mica from the dykes of eastern Canada.

Much of the muscovite found is what is termed in the trade "wedge mica," that is, the crystals taper towards one edge and yield sheets of unequal thickness, which are commercially worthless as sheet mica. Some of the dykes in Buckingham township, Que., yield muscovite of this type. Large quantities also occur in the pegmatites of Dill and Cleland townships, in the Sudbury district, Ont., sometimes accompanied by biotite, and the same association is found in Conger township, Parry Sound district, Ont.

PERISTERITE

(See albite)

PHENACITE

Small crystals of phenacite are reported (30) to accompany the beryl in a molybdenite-bearing quartz-pegmatite in the Kewagama river region, Abitibi district, Que. This is the only recorded occurrence of the mineral in Canada.

POLYCRASE

(See also euxenite)

Polycrase is stated (31) (45) to have been found many years ago, associated with beryl and xenotime, at a mica mine in Calvin township, near Mattawa, Ont.

PYRITE

Pyrite is often present in small grains in the pegmatites, particularly where much tourmaline occurs. It is usually associated with the quartz of the dykes, rather than with the feldspar; and where large segregated masses of quartz occur, pyrite—either massive or in crystals—is often present in considerable amount.

Pyrite occurs in quantity in a large, central quartz boss at the Richardson mine, in Bedford township, Ont. Large crystals

and crystal groups of splendid pyrite occur scattered through the dyke at the O'Brien mine, in Derry township, Que., and in smaller amount at the Cameron mine, in Buckingham township, Que. Small, scattered pyrite crystals occur plentifully in a dyke cutting crystalline limestone in North Burgess township, Ont. (35).

PYRRHOTITE

Less abundant than pyrite, but of fairly common occurrence. It occurs in considerable amount, and in large masses, on the waste dump of the McDonald mine, near Hybla, Ont., and is also found on the adjacent Sutherland property (23). It is also present in quantity in a narrow, quartz-rich dyke in Derry township, Que., near the O'Brien mine. It has not been observed in crystals, all the occurrences noted being of compact, massive material.

(To be continued)