AN X-RAY POWDER EXAMINATION OF
SOME PEGMATITE MINERALS
FROM SOUTHEASTERN MANITOBA

A Thesis

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Master of Science

by

Norma Agnes Bristol

(Nee Tweedy)

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

ABSTRACT

This thesis describes the results of an investigation by means of X-ray diffraction powder photographs of the minerals from the pegmatites of southeastern Manitoba. These pegmatites are located in an area that is about 100 miles northeast of Winnipeg. Reference is made to all the minerals that have been reported from these pegmatites although the X-ray diffraction study did not include all these minerals because specimens of all of them were not available to the writer.

Each mineral was photographed with a standard small (57.3 mm. diameter) powder camera, but when the complexity of the mineral warranted more detailed work a standard large (114.6 mm. diameter) powder camera was used. The main source of reference was the well-known A.S.T.M. X-ray Powder Data File. In this thesis the non-silicate minerals are classified according to the Seventh Edition of Dana's System of Mineralogy, Volume 1 and 2, and the silicates are classified according to Strunz in his Mineralogische Tabellen.

Powder data are given for 29 minerals of which six have not previously been reported from this area, and eight have been identified more specifically than previously. The minerals which had not been reported earlier are: jamesonite from south of Shatford Lake, brazilianite (?) and "sarospatite" (illite-montmorillonite) from the Chemalloy mine at Bernic Lake, sicklerite from east of Bernic Lake, and uranophane-sklodowskite and vesuvianite from the Huron claim, south of the Winnipeg River. New

localities for magnetite and pollucite are reported, these localities being the Huron claim south of the Winnipeg River and north of Maskwa Lake respectively. The minerals which have been identified more specifically are: triphylite-lithiophilite, heterosite-purpurite, muscovite and lithian muscovite (which include all the writer's specimens called lepidolite and zinnwaldite), topaz, epidote-clinozoisite (including some material called zoisite), maximum microcline and low albite. The other minerals for which powder data are given are: cassiterite, tantalite, wodginite, rhodochrosite, amblygonite, apatite, beryl, tourmaline, spodumene, chlorite, biotite, petalite, and quartz.

CHAPTER I

INTRODUCTION

Numerous studies of the pegmatite dykes occurring in south-eastern Manitoba have been made at various times since their discovery in the 1920's. Most of these studies have been of a geological nature, but because of the many interesting and varied pegmatite minerals that occur in this area, the writer decided that a thorough identification of these minerals would be a desirable study. This thesis reports an attempt to determine accurately by means of X-ray diffraction powder photographs, the actual minerals that are present. The study was limited by the actual number of minerals available for examination, and not all minerals reported have been examined in this investigation. Limits were also imposed by those inherent in the X-ray powder technique. An attempt has been made to include at least some discussion of all the minerals reported from this area, so that at least some reference is made to every mineral known at the time of this writing.

Because of the interesting and varied mineralogy, a secondary purpose of this thesis is to present suggestions for further study.

ACKNOWLEDGEMENTS

The writer wishes to express her gratitude to Dr. R. B. Ferguson, Professor of Mineralogy at the University of Manitoba, for suggesting the problem and for valuable criticism in the course of this work, and also to Mr. J. F. Davies, Chief Geologist of the Manitoba Mines Branch, for providing most of the mineral specimens, and thus making the investigation possible. Other specimens were obtained from Chemalloy Minerals Limited (formerly Montgary Explorations Limited). Permission was granted by the Department of Mines and Natural Resources, Winnipeg, Manitoba, to use their map of the Cat Lake-Bird River-Winnipeg River Area.

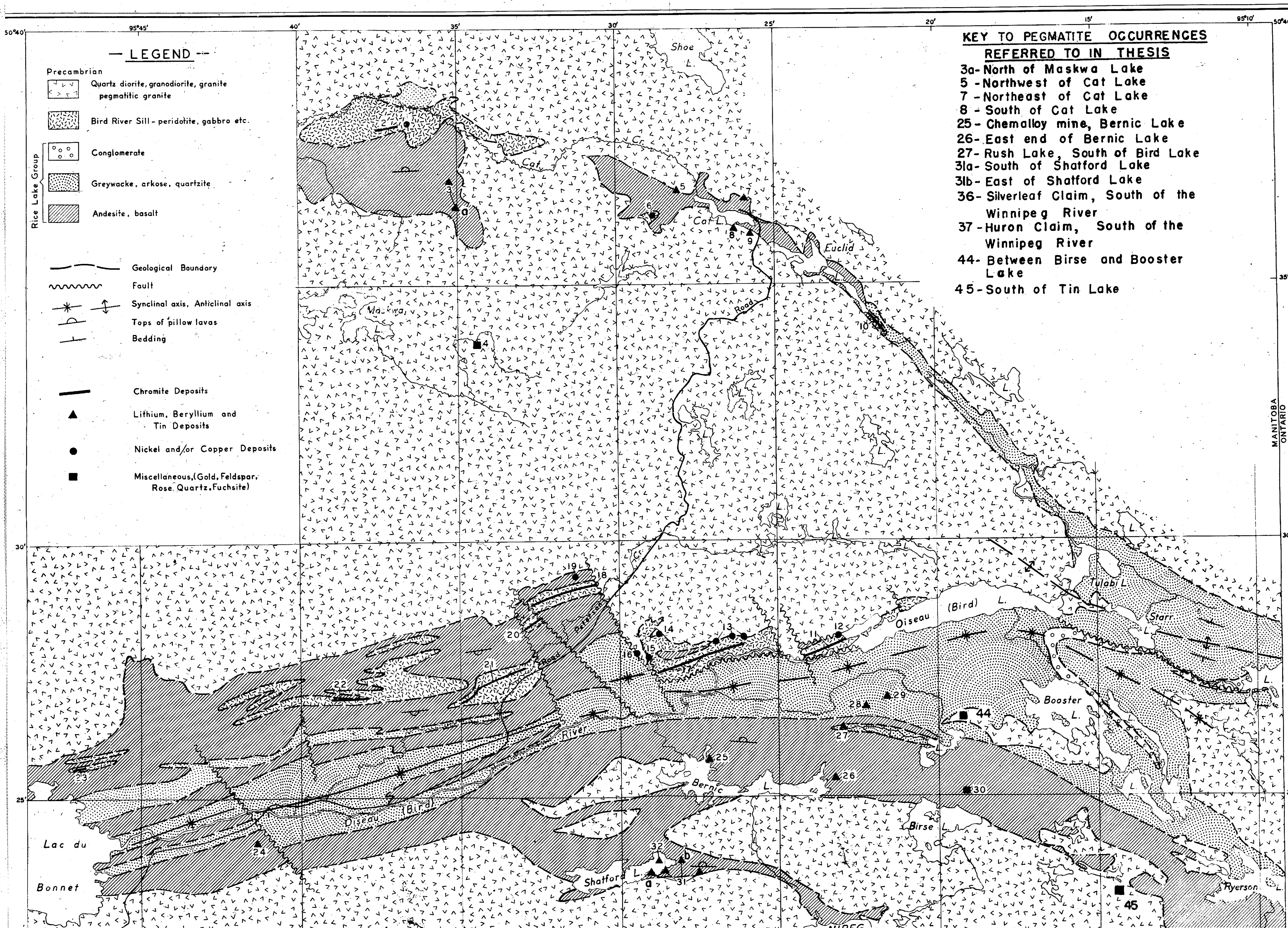
Special thanks are due to fellow graduate students, Mr. Colin Riley for the photograph of vesuvianite and to Mr. F. J. Wicks for the D.T.A. analysis of 'sarospatite'. Thanks are also due to Mr. John Jambour of the Geological Survey of Canada, Ottawa, for the photographs of triphylite (17253L) and beryl (17250L), and to the Director of the Geological Survey of Canada for the ixiolite specimen used in this report.

During the last year of this study the writer received financial assistance from the National Research Council through a Grant to Dr. Ferguson.

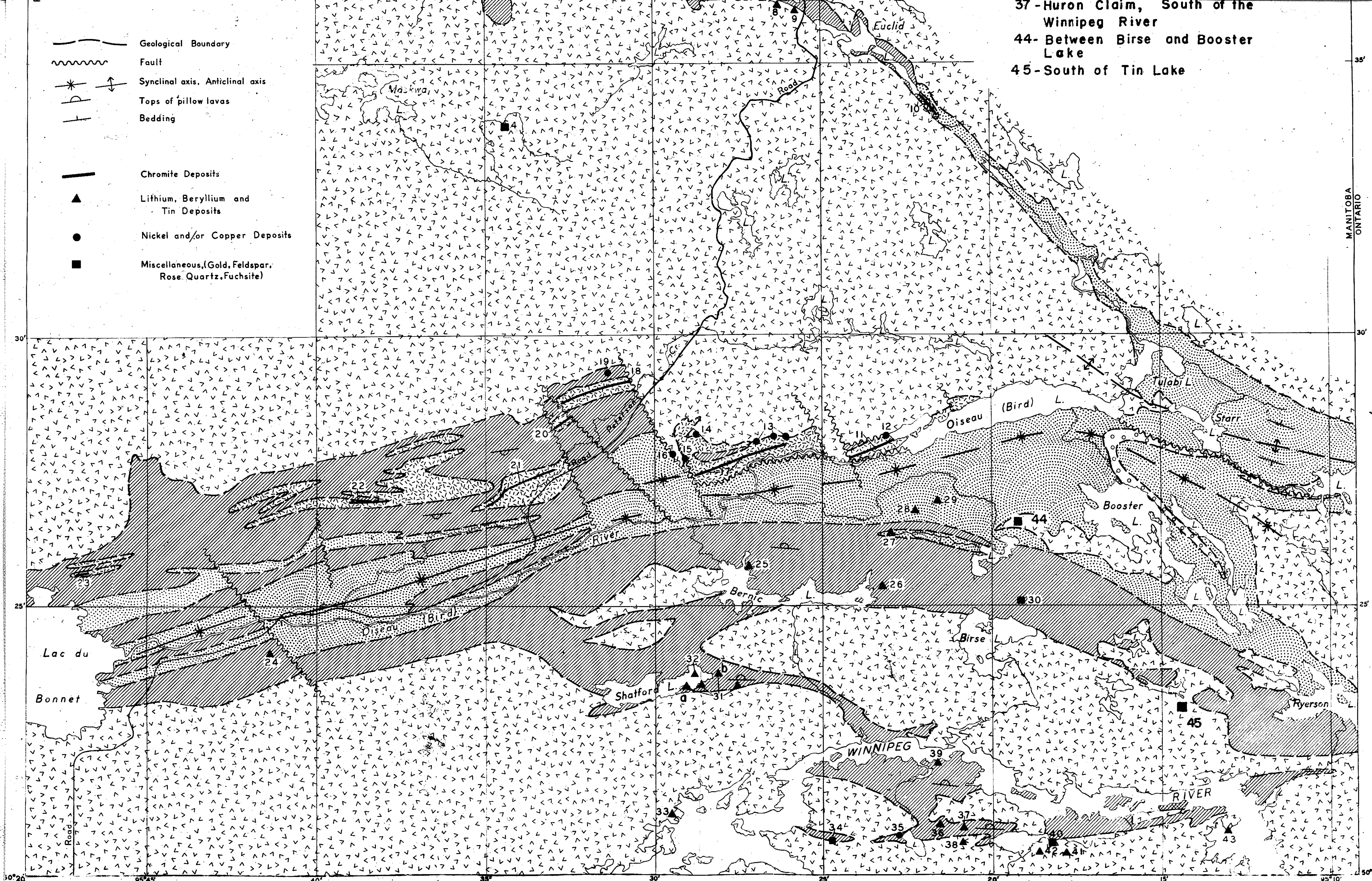
PREVIOUS WORK

A number of times since the 1920's this area has attracted prospectors and exploration geologists because of the rare minerals. The area was first explored for cassiterite in the 1920's. Since then interest has switched to feldspar, the lithium minerals (mainly spodumene and lepidolite), beryl, and most recently pollucite because of its caesium content.

FIGURE I.



— LEGEND —
Precambrian
Quartz diorite, granodiorite, granite pegmatitic granite
Bird River Sill - peridotite, gabbro etc.
Rice Lake Group
Conglomerate
Greywacke, arkose, quartzite
Andesite, basalt
Geological Boundary
Fault
Synclinal axis, Anticlinal axis
Tops of pillow lavas
Bedding
Chromite Deposits
Lithium, Beryllium and Tin Deposits
Nickel and/or Copper Deposits
Miscellaneous, (Gold, Feldspar, Rose Quartz, Fuchsite)
KEY TO PEGMATITE OCCURRENCES REFERRED TO IN THESIS
3a- North of Maskwa Lake
5 - Northwest of Cat Lake
7 - Northeast of Cat Lake
8 - South of Cat Lake
25- Chemalloy mine, Bernic Lake
26- East end of Bernic Lake
27- Rush Lake, South of Bird Lake
31a- South of Shatford Lake
31b- East of Shatford Lake
36- Silverleaf Claim, South of the Winnipeg River
37- Huron Claim, South of the Winnipeg River
44- Between Birse and Booster Lake
45- South of Tin Lake
95°45'
40'
35'
30'
25'
20'
15'
95°10'
50°40'
35'
30'
25'
MANITOBA
ONTARIO
Shoe L.
Cat Cr.
Cat L.
Euclid
Road
Maskwa L.
Oiseau (Bird) L.
Tulabi L.
Starr L.
Booster L.
River
Bernic L.
Birse L.
Oiseau (Bird)
Lac du Bonnet
Shatford L.
Ryerson L.



EOLOGICAL DIV. M.&N.R. WINNIPEG.

CAT LAKE – BIRD RIVER – WINNIPEG RIVER AREA

SOUTHEASTERN MANITOBA

SCALE

0 1 2 3 4 5 6 Miles

The general geology of the whole area has been described by a number of writers; most recently by Springer (1948, 1949, 1950) and Davies (1956, 1957, 1958). The pegmatites at Bernic Lake have been described most recently by Hutchinson (1959). For the most important references the reader is referred to Davies (1957, p. 1).

LOCATION OF THE PEGMATITES

In general the pegmatites lie immediately north of the Whiteshell Forest Reserve, Manitoba, approximately 100 miles northeast of Winnipeg, Manitoba. The pegmatites are located between the Manitoba-Ontario boundary on the east, longitude 95°45'W on the west, latitude 50°20'N on the south and latitude 50°40'N on the north. The locations of the pegmatites are given in Figure 1.

GEOLOGY AND MINERALOGY OF THE PEGMATITES OF SOUTHEASTERN MANITOBA

General Geology of the Area.

The rocks of this region are Precambrian in age except for minor Pleistocene and Recent deposits. The oldest rocks are the Rice Lake group, which consist of felsic and mafic lavas, feldspathic quartzite, conglomerate and argillite. These rocks are intruded by sills and irregular bodies of peridotite and gabbro. Base metal sulfides and chromite deposits are closely associated with these intrusions. Granitic rocks and irregular bodies of pegmatite granite and pegmatite gneiss invade the Rice Lake Group and mafic intrusions. The pegmatite dykes appear to be the youngest rocks in the area (Davies,1958).

The Pegmatites; their Mineralogy and Origin.

The pegmatites show a close spacial relationship to the batholiths of granitic rocks. In addition to the dykes containing the rarer minerals, there are numerous dykes with few or no rare minerals which occur at considerable distances from the batholithic intrusions.

The dykes, which display a variety of structural attitudes, vary in size from a few feet to several hundred feet in width and from hundreds to thousands of feet in length. They are generally tabular in shape with the thickness quite uniform in some and quite variable in others.

Mineralogically the pegmatites vary from simple to complex, the major minerals in all dykes being feldspar, quartz, and mica. The simple dykes often consist of only these three minerals whereas the complex dykes contain the rare minerals as well. A list of the minerals reported from the pegmatites of southeastern Manitoba is given in Appendix I. The most abundant of the rarer minerals are the lithium minerals (spodumene and lepidolite), beryl, tourmaline, pollucite, cassiterite, and apatite. In general, dykes with lithium contain little or no beryl; those with beryl contain few or no lithium minerals, and those with cassiterite contain few or no beryl and lithium minerals. A number of the minerals appear very similar to each other, and occur as white to light grey and cream-colored crystals in fine-grained aggregates. These include spodumene, amblygonite, petalite, beryl, pollucite, and feldspar. The grain size of the pegmatite minerals varies considerably, generally increasing toward the centre of the dyke. The mica minerals display an interesting and sometimes unique structure. They occur as flakes, books, "wheels", plumes, and curvilamellar aggregates (Davies, 1958).

Concerning the origin of the pegmatites, Davies (1958, p. 425) considers that they were formed "as cooling progressed by fractional crystallization in situ, of a pegmatite magma, giving rise to successive zones of differing composition and texture. As recrystallization proceeded the proportion of mineralizers dissolved in the fluid increased and the remaining magma became less viscous, accounting for the increased grain size toward the centre of the dykes".

CLASSIFICATION OF THE MINERALS

All the minerals except the silicates are classified here according to the Seventh edition of Dana's System of Mineralogy, Volumes 1 and 2 (Palache, Berman and Frondel, 1944 and 1951). The silicates are classified according to Strunz (1957). Quartz is classified here with the silicates, next to the feldspars, as it will appear in Volume 3 of the Seventh edition of Dana's System of Mineralogy, and not with the oxides as Strunz classified it.

EQUIPMENT AND METHODS

A standard Philips (Norelco) X-ray diffraction unit and standard Philips powder cameras were used for photographing the minerals. A small sample of the mineral was ground to a fine powder in a mortar and pestle, mixed with an equal amount of collodion, and rolled into thin rods about 0.2 mm. in diameter. These rods were allowed to harden before inserting in the X-ray cameras. Each mineral was photographed for 1 to 1½ hours with Ni-filtered Cu K radiation on a 57.54 mm. diameter* camera. The resultant photographs were used for routine identification. In those cases where the complexity of the mineral warranted more detailed work, e.g. the feldspars and micas, the minerals were re-photographed with Mn-filtered Fe K radiation on 114.83 mm. diameter* cameras for approximately twelve hours. In all cases fine, as opposed to coarse, collimators were used in order to reproduce finer lines for greater accuracy in measurements. All lattice spacings and cell dimensions are given in true Å units. Only powder photographs were used in this investigation.

The powder data from each photograph were compared with standard reference data for the particular mineral, the main source of information being the well-known A.S.T.M. X-ray Powder Data File. In the case where many references were available, the best reference, which was usually the most recent, was used. Only one reference was used with the simpler minerals whereas two or more references were used for the more complex minerals.

The numbers used in this work to identify the powder photographs

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* 57.54 mm. and 114.83 mm. are the actual diameters of these cameras, but their effective diameters in order to make line separations on the films of 1 mm. = 1°θ and 1 mm. = 2°θ respectively, are 57.3 mm. and 114.6 mm.

are those assigned to the photograph in the log books in the X-ray Diffraction Laboratory of the Department of Geology, University of Manitoba. These same numbers were also assigned to the mineral specimen. The letter S or L after the X-ray photograph number designates the size of the camera, S referring to the smaller, 57.54 mm., diameter camera and L to the larger, 114.83 mm., diameter camera.

CHAPTER II

SULFIDES AND SULFO-SALTS

The following sulfides have been reported from the pegmatites of southeastern Manitoba:

Galena PbS

Sphalerite ZnS

Stibnite Sb_2S_3

Bismuthinite Bi_2S_3

Pyrite FeS_2

Arsenopyrite FeAsS

Molybdenite MoS_2

X-ray photographs of the specimens available to the writer revealed the following sulfo-salt:

Jamesonite

II 1. SULFIDES

Sphalerite and arsenopyrite are known from the pegmatites west of Rush Lake. Bismuthinite is known from a feldspar quarry at Greer Lake and it also occurs with molybdenite at Cat Lake. Pyrite, stibnite and galena occur in minor amounts in the pegmatites at Shatford Lake (Springer 1950, Davies 1955, 1957). However none of these sulfides were available for the present study.

II 2. JAMESONITE $Pb_4FeSb_6S_{14}$

In this study one specimen of jamesonite, which was obtained from a pegmatite south of Shatford Lake, was originally identified as stibnite in the hand specimen.

Hand specimen description:

#A-366L and A-494L: Shatford Lake (Figs. 2 and 3).
Greyish-black, opaque, metallic, fibrous to plumose. It is associated with feldspar, quartz and a grey hexagonal curved crystal of mica.

A yellow metallic coating, probably pyrite occurs on this specimen, but not enough of this material could be gathered to make an X-ray photograph. A microchemical test of the black mineral gave a positive test for Sb, and suggested the presence of Pb and Fe.

X-ray powder data for this mineral are given in Table 1 where they are compared with those of Berry (1940) (A.S.T.M.8-125), and of Koch, Grasselly and Podušra (1960). The hkl values were taken from the A.S.T.M. card only. The first photograph of this mineral (A-366L, Fig. 2) showed too many quartz lines to be identified with certainty, and therefore, another purer sample was prepared and photographed (A-494L, Fig. 3). The average d values from these two photographs are given in Table 1 where it can be seen that there is good agreement of intensities with the standard data for jamesonite. The poor intensity agreement may in part be accounted for by the presence of quartz in the powder sample. There seems little doubt that this mineral is in fact jamesonite but, further work of a chemical nature would probably be required to establish this identification positively.

Table 1

X-ray Powder Data for Jamesonite

Monoclinic $P2_1/a$, a = 15.71, b = 19.05, c = 4.04, β = 91°48' (Berry, 1940)

	South of Shatford Lake A-494 L & A-366 L		Cornwall (Berry, 1940) ASTM 8-125		Kisbanya (Koch et al, 1960)	
hkl	I	d,Å	I	d,Å	I	d,Å
220			½	6.03		
310			½	5.10		
240	½	4.10	3	4.10	4	4.04
400			4	3.87	6	3.77
021,150	2	3.71	2	3.72	1	3.69
121			3	3.59	2	3.55
250	10	3.44	10	3.44	10	3.40
430,131	5	3.35	1	3.34	2	3.30
	1	3.27				
060			5	3.18	3	3.13
510,231 350,$\bar{3}$21	1	3.05	5	3.09	5	3.08
260	8	2.95	2	2.95	3	2.94
$\bar{4}$11,331	6	2.80	9	2.84	9	2.81
411,450	3	2.71	8	2.75	8	2.71
341,540			1	2.63	2	2.62
521,261 180	2	2.41	1	2.36	2	2.35

Table 1 (Cont'd)

	South of Shatford Lake A-494 L & A-366 L		Cornwall (Berry,1940) ASTM 8-125		Kisbanya (Koch et al, 1960)	
hkl	I	d,Å	I	d,Å	I	d,Å
640			3	2.30	5	2.29
	1B*	2.26	4	2.24	5	2.24
	5	2.13	1 ½	2.16 2.11	3 3	2.18 2.10
	4B	2.04	5	2.06	6	2.04
	4B	2.02	4	2.02	7	2.02
	1	1.951	1	1.965	2	1.95
	2	1.906	1	1.907	4	1.90

*B - Broad spacing

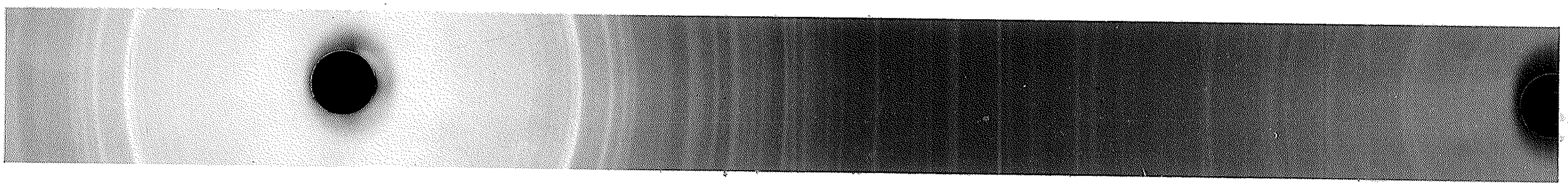

Figure 2. A-366L, South of Shatford Lake: Jamesonite and quartz.
Fe/Mn radiation, 114.83 mm. camera.

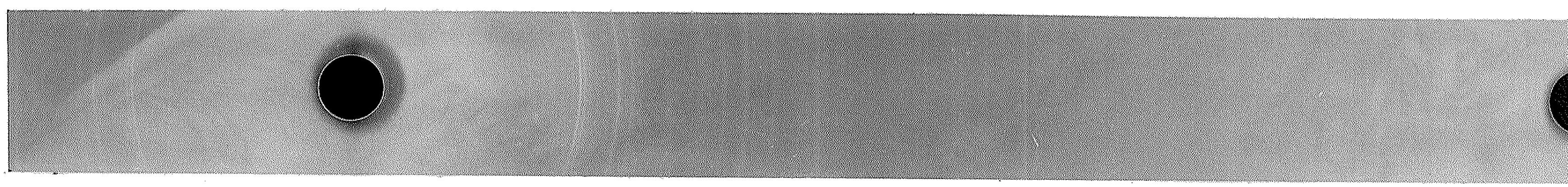

Figure 3. A-494L, South of Shatford Lake: Jamesonite.
Fe/Mn radiation, 114.83 mm. camera.

CHAPTER III

OXIDES

The following oxides have been reported from the pegmatites of southeastern Manitoba.

