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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, phosphates, vermiculite, iron, titanium, copper, and nickel. In many complex areas 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 3.2% Nb₂O₅. In Canada the only producers are St. Lawrence Columbian 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 maps. Aeronagnetic 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 Colwell, Killala Lake, Drowning River, Mammattawa 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 aeronagnetic 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 aeronagnetic 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 aeronagnetic or aeroradiometric surveys by mining companies or government agencies. The complexes are indicated on aeronagnetic maps (see inset maps) by circular, oval, elliptical, crescent-shaped or horseshoe-shaped anomalies. 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 erratic 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 the occurrence of these complexes in the exploration of the Firesand (Algonia Ore Properties, 1951-8), Manitou Islands (Beaucage, 1952-6, see Table 1), Nemogensda (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), Fort Colwell (Anaconda, 1962), Carb Lake (Big Nona Creek and Larandona), Albany Forks, Drowning River, Mammattawa, and Squirrel River (Knevil Mining Group).

Joint aeronagnetic 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 Nb₂O₅ 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, 365, 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

Complex	Company	Reserves	Production
ARGOR	Consolidated Morrison Explorations Ltd.	Ore Res: 10,000 tons/vert. ft. grading 0.82% Nb ₂ O ₅ (Northern Miner, June 18, 1970).	Production 12 mos. to Sept. 30: 1964, 1965, 1966, 1967, 1968, 1969, 1969/1970*
LACKNER	Multi-Minerals Ltd.	Ore Res: Nos. 3-4 Zones: 37,000,000 tons 21.3% apatite, 13.7% magnetite, and 0.198% Nb ₂ O ₅ . No. 6 Zone: 5,024,250 tons 69.6% magnetite, 21.9% apatite, and 0.173% Nb ₂ O ₅ . No. 8 Zone: 80,000,000 tons 0.25% Nb ₂ O ₅ . Calcite Zone: 880,000 tons 0.9% Nb ₂ O ₅ , 760,000 tons 0.23% Nb ₂ O ₅ .	Production 12 mos. to Sept. 30: 1964, 1965, 1966, 1967, 1968, 1969, 1969/1970*
MANITOU ISLANDS	Nova Beaucage Mines Ltd.	Ore Res: 1,893,000 tons 0.045% U ₃ O ₈ and 0.86% Nb ₂ O ₅ . 2,962,000 tons 0.041% U ₃ O ₈ and 0.69% Nb ₂ O ₅ . Idle since 1956.	Production 12 mos. to Sept. 30: 1964, 1965, 1966, 1967, 1968, 1969, 1969/1970*
Oka, Quebec	St. Lawrence Columbian and Metals Corp.	Ore Res: 3,125,000 tons aver. 0.487% Nb ₂ O ₅ (Oct. 1, 1969)	Production 12 mos. to Sept. 30: 1964, 1965, 1966, 1967, 1968, 1969, 1969/1970*
PALABORA, Transvaal	Palabora Mining Co. Ltd.	Ore Res: 315,000,000 tons aver. 0.6% Cu (1963). 80,000,000 tons vermiculite (to 70 feet, 30% rec.)	Production 1966, 1967, 1968, 1969
ARAXA, Minas Gerais, Brazil	Companhia Brasileira de Metalurgia e Mineração (CBMM)	Ore Res: 315,000,000 tons aver. 0.6% Cu (1963). 80,000,000 tons vermiculite (to 70 feet, 30% rec.)	Production 1966, 1967, 1968, 1969

