Ontario Department of Mines
and Northern Affairs

PRELIMINARY MAP No. P.452 (REVISED)

AEROMAGNETIC MAPS OF CARBONATITE-ALKALIC COMPLEXES IN ONTARIO

MARGINAL NOTES

In the last ten years carbonatite-alkalic complexes have become increasingly important as producers or potential sources of niobium, rare-earths, uranium, thorium, zirconium, phosphate, vermiculite, iron, titanium, copper, and nickel. In many complexes the orebodies are very large. Three of the more important world producers are: Palabora, Transvaal (see Table 1) containing 315,000,000 tons of ore grading 0.7% Cu, with by-product magnetite, phosphate, and in another orebody vermiculite; Mountain Pass, California in which the Sulphide Queen carbonatite body contains in excess of 25,000,000 tons grading 5-10% rare-earth oxides; and Araxá, Minas Gerais, Brazil with an orebody of 300,000,000 tons grading 3.3% Nb_2O_5. In Canada the only producer is St. Lawrence Columbium and Metals Corp. from the Oka complex in Quebec (see Table 1).

Although the classification of carbonatite-alkalic complexes is controversial, both Heinrich (1966, p.11) and Tuttle and Gittins (1966, p.417-541) present data indicating the occurrence of over 200 complexes in the world with about 110-120 in Africa, over 40 in Eurasia, and 10 or more in South America. The writer lists 43 in Ontario (Table 2) and their location is shown on the adjoining map. Aeromagnetic maps of 34 of these are shown in the inset maps, all at the scale of 1 inch to 2 miles, unless otherwise indicated.

A number of mafic alkalic complexes, such as Fort Coldwell, Killala Lake, Drowning River, Mammamattawa and Squirrel River are included in Table 2 because they are related in origin and age to the carbonatite-alkalic complexes and have similar outlines on the aeromagnetic maps. Little is known about the geology of many of the complexes (e.g. Niskibi Lake, Gooseberry Brook, Wapikopa River, Lawashi River, Poplar River, Nagagami River) revealed by the aeromagnetic surveys but they are included in Table 2 at the present time. For the remainder of Canada, Tuttle and Gittins (1966) describe 2 in Quebec and possibly 4 in British Columbia.

Many of the complexes have been found by aeromagnetic or aeroradiometric surveys by mining companies or government agencies. The complexes are indicated on aeromagnetic maps (see inset maps) by circular, oval, elliptical, crescent-shaped or horseshoe-shaped anomalous areas. In the simplest complexes carbonatite cores show as a central magnetic low, and surrounding concentric highs may be caused by either magnetite-bearing carbonatite or rings of alkalic rock. More complex rock relationships and mineralized bodies containing magnetite as an essential mineral are revealed by various lenticular, high anomalous areas. Because many carbonatite-alkalic complexes are poorly exposed detailed ground magnetometer surveys combined with the known distribution of boulder erratics have proved especially valuable in delineating the best areas for exploration by diamond drilling. Moreover, scintillometer surveys are also effective tools in exploration because of the radioactivity commonly associated with pyrochlore mineralization.

In Ontario some occurrences have been known for many years but were not recognized as carbonatite-alkalic complexes at the time of their discovery. The recognition of these complexes in the 1950's resulted in the exploration of the Firesand (Algoma Ore Properties, 1951-8), Manitou Islands (Beaucage, 1952-6, see Table 1), Nemegosenda (Dominion Gulf, 1954-8), Lackner (Multi-Minerals, 1954-8, see Table 1), Clay-Howells (Steel Co. of Canada, 1954-5), Cargill (Continental Copper, 1954-7, 1967), Chipman Lake (1954-5), Iron Island (Nipiron, 1952-4), and more recently, Big Beaver House (Many Lakes, 1962), Port Coldwell (Anaconda, 1962-), Carb Lake (Big Nama Creek and Larandona), Albany Forks, Drowning River, Mammamattawa, and Squirrel River (Keevil Mining Group).

Joint aeromagnetic surveys of northern Ontario during the years 1959-1967 by the Ontario Department of Mines and the Geological Survey of Canada have revealed numerous, previously unknown complexes; a number of these are under a cover of Paleozoic sedimentary rocks in the James Bay Lowland. One of these, the Argor carbonatite body (Consolidated Morrison, 1966-), contains an economically significant tonnage of Nb_2O_5 as uranium-free pyrochlore (see Table 1)

The ages of the carbonatite-alkalic complexes in eastern Canada (Gittins et al. 1967) fall into four groups. These are 125, 565, 1075, and 1700 m.y., with a possible fifth at 1560 m.y. Niobium is found in carbonatites of each age group.