Cassiterite SnO_2

Uraninite UO_2

Magnetite Fe_3O_4

Microlite $(Ca,Na)_2(Ta,Nb)_2O_6(OH,F,O)$

Tapiolite $(Ta,Nb)_2(Mn,Fe)O_6$

Tantalite-columbite $(Fe,Mn)(Ta,Nb)_2O_6$

Euxenite-polycrase $(Y,Er,Ce,U,Pb,Ca)(Ti,Nb,Ta)_2(O,OH)_6$

X-ray photographs of the specimens available to the writer revealed the following minerals:

Cassiterite

Magnetite

Tantalite-columbite

Wodginite

III 1. CASSITERITE SnO_2

Cassiterite occurs in several localities in southeastern Manitoba and some of these have been known since the 1920's. Several attempts have been made to mine the mineral economically. In 1928 Jack

Nutt Mines Limited sank a shaft on the north end of Bernic Lake, but this venture was uneconomical, and in 1934 Manitoba Tin Company sank a shaft near the east end of Shatford Lake, but this operation too was uneconomical. In addition to being found at these two localities cassiterite also occurs in pegmatites containing albite, microcline, quartz, black tourmaline and muscovite at Bernic Lake; in minor amounts in albite pegmatites and in albitite dykes associated with the pegmatites south of Bird Lake and west and north of Rush Lake; and also in minor amounts in the area south of the Winnipeg River (Springer, 1949, 1950; Davies, 1955, 1957).

In this study one specimen of cassiterite was obtained from the pegmatites of Bird Lake in the Rush Lake area.

Hand specimen description:

#2036S: Rush Lake. (Fig. 4).

Brownish-black with a sub-metallic lustre. It occurs as poorly developed prismatic crystals and is associated with quartz and muscovite.

X-ray powder data for this cassiterite are given in Table 2, where they are compared with the data given by Swanson and Tatge (1953), and de Assuncao, Torre and Garrido (1953). The hkl values were taken from Swanson et al (1953) while the intensity of the lines is best compared with de Assuncao et al (1953) because they have been taken from a powder photograph rather than from a diffractometer tracing used by Swanson et al (1953). One extra weak line in the writer's data with the apparent spacing 1.945 Å does not appear in the references for

Table 2

X-ray Powder Data for Cassiterite

Tetragonal, P4/mnm, a = 4.738, c = 3.188 (Swanson et al, 1953)

	Rush Lake, 2036 S		Swanson et al (1953)		de Assuncao et al (1953)	
hkl	I	d,Å	I	d,Å	I	d,Å
110	9	3.28	10	3.351	5	3.333
101	9	2.60	8	2.644	5	2.631
200	5	2.33	2	2.369	3	2.359
111	1	2.29	½	2.309		
210	½	2.09	½	2.120		
211 β	½	1.945				
211	10	1.753	6	1.765	8	1.758
220	5	1.664	6	1.675	5	1.670
002	3	1.585	1	1.593	3	1.584
310	6	1.493	1	1.498	5	1.495
112	6	1.433	2	1.439	4	1.435
301	6	1.412	1	1.415	5	1.410
202	4	1.315	1	1.322	3	1.320
321	6	1.210	1	1.215	6	1.213
400	4	1.180	½	1.184	2	1.182
222	5	1.149	1	1.155	5	1.153
					1	1.139

Table 2 (Cont'd)

	Rush Lake, 2036 S		Swanson et al (1953)		de Assuncao et al (1953)	
hkl	I	d,Å	I	d,Å	I	d,Å
330	1	1.114	½	1.117	5	1.115
312	5	1.090	1	1.092	6	1.090
411	5	1.078	1	1.081	7	1.079
420	4	1.063	½	1.059	6	1.059
					5	1.045
103	3	1.038	½	1.036	3	1.035
402	6	1.017	1	.9505		
510	3	.930	½	.9291		
332	3	.915	½	.9143		
501	6	.910	1	.9081		
422	6	.882	1	.8819		
303			1	.8814		
521	6	.849	1	.8480		
440	3	.839	½	.8375		
323	5	.825	½	.8261		
530	3	.812	½	.8125		
512	7	.803	1	.8026		

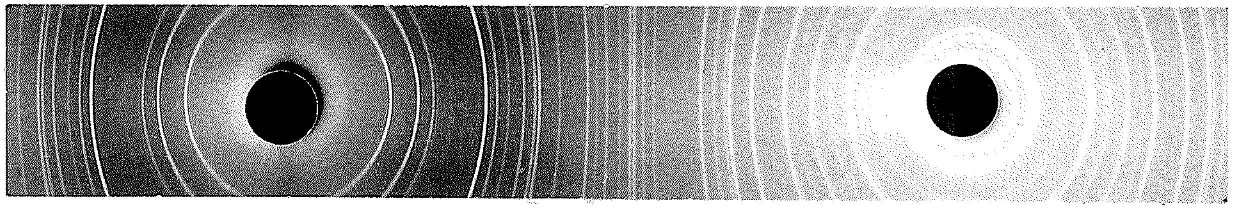

Figure 4. 2036S, Rush Lake: Cassiterite.
Cu/Ni radiation, 57.54 mm. camera.

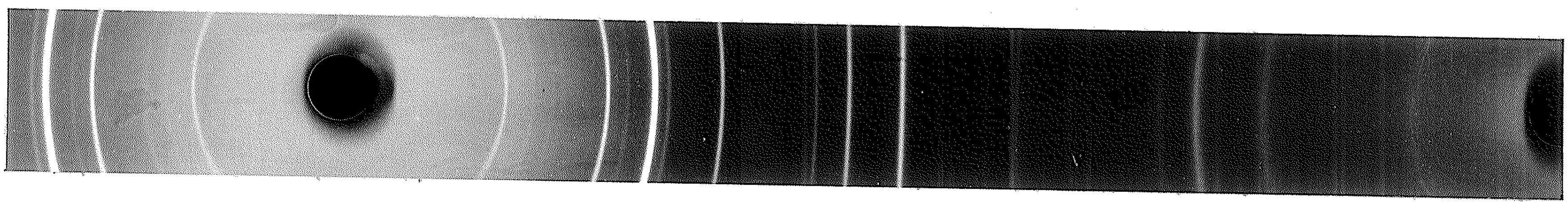

Figure 5. A-447L, Huron Claim: Magnetite.
Fe/Mn radiation, 114.83 mm. camera.

cassiterite and is apparently the K reflection for the strong line with d = 1.753 Å. A photograph of this mineral appears as Figure 4.

III 2. URANINITE UO_2

Uraninite has long been known from the Huron claim south of the Winnipeg River. It has become well known because an age determination of this material, using Sr/Rb and K/A methods, gave 2,500 million years, the greatest age ever recorded at the time the determination was made. None of this material was available as all the known crystals of uraninite have been removed from the locality for age determination work (Davies, 1957).

III 3. MAGNETITE Fe_3O_4

Only one occurrence of magnetite in the pegmatites of this district has been recorded in the literature, that one being in the pegmatites of the Booster Lake area where it is found associated with garnet and beryl (Davies, 1956).

In the present case magnetite was found to be present in a radioactive specimen from the well-known Huron claim south of the Winnipeg River. The radioactive mineral proved to be uranophane-sklodowskite, which is described below under the nesosilicates (Chapter VII 4a).

Hand specimen description:

#A-447L: Huron Claim. (Fig. 5)

Black, metallic, massive, brittle, magnetic. It is associated with

Table 3

X-ray Powder Data for Magnetite

Cubic Fd3m, a = 8.3963 (Basta, 1957)

	Huron Claim A-447L		Bisperg, Sweden (Basta, 1957) ASTM 11-614	
hkl	I	d,Å	I	d,Å
111	7	4.85	4	4.85
	1	4.11		
	1	3.76		
	1	3.61		
220	8	2.97	7	2.966
	½	2.88		
	1	2.77		
311	10	2.54	10	2.530
222	5	2.43	1	2.419
	½	2.26		
400	8	2.10	7	2.096
	½	1.929		
	½	1.884		
422	5	1.721	6	1.712
335,511	8	1.622	8½	1.614
440	9	1.486	8½	1.483
	½	1.420		

Table 3 (Cont'd)

	Huron Claim A-447L		Bisperg, Sweden (Basta, 1957) ASTM 11-614	
hkl	I	d,Å	I	d,Å
620	2	1.329	2	1.327
533	4	1.281	3	1.279
622	2	1.266	1	1.264
444	2	1.214	2	1.2112
642	3	1.123	3	1.1214
553,731	5	1.094	6	1.0922
800	4	1.050	4	1.0489
660,822	1	0.990	1	0.9890

quartz and uranophane-sklowdoskite.

X-ray powder data for this magnetite are given in Table 3, where they are compared with that of Basta (1957) (A.S.T.M. 11-614), and a powder photograph of this magnetite is shown as Figure 5. All the reflections for magnetite listed on the A.S.T.M. card are present on this photograph but as Table 3 shows, this photograph has a number of additional weak lines. These could not be accounted for.

III 4. MICROLITE $(Ca,Na)_2(Ta,Nb)_2O_6(OH,F,O)$

Creamy white microlite has been reported with tantalite and tapiolite from the Chemalloy mine at Bernic Lake (Nickel,1961). However, none of this material was available for the present study.

III 5. TAPIOLITE $(Ta,Nb)_2(Mn,Fe)O_6$

Tapiolite, a rare mineral which occurs at the Chemalloy mine at Bernic Lake, has been observed in polished sections containing tantalite and microlite (Nickel,1961). However none of this material was available for the present study.

III 6. TANTALITE $(Fe,Mn)(Ta,Nb)_2O_6$

Tantalite-columbite has been reported from many of the pegmatites of southeastern Manitoba. On the Huron claim south of the Winnipeg River tantalite-columbite occurs with uraninite and monazite where it is found in fractures in pink feldspar, forming platy crystals up to four inches in length. It has been reported from a dyke east of Starr Lake and it also occurs at Bernic Lake not only in the pegmatites east of the lake, but also on the north shore in the vicinity of the Chemalloy Mine. At the east end of the lake it is found with spodumene, phosphate minerals, petalite, beryl, and tourmaline, and in the area of the Chemalloy Mine it is found with pollucite, phosphate minerals, and apatite. Columbite is found at Greer Lake on the Grace 1 and 2 claims in pegmatites associated with mica, tourmaline, and beryl, and also south of the east end of Shatford Lake on the Dyke claims where it occurs in a coarse pink granite. Here it is present as small tabular crystals in narrow fractures in feldspar and quartz associated with zinnwaldite, monazite, euxenite, pyrite, stibnite and topaz (Springer, 1950; Davies, 1955, 1956, 1957).

Four mineral specimens labeled columbite-tantalite were examined during the present study. An X-ray photograph of one other specimen, identified as euxenite in hand specimen, which came from the east end of Bernic Lake, proved it to be tantalite.

Hand specimen descriptions:

#A-395S: Chemalloy Mine, Bernic Lake.

Black, sub-metallic, short poorly developed prismatic crystals. It is associated with feldspar and quartz.

#A-798L: Chemalloy Mine, Bernic Lake. (Fig. 6)

Brownish black, sub-metallic, short prismatic crystals randomly oriented in feldspar and quartz.

Table 4

X-ray Powder Data for Tantalite

Orthorhombic Pbcn, a = 5.082, b = 14.238, c = 5.730 (Tavora, 1955)

	Bernic Lake A-798L		Quixeramobim, Brazil (Tavora, 1955) ASTM 7-64	
hkl	I	d,Å	I	d,Å
020			1	7.11
111	7	3.65	9	3.66
040			1	3.57
	1	3.33		
131	10	2.99	10	2.97
002	1	2.87	3	2.86
200	5	2.58	3	2.54
102	6	2.51	7	2.49
220,060	4	2.38	5	2.38
	½	2.27		
132,221	1	2.22	2	2.21
231	5	2.10	3	2.09
142			1	2.04
	1	1.920	3	1.907
	1	1.836	3	1.833
			1	1.799
	7	1.778	7	1.774

Table 4 (Cont'd)

	Bernic Lake A-798L		Quixeramobim, Brazil (Tavora, 1955) ASTM 7-64	
hkl	I	d,Å	I	d,Å
	7	1.747	7	1.740
	8	1.729	9	1.724
	6	1.560	5	1.541
	½	1.529		
	1	1.496	2	1.488
	1	1.478		
	9	1.466	7	1.461
	½	1.442		
	5	1.386	2	1.379

#2094S: East end of Bernic Lake.

Black, sub-metallic, massive to tabular crystals. It is associated with pink feldspar.

#2019S, 2121S: Huron Claim.

Black, sub-metallic, prismatic to massive. It is associated with pink feldspar.

X-ray powder data for tantalite are given in Table 4, where they are compared with the data given by Tavora (1955) (A.S.T.M. 7-64), and a photograph of this tantalite is given as Figure 6. All five tantalite specimens described above gave identical X-ray powder patterns.

A chemical analysis of tantalite (A-798L) (Fig. 6) was made by Montgary Minerals Limited and kindly made available to the author. This sample yielded 65% Ta_2O_5, 15% Nb_2O_5, 15% MnO and very low FeO (less than 0.5%). They suggested that this mineral must be a mangan-tantalite and that it is probably closer to the theoretical end-member that is known anywhere.

III 7. WODGINITE $(Ta,Nb,Sn_{2x})_2(Mn,Fe,Sn_x)O_6$?

This recently discovered mineral, originally called a stanniferous tantalite, is known in this study only from Bernic Lake where it occurs in perthitic microclines and aplitic albites. The type locality for wodginite, which is the only other reported occurrence of this mineral, is at Wodgina, Australia, (Nickel, 1961; Nickel, Rowland and McAdam, 1962).

Hand specimen descriptions:

#2342L: Chemalloy Mine, Bernic Lake. (Fig. 7)

Brownish black, slightly reddish in part, massive. It is associated with microcline.

#2071S: Chemalloy Mine, Bernic Lake.

As above but with some wedge-shaped crystals.

#A-384S: Chemalloy Mine, Bernic Lake.

Black, sub-metallic, short, poorly developed prismatic crystals, radiating form.

X-ray powder data for wodginite are given in Table 5, where they are compared with the data given by Nickel (1962) for wodginite from Bernic Lake and from Wodgina, Australia. A photograph of wodginite is given as Figure 7. All three specimens described above gave identical X-ray powder patterns.

A chemical analysis of wodginite (2342L) (Fig. 7) was made by Montgary Minerals Limited and kindly made available to the writer. This analysis yielded 60% Ta_2O_5, only 3-5% Nb_2O_5, 15% MnO with very low FeO but with 15% SnO_2. At first this mineral was thought to be a tapiolite by Montgary Minerals Limited (Mr. R. W. Hutchinson, personal communication), but on the basis of the chemical analysis it was then thought to be an ixiolite, again very nearly a Mn end member. In Table 6 X-ray powder data for wodginite (2342L) (Fig. 7) may be compared with that given by the writer for tantalite (A-798L) (Fig. 6), also that given by Hutton (1958) for tapiolite and with that given by the writer for ixiolite (A-524L)

Table 5

X-ray Powder Data for Wodginite

Monoclinic C^{2}/c, a = 9.58 Å, b = 11.42 Å, c = 5.10 Å, = 91°0' (Bristol)

	Bernic Lake 2342 L		Bernic Lake (Nickel,1961)		Wodgina,Australia (Nickel et al,1962)	
hkl	I	d,Å	I	d,Å	I	d,Å
110	2	7.32	tr	7.29	11	7.22
020	2	5.68	tr	5.69	4	5.71
200	4	4.73	3	4.73	11	4.76
$\bar{1}11$	2	4.21	tr	4.20	2	4.21
111	2	4.14	tr	4.15	3	4.16
	1	4.01				
021	3	3.80	3	3.80	10	3.81
220	9	3.65	5	3.64	70	3.67
130	1	3.53	tr	3.53	2	3.60
	1	3.33				
	1	3.30				
	1	3.25				
$\bar{2}21$	10	2.99	10	2.98	100	3.00
221	10	2.94	10	2.95	70	2.95
040	4	2.86	3	2.85	25	2.87
	1	2.75				
$\bar{3}11$					1	2.66
311					1	2.60

Table 5 (Cont'd)

	Bernic Lake 2342 L		Bernic Lake (Nickel,1961)		Wodgina,Australia (Nickel et al,1962)	
hkl	I	d,Å	I	d,Å	I	d,Å
002	5	2.55	4	2.55	21	2.55
041	8	2.49	5	2.49	29	2.50
240,330	1	2.45	tr	2.45	1	2.45
112					10	2.40
400	5	2.37	4	2.37	10	2.38
$\bar{2}02$	3	2.26	2	2.26	4	2.268
240	5	2.20	3	2.20	8	2.200
$\bar{2}22$	3	2.10	2	2.10	8	2.113
222	3	2.08	2	2.08	8	2.077
$\bar{4}21$	½	2.03	tr	2.02	1	2.030
421	2B	1.998	1	1.998	2	2.004
$\bar{3}12$					1	1.966
312					1	1.933
042	6	1.908	4	1.905	11	1.906
440	6	1.827	4	1.824	14	1.831
$\bar{2}42,\bar{3}32$					1	1.780
260	9	1.772	6	1.767	27	1.774
$\bar{4}02$	6	1.754	4	1.750	13	1.760
332					1	1.747
$\bar{4}41$,402	8	1.726	6	1.723	B	1.733
441	7	1.712	5	1.711		1.715

Table 5 (Cont'd)

	Bernic Lake 2342 L		Bernic Lake (Nickel,1961)		Wodgina,Australia (Nickel et al,1962)	
hkl	I	d,Å	I	d,Å	I	d,Å
	1	1.678	tr	1.672		
	1	1.651				
	1	1.633				
	6	1.553	5	1.549		
	5	1.538	4	1.535		
	1	1.527	1	1.524		
	3	1.498	2	1.493		
	1	1.489				
	2	1.478	1	1.476		
	8B	1.469 1.462	4	1.463		
	8	1.453	4	1.449		
	2	1.434	1	1.429		
	7	1.380	4	1.376		
	1	1.356	tr	1.354		
	2	1.344	tr	1.339		
	1	1.337	tr	1.333		
	3B	1.322	1	1.316		
	2	1.300	2	1.298		
	1	1.292				
	4	1.279	2	1.276		

Table 5 (Cont'd)

	Bernic Lake 2342 L		Bernic Lake (Nickel,1961)		Wodgina,Australia (Nickel et al,1962)	
hkl	I	d,Å	I	d,Å	I	d,Å
	3	1.257	2	1.252		
	1	1.248				
	3	1.239	2	1.237		
	1	1.227				
	6	1.219	3	1.217		

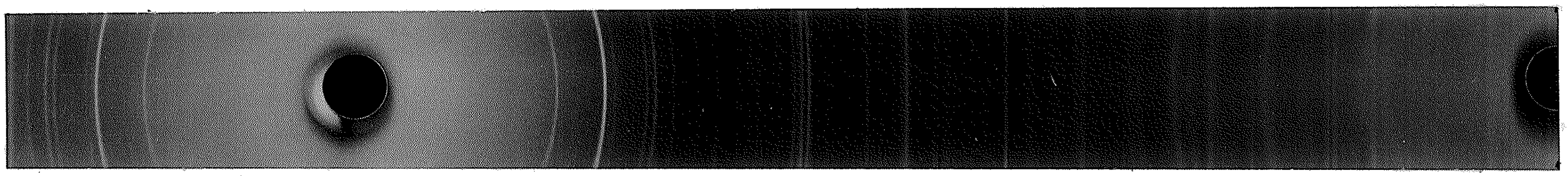

Figure 6. A-798L, Chemalloy Mine, Bernic Lake: Tantalite.
Fe/Mn radiation, 114.83 mm. camera.

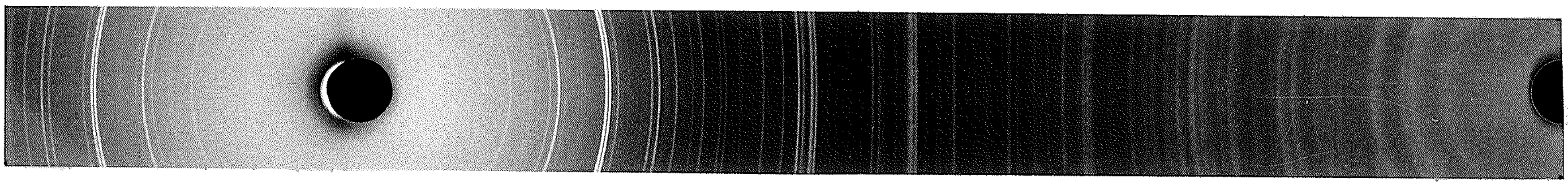

Figure 7. 2342L, Chemalloy Mine, Bernic Lake: Wodginite.
Fe/Mn radiation, 114.83 mm. camera.

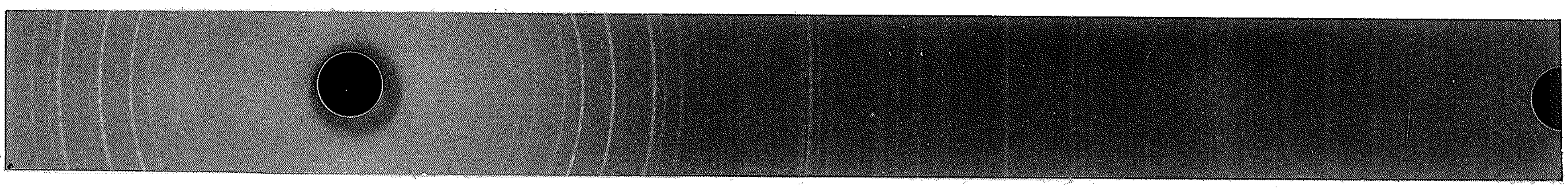

Figure 8. A-524L, Skogbole, Finland: Ixiolite.
Fe/Mn radiation, 114.83 mm. camera.

Table 6

X-ray Powder Data for Wodginite and Related Minerals

Wodginite Bernic Lake 2342 L		Tantalite Bernic Lake A-798 L		Tapiolite Westland, New Zealand (Hutton, 1958)		Ixiolite Skogbole, Finland A-524 L	
I	d,Å	I	d,Å	I	d,Å	I	d,Å
2	7.32						
2	5.68						
4	4.73			2	4.62	1	4.59
2	4.21			3	4.22	3	4.21
2	4.14						
1	4.01						
3	3.80						
9	3.65	7	3.65			5	3.64
1	3.53						
1	3.33	1	3.33	10	3.37	9	3.36
1	3.30						
1	3.25						
10	2.99	10	2.99			10	2.97
10	2.94						
4	2.86	1	2.87			½	2.85
1	2.75			2	2.71	½	2.70
5	2.55	5	2.58	9	2.58	9	2.58
8	2.49	6	2.51			5	2.49

Table 6 (Cont'd)

Wodginite Bernic Lake 2342 L		Tantalite Bernic Lake A-798 L		Tapiolite Westland, New Zealand (Hutton, 1958)		Ixiolite Skogbole, Finland A-524 L	
I	d,Å	I	d,Å	I	d,Å	I	d,Å
1	2.45						
5	2.37	4	2.38	5	2.375	6	2.38
3	2.26	½	2.27	2	2.265	½	2.26
5	2.20	1	2.22			½	2.20
				1	2.125		
3	2.10	5	2.11	1	2.114	1	2.10
3	2.08			2	2.070	½	2.07
½	2.03						
2B	1.998						
				½	1.930		
6	1.908	1	1.920	½	1.900	1	1.908
6	1.827	1	1.836			1	1.818
9	1.772	7	1.778				
						3	1.766
6	1.754	7	1.747	9	1.747	8	1.749
8	1.726	8	1.729	½	1.716	5	1.718
7	1.712						
1	1.678			5	1.677	5	1.681
1	1.651			½	1.652	3	1.643
1	1.633						

Table 6 (Cont'd)

Wodginite Bernic Lake 2342 L		Tantalite Bernic Lake A-798 L		Tapiolite Westland, New Zealand (Hutton, 1958)		Ixiolite Skogbole, Finland A-524 L	
I	d,Å	I	d,Å	I	d,Å	I	d,Å
				1	1.577	1	1.580
6	1.553	6	1.560	½	1.560	3	1.550
5	1.538			2	1.534	½	1.538
1	1.527	½	1.529				
3	1.498	1	1.496	5	1.501	4	1.504
1	1.489					½	1.489
2	1.478	1	1.478				
8B	1.469 1.462	9	1.466			½	1.468
8	1.453	½	1.442			4	1.455
2	1.434			1	1.429	1	1.431
				5	1.407	3	1.410
				5	1.395	2	1.397
7	1.380	5	1.386			1	1.378

(Fig. 8). No cassiterite lines are present to account for the high tin content.

Wodginite was originally thought to be a stanniferous tantalite (Nickel, 1961) but on the basis of a single crystal X-ray analysis, it is now considered to be a new mineral (Nickel et al, 1962). Independent single-crystal precession work by the writer confirmed the following crystal data for wodginite:

		Nickel et al (1962)	Writer
Crystal System		Monoclinic	Monoclinic
Space Group		C2/c or Cc	-
Cell dimensions	a	9.47 Å	9.58 Å
	b	11.42 Å	11.42 Å
	c	5.09 Å	5.10 Å
		91°02'	91°0'
Cleavage		-	$\bar{1}01$
Density		7.36	-
Cell content		557.4 A^3	-

<u>III 8. EUXENITE-POLYCRASE</u> $(Y,Er,Ce,U,Pb,Ca)(Ti,Nb,Ta)_2(O,OH)_6$

Euxenite-polycrase in association with columbite has been noted from the Huron claim south of the Winnipeg River and has also been found in the pegmatites of Shatford Lake (Davies, 1957).

In this study two specimens of euxenite were obtained. One specimen identified in the hand specimen as euxenite, which came from the east end of Bernic Lake, produced an X-ray powder photograph for tantalite (2094S). Another specimen thought to be euxenite from the pegmatites of Shatford Lake, produced an X-ray powder photograph without lines, which is characteristic of metamict minerals. However, not enough of this mineral was left to do any further work.

CHAPTER IV

HALIDES

Only one halide has been reported from the pegmatites of southeastern Manitoba:

Fluorite CaF_2

IV 1. FLUORITE CaF_2

Purple fluorite has been reported from the Eagle claim at Cat Lake where it occurs as small crystals and it has also been noted from the pegmatites of the Winnipeg River on the Silverleaf claim, and at Shatford Lake (Springer, 1950; Davies, 1957). However none of this material was available for the present study.