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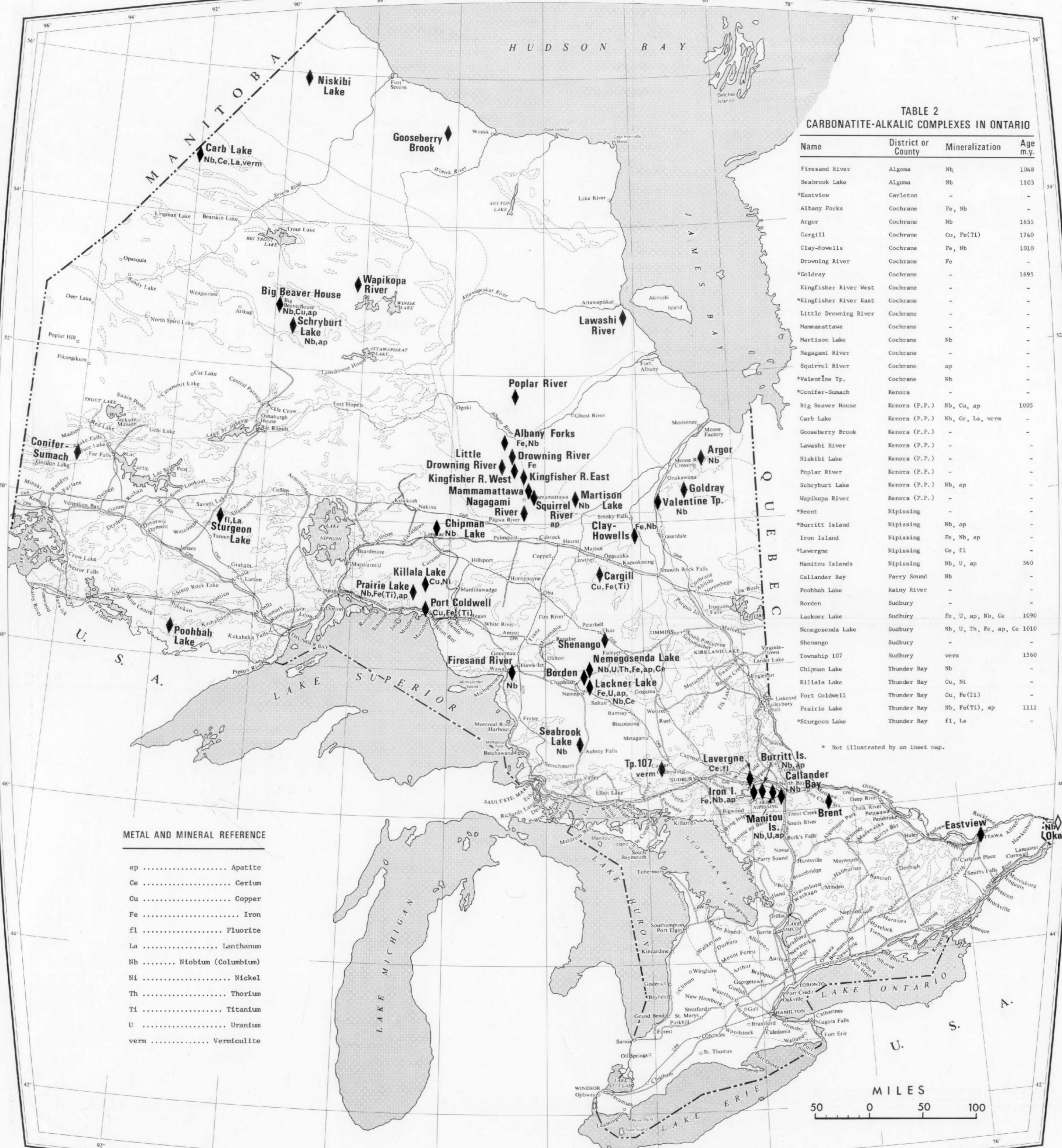
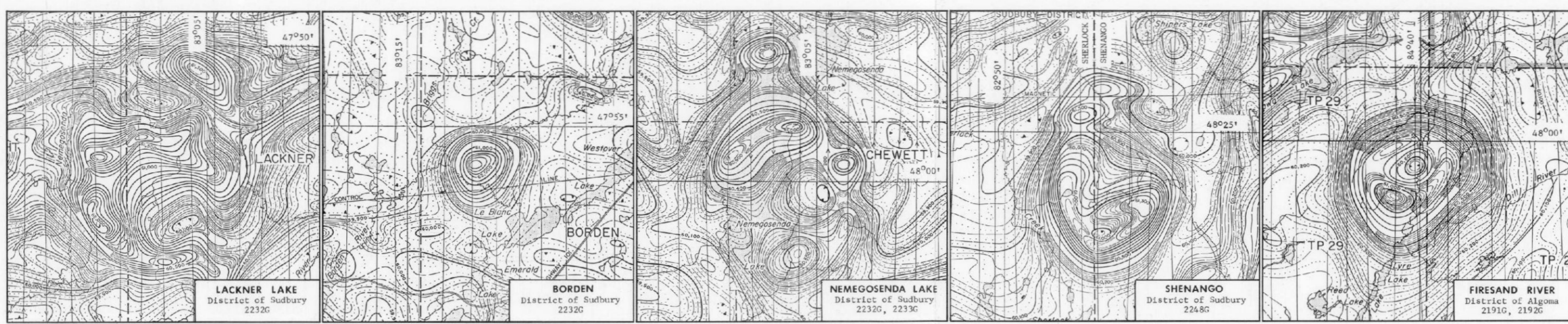
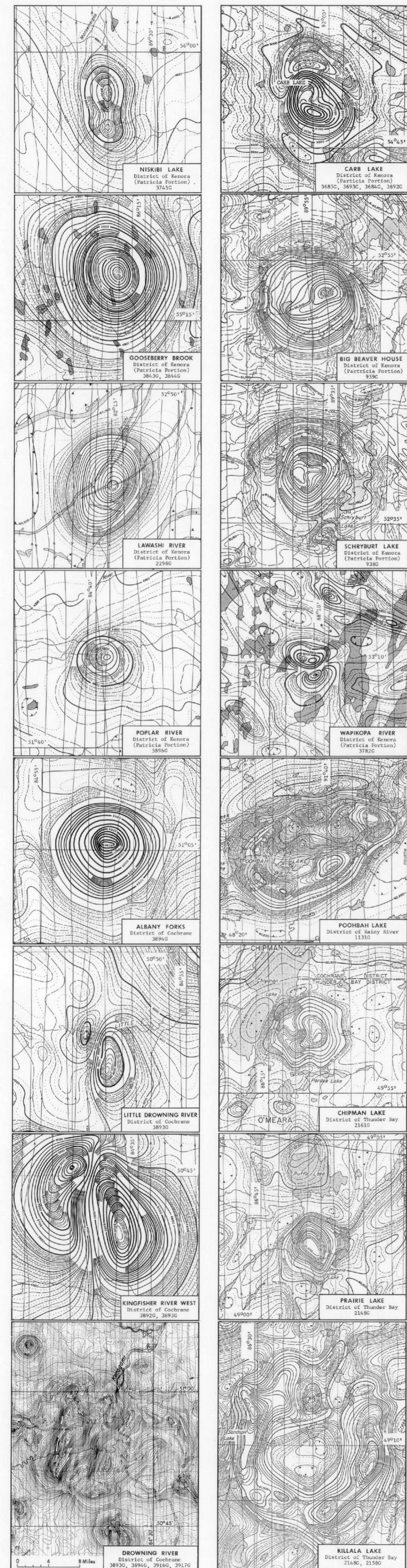