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Table 1 ORE RESERVES AND PRODUCTION

ARGOR — Consolidated Morrison Explorations Ltd.

Ore Res: 10,000 tons/vert. ft. grading 0.82% Nb_2O_5 (Northern Miner, June 18, 1970).

LACKNER — Multi-Minerals Ltd.

Ore Res: Nos. 3-4 Zones: 37,000,000 tons 21.3% apatite, 13.7% magnetite, and 0.198% Nb_2O_5.

No. 6 Zone: 5,024,250 tons 69.6% magnetite, 21.9% apatite, and 0.173% Nb_2O_5.

No. 8 Zone: 80,000,000 tons 0.25% Nb_2O_5.

Calcite Zone: 880,000 tons 0.9% Nb_2O_5.
760,000 tons 0.23% Nb_2O_5.

MANITOU ISLANDS — Nova Beaucage Mines Ltd.

Ore Res: 1,893,000 tons 0.049% U_3O_8 and 0.86% Nb_2O_5
2,962,000 tons 0.041% U_3O_8 and 0.69% Nb_2O_5
Idle since 1956.

OKA, Quebec — St. Lawrence Columbium and Metals Corp.

Ore Res: 3,125,000 tons aver. 0.487% Nb_2O_5 (Oct. 1, 1969)

Production
12 mos. to Sept. 30:

	1964	1965	1966	1967	1968	1969	1969/1970*
Tons milled	321,585	383,553	406,698	369,642	360,194	475,201	350,762
Niobium pentoxide, lbs.	2,091,725	2,203,985	2,647,667	2,368,225	2,005,989	3,059,052	2,461,000
Production revenue, $	2,164,443	2,328,638	3,188,114	2,799,982	1,966,937	3,107,514	2,650,794
Average per ton, $	6.53	6.52	7.85	7.57	5.46	6.53	7.56

*6 months

PALABORA, Transvaal — Palabora Mining Co. Ltd.

Ore Res: 315,000,000 tons aver. 0.69% Cu (1963)
80,000,000 tons vermiculite (to 70 feet, 30% rec.)

Production

	1966	1967	1968	1969
	short tons	short tons	short tons	short tons
Copper (99.49% Cu)*	68,276	84,370	79,433	85,198
Magnetite conc. (66.1% Fe, 0.88% TiO_2)*	347,405	961,556	800,305	1,137,908
Sulphuric Acid (95.3% H_2SO_4)*	53,254	109,873	106,849	111,096
Vermiculite (91.1% Verm.)*	113,732	110,840	121,298	141,963

*1969 values

ARAXA, Minas Gerais, Brazil — Companhia Brasileira de Metalurgia e Mineracão (CBMM)

Production	1966	1967	1968	1969
Niobium pentoxide, lbs., in pyrochlore concentrates (averaging 59% Nb_2O_5)	6,210,909	6,017,103	6,502,269	6,667,000

SOURCES OF INFORMATION

Compilation by J. Satterly, 1968; revised with additions 1970.
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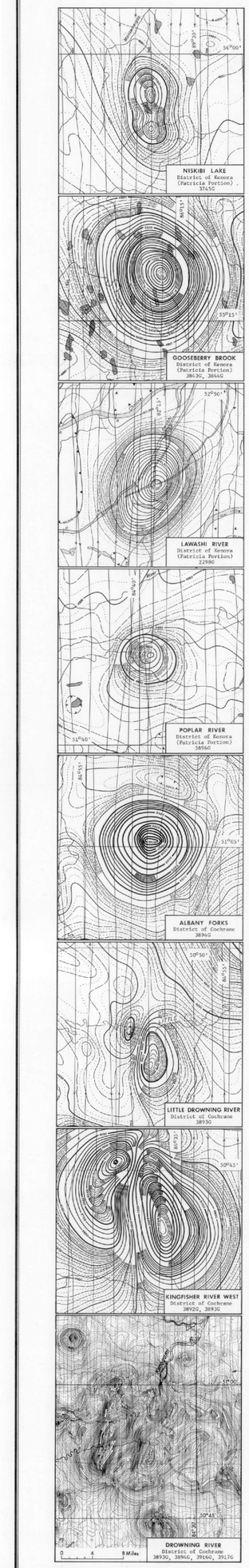
METAL AND MINERAL REFERENCE