CHAPTER V

CARBONATES

The following carbonates have been reported from the pegmatites of southeastern Manitoba:

Calcite $CaCO_3$

Rhodochrosite $MnCO_3$

X-ray photographs of the specimens available to the writer revealed the following carbonate:

Rhodochrosite

V 1. CALCITE $CaCO_3$

Calcite has been reported associated with fluorite on the Silverleaf claim south of the Winnipeg River (Davies 1957) but none of this material was available to the author for study.

V 2. RHODOCHROSITE $MnCO_3$

Rhodochrosite has been mentioned by Brimstead (1960) as occurring at Bernic Lake and one such specimen from the Chemalloy mine at Bernic Lake was obtained for X-ray analysis.

Hand specimen description:

#A-340S: Chemalloy Mine, Bernic Lake. (Fig. 9)

Pink, transparent to translucent, coarsely granular, brittle, rhombohedral

$\{10\bar{1}1\}$ cleavage. X-ray powder data for this rhodochrosite are given in Table 7, where they are compared with those given by Swanson, Gilfrich and Cook (1957). One relatively weak line at 3.47 Å could not be accounted for. It is not the K_β for the strong line with spacing 2.84 Å. A photograph of this rhodochrosite appears as Figure 9.

Table 7

X-ray Powder Data for Rhodochrosite

Hexagonal $R\bar{3}c$, a = 4.777 Å, c = 15.67 Å (Swanson et al, 1957)

	Bernic Lake A-340 S		(Swanson et al,1957)	
hkl	I	d,Å	I	d,Å
012	5	3.52	3	3.66
	1	3.47		
104	10	2.84	10	2.84
110	4	2.39	2	2.39
113	4	2.16	3	2.172
202	4	1.99	2	2.000
024	2	1.83	1	1.829
018	8	1.77	3	1.770
116			3	1.763
211			½	1.556
122	2	1.51	1	1.533
214	2	1.45	½	1.452
208			½	1.423
030	2	1.38	1	1.379
0.0.12	2	1.33	½	1.306

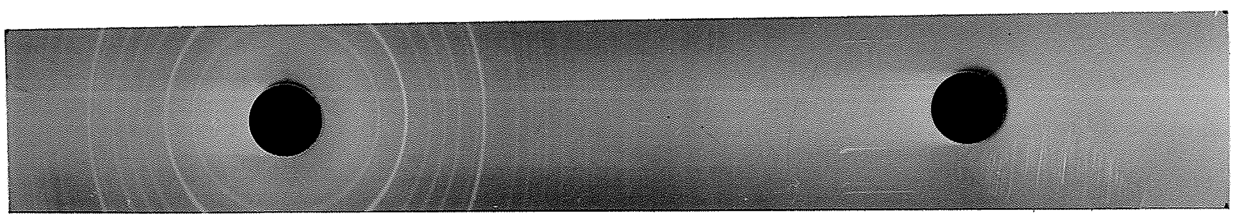

Figure 9. A-340S, Chemalloy Mine, Bernic Lake: Rhodochrosite.
Cu/Ni radiation, 57.54 mm. camera.

CHAPTER VI

PHOSPHATES

The following phosphate minerals have been reported from the pegmatites of southeastern Manitoba:

Triphylite $LiFe(PO_4)$

Lithiophilite $LiMn(PO_4)$

Purpurite $(Mn^{+3},Fe^{+3})(PO_4)$

Monazite $(Ce,La,Y,Th)(PO_4)$

Amblygonite $(Li,Na)Al(PO_4)(F,OH)$

Montebrasite $(Li,Na)Al(PO_4)(OH,F)$

Apatite $Ca_5(PO_4)_3(F,OH,Cl)$

X-ray photographs of the specimens available to the writer revealed the following minerals:

Triphylite-lithiophilite group and the two closely related groups:

Sicklerite series

Heterosite series which includes purpurite

Amblygonite-montebrasite

Apatite

Because of the very close relationship of the first three of these groups to each other, they are all treated together immediately following.

VI 1. TRIPHYLITE GROUP

VI 1a. TRIPHYLITE $LiFe(PO_4)$

VI 1b. LITHIOPHILITE $LiMn(PO_4)$

VI 2. SICKLERITE SERIES

VI 2a. FERRI-SICKLERITE $(Li,Fe^{+3},Mn^{+2})(PO_4)$

VI 2b. SICKLERITE $(Li,Mn^{+2},Fe^{+3})(PO_4)$

VI 3. HETEROSITE SERIES

VI 3a. HETEROSITE $(Fe^{+3},Mn^{+3})(PO_4)$

VI 3b. PURPURITE $(Mn^{+3},Fe^{+3})(PO_4)$

According to Palache, Berman and Frondel (1951) a complete series by mutual substitution of Fe^{+2} and Mn^{+2} extends between triphylite and lithiophilite. These minerals are however, relatively unstable and they may undergo alteration, first by the oxidation of Fe^{+2} to Fe^{+3}, to produce the minerals of the Heterosite series. During oxidation Li is leached concomitantly to effect valence compensation. These oxidation processes are not accompanied by marked changes in crystal structure and this is why these minerals can properly be discussed as a group, rather than as individuals.

Triphylite has been found in small crystals from the old Jack Nutt mine north of Bernic Lake. Numerous small dykes east of Bernic Lake are characterised by phosphate minerals including purpurite and triphylite, where they are associated with spodumene, lepidolite and amblygonite. On the east side of Buck claim triphylite occurs in large grey-green masses up to one foot across. Triphylite and purpurite occur in small amounts with spodumene, amblygonite and beryl on the old Stannite and Rush claims, north and west of Rush Lake. On the west side of the Buck claim, east of Bernic Lake, deep purple purpurite is associated with spodumene and amblygonite. Triphylite occurs with mica and blue apatite on the Coe claim at the east end of Bernic Lake. Lithiophilite has been reported from the Silverleaf claim, south of the Winnipeg River (Springer 1948, 1950; Davies 1955, 1957).

Eight specimens were available in this study, seven from the east end of Bernic Lake and one from the Chemalloy mine at Bernic Lake.

Hand specimen descriptions:

#A-403L (2050S): East end of Bernic Lake. (Fig. 10) (Fig. 12)
Vitreous, bluish-grey, translucent, surface altered to a black earthy mineral. X-ray identification: Triphylite-lithiophilite.

#17253L: Chemalloy Mine, Bernic Lake.
Brown, vitreous, translucent, in cleavable masses. X-ray identification: Triphylite-lithiophilite.

#2101S: East end of Bernic Lake. (Fig. 13)
Black, earthy to flaky, brown streak. X-ray identification: Sicklerite.

#A-405L: East end of Bernic Lake. (Fig. 15)
Black, earthy, purplish-brown streak, opaque. X-ray identification: Sicklerite and/or Heterosite-purpurite.

#2017S: East end of Bernic Lake.
Black, earthy, opaque, brown streak. This specimen has a core of the original crystal of yellowish-brown triphylite-lithiophilite. X-ray identification: Sicklerite and/or Heterosite-purpurite.

#2079S: East end of Bernic Lake.

Black to purplish, opaque, earthy to flaky, light brown streak. X-ray identification: Sicklerite and/or Heterosite-purpurite.

#A-404L: East end of Bernic Lake. (Fig. 14)

Dark brown, opaque, brown streak, massive. X-ray identification: Heterosite-purpurite?

#A-406L: East end of Bernic Lake. (Fig. 11)

Purplish to black, opaque, purple streak, flaky to earthy. X-ray identification: Mixture of Triphylite-lithiophilite and Heterosite-purpurite.

X-ray powder data for specimen #A-403L (2050S) are presented in Table 8, where they are compared with that of Quensel (1957) for a chemically analysed triphylite, of Volborth (1955) for a chemically analysed lithiophilite, and of Correia Neves (1960) for another chemically analysed lithiophilite, and a photograph of this triphylite-lithiophilite appears as Figure 10. Specimens # 2101S and 17253L gave powder patterns identical with that for #A-403L (2050S). A chemical analysis would be necessary to determine the position of these three minerals in the triphylite-lithiophilite series.

The hand specimen appearance of #2101S suggests it may be a different mineral from triphylite-lithiophilite. This mineral, therefore, is a sicklerite, which has been produced by alteration from triphylite-lithiophilite with little or no change in structure. Figure 12 and 13 show the similarity between the X-ray powder pattern for triphylite-lithiophilite

Table 8

X-ray Powder Data for Triphylite-Lithiophilite

Triphylite - Orthorhombic Pmcn, a = 6.04, b = 10.39, c = 4.72 (Quensel, 1957)

Triphylite Varutrask(Sweden) Quensel,1957	East of Bernic Lake A-403L		Triphylite Varutrask(Sweden) (Quensel,1957) ASTM 11-456		Lithiophilite Viitaniemi(Finland) (Volborth,1955)		Lithiophilite Quinta da Rebeira (Correia Neves,1960)	
hkl	I	d,Å	I	d,Å	I	d,Å	I	d,Å
020,110	2	5.11	3	5.22	4	5.21	2	5.20
011	7	4.25	9	4.29	8	4.26	8	4.32
120	3	3.89	3	3.95	3	3.94	3	3.96
	1	3.67			2	3.72	1	3.73
111,021	7	3.48	9	3.51	8	3.50	9	3.51
	3	3.32	1	3.33	4	3.33		
200,121	8	3.00	9	3.03	8	3.02	9	3.02
031	4	2.77	4	2.79	3	2.79	3	2.80
131,201	10	2.51	10	2.54	8	2.53	10	2.54
211	4	2.45	2	2.47	2	2.48	2	2.48

Table 8 (Cont'd)

Triphylite Varutrask(Sweden) Quensel,1957	East of Bernic Lake A-403L		Triphylite Varutrask(Sweden) (Quensel,1957) ASTM 11-456		Lithiophilite Viitaniemi(Finland) (Volborth,1955)		Lithiophilite Quinta da Rebeira (Correia Neves,1960)	
hkl	I	d,Å	I	d,Å	I	d,Å	I	d,Å
140	3	2.37	1	2.39	2	2.38	2	2.39
221	3B	2.27	2	2.29	4B	2.28	4B	2.28
112,021	4	2.14	1	2.15	2	2.14	3	2.16
	½	2.05						
	½	2.02						
132,202	1	1.851	1	1.86	2	1.86	1	1.865
151,241	1	1.822	1	1.81	3B	1.81	1	1.830
222,042	7	1.745	5	1.75	5	1.74	5	1.752
							1	1.682
	3	1.671	1	1.67	4B	1.67	1	1.670
	3	1.658						
	5	1.631	1	1.63	3	1.63	2	1.640
	2	1.587	1	1.59	3	1.59	1	1.598
	7B	1.503	4	1.51	6	1.51	6B	1.513

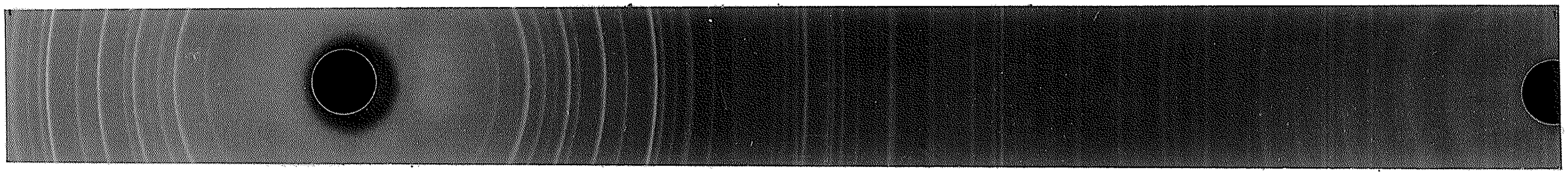

Figure 10. A-403L, East end of Bernic Lake: Triphylite-lithiophilite. Fe/Mn radiation, 114.83 mm. camera.

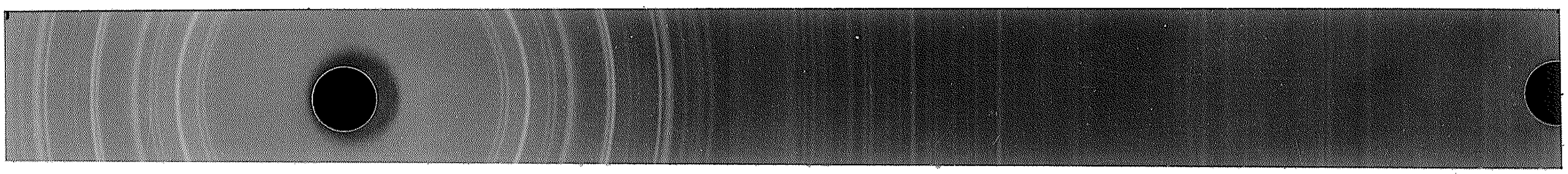

Figure 11. A-406L, East end of Bernic Lake: Mixture of Triphylite-lithiophilite and Heterosite-purpurite. Fe/Mn radiation, 114.83 mm. camera.

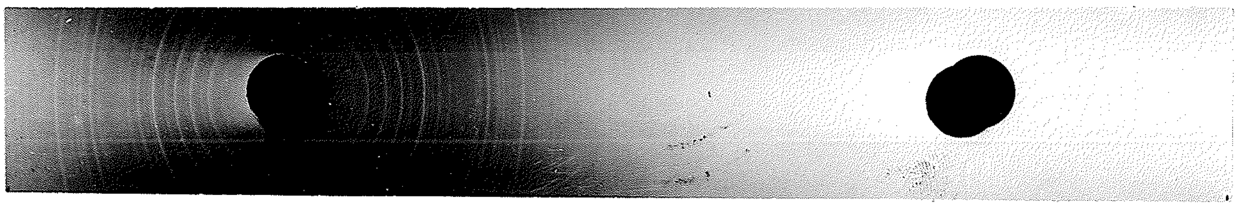

Figure 12. 2050S, East end of Bernic Lake: Triphylite-lithiophilite. Cu/Ni radiation, 57.54 mm. camera.

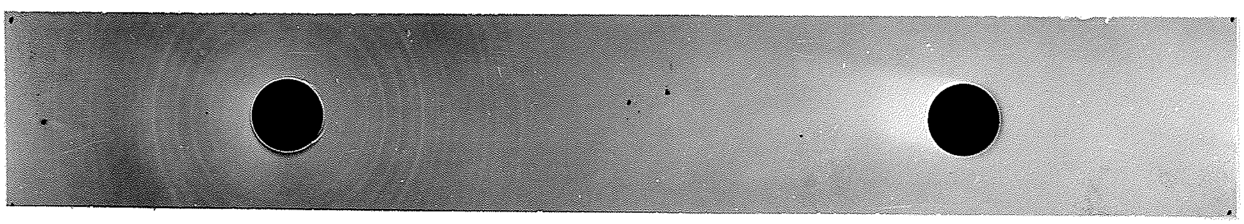

Figure 13. 2101S, East end of Bernic Lake: Sicklerite. Cu/Ni radiation, 57.54 mm. camera.

(2050S) and sicklerite (2101S). According to Quensel (1957) sicklerite has the same structure as triphylite-lithiophilite. The close similarity of the data for triphylite-lithiophilite given in Table 8 with those for ferri-sicklerite given in Table 9 appears to confirm the close similarity of the structure.

The remaining five minerals gave three different patterns, with A-405L, 2017S, 2079S giving identical patterns. X-ray powder data for A-404L and A-405L are given in Table 9, where they are compared with those given by Quensel (1957) for a chemically analysed ferri-sicklerite and heterosite, and those given by Correia Neves (1960) for a chemically analysed purpurite. The presence of an additional weak line at 3.33 Å on A-404L may be due to a minor amount of quartz or to minute quantities of unaltered triphylite-lithiophilite in the specimen. Since all the possible alteration products may be found in a single mineral specimen, it is quite possible that more than one phase may be present in a given sample. The ambiguity of the example illustrated by the photograph given as Figure 11 which exhibits characteristics of both triphylite-lithiophilite and heterosite-purpurite, is probably due to this cause. Note the similarity between this photograph and those shown as Figure 10, 11, 12, and 13, indicating the close similarity in structure.

Further work of a chemical and structural nature is warranted on all the minerals of the triphylite-lithiophilite group and its alteration products - sicklerite and heterosite-purpurite.

Table 9

X-ray Powder Data for Ferri-sicklerite, Heterosite, and Purpurite

Ferri-sicklerite - Orthorhombic Pmcn, a = 5.95, b = 10.10, c = 4.80 (Quensel, 1957)

Heterosite - Orthorhombic Pmcn, a = 5.83, b = 9.70, c = 4.77 (Quensel, 1957)

Heterosite-Purpurite? East of Bernic Lake A-404L		Sicklerite or Heterosite-Purpurite? East of Bernic Lake A-405L		Ferri-sicklerite Varutrask(Sweden) (Quensel,1957) ASTM 11-455			Heterosite Varutrask(Sweden) (Quensel,1957) ASTM 11-457			Purpurite Sahagal,Guarda (Correia Neves,1960)		
I	d,Å	I	d,Å	hkl	I	d,Å	hkl	I	d,Å	hkl	I	d,Å
5	6.24							4	6.28			
5	5.46							1	5.51			
5	5.05	6	5.03	020,110	4	5.04	020	2½	4.85	002	3	4.961
9	4.30	7	4.34	011	9	4.35	011	7½	4.29	011	7	4.369
6	3.86	6	3.84	120	2	3.83	120?	4	3.87			
1	3.73	2	3.73							102	1½	3.776
10	3.49	8	3.49	111,021	9	3.48	111	10	3.48	111	4	3.469
7	3.33											
5	3.08							2½	3.06			

Table 9 (Cont'd)

Heterosite-Purpurite? East of Bernic Lake A-404L		Sicklerite or Heterosite-Purpurite? East of Bernic Lake A-405L		Ferri-sicklerite Varutrask(Sweden) (Quensel,1957) ASTM 11-455			Heterosite Varutrask(Sweden) (Quensel,1957) ASTM 11-457			Purpurite Sahagal,Guarda (Correia Neves,1960)		
I	d,Å	I	d,Å	hkl	I	d,Å	hkl	I	d,Å	hkl	I	d,Å
8	2.98	10	2.97	121,130	9	2.96	200,121	5	2.93	112	10	2.952
		1	2.91									
7	2.73	3	2.78	031	2	2.75	031	7½	2.73	013	1	2.702
9	2.50	10	2.50	131	10	2.50	220	1	2.51			
7	2.46	7	2.45	211	3	2.45	040,131	4	2.43	113	10	2.448
3	2.33	4	2.32		1	2.33	012	1	2.32	104	1	2.339
3	2.27	3	2.26									
					1	2.25						
3	2.24	3	2.23							212	1	2.237
4	2.16	3	2.17		1	2.17	230,112	1	2.16	203	2	2.174
½	2.03	1	2.03							122	1	2.023
										213	1	1.979
1	1.866	4	1.869		1	1.87				220	1	1.859
		1	1.837									

Table 9 (Cont'd)

Heterosite-Purpurite? East of Bernic Lake A-404L		Sicklerite or Heterosite-Purpurite? East of Bernic Lake A-405L		Ferri-sicklerite Varutrask(Sweden) (Quensel,1957) ASTM 11-455			Heterosite Varutrask(Sweden) (Quensel,1957) ASTM 11-457			Purpurite Sahagal,Guarda (Correia Neves,1960)		
I	d,Å	I	d,Å	hkl	I	d,Å	hkl	I	d,Å	hkl	I	d,Å
1	1.812	4	1.810		1	1.80				221	2	1.823
		1	1.781							311	1	1.778
7	1.753	5	1.756		2	1.75						
1	1.726	4	1.726							222	$1\frac{1}{2}$	1.736
2	1.671	5	1.673		1	1.67				312	2	1.697
3	1.632									124	1	1.640
3	1.616	7B	1.617		3	1.61						
										031	2	1.575
		4	1.566		1	1.56						
										106	2	1.558
		1	1.532							304	1	1.523
		6	1.486		1	1.48						
		4	1.462					$2\frac{1}{2}$	1.46	132	5	1.466

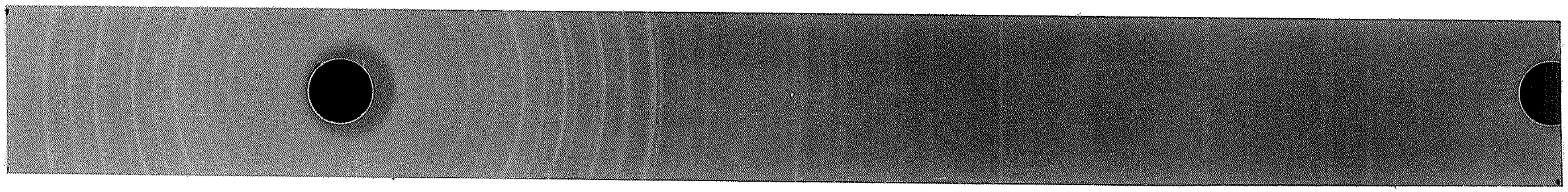

Figure 14. A-404L, East end of Bernic Lake: Heterosite-purpurite?
Fe/Mn radiation, 114.83 mm. camera.

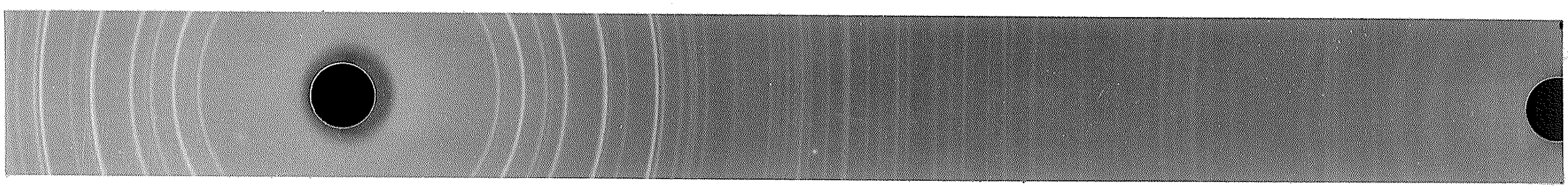

Figure 15. A-405L, East end of Bernic Lake: Sicklerite and/or
Heterosite-purpurite?
Fe/Mn radiation, 114.83 mm. camera.

VI 4. MONAZITE (Ce,La,Th)(PO_4)

Monazite in association with tantalite and uraninite has been reported from the Huron claim, south of the Winnipeg River, and it has also been noted from Shatford and Ryerson Lakes. At Shatford Lake monazite occurs as reddish- to greyish-brown crystals up to eight or ten inches across, associated with zinnwaldite, lithium micas, tantalite, topaz, fluorite, and euxenite. Most of this material has been removed from the pegmatites (Springer, 1950; Davies, 1957), and none of this material was available to the writer for study.

VI 5. AMBLYGONITE (Li,Na)Al(PO_4)(F,OH)

Amblygonite occurs at the north end of Bernic Lake in a quartz zone in association with spodumene, lepidolite and triphylite, and at the east end of the lake in small dykes characterised by phosphate minerals. In the latter area, on the Buck claim, amblygonite has been found in large crystals up to six inches across associated with platy albite and in the centre of a dyke on the west side of this claim it is found associated with spodumene. North and west of Rush Lake on the old Stannite and Rush claims, amblygonite has been reported with spodumene, beryl and triphylite. Montebrasite, hydroxy-amblygonite, has been reported by Stockwell from the Silverleaf claim south of the Winnipeg River (Springer, 1949; Davies, 1955, 1957).

Four amblygonite specimens were available to the writer, three from the pegmatites east of Bernic Lake, and one from the Chemalloy mine at Bernic Lake.

Hand specimen descriptions:

#2004S: East of Bernic Lake.

Pale green to milky, opaque, vitreous, brittle.

#2006S: East of Bernic Lake.

Milky white, opaque to translucent, vitreous, brittle.

#2080S: East of Bernic Lake.

White, opaque. It is associated with feldspar with a thin red reaction border between the amblygonite and the feldspar.

#A-338S (A-408L): Chemalloy Mine, Bernic Lake. (Fig. 16, 17).

White, opaque to translucent, vitreous, brittle. It is associated with quartz with a black reaction border between the quartz and the amblygonite.

All four specimens gave identical powder patterns and X-ray powder data for A-338S are given in Table 10, where they are compared with those given in the ASTM card #8-102 and a photograph of this amblygonite appears as Figure 16 (A-338S) and Figure 17 (A-408L). One additional weak line at 2.80 Å could not be accounted for. A number of additional reflections on the ASTM card did not show on the pattern, possibly because the writer's photograph had a shorter exposure time than Murdoch's.