TABLE 2
CARBONATITE-ALKALIC COMPLEXES IN ONTARIO

Name	District or County	Mineralization	Age m.y.
Firesand River	Algonia	Nb	1049
Seabrook Lake	Algonia	Nb	1163
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	-	-
Mammattawa	Cochrane	-	-
Manitou Lake	Cochrane	Nb	-
Nagagami River	Cochrane	-	-
Squirrel River	Cochrane	ap	-
Valentine Tp.	Cochrane	Nb	-
Nickel-Beamish	Kenosia	-	-
Big Beaver House	Kenosia (P.P.)	Nb, Cu, ap	1005
Carb Lake	Kenosia (P.P.)	Nb, Cu, Fe, La, verm	-
Gooseberry Brook	Kenosia (P.P.)	-	-
Niskibi Lake	Kenosia (P.P.)	-	-
Poplar River	Kenosia (P.P.)	-	-
Schryburt Lake	Kenosia (P.P.)	Nb, ap	-
Agayagay River	Kenosia (P.P.)	-	-
Wapikopa River	Kenosia (P.P.)	-	-
Iron Island	Kipissing	Nb, ap	-
Lawashi	Kipissing	Fe, Nb, ap	-
Manitou Islands	Kipissing	Nb, U, ap	560
Callander Bay	Perry Sound	Nb	-
Poohbah Lake	Katyn River	-	-
Borden	Sudbury	-	-
Lackner Lake	Sudbury	Fe, U, ap, Nb, Cu	1090
Nemogensda Lake	Sudbury	Nb, U, Th, Fe, ap, Co	1010
Shenango	Sudbury	-	-
Chipman Lake	Thunder Bay	verm	1560
Killala Lake	Thunder Bay	Cu, Ni	-
Port Colwell	Thunder Bay	Cu, Fe(Ti)	-
Prairie Lake	Thunder Bay	Nb, U, Th, Fe, ap, Co	-
Firesand River	Thunder Bay	Nb	-
Seabrook Lake	Thunder Bay	Nb	1112
Lavergne	Thunder Bay	Ce, Fe	-
Iron I.	Thunder Bay	Fe, Nb, ap	-
Manitoi Is.	Thunder Bay	Nb, U, ap	-
Callander Bay	Thunder Bay	Nb	-
Eastview	Thunder Bay	Nb	-

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