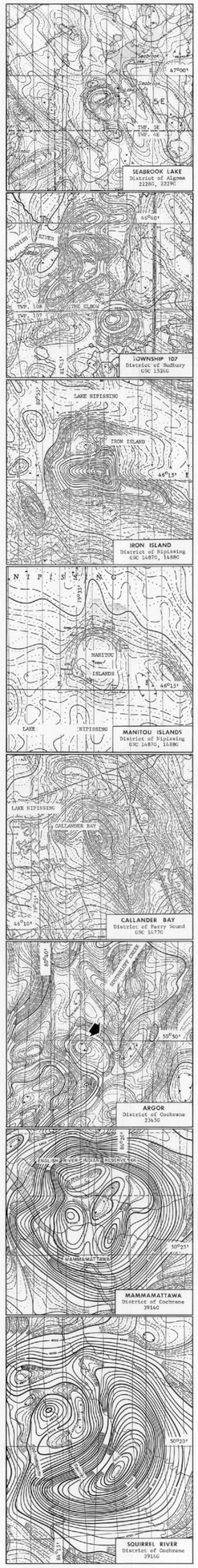
ap	Apatite
Ce	Cerium
Cu	Copper
Fe	Iron
fl	Fluorite
La	Lanthanum
Nb	Niobium (Columbium)
Ni	Nickel
Th	Thorium
Ti	Titanium
U	Uranium
verm	Vermiculite

TABLE 2
CARBONATITE-ALKALIC COMPLEXES IN ONTARIO

Name	District or County	Mineralization	Age m.y.
Firesand River	Algoma	Nb	1048
Seabrook Lake	Algoma	Nb	1103
*Eastview	Carleton	-	-
Albany Forks	Cochrane	Fe, Nb	-
Argor	Cochrane	Nb	1655
Cargill	Cochrane	Cu, Fe(Ti)	1740
Clay-Howells	Cochrane	Fe, Nb	1010
Drowning River	Cochrane	Fe	-
*Goldray	Cochrane	-	1695
Kingfisher River West	Cochrane	-	-
*Kingfisher River East	Cochrane	-	-
Little Drowning River	Cochrane	-	-
Mammamattawa	Cochrane	-	-
Martison Lake	Cochrane	Nb	-
Nagagami River	Cochrane	-	-
Squirrel River	Cochrane	ap	-
*Valentine Tp.	Cochrane	Nb	-
*Conifer-Sumach	Kenora	-	-
Big Beaver House	Kenora (P.P.)	Nb, Cu, ap	1005
Carb Lake	Kenora (P.P.)	Nb, Ce, La, verm	-
Gooseberry Brook	Kenora (P.P.)	-	-
Lawashi River	Kenora (P.P.)	-	-
Niskibi Lake	Kenora (P.P.)	-	-
Poplar River	Kenora (P.P.)	-	-
Schryburt Lake	Kenora (P.P.)	Nb, ap	-
Wapikopa River	Kenora (P.P.)	-	-
*Brent	Nipissing	-	-
*Burritt Island	Nipissing	Nb, ap	-
Iron Island	Nipissing	Fe, Nb, ap	-
*Lavergne	Nipissing	Ce, fl	-
Manitou Islands	Nipissing	Nb, U, ap	560
Callander Bay	Parry Sound	Nb	-
Peohbah Lake	Rainy River	-	-
Borden	Sudbury	-	-
Lackner Lake	Sudbury	Fe, U, ap, Nb, Ce	1090
Nemegosenda Lake	Sudbury	Nb, U, Th, Fe, ap, Ce	1010
Shenango	Sudbury	-	-
Township 107	Sudbury	verm	1560
Chipman Lake	Thunder Bay	Nb	-
Killala Lake	Thunder Bay	Cu, Ni	-
Fort Coldwell	Thunder Bay	Cu, Fe(Ti)	-
Prairie Lake	Thunder Bay	Nb, Fe(Ti), ap	1112
*Sturgeon Lake	Thunder Bay	fl, La	-

* Not illustrated by an inset map.





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