Amblygonite is the F end-member and montebrasite the hydroxyl end-member of a series, and both give identical powder spacings with some slight differences in the intensities of the lines (Fisher, 1958). The intensities of the lines on the powder pattern given in Table 10 agree to a certain extent with those of Fisher for both amblygonite and

Table 10

X-ray Powder Data for Amblygonite

Triclinic $P\bar{1}$, a = 5.19, b = 7.12, c = 5.04, α = 112°02.5',
β = 97°495', γ = 68°07.5' (Murdoch)

	Bernic Lake A-338 S		Brazil (Murdoch ASTM 8-102)	
hkl	I	d,Å	I	d,Å
010	½	6.46	½	6.17
			½	5.10
001,0$\bar{1}$1	10	4.65	10	4.64
$\bar{1}\bar{1}$1	1	3.86	1	3.86
$\bar{1}$01,101			½	3.36
1$\bar{1}$0	4	3.31	3	3.31
011,$\bar{1}$21			3	3.24
120,0$\bar{2}$1 020	10	3.15	10	3.151
1$\bar{1}$1,111	9	2.97	10	2.925
	½	2.80		
210	3	2.56	1	2.565
0$\bar{1}$2	4	2.50	2	2.500
$\bar{1}$11			½	2.449
200,$\bar{2}$11 $\bar{2}\bar{2}$1	6	2.38	5	2.386
002			1	2.334
	1B	2.30	1	2.286
			½	2.242

Table 10 (Cont'd)

	Bernic Lake A-338 S		Brazil (Murdoch ASTM 8-102)	
hkl	I	d,Å	I	d,Å
	1	2.19	1	2.190
	5	2.11	4	2.106
	1	2.04	1	2.045
			½	1.993
	6	1.945	4	1.944
	4	1.899	3	1.898
	½	1.834	½	1.829
	1	1.795	1	1.792
	4	1.74	3	1.740
	2B	1.655	1	1.658
	5	1.618	3	1.617
	3B	1.583	3	1.587
	1	1.544	1	1.540
	1	1.526	1	1.523
	2	1.482	2	1.479
	1	1.465	1	1.458
	2B	1.437	1	1.429
	2	1.41	½	1.418
			1	1.401
	1	1.384	1	1.381
			½	1.352
			½	1.326
	1	1.310	1	1.307

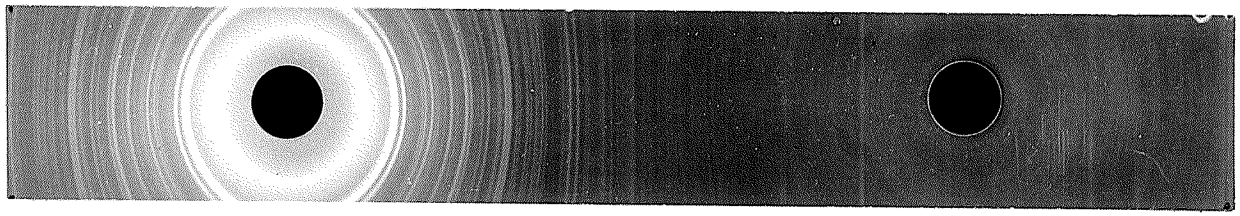

Figure 16. A-338S, Chemalloy Mine, Bernic Lake: Amblygonite. Cu/Ni radiation, 57.54 mm. camera.

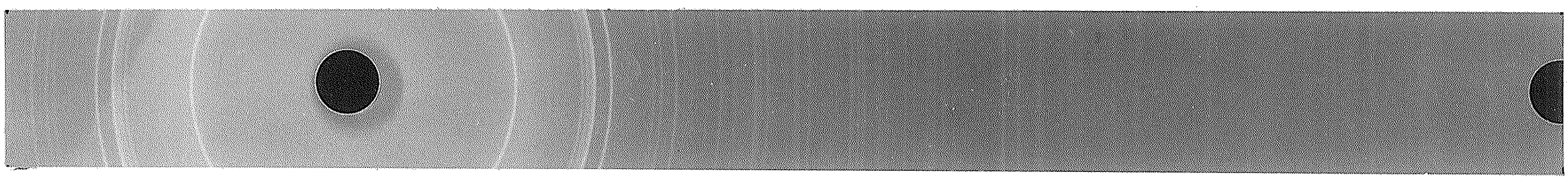

Figure 17. A-408L, Chemalloy Mine, Bernic Lake: Amblygonite. Fe/Mn radiation, 114.83 mm. camera.

montebrasite, and it would obviously require chemical analyses or optical work to determine the positions of these four specimens in the amblygonite-montebrasite series.

VI 6. BRAZILIANITE $NaAl_3(PO_4)_2(OH)_4$

A vug in one of the hand specimens from the Chemalloy mine at Bernic Lake contained a few minute colorless crystals which appeared to be quartz, but which gave an X-ray powder pattern very similar to that of the rare phosphate brazilianite.

Hand specimen description:

#A-387L (A-509S): Chemalloy Mine, Bernic Lake. (Fig. 18 and 19). Small colorless crystals about 0.5 mm. across, found in vug with white spodumene and pink apatite.

X-ray powder data for this mineral are given in Table 11, where they are compared with those for brazilianite given by Frondel and Lindberg (1948) (ASTM 6-0136), and an X-ray powder photograph of this mineral are given as Figure 18 and 19. There is fairly good agreement between the measured spacings and the visually estimated intensities, but unfortunately not enough of this material could be obtained to carry out further tests such as optical and chemical. Differences between the two patterns may be due to chemical differences in the two specimens and to the presence of some quartz and possibly microcline in the writer's sample, which would account for the writer's stronger line at 3.34 Å and for her additional line at 3.24 Å respectively. A search of the ASTM card index showed that

Table 11

X-ray Powder Data for Brazilianite

Monoclinic $P2_1/n$, a = 11.19, b = 10.08, c = 7.06, β = 97°22'
(Hurlbut and Weichel, 1946)

Chemalloy Mine, Bernic Lake A-509 L		New Hampshire (Frondel et al,1948) (ASTM 6-0136)	
I	d,Å	I	d,Å
5	6.28	3	5.84
1	5.13		
7	5.00	10	5.04
5	4.50	1	4.62
1	4.24	1	4.21
		4	3.77
4	3.50	1	3.48
2	3.42		
6	3.34	3	3.30
4	3.24		
10	3.135	2	3.16
9B	3.03	8	2.98
4	2.86	7	2.87
4	2.81	1	2.80
½	2.78		
9B	2.71	8	2.73

Table 11 (Cont'd)

Chemalloy Mine, Bernic Lake A-509 L		New Hampshire (Frondel et al,1948) (ASTM 6-0136)	
I	d,Å	I	d,Å
9	2.67	8	2.68
2	2.58	3	2.61
4	2.54	3	2.47
		2	2.41
		1	2.34
3	2.29	1	2.30
5	2.23	1	2.23
3	2.19	2	2.17
2	2.11	1	2.11
2	2.08		
2	2.06	4	2.05
		3	2.01
2	1.967	4	1.98
		3	1.93
3	1.867	2	1.85
4	1.837	1	1.82
4	1.757	3	1.75
1	1.712	2	1.72
4	1.695		
7	1.667	1	1.66

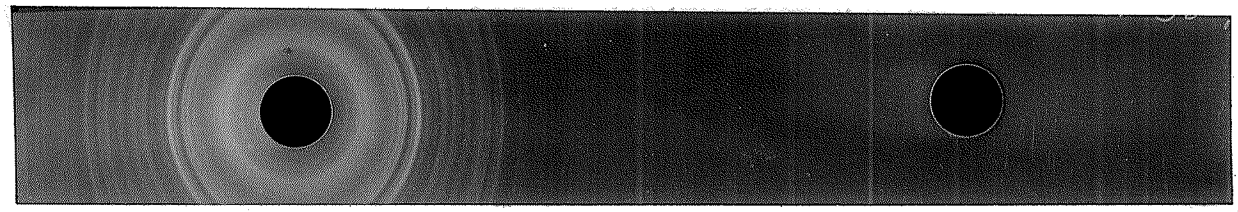

Figure 18. A-387S, Chemalloy Mine, Bernic Lake: Brazilianite?
Cu/Ni radiation, 57.54 mm. camera.

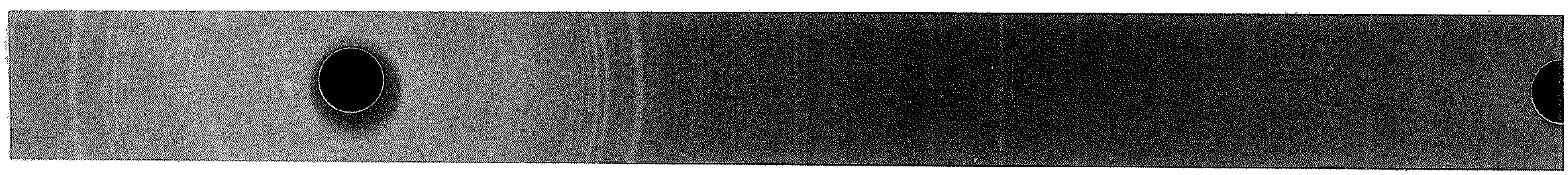

Figure 19. A-509L, Chemalloy Mine, Bernic Lake: Brazilianite?
Fe/Mn radiation, 114.83 mm. camera.

the brazilianite pattern agreed better than any other with the writer's photograph, and thus the identification of this mineral as brazilianite seems reasonably certain.

VI 7. APATITE $Ca_5(PO_4)_3(F,OH,CL)$

At the east end of Bernic Lake, on the west side of the Buck claim apatite occurs as deep blue crystals in association with tourmaline and on the Coe claim blue apatite occurs in association with mica and tourmaline. Apatite has been reported from the pegmatites of Shatford and Ryerson lakes and from the Booster Lake area where it occurs as small crystals associated with tourmaline in the pegmatites (Davies, 1955, 1956, 1957).

Five specimens of apatite were available, three from the pegmatites at the Chemalloy mine at Bernic Lake, one from a pegmatite east of Bernic Lake, and one from a pegmatite at Cat Lake.

Hand specimen descriptions:

#2042S: South of Cat Lake. (Fig. 22)

Blue granular, translucent, fractured apatite embedded in white albite.

#2059S: East of Bernic Lake.

In minute quantities, dark blue granular apatite, associated with smoky quartz.

#A-335S (A-407L): Chemalloy Mine, Bernic Lake. (Fig. 20, 21)

Dark blue, opaque to translucent, brittle, coarsely granular, fractured.

#A-385S: Chemalloy Mine, Bernic Lake.

Pinkish red, translucent to transparent, fractured, vitreous, granular, associated with transparent blades of spodumene.

#A-386S: Chemalloy Mine, Bernic Lake.

Pinkish to mauve, transparent to translucent, some minor deep red apatite, fractured, vitreous, granular.

All the minerals X-rayed gave identical patterns with the exception of the apatite from Cat Lake, which proved to be a mixture of apatite and albite. X-ray powder data for apatite are given in Table 12 where they are compared with those given by Hendricks, Jefferson and Mosley (1932) (ASTM 2-0851) for chlorapatite, by McConnell (1937) for fluorapatite, and by Correia Neves (1960) for fluorapatite. A photograph of this apatite appears as Figure 20, 21. A qualitative microchemical test revealed the presence of manganese in the apatite from Cat Lake and a photograph of this apatite appears as Figure 22. The remaining apatites compare well with both fluorapatite and chlorapatite, and a chemical analysis and/or optical work would be necessary to determine the positions of these minerals in the apatite series.

Table 12

X-ray Powder Data for Apatite

Chlorapatite - Hexagonal $P6_3/m$, a = 9.54, c = 6.86 (Hendricks et al, 1932)

Fluorapatite - Hexagonal $P6_3/m$, a = 9.38, c = 6.89 (McConnell, 1937)

Chemalloy Mine Bernic Lake A-335 S		Chlorapatite Kragero, Norway (Hendricks et al, 1932) ASTM 2-0851			Fluorapatite Faraday Tw, Ontario (McConnell, 1937) ASTM 3-0736			Fluorapatite Sahagal, Guarda (Correia Neves, 1960)		
I	d, Å	hkl	I	d, Å	hkl	I	d, Å	hkl	I	d, Å
1	5.34									
1	4.75									
2	4.11									
2	3.85	111	½	3.92						
8	3.47	002	2	3.43	002	2	3.44	002	4	3.42
3	3.17							102	1	3.16
3	3.07	210,102	1	3.09	120	3	3.07	210	2	3.07
10	2.80	211	9	2.85	121	10	2.81			
		300,112	10	2.77	112	4	2.78	112	10	2.77
8	2.71				300	6	2.71	300	5	2.69

Table 12 (Cont'd)

Chemalloy Mine Bernic Lake A-335 S		Chlorapatite Kragero, Norway (Hendricks et al, 1932) ASTM 2-0851			Fluorapatite Faraday Tw, Ontario (McConnell, 1937) ASTM 3-0736			Fluorapatite Sahagal, Guarda (Correia Neves, 1960)		
I	d,Å	hkl	I	d,Å	hkl	I	d,Å	hkl	I	d,Å
5	2.63	202	2	2.65	202	3	2.63	202	3	2.616
2	2.54	301	1	2.55	301	½	2.53			
		212	3	2.31	122	½	2.30		1	2.280
7	2.26				130	2	2.26	310	4	2.249
4	2.15	302	½	2.16	131	1	2.14	302	1	2.130
4	2.06	113,400	½	2.04	113	1	2.06	113	1	2.055
2	1.993				203	½	2.00			
8	1.941	222	5	1.95	222	4	1.94	222	5	1.935
5	1.885	312	2	1.91	132	1	1.89	312	2	1.882
8	1.838	213,321	5	1.84	123	6	1.84	213	6	1.835
4	1.787	410	2	1.81	231	3	1.80	321	3	1.797
4	1.771	402,303	1	1.77	140	3	1.77	410	3	1.770
4	1.750				402	3	1.75	402,303	3	1.747

Table 12 (Cont'd)

Chemalloy Mine Bernic Lake A-335 S		Chlorapatite Kragero, Norway (Hendricks et al, 1932) ASTM 2-0851			Fluorapatite Faraday Tw, Ontario (McConnell, 1937) ASTM 3-0736			Fluorapatite Sahagal, Guarda (Correia Neves, 1960)		
I	d, Å	hkl	I	d, Å	hkl	I	d, Å	hkl	I	d, Å
5	1.716	104	2	1.69	004	3	1.72	411	3	1.720
3	1.637				232	1	1.64	223	2	1.638
2	1.602	114,501	1	1.61	133	½	1.61			
4	1.533				240	½	1.54			
					331	½	1.52			
4	1.501				124	1	1.50	421,214	1	1.500
5	1.473				502	2	1.47	502	2	1.468
					304	1	1.46			
5	1.451				233	1	1.45	304	2	1.450
4	1.428				151	1	1.43	511	2	1.425
1	1.404									
1	1.344									
3B	1.312							404,431	1	1.313

<u>Table 12</u> (Cont'd)

Chemalloy Mine Bernic Lake A-335 S		Chlorapatite Kragero, Norway (Hendricks et al, 1932) ASTM 2-0851			Fluorapatite Faraday Tw, Ontario (McConnell, 1937) ASTM 3-0736			Fluorapatite Sahagal, Guarda (Correia Neves, 1960)		
I	d,Å	hkl	I	d,Å	hkl	I	d,Å	hkl	I	d,Å
								520	1	1.302
2	1.278							521	2	1.278
2	1.258							602	2	1.258
3	1.236							414	2	1.234
2	1.217							522	2	1.216

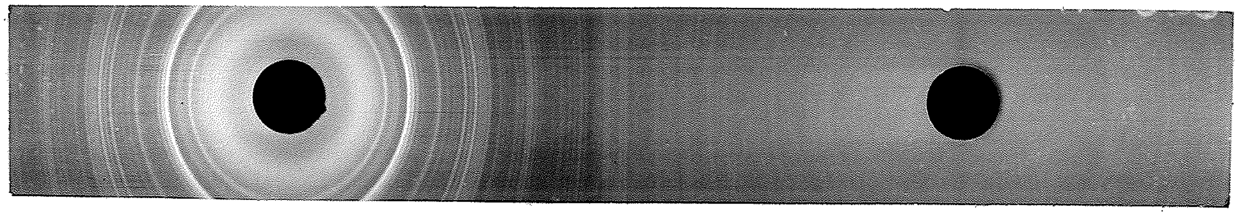

Figure 20. A-335S, Chemalloy Mine, Bernic Lake: Apatite.
Cu/Ni radiation, 57.54 mm. camera.

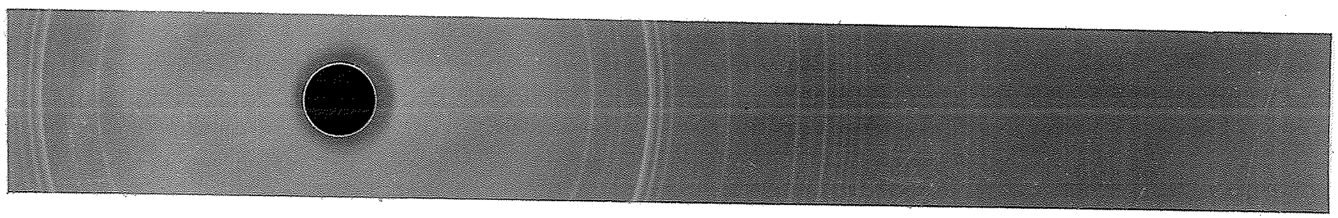

Figure 21. A-407L, Chemalloy Mine, Bernic Lake: Apatite.
Fe/Mn radiation, 114.83 mm. camera.

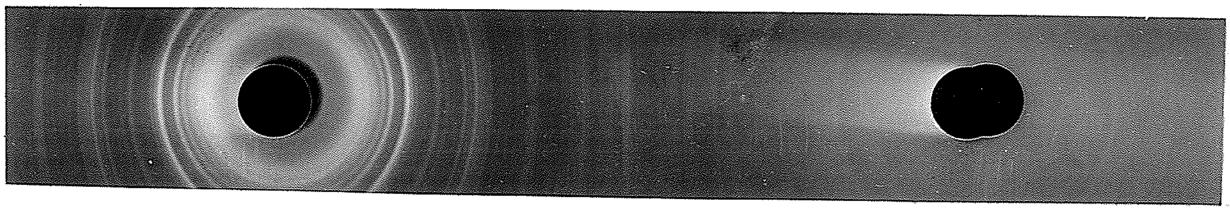

Figure 22. 2042S, South of Cat Lake: Apatite and low albite.
Cu/Ni radiation, 57.54 mm. camera.

CHAPTER VII

SILICATES

VII a. NESOSILICATES

The following nesosilicates have been reported from the pegmatites of southeastern Manitoba:

Eucryptite $LiAl(SiO_4)$

Garnet $R_3R_2(SiO_4)$

Topaz $Al_2(SiO_4)F_2$

An X-ray analysis of the minerals available to the writer revealed the following nesosilicates:

Topaz

Uranophane-sklodowskite

VII a1. EUCRYPTITE $LiAl(SiO_4)$

Eucryptite occurs at the Chemalloy mine at Bernic Lake (Davies, 1958), but none of this material was available for study.

VII a2. GARNET $R_3R_2(SiO_4)$

Garnet has been reported in spodumene dykes on the Eagle and Irgon claims at Cat Lake and small red garnets have been reported from the Buck claim east of Bernic Lake. Yellow spessartite and dark red almandine have been reported from the Silverleaf claim south of the

Winnipeg River (Springer, 1948; Davies, 1955, 1957; Gass, 1957), but none of this material was available for study.

VII a3. TOPAZ $Al_2(SiO_4)F_2$

Topaz occurs with other rare minerals in small amounts in the beryl dykes in the Greer Lake and Shatford Lake areas. On the Dyke claim at Shatford Lake large crystals of topaz occur almost completely altered to "pinite". Clear sky-blue topaz has been reported from the Bear mineral claim south of the Winnipeg River, and germanium has been reported in topaz from the Silverleaf claim, south of the Winnipeg River (Davies, 1957; Wright, 1938; Rowe, 1956).

One specimen of topaz was available, this coming from a pegmatite south of Shatford Lake.

Hand specimen description:

#A-456L: South of Shatford Lake. (Fig. 23)

White, coarsely crystalline, translucent to opaque, cleavage parallel to 001 , vitreous.

X-ray powder data for topaz are given in Table 13, where they are compared with those given by de Assuncao and Garrido (1953), and a photograph of this topaz appears as Figure 23. Since the indexing of the powder pattern of topaz has apparently not been published, it was carried out by the writer using the cell dimensions and space group of Alston and West (1928); Pbnm, a = 4.65Å, b = 8.80Å, c = 8.40Å. This

Table 13

X-ray Powder Data for Topaz

Orthorhombic Pbnm, a = 4.65 Å, b = 8.80 Å, c = 8.40 Å (Alston and West)

	Shatford Lake A-456 L			de Assuncao and Garrido (1953)	
hkl	I	d,Å(meas)	d,Å(calc)	I	d,Å
	½	7.2			
020	1	4.39	4.40		
110,101	2	4.09	4.11,4.07	5	4.12
021	1	3.88	3.90		
111	8	3.69	3.69	7	3.67
	½	3.34			
120	9	3.20	3.20	9	3.20
022	6	3.04	3.03		
121	2	2.99	2.99		
112	10	2.93	2.94	10	2.96
				2	2.60
130	4	2.48	2.48		
103	2	2.40	2.40	2	2.43
131,023	7	2.36	2.38,2.36		
200,113	2	2.33	2.32,2.31	7	2.32
210	1	2.25	2.25		
040	2	2.20	2.20		
211	2	2.17	2.17	2	2.15

Table 13 (Cont'd)

	Shatford Lake A-456 L			de Assuncao and Garrido (1953)	
hkl	I	d,Å(meas)	d,Å(calc)	I	d,Å
132,041	1	2.13	2.14,2.12		
123,004	8	2.10	2.11,2.10	9	2.07
220,202	5	2.06	2.05,2.03	6	2.01
221,140 212	2	1.989	1.996,1.989 1.982		
141	1	1.938	1.935	2	1.951
114	4	1.869	1.870		
133	4	1.855	1.857		
230	2	1.823	1.822	7	1.834
142	1	1.797	1.797	5	1.795
231	1	1.788	1.781	5	1.758
232	4	1.673	1.671	5	1.677
223	1	1.657	1.656	9	1.651
143	2	1.622	1.621		
134	½	1.601	1.602	5	1.600
105	½	1.578	1.580		
204	½	1.556	1.558	2	1.560
115	1	1.553	1.555	2	1.538
233,310 301	3	1.525	1.527,1.526 1.524		
044	½	1.517	1.519	7	1.509
242	½	1.495	1.493		

Table 13 (Cont'd)

	Shatford Lake A-456 L			de Assuncao and Garrido (1953)	
hkl	I	d,Å(meas)	d,Å(calc)	I	d,Å
320	2	1.462	1.461		
061	2	1.446	1.444	5	1.448
312	1	1.435	1.435		
153	5	1.420	1.419		
250	4	1.404	1.403	10	1.403
160	4	1.396	1.398	10	1.384

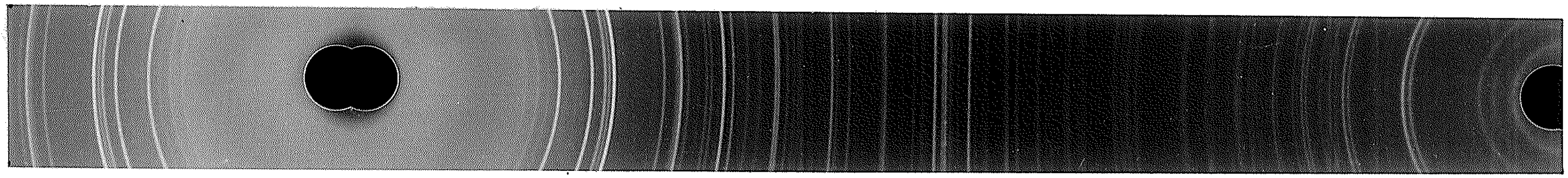

Figure 23. A-456L, South of Shatford Lake: Topaz.
Fe/Mn radiation, 114.83 mm. camera.

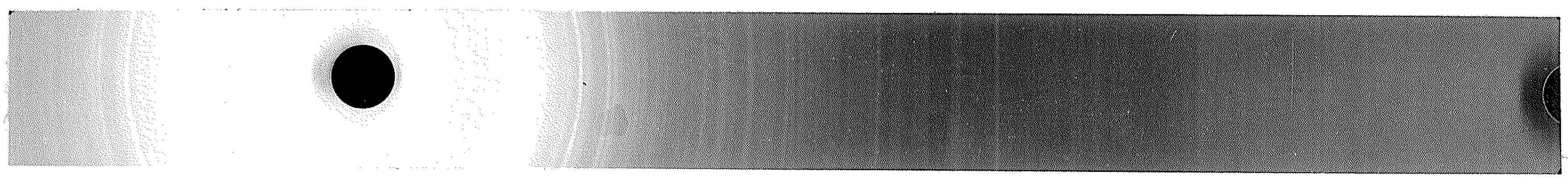

Figure 24. A-448L, Huron Claim, South of the Winnipeg River:
Uranophane-sklodowskite and quartz.
Fe/Mn radiation, 114.83 mm. camera.

indexing is included in Table 13. The weak line at 3.34 Å which does not index, may be due to minute quantities of quartz in the topaz.

VII a4. URANOPHANE-SKLODOWSKITE $2(CaO.2UO_3.2SiO_2.6H_2O)-2(MgO.2UO_3.2SiO_2.6H_2O)$

A radioactive specimen was obtained from the Huron claim south of the Winnipeg River.

Hand specimen description:

#A-448L: Huron Claim, South of the Winnipeg River. (Fig. 24)
Pale to medium yellow, opaque, dull lustre. It occurs as scaly incrustations associated with quartz and magnetite.

An X-ray powder photograph of this mineral showed it to be uranophane-sklodowskite. The powder data for it are given in Table 14, where they are compared with those given by Frondel, Riska and Frondel (1956) for uranophane (ASTM 8-442) and sklodowskite (ASTM 8-447), and a photograph of this uranophane-sklodowskite is given as Figure 24.

Uranophane and sklodowskite are thought by Schoep (1922) to be isomorphous with Mg and Ca completely interchangeable but Gorman (1957) has shown that there may not be complete isomorphism because of differences in specific gravity, cell edges and indices. Because of the very small amount of material available to the writer no further work could be done on this mineral.

Table 14

X-ray Powder Data for Uranophane-Sklodowskite

Uranophane - Monoclinic, $P2_1/a$? a = 15.87, b = 7.05, c = 6.66, β = 97°15' (Gorman and Nuffield, 1955)

Sklodowskite - Monoclinic, $C2/m$, a = 17.28, b = 7.03, c = 6.56, β = 105°53' (Gorman, 1957)

Huron Claim A-448L		Uranophane Grafton Centre, New Hampshire (Frondel et al, 1956) ASTM 8-442			Sklodowskite Katanga, Belgian Congo (Frondel et al, 1956) ASTM 8-447		
I	d, Å	hkl	I	d, Å	hkl	I	d, Å
10	8.33				200	10	8.42
9	7.87	200	10	7.88			
2	6.60	110	4	6.61			
1	6.35				001	2	6.37
2	5.88				$\bar{2}01$	5	5.91
2	5.46	$\bar{2}01$	4	5.42			
6	4.79	$\bar{1}11$	5	4.76	$\bar{1}11$	4	4.82
1	4.50				310	1	4.51
5	4.29	$\bar{2}11$	2	4.29	111	4	4.33
6	4.16				400	8	4.19
1	4.03	400	9	3.94	$\bar{4}01$	5	4.00
5	3.87						
½	3.72						
1	3.60	$\bar{4}01$	4	3.60			
3	3.51	020	4	3.51	020	6	3.52

Table 14 (Cont'd)

Huron Claim A-448L		Uranophane Grafton Centre, New Hampshire (Frondel et al, 1956) ASTM 8-442			Sklodowskite Katanga, Belgian Congo (Frondel et al, 1956) ASTM 8-447		
I	d,Å	hkl	I	d,Å	hkl	I	d,Å
		311	1	3.41			
8	3.34	002	1	3.35			
2	3.27				220,311 $\bar{2}02$	7	3.27
2	3.19	$\bar{2}02,\bar{4}11$	5	3.20			
½	3.07	$\bar{1}21$	1	3.09			
5	2.99	012	8	2.99		6	3.00
4	2.92	411,202	8	2.91			
1	2.85					5	2.87
1	2.79					2	2.80
1	2.74					2	2.74
2	2.69	$\bar{4}02$	4	2.69		1	2.70
1	2.62	600,420	5	2.63		1	2.66
		$\bar{6}01$	2	2.57			
1	2.52	$\bar{4}21$	2	2.52		1	2.52
1	2.45		1	2.40			
1	2.33					2	2.34
1	2.27		2	2.26		½	2.27
2	2.20		4	2.20		2	2.22
						2	2.19

Table 14 (Cont'd)

Huron Claim A-448L		Uranophane Grafton Centre, New Hampshire (Frondel et al, 1956) ASTM 8-442			Sklodowskite Katanga, Belgian Congo (Frondel et al, 1956) ASTM 8-447		
I	d,Å	hkl	I	d,Å	hkl	I	d,Å
						2	2.17
2	2.12					3	2.13
2	2.09		5	2.10		3	2.09
1	2.05		2	2.06			
						2	1.985
3	1.969		7	1.969		2	1.961
						2	1.918
1	1.908		2	1.906			
1	1.885		1	1.889		1	1.884
1	1.866		3	1.867			
						2	1.848
2	1.818		1	1.827		½	1.821
½	1.795					1	1.801
1	1.772		3	1.769		1B	1.768

VII b. SOROSILICATES

The following sorosilicates have been reported from the pegmatites of southeastern Manitoba:

Epidote $Ca_2(Al,Fe,Mn)_3Si_3O_{12}(OH)$

Zoisite $Ca_2Al_3Si_3O_{12}(OH)$

An X-ray examination of the minerals obtained revealed the following sorosilicates:

Epidote-clinozoisite

Vesuvianite

VII b1. EPIDOTE-CLINOZOISITE $Ca_2(Al,Fe,Mn)_3Si_3O_{12}(OH)$

Epidote and zoisite have been reported from the pegmatites in the Shatford Lake and Bernic Lake areas. On the Huron claim south of the Winnipeg River, dark grey massive and granular zoisite and small honey-colored striated crystals of zoisite occur with euxenite-polycrase, columbite, quartz and beryl (Wright 1938).

Four specimens were available from the Huron claim, south of the Winnipeg River.

Hand specimen descriptions:

#2046S: Huron Claim.

Greyish green, striated acicular to divergent crystals, vitreous, opaque, associated with pink feldspar.

#2047S: Huron Claim.

Pistachio green, striated divergent to acicular crystals, vitreous, associated with pink feldspar, opaque to sub-translucent.

#2111S: Huron Claim. (Fig. 25)

Same as 2046 and 2047, showing both colors. The light green material was X-rayed.

#2118S: Huron Claim.

Same as 2047.

All four minerals examined gave identical X-ray patterns, the data for one of which are given in Table 15, where they are compared with those of Lapham (1957) for a chemically analysed epidote from Hawleyville, Connecticut, and a zoisite from Ducktown, Tennessee, and with those of Seki (1959) for a chemically analysed clinozoisite from Sasaguri. A photograph of one of the author's epidotes appears as Figure 25. From the table it can be seen that these minerals belong in the epidote group and they are not zoisite as had been reported previously. A few significant intensity differences exist between the patterns of zoisite and epidote-clinozoisite; 2.87 Å and 2.70 Å are the strongest lines on the zoisite pattern, in contrast to epidote with its strongest line at 2.90 Å. Also according to Lapham, as the composition changes from light zoisite to dark green epidote the 7 Å and 8 Å lines gradually become weaker and this appears in Table 15. These lines are missing from the epidote from the Huron claim. Only on the basis of a careful chemical analysis and optical data could the position of these minerals be determined within the epidote-clinozoisite series.

Table 15

X-ray Powder Data for Epidote

Epidote - Monoclinic $P2_1/m$, a = 8.98, b = 5.64, c = 10.22, β = 115°24' (Ito, 1957)

	Huron Claim 2111S		Epidote Hawleyville, Conn. (Lapham, 1957)		Zoisite Ducktown, Tenn. (Lapham, 1957)		Clinozoisite Sasaguri, Japan (Seki, 1959)	
hkl	I	d,Å	I	d,Å	I	d,Å	I	d,Å
100			½	7.98	3	8.13	1	8.04
			½	7.02				
101,10$\bar{2}$	5	5.01	4	5.018	5	5.027	3	5.01
011					1	4.675	2	4.72
002	½	4.62	½	4.621				
					1	4.245		
200	5	4.00	4	3.997	4	4.048	2	4.003
111	1	3.77	½	3.762			1	3.748
21$\bar{1}$	5	3.51	4	3.492	6	3.615	1	3.477
102	1	3.40	1	3.372			1	3.396
					½	3.328		

Table 15 (Cont'd)

	Huron Claim 2111S		Epidote Hawleyville, Conn. (Lapham, 1957)		Zoisite Ducktown, Tenn. (Lapham, 1957)		Clinozoisite Sasaguri, Japan (Seki, 1959)	
hkl	I	d, Å	I	d, Å	I	d, Å	I	d, Å
201	3	3.20	1	3.197			2	3.197
					3	3.106		
003			½	3.060			1	3.052
30$\bar{1}$							3	2.913
112							3	2.901
11$\bar{3}$	10	2.90	10	2.900			10	2.889
					10	2.869		
020	6	2.80	5	2.809			5	2.796
					3	2.783		
							1	2.778
					10	2.703		
021							5	2.680
300	6	2.67	6	2.677			5	2.671
120							2	2.642
					2	2.626		

Table 15 (Cont'd)

	Huron Claim 2111S		Epidote Hawleyville, Conn. (Lapham, 1957)		Zoisite Ducktown, Tenn. (Lapham, 1957)		Clinozoisite Sasaguri, Japan (Seki, 1959)	
hkl	I	d,Å	I	d,Å	I	d,Å	I	d,Å
$31\bar{1}$	5	2.60	5	2.593			4	2.590
103,202	1	2.51	1	2.525	3	2.531	3	2.525
121	$\frac{1}{2}$	2.45	1	2.449	$\frac{1}{2}$	2.459	1	2.471
$31\bar{3}$	6	2.39	7	2.396	4	2.407	2	2.399
022							3	2.389
					6	2.335		
220,004	5	2.29					3	2.290
$22\bar{2}$			2	2.289			3	2.287
					1	2.238		
122	5	2.16	2	2.161			3	2.161
$12\bar{3}$							1	2.151
014							1	2.121
221	6	2.11	4	2.111	1	2.111	3	2.106
$22\bar{3}$							3	2.099

Table 15 (Cont'd)

hkl	Huron Claim 2111S I	Huron Claim 2111S d,Å	Epidote Hawleyville,Conn. (Lapham,1957) I	Epidote Hawleyville,Conn. (Lapham,1957) d,Å	Zoisite Ducktown,Tenn. (Lapham,1957) I	Zoisite Ducktown,Tenn. (Lapham,1957) d,Å	Clinozoisite Sasaguri,Japan (Seki,1959) I	Clinozoisite Sasaguri,Japan (Seki,1959) d,Å
$41\bar{2}$,023	½	2.08	1	2.065	6	2.064	1	2.062
203			½	2.043			1	2.040
$41\bar{3}$			½	2.020	½	2.020	1	2.021
400			½	2.003	1	1.982	2	2.001
$30\bar{5}$							1	1.951
$21\bar{3}$			½	1.914	2	1.903	1	1.919
123,114 222	7	1.877	6	1.867			1	1.873
$11\bar{5}$,$12\bar{4}$ $22\bar{4}$							2	1.866

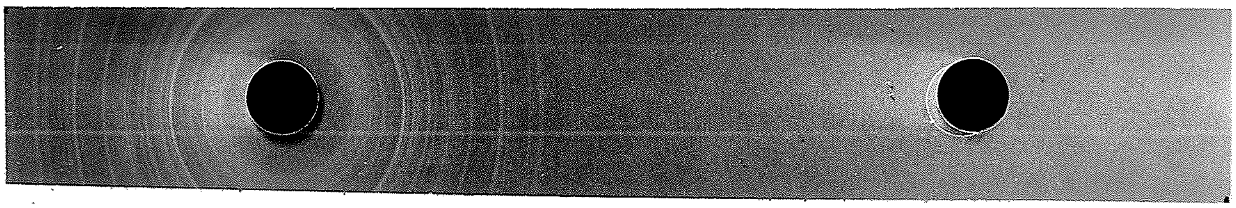

Figure 25. 2111S, Huron Claim, South of the Winnipeg River: Epidote. Cu/Ni radiation, 57.54 mm. camera.

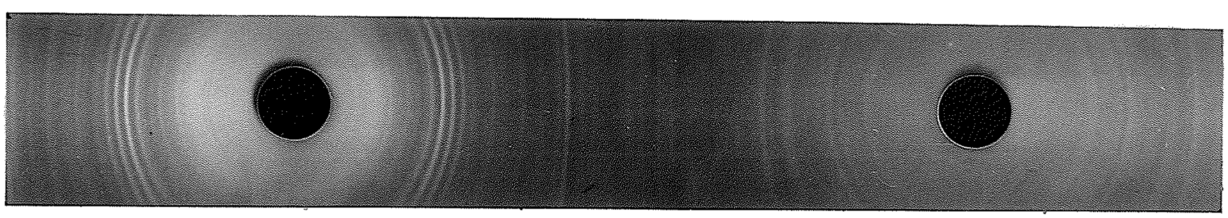

Figure 26. A-486S, Huron Claim, South of the Winnipeg River? Vesuvianite. Fe/Mn radiation, 57.54 mm. camera.

VII b2. VESUVIANITE $Ca_{10}Mg_2Al_4(Si_2O_7)_2(SiO_4)_5(OH)_4$

No mention of this mineral was found in the literature of the area. One specimen of vesuvianite was obtained from the Huron claim, south of the Winnipeg River, although it may have come from either "float" or frost heaved slabs, along the south shore of the Winnipeg River (Mr. J. F. Davies, personal communication).

Hand specimen description:

#A-486S: Huron Claim? (Fig. 26)

Brown, granular, resinous, translucent to transparent, some vertical striations, prismatic crystals with tetragonal prisms 110 and 100 . One crystal shows a dipyramid 111 and basal pinacoid 001 .

X-ray powder data for this vesuvianite are presented in Table 16, where they are compared with those given in the ASTM card #11-145, and an X-ray photograph of this vesuvianite appears as Figure 26.

Table 16

X-ray Powder Data for Vesuvianite

Tetragonal P^4/nnc, a = 15.58, c = 11.93 (Donnay and Nowacki, 1953)

	Huron Claim ? A-486S		(Berry,L.G.) ASTM 11-145	
hkl	I	d,Å	I	d,Å
110			½	11.0
211	1	5.95	1	5.90
202			½	4.69
222	1	3.98	2	4.03
420,322	2	3.49	2	3.469
402	1	3.22	1	3.244
313,510			2	3.054
431,422			½	2.999
004	6	2.94	4	2.946
204,440	10	2.74	10	2.752
600,522	7	2.58	8	2.593
620	5	2.45	5	2.452
	1	2.33	1B	2.332
	1	2.20	1	2.194
	2	2.12	3	2.122
	2	2.01	1B	1.997
			½	1.960

Table 16 (Cont'd)

hkl	Huron Claim ? A-486S I	d,Å	(Berry,L.G.) ASTM 11-145 I	d,Å
	1	1.893	1	1.882
			½	1.793
	2	1.763	2	1.762
			½	1.679
	1	1.654	3	1.662
	4	1.615	6	1.621
	1	1.564	½	1.568
			1	1.556
			½	1.539
			½	1.525
	1	1.491	1	1.495

VII c. CYCLOSILICATES

The following cyclosilicates have been reported from the pegmatites of southeastern Manitoba:

Beryl $Be_3Al_2Si_6O_{18}$

Variety - Aquamarine

Tourmaline $(Na,Ca)_5(Al,Fe,Mg,Mn,Ti)_{27}(Si,B)_{27}O_{86}(OH)_4$

An X-ray examination of the cyclosilicates made available to the writer revealed the following minerals:

Beryl

Tourmaline

VII c1. BERYL $Be_3Al_2Si_6O_{18}$

Beryl has been reported from many of the pegmatite dykes of southeastern Manitoba. In general it is not an important constituent of the lithium pegmatites, but when it is present in these it occurs outside the lithium zones. Beryl is most common in dykes containing few or no lithium minerals, where it is associated with pink microcline, albite, quartz and mica.

A great deal has been written about the beryl occurrences of southeastern Manitoba, but only a brief account of these will be presented here. For further details the reader is referred to the most important references: Springer, 1949, 1950; Davies, 1955, 1957, 1958; and Mulligan, 1960.

White beryl and pale green beryl crystals occur as minor constituents of some spodumene-bearing dykes. White beryl has been reported at Bernic Lake in the outermost zones of the dykes, where it occurs as coarse irregular crystals and masses associated with triphylite, amblygonite, tantalite, apatite, and spodumene. At Shatford Lake beryl has been found in crystals up to two inches across. There the beryl is white to yellow and is associated with quartz. Beryl has been reported from the old Stannite and Rush claims west and north of Rush Lake in association with spodumene, amblygonite and triphylite. On the Grace, Huron, and Annie claims at Greer Lake in the Winnipeg River area, yellow-green beryl occurs in crystals up to eighteen inches across. Aquamarine, a gem variety of beryl, has been reported from the albite pegmatites of this area. Beryl also occurs in numerous dykes outcropping along the south shore of the Winnipeg River (Springer 1949, 1950; Davies 1955, 1957, 1958; Mulligan 1960).

Eight specimens of beryl were obtained from five localities.

Hand specimen descriptions:

#2052S: South of Shatford Lake.

Pale yellowish green, translucent to opaque, small coarse crystals up to one cm. long. It is associated with quartz and feldspar.

#2114S: South of Shatford Lake. (Fig. 27)

Large pale green prismatic crystals associated with quartz and muscovite, striated.

#2113S: East of Shatford Lake.

Yellowish-green, small hexagonal crystals unterminated, striated, brittle, translucent to opaque. It is associated with small muscovite books and quartz.

#2005S: Chemalloy Mine, Bernic Lake.

White, coarsely crystalline, translucent to opaque, brittle, muscovite flakes occurring as books embedded in the beryl, vitreous.

#17250L: Chemalloy Mine, Bernic Lake.

Large white crystal of beryl, about three and one-half inches across with prismatic faces only, vitreous, brittle, translucent to transparent.

#2089S: East of Bernic Lake.

Pale yellowish-green, coarsely crystalline beryl, translucent to opaque, brittle, vitreous, associated with quartz and muscovite.

#2003S: Huron Claim, South of the Winnipeg River.

Pale yellowish-green translucent to opaque, coarsely crystalline.

#2120S: Huron Claim, South of the Winnipeg River.

Pale green, prismatic crystals, vertically striated, coarsely crystalline, vitreous, transparent to translucent. It is associated with pink feldspar and tantalite.

All beryl specimens gave the same X-ray powder pattern. #2114S contained one extra line of weak intensity at 3.34 Å which could be accounted for by quartz as an impurity. Some of the very weak lines are missing from the writer's pattern. Powder data for one of the beryls are given in Table 17 where they are compared with those given by Swanson et al (1959) (ASTM 9-430), and a photograph of this beryl appears as Figure 27.

Table 17

X-ray Powder Data for Beryl

Hexagonal P^6/mcc, a = 9.215, c = 9.192 (Swanson et al, 1959)

	South of Shatford Lake 2114-S		Royalston, Mass. (Swanson et al, 1959) (ASTM 9-430)	
hkl	I	d,Å	I	d,Å
100	10	7.90	9	7.98
110,002	6	4.58	5	4.60
200,102	6	3.96	5	3.99
	1	3.34		
112	10	3.25	9	3.254
210,202	6	3.01	4	3.015
211	10	2.87	10	2.867
300	½	2.66	½	2.660
212	6	2.53	3	2.523
220,302	3	2.29	1	2.293
310			1	2.213
104	2	2.21	½	2.208
311	3	2.16	1	2.152
222	1	2.06	½	2.060
114			½	2.056
312,204	5	1.997	2	1.9926
320,402	2	1.838	1	1.8308
321,313	3	1.804	2	1.7954

Table 17 (Cont'd)

	South of Shatford Lake 2114-S		Royalston, Mass. (Swanson et al, 1959) (ASTM 9-430)	
hkl	I	d,Å	I	d,Å
304	5	1.750	2	1.7397
411	2	1.725	1	1.7110
322	½	1.670	½	1.7007
412,224	4	1.637	2	1.6265
500,314	2	1.605	1	1.5953
323	2	1.583	1	1.5710
215			1	1.5690
330	1	1.544	½	1.5349
006			1	1.5320
413	4	1.523	1	1.5138
421	½	1.492	½	1.4882
332	3	1.467	1	1.4566
116			1	1.4535
510,422	4	1.445	1	1.4324
315			½	1.4148
512	1	1.372	1	1.3682
216			1	1.3656
600	½	1.331	½	1.3306
430,504	½	1.312	½	1.3117
513,325	½	1.299	½	1.2977
520,602	4	1.281	1	1.2774
415,521	5	1.266	1	1.2657

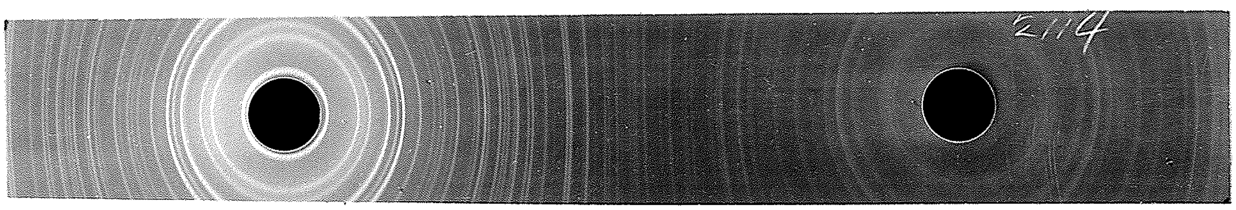

Figure 27. 2114S, Huron Claim, South of the Winnipeg River: Beryl. Cu/Ni radiation, 57.54 mm. camera.

VII c2. TOURMALINE $(Na,Ca)_5(Al,Fe,Mg,Mn,Ti)_{27}(Si,B)_{27}O_{86}(OH)_4$

Tourmaline has been noted at the old Jack Nutt Tin Mine on the north shore of Bernic Lake where it occurs as black crystals up to two inches in diameter in association with cassiterite, quartz, feldspar and muscovite. At the east end of Bernic Lake, on the Buck and adjacent claims, black tourmaline occurs in crystals growing normal to the walls of the dyke. Some dark green translucent tourmaline also occurs there. At Cat Lake, black tourmaline has been noted with green beryl and feldspar. Black tourmaline has been reported with muscovite and cassiterite at Rush Lake, in crystals up to three inches in length by one inch in diameter west of the lake. In the Booster Lake area, black tourmaline occurs in small amounts with quartz, feldspar and muscovite in the pegmatites. At Greer Lake, black tourmaline occurs with columbite in feldspar, quartz and muscovite on the Grace 1 and 2 claims (Wright,1938; Springer,1949, 1950; Davies,1955, 1956, 1957).

Twenty-four specimens of tourmaline were obtained from six different localities.

Hand specimen descriptions:

#2018S: North of Maskwa Lake.

Small olive green crystals about 3 mm. wide, prismatic slender, barrel-shaped, transparent, vitreous.

#2107S: Rush Lake, South of Bird Lake.

Black, coarsely prismatic crystals, opaque, 3 x 5 mm. It is associated with quartz and feldspar and muscovite.

#2130S: Silverleaf Claim, South of the Winnipeg River.

Blue, transparent, prismatic crystals, slender, up to 1 cm. long, some divergent, others almost acicular.

#2104S: Between Birse and Booster Lake.

Black, opaque, prismatic crystals. It is associated with quartz and feldspar.

#2105S: Between Birse and Booster Lake.

Black, opaque, massive, associated with quartz, and feldspar.

#2007S: East of Bernic Lake.

Black, opaque, massive. It is associated with feldspar with some red alteration material on surface. One vertical prismatic face present shows deep striations.

#2061S: East of Bernic Lake.

Black, opaque, massive, friable, vitreous.

#2076S: East of Bernic Lake.

Black, opaque, coarsely prismatic crystals. It is associated with feldspar.

#2093S: East of Bernic Lake.

Black, opaque, prismatic crystals. It is associated with quartz, feldspar, and muscovite books.

#2097S: East of Bernic Lake.

Medium blue, very small prismatic slender crystals, about 1 to 2 mm., barrel-shaped, some short stubby prismatic crystals without striations. It is associated with feldspar.

#2098S: East of Bernic Lake.

As above, dark blue.

#2100S: East of Bernic Lake.

Blue opaque to olive green translucent, very small crystals, stubby to slender prismatic, 1 mm. long.

#2103S: East of Bernic Lake.

Olive green, transparent, barrel-shaped, prismatic crystals, striated. It is associated with feldspar, transparent quartz, and muscovite, embedded in muscovite.

#2077S: Chemalloy Mine, Bernic Lake.

Black, opaque, coarsely prismatic crystals, about 1 x 2¼ cm. long, dull lustered, associated with quartz.

#2081S: Chemalloy Mine, Bernic Lake.

Black, opaque, coarsely prismatic crystals, striated vertically, hexagonal prisms present, vitreous to dull on weathered surface.

#A-468L: Chemalloy Mine, Bernic Lake. (Fig. 28)

Black, opaque, slender prismatic crystals, divergent to parallel, about 1 mm. x 4 mm.

#2091S: Chemalloy Mine, Bernic Lake.

Black, opaque, stubby coarsely prismatic crystals. It is associated with quartz, feldspar, and books of muscovite.

#2096S: Chemalloy Mine, Bernic Lake.

Black, opaque, stubby prismatic crystals, 1 cm. x 3 mm. It is associated with quartz, feldspar, and muscovite.

#2102S: Chemalloy Mine, Bernic Lake.

Black, opaque, prismatic crystals, various sizes, some not striated, vitreous. It is associated with quartz, feldspar, and muscovite.

#2109S: Chemalloy Mine, Bernic Lake.

Black, opaque, prismatic crystals, vertically striated, associated with quartz, vitreous, crystals grow together.

#2084S: Chemalloy Mine, Bernic Lake.

Black, opaque, coarsely prismatic crystals. It is associated with quartz, feldspar, and muscovite books.

#2092S: Chemalloy Mine, Bernic Lake.

Same as 2091, but with a higher lustre.

#A-341S: Chemalloy Mine, Bernic Lake.

Pale olive green to yellowish green, transparent, slender prismatic crystals, about 1 mm. long, not striated. Many crystals are fractured but a few are flawless. It is associated with quartz and feldspar.

#A-469L: Chemalloy Mine, Bernic Lake. (Fig. 29)

Pale pink, massive, in small quantities, transparent to translucent, some fragments are striated. It is associated with curvi-lamellar 'lepidolite'.

X-ray powder data for the black opaque tourmaline (A-468L) and the pink tourmaline (A-469L) are given in Table 18, where they are compared with the data given by the ASTM card #11-592, and a photograph of these tourmalines appear as Figure 28 and 29. All twenty-four tourmaline specimens gave identical powder photographs although most contained minor amounts of quartz as an impurity. The pale pink tourmaline (A-469L) (Fig. 29) which contained quartz and 'lepidolite' impurities gave a tourmaline powder pattern but with a number of additional lines.

Table 18

X-ray Powder Data for Tourmaline

Hexagonal R3m, a = 15.95, c = 7.24 (Donnay and Buerger, 1950)

	Chemalloy Mine Bernic Lake A-468 L		Chemalloy Mine Bernic Lake A-469 L		Gouverneur, New York Berry - ASTM 11-592	
hkl	I	d,Å	I	d,Å	I	d,Å
			3	7.92		
101	8	6.35	4	6.30	4	6.41
021	5	4.95	5	4.93	3	5.00
300	5	4.61	3	4.58	2	4.61
211	8	4.20	9	4.17	7	4.24
220	8	3.99	9	3.96	7	4.00
012	9	3.46	8	3.44	7	3.505
131					½	3.406
	1B	3.35	4	3.35		
	½	3.18	5B	3.20		
	½	3.10	2	3.09		
	½	3.01	2	2.99		
122	9	2.95	10	2.93	9	2.977
321	1	2.89	½	2.87	½	2.906
312			½	2.59	½	2.635
051	10	2.58	10	2.56	10	2.584
003					1	2.419

Table 18 (Cont'd)

	Chemalloy Mine Bernic Lake A-468 L		Chemalloy Mine Bernic Lake A-469 L		Gouverneur, New York Berry - ASTM 11-592	
hkl	I	d,Å	I	d,Å	I	d,Å
232	5	2.38			1	2.388
511	4	2.34			1	2.361
502	4	2.19			1	2.200
431	4	2.16			1	2.177
303	5	2.11			2	2.133
152	7	2.04			5	2.050
342	6	1.916			4	1.926
413	4	1.869			½	1.887
621	3	1.850			½	1.854
333,104	4	1.774			½	1.788
024	3	1.731			½	1.751
262	2	1.692			½	1.697
603,063	5	1.659			3	1.670
271	4	1.644			2	1.648
550	4	1.599			3	1.598

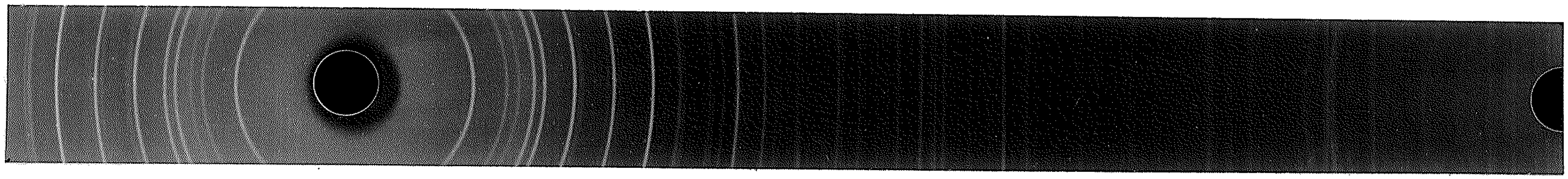

Figure 28. A-468L, Chemalloy Mine, Bernic Lake: Tourmaline.
Fe/Mn radiation, 114.83 mm. camera.

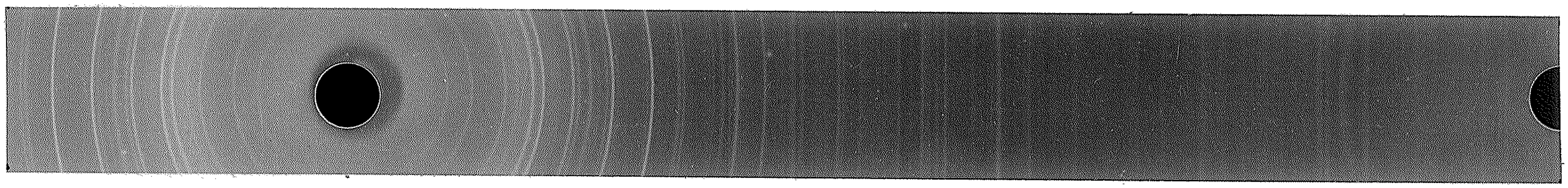

Figure 29. A-469L, Chemalloy Mine, Bernic Lake: Tourmaline.
Fe/Mn radiation, 114.83 mm. camera.

VII d. INOSILICATES

The following inosilicates have been reported from the pegmatites of southeastern Manitoba:

Spodumene $LiAl(SiO_3)_2$

Variety - Kunzite

An X-ray examination of the specimens submitted revealed the following inosilicate:

Spodumene

VII d1. SPODUMENE $LiAl(SiO_3)_2$

Spodumene is the most abundant and widespread of the lithium-bearing minerals in the area. Generally it occurs as small blade-like crystals up to 2" or 3" in length, or as intergrowths with quartz and feld-spar. At Cat Lake on the Eagle and Irgon claims, white and green spodumene occur in crystals up to several inches across in association with quartz, feldspar, and muscovite. North of Maskwa Lake on the Spot group, spodumene has been reported in very large quantities, and at Bernic Lake spodumene occurs in large euhedral crystals. On the Grace 2 claim south and east of Greer Lake, kunzite has been reported in albite pegmatites. White spodumene has been noted from the Stannite and Rush claims west and north of Rush Lake. On the Silverleaf claim south of the Winnipeg River, spodumene occurs in a quartz-spodumene intergrowth in the second and third zones of a zoned pegmatite. In the pegmatites of the Winnipeg River, spodumene occurs in the intermediate zones adjacent to the core of all lithium-bearing dykes (Springer, 1948, 1949, 1950; Davies, 1955, 1957, 1958; Rowe, 1956; Gass, 1957).

Fifteen specimens of spodumene were obtained from five localities.

Hand specimen descriptions:

#2016S: North of Maskwa Lake.

White, dull lustre, coarse cleavable masses, 110 and 100 cleavages giving platy appearance.

#2038S: North of Maskwa Lake.

White to greenish white, cleavable. It is associated with medium-grained granite.

#2037S: North of Maskwa Lake.

Colorless to white, translucent, cleavable, about 5 mm. long. It is associated with quartz, feldspar, and lilac-colored mica.

#2049S: North of Maskwa Lake.

Colorless to white, translucent, cleavable, cleavage well developed, brittle, cleavage faces striated.

#2029S: Northwest of Cat Lake.

Pale greenish-yellow, in small cleavable masses, striated. It is associated with quartz, feldspar, and lime-green mica.

#2031S: Northeast of Cat Lake.

White, translucent, striated, cleavable.

#2055S: Northeast of Cat Lake.

White, translucent to opaque, cleavable masses, up to 2 cm. in length, deeply striated. It is associated with quartz and muscovite books.

#2021S: Chemalloy Mine, Bernic Lake.

White to pale green, cleavable, vertical striations. It is associated with quartz.

#2066S: Chemalloy Mine, Bernic Lake.

Green, cleavable masses, translucent, brittle, vitreous, some faces striated. It is associated with quartz, "cleavelandite", and bright lime-green mica.

#A-388S: Chemalloy Mine, Bernic Lake.

White to colorless, translucent, striated, cleavable, also many small transparent colorless prismatic crystals with vertical faces striated. It is associated with pink transparent apatite.

#A-390S: Chemalloy Mine, Bernic Lake.

Colorless to white, transparent to translucent, cleavable, vitreous, brittle, also many small colorless transparent, striated, flawless, prismatic crystals up to 1 mm., associated with the pink clay mineral (Sarospatite VII e4.).

A-471L: Chemalloy Mine, Bernic Lake. (Fig. 30)

White, large cleavable masses, striated.

#2024S: East of Bernic Lake.

White, very brittle, in cleavable masses.

#2122S: East of Bernic Lake.

White, translucent to opaque, large coarse crystals, striated vertically, some alteration on surface.

#2123S: East of Bernic Lake.

Green, vitreous, cleavable masses, striated. It is associated with quartz and feldspar and mica.

All fifteen specimens obtained gave identical patterns although some had additional quartz lines. The X-ray powder diffraction pattern of one of these spodumenes is given as Figure 30, and the measured d spacings and the visually estimated intensities of the lines of this pattern are given in Table 19, where they are compared with those given by Gabriel, Slavin, and Carl (1942) (ASTM 9-468). One additional weak line on the photograph with the spacing of 3.34 Å is probably due to quartz.

Table 19

X-ray Powder Data for Spodumene

Monoclinic C^2/c, a = 9.52, b = 8.32, c = 5.25, β = 111°20'
(Warren and Biscoe, 1931)

	Chemalloy Mine Bernic Lake A-471 L		(Gabriel et al,1942) (ASTM 9-468)	
hkl	I	d,Å	I	d,Å
110	5	6.07	3	6.12
	4	4.44		
$\bar{1}$11	5	4.34	5	4.38
020	7	4.18	6	4.21
111	5	3.44	4	3.45
	1	3.34		
021	5	3.19	4	3.19
220	½	3.04	½	3.04
$\bar{2}$21	10	2.91	10	2.93
$\bar{3}$11	2	2.86	1	2.87
310	9	2.79	8	2.80
130	2	2.66	1B	2.67
$\bar{2}$02	2	2.55	1	2.56
002,$\bar{1}$31	6	2.45	6	2.45
221,$\bar{4}$01	4	2.35	2	2.35
400,131	1	2.22	½	2.21
$\bar{2}$22			½	2.17

Table 19 (Cont'd)

	Chemalloy Mine Bernic Lake A-471 L		(Gabriel et al,1942) (ASTM 9-468)	
hkl	I	d,Å	I	d,Å
311	2	2.14	1	2.14
022,112	3	2.11	4	2.10
$\bar{3}31,\bar{4}21$	3	2.06	2	2.05
330	1	2.05	1	2.02
	3	1.929	2	1.928
	4	1.866	4	1.862
	1	1.848		
	1	1.829	½	1.824
	½	1.793	½	1.787
	2	1.739	1	1.737
			½	1.718
			½	1.683
			½	1.666
	2	1.651	½	1.647
	3	1.608	6	1.606
	2	1.599	½	1.593
	4	1.571	7	1.568
	3	1.527	3	1.523
	½B	1.487	½B	1.486
	2	1.460	4	1.460

Table 19 (Cont'd)

	Chemalloy Mine Bernic Lake A-471 L		(Gabriel et al,1942) (ASTM 9-468)	
hkl	I	d,Å	I	d,Å
	½	1.416	½	1.418
	2	1.398	2	1.397
	2	1.360	2	1.359
	1	1.345	1B	1.341
	1	1.339		
	3	1.329	4	1.331

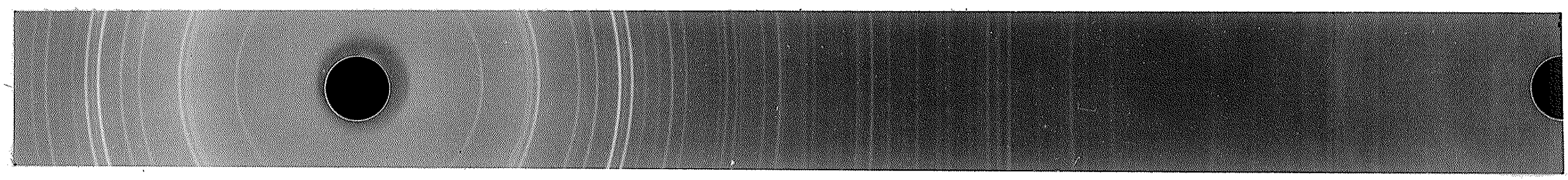

Figure 30. A-471L, Chemalloy Mine, Bernic Lake: Spodumene.
Fe/Mn radiation, 114.83 mm. camera.

VII e. PHYLLOSILICATES

The following phyllosilicates have been reported from the pegmatites of southeastern Manitoba:

Muscovite $KAl_2(AlSi_3)O_{10}(OH,F)_2$

Biotite $K(Mg,Fe,Mn)_3(AlSi_3)O_{10}(OH,F)_2$

Lepidolite $KLi_2AlSi_4O_{10}(F,OH)_2$

Zinnwaldite $KLiFe^{+2}Al(AlSi_3)O_{10}(F,OH)_2$

Chlorite $(Mg,Fe)_3(AlSi_3)O_{10}(O,OH)_2$

An X-ray analysis of the specimens available to the writer revealed the following phyllosilicates:

Muscovite

Biotite

Illite-montmorillonite (Sarospatite)

Chlorite

VII e1. and e2. MUSCOVITE AND LITHIAN MUSCOVITE $KAl_2(AlSi_3)O_{10}(OH,F)_2$

The micas are common and widespread minerals of the pegmatite dykes of the area where they display many varied and interesting textural features.

Muscovite occurs in spodumene dykes on the Irgon and Eagle claims at Cat Lake, and also at Bernic Lake in association with feldspar and tourmaline. Lithian micas, those with small amounts of Li, occur at

Bernic Lake, and yellowish-green and bronze micas occur at Booster Lake, and on the Winnipeg River.

Minerals which appear as and have always been called lepidolite and zinnwaldite occur throughout the whole area but as explained later the X-ray powder photographs suggest that these are not true lepidolites and true zinnwaldites. "Lepidolite" occurs with spodumene at Bernic Lake at the Chemalloy mine and also at the east end of the lake. Plumose and curvi-lamellar "lepidolite" are very common on the Silverleaf and Huron claims. "Zinnwaldite" is common at the Silverleaf claim and it occurs as rhombs and wheels at Shatford Lake (Springer 1948, 1949, 1950; Davies 1955, 1956, 1957; Gass 1957).

A great deal of literature on the mica minerals in the area has been published. For a discussion of the many and varied types of mica that occur in this area, the reader is referred to Davies (1957). Chemical and spectrographic analyses of some of these micas from the Chemalloy mine at Bernic Lake are given by Nickel (1961).

Before the interpretation of these micas is given it should be understood that according to Levinson (1953), normal muscovites can contain up to 3.30% Li_2O whereas those micas containing 3.4-4.0% Li_2O have transitional structures, and those containing greater than 4.0% Li_2O have one of the three different lepidolite structures. All of these main mica types are easily distinguished by their powder photographs.

<u>Hand specimen descriptions:</u>

VII el. NORMAL MUSCOVITES

#A-688L: North of Maskwa Lake.

"Lepidolite". Pink, in small veins about 1 mm. across, pearly lustre, translucent, plumose. It is associated with pollucite.

#A-687L: North of Maskwa Lake.

"Lepidolite". Coarse-grained scaly aggregate of violet mica, pearly, translucent.

#A-693L: South of Shatford Lake.

"Zinnwaldite". Curved, grey-brown, pearly, transparent. It is associated with quartz and albite.

#A-731L: South of Shatford Lake.

"Zinnwaldite". Curvi-lamellar, grey, pseudo-hexagonal crystal 16 mm. across, vitreous, translucent. It is associated with jamesonite.

#A-696L: Chemalloy Mine, Bernic Lake.

"Muscovite". Yellowish-green, medium-grained scaly aggregate, vitreous, transparent. It is associated with spodumene, microcline, and quartz.

#A-697L: Chemalloy Mine, Bernic Lake. (Fig. 31 and 34).

"Muscovite". Pale green, fine-grained, vitreous. It is associated with microcline and wodginite.

#A-330S: Chemalloy Mine, Bernic Lake.

"Lepidolite". Pale violet, fine-grained scaly aggregate, pearly, translucent.

#A-724L: Chemalloy Mine, Bernic Lake.

Wheel of grey "zinnwaldite", pearly, translucent. It is associated with quartz.

#A-726L: Chemalloy Mine, Bernic Lake.

"Lepidolite". Pale violet, long coarse fibres, translucent, dull to pearly. It is associated with quartz.

#A-727L: Chemalloy Mine, Bernic Lake.

"Muscovite". Pale green, fine-grained, massive, vitreous, transparent.

#A-698L: Silverleaf Claim, South of the Winnipeg River. (Fig. 32)

"Lepidolite". Violet, coarse-grained scaly aggregate, pearly, transparent.

#A-701L: Silverleaf Claim, South of the Winnipeg River. (Fig. 33)

"Zinnwaldite". Grey, plumose, translucent, some divergent scales. It is associated with feldspar.

#A-714L: Silverleaf Claim, South of the Winnipeg River.

"Lepidolite". Violet, curvi-lamellar, tabular crystals about 1-2 cm. across. It is associated with an albite-quartz intergrowth.

#A-715L: Silverleaf Claim, South of the Winnipeg River.

"Lepidolite". Pale pink, pearly, translucent. It is associated with an albite-quartz intergrowth.

#A-716L: Silverleaf Claim, South of the Winnipeg River.

"Zinnwaldite". Grey, plumose, pearly, translucent.

#A-690L: Silverleaf Claim, South of the Winnipeg River.

"Lepidolite". Violet, coarse-grained scaly aggregate, pearly, translucent, scaly flakes of unoriented mica in centre. It is associated with tourmaline.

VII e2. LITHIAN MUSCOVITE OR TRANSITIONAL MUSCOVITE

#A-723L: Chemalloy Mine, Bernic Lake.

"Lepidolite". Violet, fine-grained scaly aggregate, very compact, pearly, translucent.

#A-733L: Chemalloy Mine, Bernic Lake. (Fig. 35)

"Lepidolite". Violet, curvi-lamellar, vitreous, transparent to translucent. It is associated with feldspar.

The first sixteen of the writer's specimens described above are, from their powder patterns, normal muscovites, although the terms "lepidolite" and "zinnwaldite" have been used for the violet and grey-brown curvi-lamellar micas respectively. The last two specimens which are violet "lepidolites" (A-723L and A-733L) gave powder patterns which show them to be transitional micas, i.e. a lithian muscovite. X-ray powder data for a normal muscovite and a lithian muscovite are given in Table 20, where they are compared with that given by the ASTM card #6-0263 for muscovite. X-ray powder photographs of muscovite, a violet "lepidolite" and a grey "zinnwaldite" are compared in Figure 31, 32, and 33. All gave identical powder patterns. In Figure 35 the lithian muscovite is compared with normal muscovite (Figure 34) to show the difference in structure.

According to Heinrich and Levinson (1953), the violet color in mica is due to the presence of trivalent Mn in excess of trivalent Fe, and in the relative absence of divalent Fe. The cause and significance of the curvi-lamellar form that is taken by many of these micas is not known and more detailed study is necessary to understand this feature.

VII e3. BIOTITE $K(Mg,Fe,Mn)_3(Al,Si_3)O_{10}(OH,F)_2$

Biotite, which occurs throughout the pegmatites, is particularly

Table 20

X-ray Powder Data for Muscovite and Lithian Muscovite

Monoclinic C^2/c, a = 5.19 Å, b = 9.03 Å, c = 20.02 Å, β = 95°46'

(ASTM 6-0263)

	Muscovite ASTM 6-0263		Muscovite Bernic Lake A-500 L		Lithian Muscovite Bernic Lake A-514 L	
hkl	I	d,Å	I	d,Å	I	d,Å
002	95	9.95	10	10.01	7	10.01
004	31	4.97	7	5.00	5	5.01
110	21	4.47	9	4.46	6	4.48
111	4	4.30	3	4.30	½	4.32
022	4	4.11	3	4.09	10	4.12
112	6	3.95				
$11\bar{3}$	14	3.882	5	3.87	1	3.84
023	17	3.731	5	3.73	4	3.73
					9	3.63
$11\bar{4}$	22	3.489	7	3.49	1	3.48
024	23	3.342				
006	100	3.320	10	3.34	10	3.34
114	28	3.199	7	3.20	1	3.21
$11\bar{5}$	2	3.122			9	3.08
025	34	2.987	9	2.99	1	2.99
115	24	2.859	6	2.86	4	2.91
$11\bar{6}$	21	2.789	6	2.79	1	2.78

Table 20 (Cont'd)

	Muscovite ASTM 6-0263		Muscovite Bernic Lake A-500 L		Lithian Muscovite Bernic Lake A-514 L	
hkl	I	d,Å	I	d,Å	I	d,Å
					3	2.68
$13\bar{1}$	16	2.596	7	2.58	8	2.59
$20\bar{2}$	54	2.566	9	2.55	9	2.56
008	7	2.505	3	2.51	1	2.51
132	14	2.491				
$13\bar{3}$	8	2.465				
202	7	2.450	2	2.45	1	2.46
$20\bar{4}$	10	2.398			2B	2.39
133	27	2.384	3	2.37		
134	9	2.254			1	2.25
$13\bar{5}$	4	2.236	3	2.24		
221,204	7	2.208	2B	2.20		
$22\bar{3}$	4	2.189				
$20\bar{6}$	15	2.149	1	2.15	2B	2.15
135	21	2.132	4	2.13		
223	4	2.070				
044	6	2.053				
00.10	46	1.993	9	2.00	6	2.01
224,045	9	1.972	2	1.973	1	1.960
206	6	1.951				

Table 20 (Cont'd)

	Muscovite ASTM 6-0263		Muscovite Bernic Lake A-500 L		Lithian Muscovite Bernic Lake A-514 L	
hkl	I	d,Å	I	d,Å	I	d,Å
22$\bar{6}$	3	1.941	1	1.945		
20$\bar{8}$	2	1.894				
046	3	1.871				
	3	1.822				
22$\bar{8}$	3	1.746				
13$\bar{9}$	8	1.731	2B	1.733		
24$\bar{1}$	5	1.710				
15$\bar{1}$,150	5	1.704				
240	4	1.699				
00.12,20.$\overline{10}$	11	1.662	2	1.668	2	1.666
312	23	1.646	4	1.649	1	1.641
15$\bar{4}$	6	1.631				
13.$\overline{10}$	6	1.620			½	1.622
313	6	1.603	1	1.60		
244	3	1.573				
314	7	1.559	1	1.559		
155	3	1.541				
245	11	1.524	3	1.527		
060,33$\bar{1}$	30	1.504	6	1.498	6	1.503
	4	1.453	1	1.462		

Table 20 (Cont'd)

	Muscovite ASTM 6-0263		Muscovite Bernic Lake A-500 L		Lithian Muscovite Bernic Lake A-514 L	
hkl	I	d,Å	I	d,Å	I	d,Å
00.14	1	1.424				
	1	1.414				
	1	1.388				
	2	1.375				
	11	1.352	5	1.358		
	9	1.335	4	1.344	2	1.346
	3	1.321				
	8	1.299	4	1.296	4	1.303
	6	1.292				
	5	1.274				
	4	1.267				
	5	1.253	2	1.256		
	8	1.246				
	3	1.227	2	1.223		

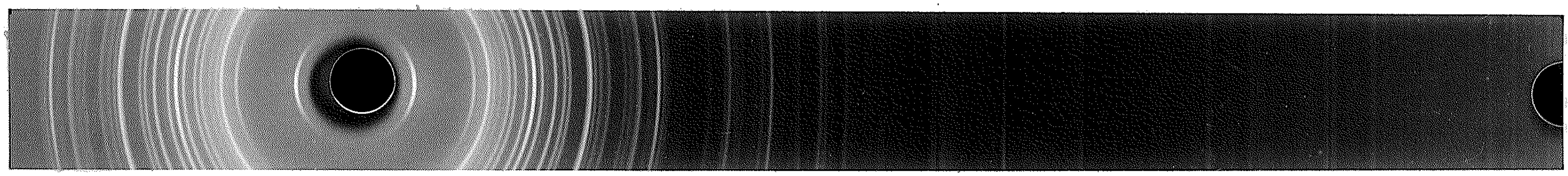

Figure 31. A-697L, Chemalloy Mine, Bernic Lake: Muscovite - Pale green.
Cu/Ni radiation, 114.83 mm. camera.

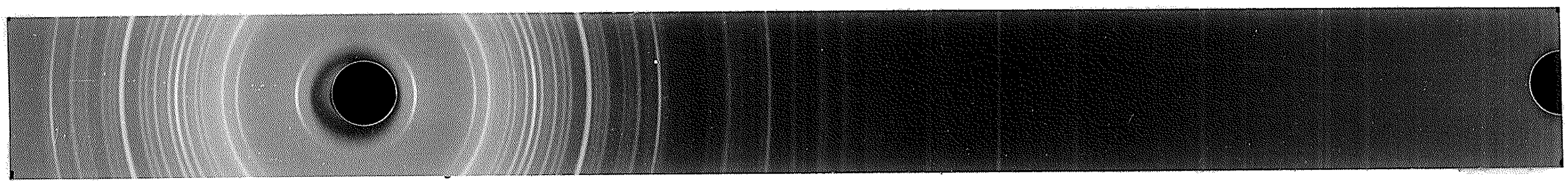

Figure 32. A-698L, Silverleaf Claim, South of the Winnipeg River: Muscovite. (Violet 'lepidolite').
Cu/Ni radiation, 114.83 mm. camera.

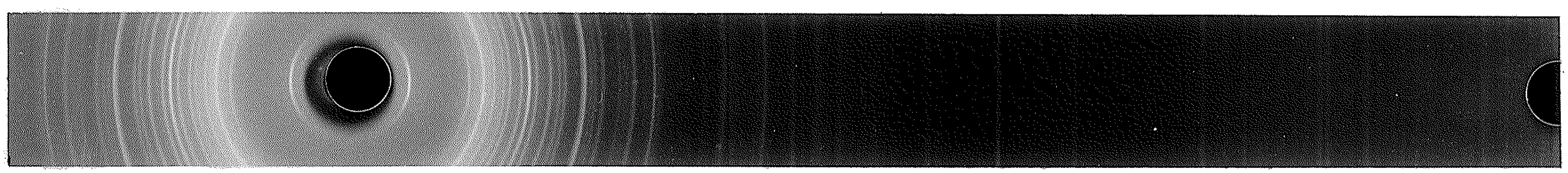

Figure 33. A-701L, Silverleaf Claim, South of the Winnipeg River: Muscovite. (Grey 'zinnwaldite').
Cu/Ni radiation, 114.83 mm. camera.

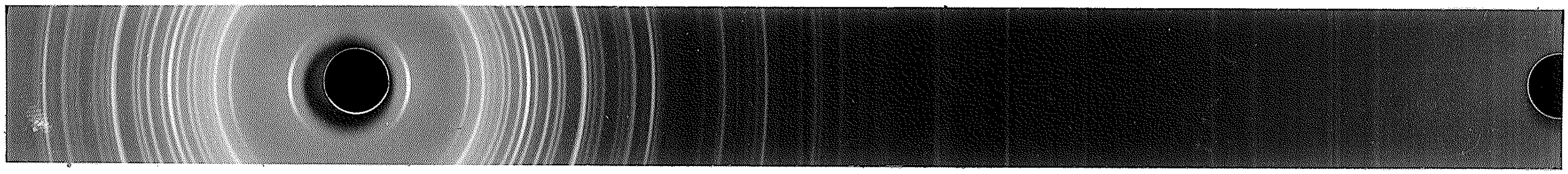

Figure 34. A-697L, Chemalloy Mine, Bernic Lake: Normal Muscovite.
Cu/Ni radiation, 114.83 mm. camera.

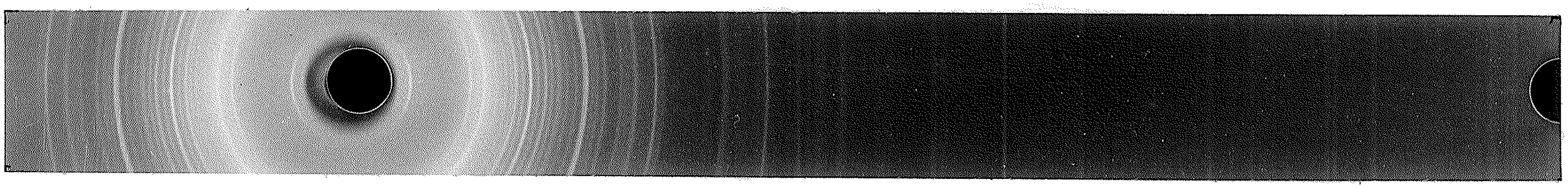

Figure 35. A-733L, Chemalloy Mine, Bernic Lake: Lithian muscovite or a transitional mica between Muscovite and Lepidolite?
Cu/Ni radiation, 114.83 mm. camera.

common in the simple pegmatites of Booster Lake (Davies 1956). One specimen of biotite was obtained from the pegmatite south of Tin Lake.

Hand specimen description:

#A-505L: South of Tin Lake. (Fig. 36)

Black, transparent, in small scaly aggregates. It is associated with feldspar and quartz.

X-ray powder data for biotite are given in Table 21, where they are compared with those given by Nagelschmidt (1937), and a photograph of this biotite appears as Figure 36. A number of weak extra lines occurring at 3.82Å, 3.52Å, 2.83Å, 2.31Å, and 1.405Å may be accounted for by the presence of microcline.

VII e4. ILLITE-MONTMORILLONITE ("SAROSPATITE")

This unusual clay mineral has not been reported in the literature of the area to date. One specimen was obtained from the Chemalloy mine at Bernic Lake.

Hand specimen description:

#A-521L (A-389S): Chemalloy Mine, Bernic Lake. (Fig. 37 and 38)

Pale pink to violet, opaque, hardness 2½, dull lustre, often shows a narrow white rim. It occurs in fine-grained masses intergrown with spodumene (A-390), from which it may have altered.

X-ray powder data for this pink clay mineral are given in Table 22, where they are compared with those given by Magdefrau and Hofmann

Table 21

X-ray Powder Data for Biotite

Monoclinic C^2/m, a = 5.30, b = 9.21, c = 10.16, β = 99°03' (Hendricks and Jefferson, 1939)

	South of Tin Lake A-505 L		Edenville, U.S.A. (Nagelschmidt, 1937) (ASTM 2-0045)	
hkl	I	d,Å	I	d,Å
001	10	10.01	10	10.1
110,020	2	4.62	2	4.59
	½	3.82		
	1	3.52		
003	9	3.36	10	3.37
112	½	3.27	2	3.16
11$\bar{3}$	1	3.04	2	2.92
	½	2.83		
20$\bar{1}$,130	8	2.63	8	2.66
004,113	2	2.52	4	2.52
201	4	2.44	8	2.45
	1	2.31		
040,132	1	2.27	2	2.28
	4	2.18	8	2.18
	4	2.01	8	2.00
	1	1.916	2	1.91

Table 21 (Cont'd)

	South of Tin Lake A-505 L		Edenville, U.S.A. (Nagelschmidt, 1937) (ASTM 2-0045)	
hkl	I	d,Å	I	d,Å
			2	1.75
	5	1.678	8	1.67
	6	1.545	8B	1.54
	1	1.528		
	1	1.486	2	1.47
	1	1.438	2	1.43
	1	1.405		
	2B	1.369	6	1.36
	1	1.332	4	1.33

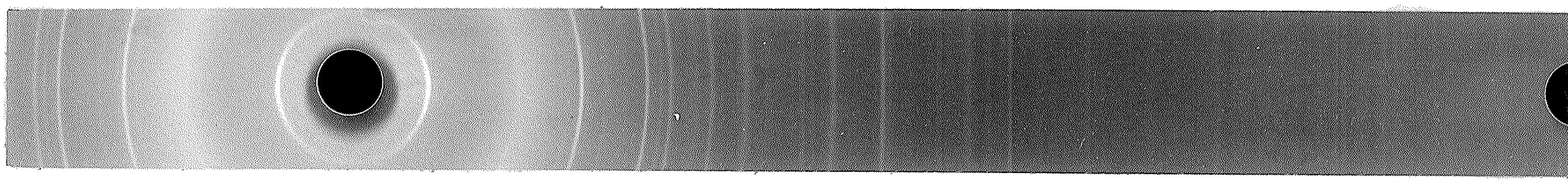

Figure 36. A-505L, South of Tin Lake: Biotite.
Fe/Mn radiation, 114.83 mm. camera.

Table 22

X-ray Powder Data for Sarospatite

Chemalloy Mine, Bernic Lake A-521 L		Magdefrau & Hofmann (1937) ASTM 2-0227	
I	d,Å	I	d,Å
6	9.97	6	10.09
5	4.90	4	5.01
10	4.46	10	4.45
3	3.64	4	3.64
4	3.34	6	3.31
3	3.05	4	3.07
9	2.57	10	2.56
		2	2.46
7	2.37	4	2.38
½	2.26	2B	2.24
½	2.13	4B	2.13
½B	1.985	1B	2.00
1B	1.710	2B	1.69
1B	1.637	2B	1.63
9	1.502	8	1.508
7	1.301	4	1.290

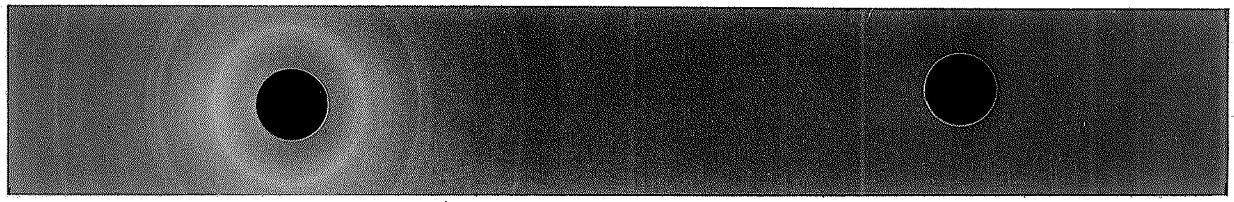

Figure 37. A-389S, Chemalloy Mine, Bernic Lake: Mixed layer illite-montmorillonite ('sarospatite'). Cu/Ni radiation, 114.83 mm. camera.

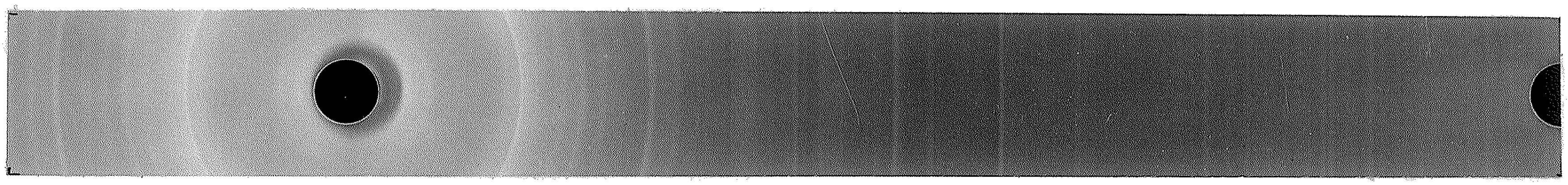

Figure 38. A-521L, Chemalloy Mine, Bernic Lake: Mixed layer illite-montmorillonite (sarospatite). Fe/Mn radiation, 114.83 mm. camera.

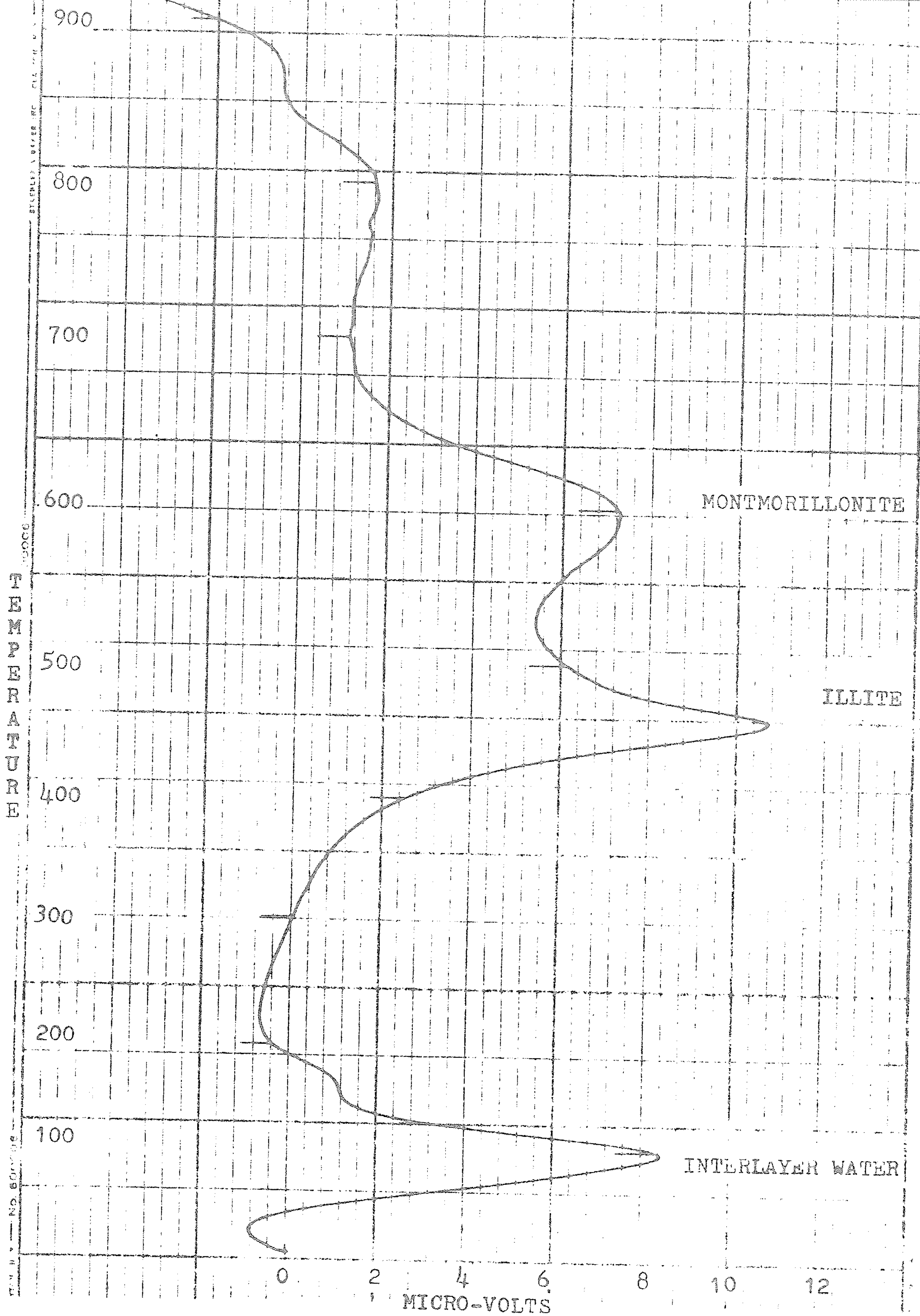

Figure 39. Differential thermal analysis curve of mixed layer illite-montmorillonite. Chemalloy mine, Bernic Lake.

(1937) (ASTM 2-0227). X-ray powder photographs of this mineral are given as Figure 37 and 38, and the DTA curve of it is given as Figure 39. There is very good agreement of the measured d spacings and the visually estimated intensities with the data given on the ASTM card for this mineral, although one line at 2.46 Å is missing from the writer's powder pattern. This mineral (sarospatite) was originally thought to be a distinct species but it has since been discredited, and it is now known to be an illite with mixed layers of montmorillonite (Brindley, 1951). The DTA curve obtained agrees well with the DTA curve for the mixed layer illite-montmorillonite known as sarospatite given in Brindley (1951, p. 149).

VII e5. CHLORITE $(Mg,Fe)_3(AlSi_3)O_{10}(O,OH)_2$

Chlorite has been reported from the pegmatites where it occurs in small irregular patches associated with 'epidote' (Davies, 1957). One specimen of chlorite was obtained from the Huron claim, south of the Winnipeg River.

Hand specimen description:

#A-501L: Huron Claim. (Fig. 40)
Black, opaque, earthy to massive, dull lustre, occurs as an alteration of epidote, associated with pink feldspar.

X-ray powder data for this chlorite are given in Table 23, where they are compared with those of McMurchy (1934), and an X-ray powder photograph of this chlorite is given as Figure 40. Additional lines at

4.99Å, 2.12Å, and 1.87Å, are probably due to epidote and that at 3.33Å to quartz. The additional lines at 9.93Å, 4.51Å, 4.14Å, and 2.50Å could not be accounted for.

Table 23

X-ray Powder Data for Chlorite

Huron Claim A-501 L		West Chester,Pa. (McMurchy, 1934) (ASTM 2-0028)	
I	d,Å	I	d,Å
		10	13.8
1	9.93		
10	7.07	8	7.0
1	4.99	8	4.68
8	4.51		
1	4.14		
8	3.54	8	3.53
1	3.33		
4	2.91	6	2.83
2B	2.65	5	2.65
4B	2.58	6	2.55
4	2.50		
4B	2.39	6B	2.40
		½	2.24
2B	2.13		
1	1.998	4	2.02
1	1.874		

Table 23 (Cont'd)

Huron Claim A-501 L		West Chester, Pa. (McMurchy, 1934) (ASTM 2-0028)	
I	d,Å	I	d,Å
		1	1.70
		1	1.67
3	1.586	9B	1.54
2	1.507	1	1.51

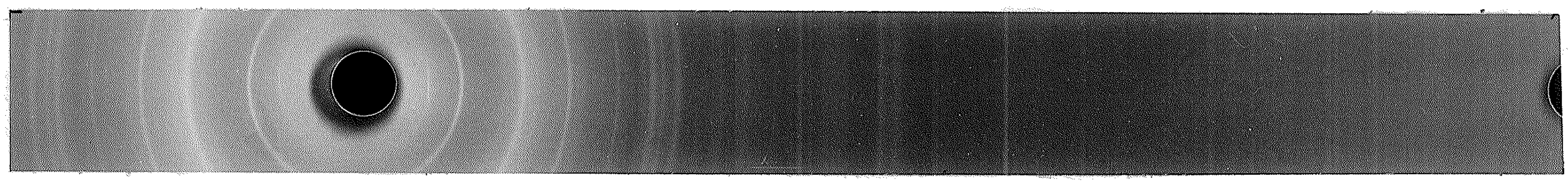

Figure 40. A-501L, Huron Claim, South of the Winnipeg River: Chlorite. Fe/Mn radiation, 114.83 mm. camera.

VII f. TECTOSILICATES

The following tectosilicates have been reported from the pegmatites of southeastern Manitoba:

Petalite $Li(AlSi_4O_{10})$

Pollucite $(Cs,Na)(AlSi_2O_6).H_2O$

Quartz SiO_2

Variety - Rose quartz

Albite $NaAlSi_3O_8$

Microcline $KAlSi_3O_8$

An X-ray examination of the specimens obtained revealed the following tectosilicates:

Petalite

Pollucite

Quartz

Low Albite

Maximum Microcline

VII f1. PETALITE $Li(AlSi_4O_{10})$

Petalite occurs as large cleavable masses in a few pegmatites. At Bernic Lake at the Chemalloy mine it occurs with spodumene and beryl, and it has been reported from east of Bernic Lake on the Buck claim, and on the Coe claim where it occurs with quartz and feldspar (Springer 1949, 1950; Davies 1955, 1958).

One specimen of petalite was obtained from the pegmatite east of Bernic Lake.

Hand specimen description:

#2012S (A-472L): East of Bernic Lake. (Fig. 41, 42)
White opaque to colorless transparent, cleavable masses, conchoidal fracture, vitreous, good cleavage in 001 direction.

X-ray powder data for this petalite are given in Table 24 where they are compared with those given in the ASTM card #9-475, and the X-ray diffraction patterns of this petalite are illustrated as Figure 41, 42. A number of additional weak lines on the photograph which occur at 3.19Å, 3.05Å, 2.91Å, 2.60Å, and 2.45Å can most easily be accounted for by the presence of feldspar and one at 3.30Å, by quartz, as impurities in the specimen.

VII f2. POLLUCITE $(Cs,Na)(AlSi_2O_6).H_2O$

Pollucite has been discovered quite recently at the Chemalloy mine north of Bernic Lake, where it occurs as white masses resembling an intergrowth of quartz and feldspar. At the mine pollucite occurs in a lenticular mass in association with quartz and amblygonite (Davies 1958, Mulligan 1961). According to Hutchinson (1959) drill core analyses of pollucite yield about 28.0% Cs_2O, 1.0% Rb_2O, and 0.5% Li_2O. The lithia content is probably due to spodumene and lepidolite. He gives the hardness as 6.5, the specific gravity as 2.89 and the refractive index as 1.5185.

Table 24

X-ray Powder Data for Petalite

Monoclinic C_{2h}^{6}, a = 11.79, b = 5.14, c = 15.2, β = 112°44',
(Gossner and Mussgnug, 1930)

	East end of Bernic Lake A-472 L		Varutrask, Sweden Murdoch ASTM 9-475	
hkl	I	d,Å	I	d,Å
002	½	6.99	½	6.97
			½	6.29
200,$\bar{2}$02	1	5.42	1	5.25
003,110	1	4.64	1	4.64
111,$\bar{1}$12	1	4.21	½	4.225
$\bar{2}$12,210	10	3.75	10	3.73
202,$\bar{2}$04 $\bar{1}$13	9	3.65	10	3.65
004	6	3.51	4	3.50
	6	3.30		
	½	3.19		
$\bar{3}$12	2	3.11	2	3.09
	1	3.05		
212,$\bar{2}$14	4	2.99	3	2.97
	1	2.91		
	2	2.79		
400,$\bar{4}$04 $\bar{3}$14	2	2.71	1	2.70

Table 24 (Cont'd)

	East end of Bernic Lake A-472 L		Varutrask, Sweden Murdoch ASTM 9-475	
hkl	I	d,Å	I	d,Å
	½	2.60		
020,114	3	2.57	2	2.57
$\bar{2}$06,204 021	1	2.54	1	2.53
	1	2.45		
$\bar{4}$14,410	2B	2.41	1	2.40
			½	2.34
			½	2.31
			½	2.249
	1	2.13	½	2.127
	5B	2.07	4	2.062
			½	1.994
	3	1.938	3	1.933
	2	1.899	3	1.896
			½	1.827
	1	1.807	½	1.802
	1	1.761	1	1.771
	2B	1.729	1	1.727
	3	1.638	2	1.633
	½B	1.606	½	1.599
	½	1.572	½	1.549

Table 24 (Cont'd)

	East end of Bernic Lake A-472 L		Varutrask, Sweden Murdoch ASTM 9-475	
hkl	I	d,Å	I	d,Å
	1	1.531	½	1.528
	½	1.479	2	1.487
	½	1.448	2	1.446
	½	1.407	½	1.412
	½	1.396	1	1.380
	½	1.364	½	1.332
	½	1.287	½	1.285
	½	1.276	½	1.275
	½	1.250	½	1.248

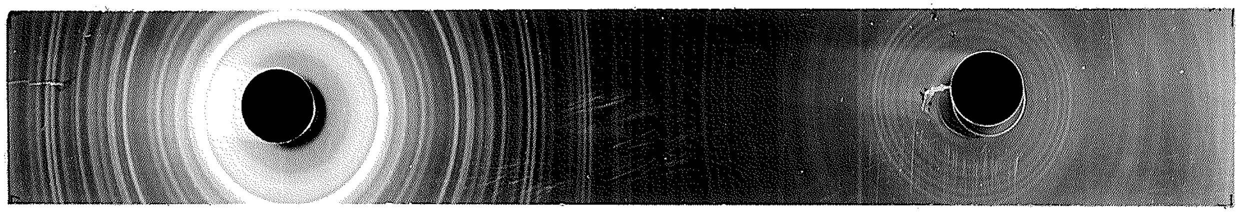

Figure 41. 2012S, East end of Bernic Lake: Petalite.
Cu/Ni radiation, 57.54 mm. camera.

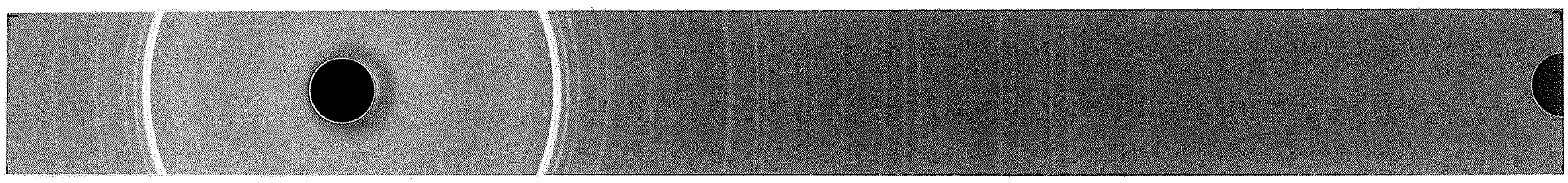

Figure 42. A-472L, East end of Bernic Lake: Petalite.
Fe/Mn radiation, 114.83 mm. camera.

Five specimens of pollucite were obtained from two localities. To the writer's knowledge, pollucite has been reported from only one locality in the area, that at Bernic Lake. However an X-ray examination of a mineral from a pegmatite north of Maskwa Lake proved it to be pollucite.

Hand specimen descriptions:

#2070S: Chemalloy Mine, Bernic Lake.

White, massive pollucite, some glassy parts, brittle.

#2030S: Chemalloy Mine, Bernic Lake.

Drill core sample, white, opaque to transparent colorless, conchoidal fracture.

#2131S: Chemalloy Mine, Bernic Lake.

White opaque to colorless transparent, 'perthitic' texture, very brittle, vitreous.

#A-473L: Chemalloy Mine, Bernic Lake. (Fig. 43)

White opaque to colorless transparent, 'perthitic' texture, vitreous, massive, associated with feldspar.

#A-490L: North of Maskwa Lake. (Fig. 44)

Colorless transparent, massive, brittle, vitreous. It is associated with lepidolite and feldspar, the lepidolite occurring in veins throughout the pollucite.

X-ray powder data for one of the pollucites are given in Table 25 where they are compared with those given by Fleischer and Ksanda (1940) and those given by Neuvonen and Vesasalo (1960). The latter is for a chemically analysed pollucite, X-rayed with a diffractometer using Si as an internal standard and Ni-filtered Cu radiation. The X-ray diffraction patterns for pollucite are given as Figures 43 and 44. Patterns for both the material from Bernic Lake and that from Maskwa Lake are presented to show that they are identical minerals.

According to Neuvonen and Vesasalo (1960), all the pollucites described in the literature are optically isotropic, and this is the case with those from Bernic Lake and Maskwa Lake. Naray Szabo (1938) claims that the symmetry of this mineral depends on the type of arrangement of the Al and Si atoms: he thinks that if they are ordered into specific sites, the structure would be tetragonal; but if they are statistically distributed over all the tetrahedral sites, then it is cubic. Neuvonen and Vesasalo therefore, conclude, that since all natural pollucites are isotropic, the disordered structure has to be assumed to be valid for the natural mineral. Detailed structure analyses would probably be necessary to confirm this idea. Powder data reveals no difference between the opaque stringers and the colorless transparent pollucite. If these different parts are the result of some kind of segregation of the Na and Cs atoms, as their appearance suggests they might be, this could only be determined by a single crystal X-ray analysis.

VII f3. QUARTZ SiO_2

Because quartz is a common mineral in all the pegmatites, only a very brief account will be presented here. It occurs as a clear,

Table 25

X-ray Powder Data for Pollucite

Cubic I^4/acd, a = 13.74 (Neuvonen and Vesasalo, 1960)

	Chemalloy Mine Bernic Lake A-473 L		Fleischer & Ksanda 1940		Samero, Finland Neuvonen & Vesasalo, 1960	
hkl	I	d,Å	I	d,Å	I	d,Å
211	1	5.61	2	5.64	2	5.56
220	1	4.84	3	4.90	1	4.82
			3	4.17		
321	6	3.66	4	3.67	36	3.65
400	10	3.42	10	3.43	100	3.417
420					1	3.053
332	8	2.92	8	2.925	45	2.911
422					1	2.792
431	1	2.67	2	2.690	3	2.681
521	1	2.49			4	2.503
440	7	2.41	6	2.424	25	2.418
532	5	2.22	4	2.224	12	2.221
620					1	2.165
631	3	2.02	1	2.019	4	2.018
444	1	1.981	1	1.977	3	1.976
640	½	1.845	2	1.899	2	1.899
552	5	1.856	5	1.863	12	1.863
			1	1.830		
732	6	1.740	7	1.740	15	1.738

Table 25 (Cont'd)

	Chemalloy Mine Bernic Lake A-473 L		Fleischer & Ksanda 1940		Samero, Finland Neuvonen & Vesasalo, 1960	
hkl	I	d,Å	I	d,Å	I	d,Å
800	2	1.716	2	1.713	5	1.710
741	½	1.686	1	1.686	2	1.685
644	1	1.645	1	1.637	1	1.660
822					1	1.614
831	½	1.590	2	1.592	1	1.592
752	3	1.558	2	1.531	3	1.550
840	4	1.528			5	1.530
921	2	1.478	2	1.477	2	1.4758
930	½	1.444	1	1.444	1	1.4435
932	4	1.411	3	1.413	5	1.4120
844	1	1.399			1	1.3981
10.1.1	5	1.356	4	1.356	1	1.3558
765	4	1.307	3	1.306	5	1.3054
855	1	1.285	2	1.282	1	1.2814
864					1	1.2708
10.3.3	1	1.265	2	1.260	1	1.2601
10.5.1	3	1.218	3	1.219	4	1.2197
880					1	1.2094
10.5.3	3	1.186	3	1.182	4	1.1822
875	1	1.166	1	1.164	1	1.1647
884	1	1.139	1	1.140	1	1.1408
10.5.5	3	1.119	3	1.117	3	1.1173

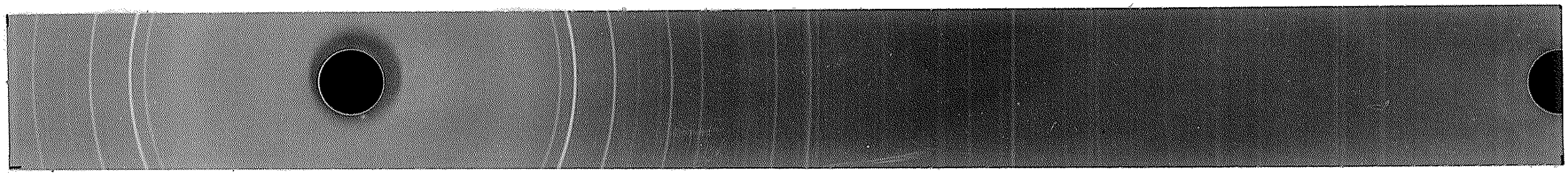

Figure 43. A-473L, Chemalloy Mine, Bernic Lake: Pollucite.
Fe/Mn radiation, 114.83 mm. camera.

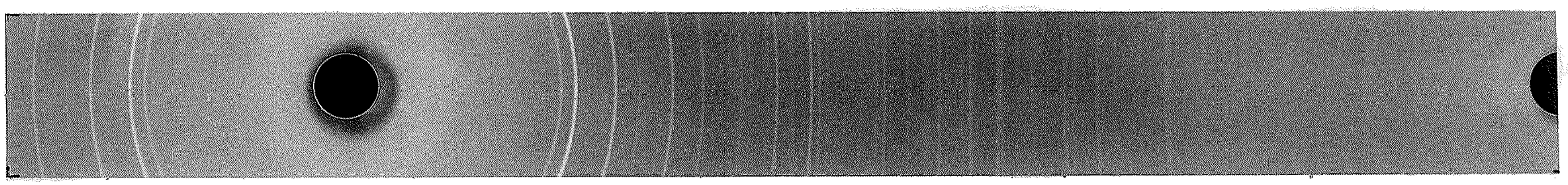

Figure 44. A-490L, North of Maskwa Lake: Pollucite.
Fe/Mn radiation, 114.83 mm. camera.

milky, smoky, or black mineral in the pegmatites, but usually it is glassy. Black vitreous quartz has been reported from the Huron claim south of the Winnipeg River. On the Silverleaf claim, south of the Winnipeg River germanium has been found in the quartz. Both black and smoky quartz occur on the Grace claim at Greer Lake. Rose- to flesh-colored quartz occurs on the north side of Birse Lake. Quartz is common with feldspar and tourmaline in the cassiterite dykes on the old Jack Nutt property (Springer 1949, 1950; Davies 1956, 1957; Rowe 1956).

Ten specimens of quartz were obtained from three localities.

Hand specimen descriptions:

#2054S: Northeast of Cat Lake.

Colorless, transparent, fractured. It is associated with spodumene and muscovite.

#2022S: Chemalloy Mine, Bernic Lake. (Fig. 46)

Colorless, transparent, massive. It is associated with spodumene.

#2065S: Chemalloy Mine, Bernic Lake.

Colorless, transparent, to white opaque, conchoidal fracture. It is associated with green mica and tantalite.

#2069S: Chemalloy Mine, Bernic Lake.

Colorless transparent to white opaque, massive, conchoidal fracture. It is associated with cleavelandite, green spodumene and green mica.

#2083S: Chemalloy Mine, Bernic Lake.

Smoky, transparent, massive, conchoidal fracture. It is associated with muscovite books.

#2060S: East of Bernic Lake.

Smoky to colorless, massive, transparent. It is associated with blue apatite, and feldspar.

#2075S: East of Bernic Lake.

White, opaque, massive, also smoky. It is associated with tourmaline and albite.

#2078S: East of Bernic Lake. (Fig. 47)

Colorless to white, massive, highly fractured. It is associated with heterosite-purpurite.

#2085S: East of Bernic Lake. (Fig. 45)

Smoky quartz, massive, conchoidal fracture.

#2088S: East of Bernic Lake.

White transparent to opaque, splintery, highly fractured, massive. It is associated with heterosite-purpurite.

X-ray powder data for one of these quartz are given in Table 26 where they are compared with those given by Swanson and Fuyat (1953) (ASTM 5-0490) and an X-ray diffraction pattern of this quartz is given as Figure 45. Two additional weak lines with the apparent spacing of 3.69Å and 2.63Å which appeared on all ten quartz photographs are actually the K reflections for the strong lines at 3.34Å and 2.45Å. Number 2022 contained two additional weak lines at 2.94Å and 2.78Å which could be accounted for by assuming the presence of spodumene. A number of additional weak lines on 2088 and 2078 at 4.95Å, 4.50Å, 3.90Å, 3.10Å, 2.90Å, 2.40Å, and 1.74Å could be accounted for by assuming presence of heterosite-

Table 26

X-ray Powder Data for Quartz

Hexagonal $P3_1 21$, a = 4.913, c = 5.405 (Swanson and Fuyat, 1953)

	East of Bernic Lake 2085 S		Lake Toraway, N.Carolina (Swanson & Fuyat, 1953) ASTM 5-0490	
hkl	I	d,Å	I	d,Å
100	7	4.25	35	4.26
	2	3.69		
101	10	3.34	100	3.343
	1	2.65		
110	5	2.45	12	2.458
102	5	2.27	12	2.282
111	4	2.23	6	2.237
200	5	2.13	9	2.128
201	4	1.977	6	1.980
112	7	1.820	17	1.817
003			<* 1	1.801
202	4	1.672	7	1.672
103	1	1.661	3	1.659
210			< 1	1.608

* < - less than

Table 26 (Cont'd)

	East of Bernic Lake 2085 S		Lake Toraway, N.Carolina (Swanson & Fuyat, 1953) ASTM 5-0490	
hkl	I	d,Å	I	d,Å
211	7	1.542	15	1.541
113	3	1.453	3	1.453
300	1	1.418	<1	1.418
212			7	1.382
203	8B	1.373	11	1.375
301			9	1.372
104	2	1.288	3	1.288
302	3	1.256	4	1.256
220	2	1.229	2	1.228
213	4	1.201	5	1.1997
221			2	1.1973
114			4	1.1838
310	4	1.181	4	1.1802
311	3	1.156	2	1.1530
204	1	1.139	<1	1.1408
303	1	1.116	<1	1.1144
312	4	1.084	4	1.0816
400	1	1.066	1	1.0636
105	3B	1.047	2	1.0477
401			2	1.0437

Table 26 (Cont'd)

	East of Bernic Lake 2085 S		Lake Toraway, N.Carolina (Swanson & Fuyat, 1953) ASTM 5-0490	
hkl	I	d,Å	I	d,Å
214	3	1.037	2	1.0346
223	3	1.016	2	1.0149
402,115	3	.989	2	.9896
313			2	.9872
304	2	.979	< 1	.9781
320			1	.9762
321	3	.961	2	.9607
410			< 1	.9285
322			1	.9182
403	5	.917	3	.9160
411			2	.9152
224	1	.909	1	.9090
006			< 1	.9008
215	2	.899	2	.8971
314	2	.891	2	.8889
106			< 1	.8812
412	2	.879	1	.8782
305	1	.863	< 1	.8598
116	1	.847	< 1	.8460

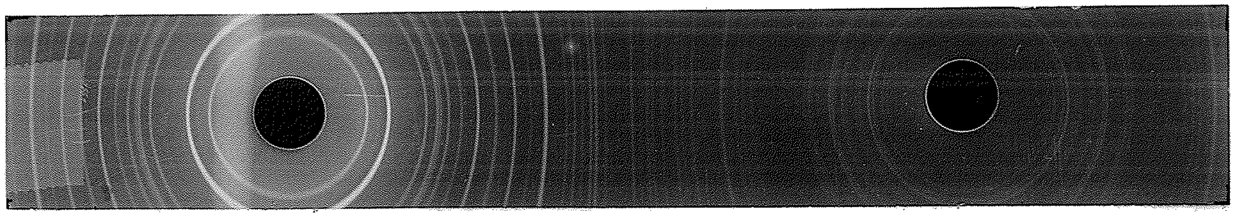

Figure 45. 2085S, East end of Bernic Lake: Quartz.
Cu/Ni radiation, 57.54 mm. camera.

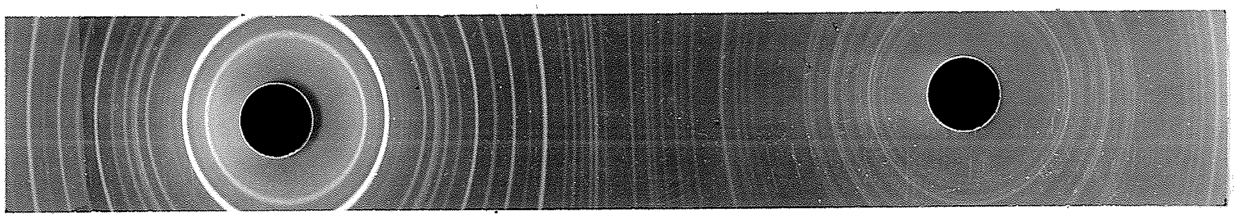

Figure 46. 2022S, Chemalloy Mine, Bernic Lake: Quartz and minor spodumene.
Cu/Ni radiation, 57.54 mm. camera.

Figure 47. 2078S, East end of Bernic Lake: Quartz with minor purpurite.
Cu/Ni radiation, 57.54 mm. camera.

purpurite. The X-ray powder photographs of the quartz specimens with additional lines due to spodumene and to heterosite-purpurite are given as Figure 46, 47.

VII f4. and f5. FELDSPARS - LOW ALBITE $NaAlSi_3O_8$, MAXIMUM MICROCLINE $KAlSi_3O_8$

Feldspars in the form of albite and microcline are abundant throughout the pegmatites. In general the grey feldspar pegmatites are usually albite, the pink feldspar pegmatites are microcline and/or albite, and albite often occurs as 'cleavelandite', a platy albite. In albite pegmatite gneisses large crystals of graphic quartz and albite intergrowths may occur. Microcline and albite occur in spodumene dykes at Cat Lake. They occur with tourmaline, muscovite, cassiterite and quartz at the old Jack Nutt Tin mine at Bernic Lake. At Shatford Lake feldspar occurs in the form of large crystals and curved plates. Albite occurs as 'cleavelandite' on the Huron claim, south of the Winnipeg River. Some of the dykes in the Winnipeg River area contain almost pure feldspar. At Greer Lake both albite and microcline were quarried at one time. Perthites are not common in the pegmatite dykes of the Winnipeg River area (Springer 1948, 1949, 1950; Davies 1957, 1958).

VII f4. LOW ALBITE $NaAlSi_3O_8$

Hand specimen descriptions:

#A-357L: Huron Claim, South of the Winnipeg River.

White to pink cleavable masses, twinning striations on basal cleavage. It is associated with tantalite.

#A-358L: Huron Claim, South of the Winnipeg River.

Pink, cleavable, opaque. It is associated with epidote.

#A-365L: Huron Claim, South of the Winnipeg River.

Pink, cleavable. It is associated with epidote.

#A-364L: South of Cat Lake.

Granular, white, vitreous, brittle. It is associated with blue apatite and quartz.

#A-373L: Rush Lake, South of Bird Lake.

White to grey granular albite, vitreous. It is associated with quartz and tourmaline.

#A-359L: South of Shatford Lake.

Pink to grey, opaque.

#A-378L: South of Shatford Lake.

Pink, cleavable masses, vitreous. It is associated with jamesonite, quartz, and curvi-lamellar 'zinnwaldite'.

#A-372L: Between Birse and Booster Lake.

White to pink, coarsely cleavable. It is associated with quartz and tourmaline.

#A-376L: Silverleaf Claim, South of the Winnipeg River.

White albite intergrown with quartz.

#A-377L: Silverleaf Claim, South of the Winnipeg River. (Fig. 48)

Pink to white, vitreous. It is associated with muscovite and tourmaline.

#A-355L: East of Bernic Lake.

Pale orange to white, striations on basal cleavage, in small cleavable masses. It is associated with tourmaline.

#A-356L: East of Bernic Lake.

White, cleavable masses, vitreous.

#A-369L: East of Bernic Lake.

Bluish-grey, coarsely cleavable masses, opaque to translucent, striations on basal cleavage, associated with tourmaline and quartz.

#A-370L: East of Bernic Lake.

Pale pink, cleavable masses, brittle, vitreous.

#A-371L: East of Bernic Lake.

Pale pink granular albite, associated with tourmaline.

#A-375L: East of Bernic Lake.

White, granular, associated with quartz and muscovite.

VII f5. MAXIMUM MICROCLINE $KAlSi_3O_8$

Hand specimen descriptions:

#A-367L: Chemalloy Mine, Bernic Lake.

White cleavable masses, vitreous. It is associated with blue-green spodumene, pale-green muscovite and quartz.

#A-379L: Chemalloy Mine, Bernic Lake. (Fig. 49)

Finely perthitic microcline in large cleavable masses, white to pale pink, vitreous, translucent.

#A-380L: Chemalloy Mine, Bernic Lake.

As above, whiter in color.

All feldspar specimens were first photographed with a 57.54 mm. camera and their identifications were attempted using four standard patterns: orthoclase, intermediate and maximum microcline, and low albite. It proved impossible to identify these photographs due to poor resolution in the $2\theta = 30°$ area, which is critical for powder identification of the feldspars. All specimens were then rephotographed on a 114.83 mm. camera with Fe/Mn radiation to improve resolution in the $2\theta = 30°$ area and also in the $2\theta = 27°$ and $2\theta = 14°$ areas. It then became possible to identify the feldspars by using the charts compiled by Patterson (1959) from Smith (1956) and Goldsmith and Laves (1954). All fell into two categories - low albite and maximum microcline. All the maximum microcline patterns showed the strongest line of albite and so should strictly speaking be considered microcline perthites.

X-ray powder data for one of the low albites are given in Table 27 where they are compared with the data given by Smith (1956), and a photograph of this low albite appears as Figure 48. X-ray powder data for maximum microcline are given in Table 28, where they are compared with the data given by Goldsmith and Laves (1954) and a photograph of this maximum microcline appears as Figure 49.

Table 27

X-ray Powder Data for Low Albite

Triclinic C$\bar{1}$, a = 8.144, b = 12.787, c = 7.160, α = 94°2', β = 116°58', γ = 87°67' (Smith, 1956)

	Silverleaf Claim South of the Winnipeg River A-377 L		Amelia, Virginia (Smith, 1956) (ASTM 9-466)	
hkl	I	d,Å	I	d,Å
001	5	6.39	20	6.39
11$\bar{1}$	½	5.92	1	5.94
$\bar{1}$11	½	5.61	1	5.59
20$\bar{1}$	7	4.03	15	4.030
1$\bar{1}$1	½	3.86	7	3.857
111	5	3.77	25	3.780
130	6	3.67	20	3.684
13$\bar{1}$,1$\bar{3}$0			15	3.663
11$\bar{2}$	3	3.50	10	3.509
22$\bar{1}$			1	3.484
$\bar{1}$12	3	3.36	7	3.375
002	10	3.19	100	3.196
2$\bar{2}$0			9	3.151
1$\bar{3}$1	5B	2.95	9	2.964
02$\bar{2}$			15	2.933
131	2	2.86	7	2.866
13$\bar{2}$			1	2.843
022			1	2.787

Table 27 (Cont'd)

	Silverleaf Claim South of the Winnipeg River A-377 L		Amelia, Virginia (Smith, 1956) (ASTM 9-466)	
hkl	I	d,Å	I	d,Å
$\bar{1}32$	2	2.64	5	2.639
$24\bar{1}$	3	2.55	7	2.563
$31\bar{2}$			1	2.538
$1\bar{1}2$			1	2.511
$2\bar{2}1$			5	2.496
221			5	2.460
$\bar{2}41$	2	2.44	3	2.443
$15\bar{1}$			1	2.431
240			1	2.405
310	½	2.39	3	2.388
$33\bar{1}$	2	2.32	3	2.320
$\bar{1}13$			1	2.278
042	1	2.18	3	2.189
060			7	2.125
151	3	2.12	5	2.119
$2\bar{4}1$	1	2.08	1	2.076
241	1B	2.03	1	2.035
202	½	1.924	1	2.000
061			3	1.980
$42\bar{1}$			1	1.927
222	4	1.892	7	1.889

Table 28

X-ray Powder Data for Maximum Microcline

Triclinic $P\bar{1}$, a = 8.58, b = 12.97, c = 7.22, α = 90°38.5',
β = 115°56', γ = 87°41' (Goldsmith and Laves, 1954)

	Chemalloy Mine Bernic Lake A-379 L		Madagascar (Goldsmith et al,1954) (ASTM 10-479)	
hkl	I	d,Å	I	d,Å
$1\bar{1}0$,001 020	2	6.42	2	6.46
$11\bar{1}$	1	5.86	1	5.91
021			1	4.62
$20\bar{1}$	6	4.22	6	4.21
	2	4.13		
111	3	4.00	3	3.98
$1\bar{1}1$			1	3.92
200,130	4	3.84	5	3.83
$1\bar{3}0$	1	3.71	4	3.71
$13\bar{1}$	1	3.65	1	3.64
$22\bar{1}$,$\bar{1}31$			2	3.57
$11\bar{2}$,$\bar{2}21$ $\bar{1}12$	6	3.47	5	3.48
220	5	3.37	5	3.366
$20\bar{2}$	3	3.29	4	3.290
$2\bar{2}0$,002 040	10	3.24	10	3.244
	4	3.18		

Table 28 (Cont'd)

	Chemalloy Mine Bernic Lake A-379 L		Madagascar (Goldsmith et al,1954) (ASTM 10-479)	
hkl	I	d,Å	I	d,Å
131	3	3.02	4	3.025
$22\bar{2},1\bar{3}1$	4	2.96	5	2.964
$002,041$ $\bar{2}22,02\bar{2}$ $04\bar{1}$	3	2.90	5	2.902
$13\bar{2}$	2	2.77	1	2.772
$\bar{3}11,\bar{1}32$			2	2.759
$31\bar{2},24\bar{1}$ 221	3	2.62	3	2.620
112	2	2.56	2	2.572
$310,240$ $\bar{2}41$	2	2.52	3	2.531
$3\bar{1}0$			1	2.497
$\bar{2}40,\bar{1}50$ $1\bar{5}1,33\bar{1}$	2	2.43	1	2.429
$\bar{1}51,20\bar{3}$	½	2.39	1	2.391
$\bar{3}31,11\bar{3}$ $\bar{1}13$	2	2.33	?	2.333
$\bar{3}32,151$ $\bar{2}23$	½	2.23	½	2.228
241,060	6	2.16	5	2.161

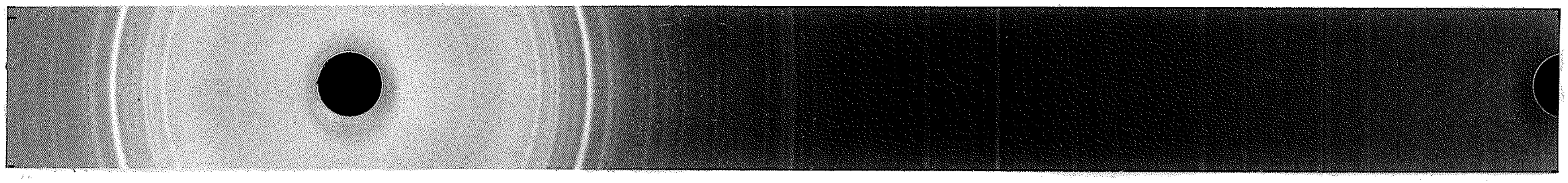

Figure 48. A-377L, Silverleaf Claim, South of the Winnipeg River: Low Albite.
Fe/Mn radiation, 114.83 mm. camera.

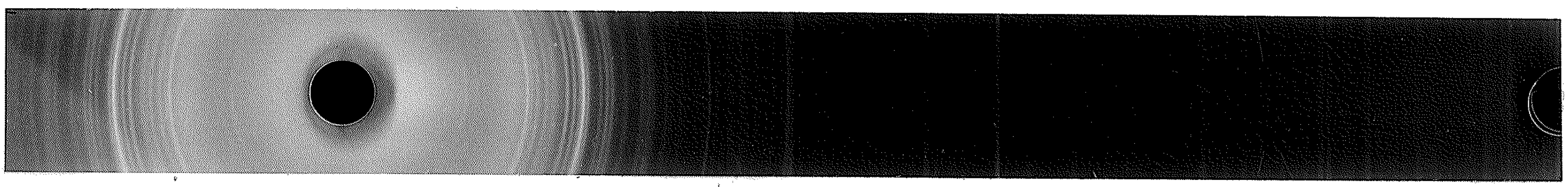

Figure 49. A-379L, Chemalloy Mine, Bernic Lake: Maximum microcline.
Fe/Mn radiation, 114.83 mm. camera.

APPENDIX I

A List of Minerals from the Pegmatites of Southeastern Manitoba

The following list of minerals reported from the pegmatites of southeastern Manitoba is classified after Strunz (1957) and Palache et al (1944, 1951), and has been compiled from reports, mainly Davies and Springer, published on this area and also includes those minerals which the writer has identified by X-ray diffraction.

SULFIDES AND SULFO-SALTS

Galena

Sphalerite

Stibnite

Bismuthinite

Pyrite

Arsenopyrite

Molybdenite

**Jamesonite

OXIDES

Cassiterite

Uraninite

*Magnetite (new locality)

---

* - Minerals which have been more clearly defined.

** - Mineral identified by the writer, which had not been reported in the literature of the area to our knowledge.

Microlite

Tapiolite

Tantalite-columbite

*Wodginite

Euxenite-polycrase

FLUORIDES

Fluorite

PHOSPHATES

*Triphylite-lithiophilite

**Sicklerite

*Purpurite-heterosite

Monazite

Amblygonite-montebrasite

**Brazilianite

Apatite

CARBONATES

Calcite

Rhodochrosite

NESOSILICATES

Eucryptite

Garnet

Topaz

**Uranophane-sklodowskite

SOROSILICATES

*Epidote-clinozoisite

Zoisite

**Vesuvianite

CYCLOSILICATES

Beryl, variety Aquamarine

Tourmaline

INOSILICATES

Spodumene, variety Kunzite

PHYLLOSILICATES

*Muscovite

Biotite

*Lepidolite (= Muscovite or Lithian muscovite)

*Zinnwaldite (= Muscovite)

**Illite-montmorillonite (Sarospatite)

Chlorite

TECTOSILICATES

Petalite

*Pollucite (new locality)

Quartz

*Low Albite

*Maximum Microcline

APPENDIX II

Minerals Identified by X-ray Diffraction from the Pegmatites of Southeastern Manitoba

The following list of minerals identified by X-ray diffraction powder photographs from the pegmatites of southeastern Manitoba is arranged according to locality, and classified within each locality according to Strunz (1957) and Palache et al (1944, 1951).

NORTH OF MASKWA LAKE

Tourmaline

Spodumene

*Muscovite ("lepidolite")

**Pollucite (new locality)

NORTHWEST OF CAT LAKE

Spodumene

NORTHEAST OF CAT LAKE

Spodumene

Quartz

SOUTH OF CAT LAKE

Apatite

*Low Albite

---

* - Minerals which have been more clearly defined.

** - Minerals identified by the writer which had not previously been reported in the literature of the area to our knowledge.

CHEMALLOY MINE, BERNIC LAKE

Tantalite-columbite

*Wodginite

Rhodochrosite

*Triphylite-lithiophilite

Amblygonite

**Brazilianite

Apatite

Beryl

Tourmaline

Spodumene

*Muscovite (normal, "lepidolite", "zinnwaldite")

*Lithian muscovite

**Illite-montmorillonite (Sarospatite)

*Pollucite (new locality)

Quartz

*Maximum microcline

EAST END OF BERNIC LAKE

Tantalite-columbite

*Triphylite-lithiophilite

**Sicklerite

*Heterosite-purpurite

Amblygonite

Apatite

Beryl

Tourmaline

Spodumene

Petalite

Quartz

*Low albite

RUSH LAKE, SOUTH OF BIRD LAKE

Cassiterite

Tourmaline

*Low albite

SOUTH OF SHATFORD LAKE

**Jamesonite

Topaz

Beryl

*Muscovite ("zinnwaldite")

*Low albite

EAST OF SHATFORD LAKE

Beryl

SILVERLEAF CLAIM, SOUTH OF THE WINNIPEG RIVER

Tourmaline

*Muscovite ("lepidolite", "zinnwaldite")

*Low albite

HURON CLAIM, SOUTH OF THE WINNIPEG RIVER

*Magnetite (new locality)

Tantalite-columbite

**Uranophane-sklodowskite

*Epidote-clinozoisite

**Vesuvianite

Beryl

Chlorite

*Low albite

BETWEEN BIRSE AND BOOSTER LAKE

Tourmaline

*Low albite

SOUTH OF TIN LAKE

Biotite

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