

## DESCRIPTIVE MODEL OF CARBONATITE DEPOSITS

By Donald A. Singer

APPROXIMATE SYNONYM Apatite-magnetite and rare earths in carbonatites.DESCRIPTION Apatite-magnetite and rare-earth deposits and combinations of these in zoned complexes consisting of central plug of carbonatite or syenite breccia surrounded by ring dikes and cone sheets of alternating rock types.GENERAL REFERENCE Tuttle and Gittins (1966).GEOLOGICAL ENVIRONMENTRock Types Apatite-magnetite deposits tend to be in sovite (calcitic carbonatite); RE types tend to occur in ankerite carbonatite; most deposits have both. In general pyroxenite, nepheline and feldspathic pyroxenite, carbonatite, fenite, ijolite, dunite, picrite-porphyrates, gneiss and alkalic fenitized gneiss, and locally alkaline volcanics rocks.Textures Hypidiomorphic-granular, poikiloblastic. Breccias abundant. Carbonatites show intrusive relations. Wallrocks fenitized.Age Range Almost all known carbonatite complexes are intrusive into Precambrian shields, however, the carbonatites themselves may be much younger.Depositional Environment Multiple stages of igneous, deuteric and metasomatic crystallization in carbonatite magma.Tectonic Setting(s) Continental shields. Spatially related to fault lineaments such as East African rift system. Locally related to alkaline volcanism.Associated Deposit Types None.DEPOSIT DESCRIPTIONMineralogy Apatite-magnetite-type: apatite, magnetite, pyrochlore ± columbite ± perovskite ± niocalite. RE-type: barite, strontianite ± siderite ± rhodochrosite ± ankerite ± bastnaesite ± chlorites ± parisite ± monagite ± breunnerite. General: calcite, dolomite, fluorite, pyrrhotite, ilmenite, molybdenite, chalcopyrite, pyrite, sphalerite, pyroxene, biotite, phlogopite, amphibole, spinel, ± galena, ± hematite, ± quartz, ± forsterite, ± serpentine, ± zircon ± sphene, ± anatase, ± rutile, ± brookite, ± fersmite.Texture/Structure Disseminated and banded.Alteration Fenitization (widespread alkali metasomatism of quartzo-feldspathic rock; mostly alkalic feldspar with some aegerine and subordinate alkali-hornblende and accessory sphene and apatite) near contact of carbonatite intrusion. Locally, chloritization.Ore Controls Commonly restricted to carbonatite dikes, sills, breccias, sheets, veins, and large masses, but may occur in other rocks associated with the complex rocks.Weathering May result in goethite-rich soil enriched in P, Nb, and RE.Geochemical Signature Radiometric anomalies, magnetic anomalies, high gravity anomalies, Th, U, Ti, Zn, Nb, Y, Ce, Mo, Cu, V, P, Mn, S, La, Sm, Pb, Zr, Ba, Eu. High values of Be, B, Li, Sn, Ta, Hf, and W are rare.EXAMPLES

Oka, CNQU	(Gold and others, 1966)
Iron Hill, USCO	(Temple and Grogan, 1965)
St. Honore, CNQU	(Dawson, 1974)
Gem Park, USCO	(Parker and Sharp, 1970)
Mountain Pass, USCA	(Olson and others, 1954)

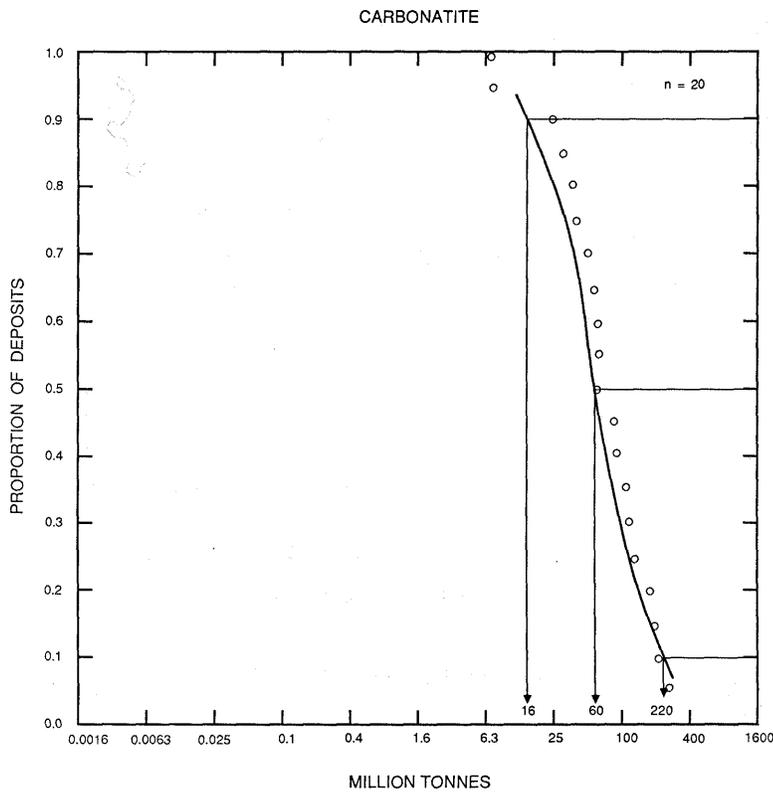
**GRADE AND TONNAGE MODEL OF CARBONATITE**

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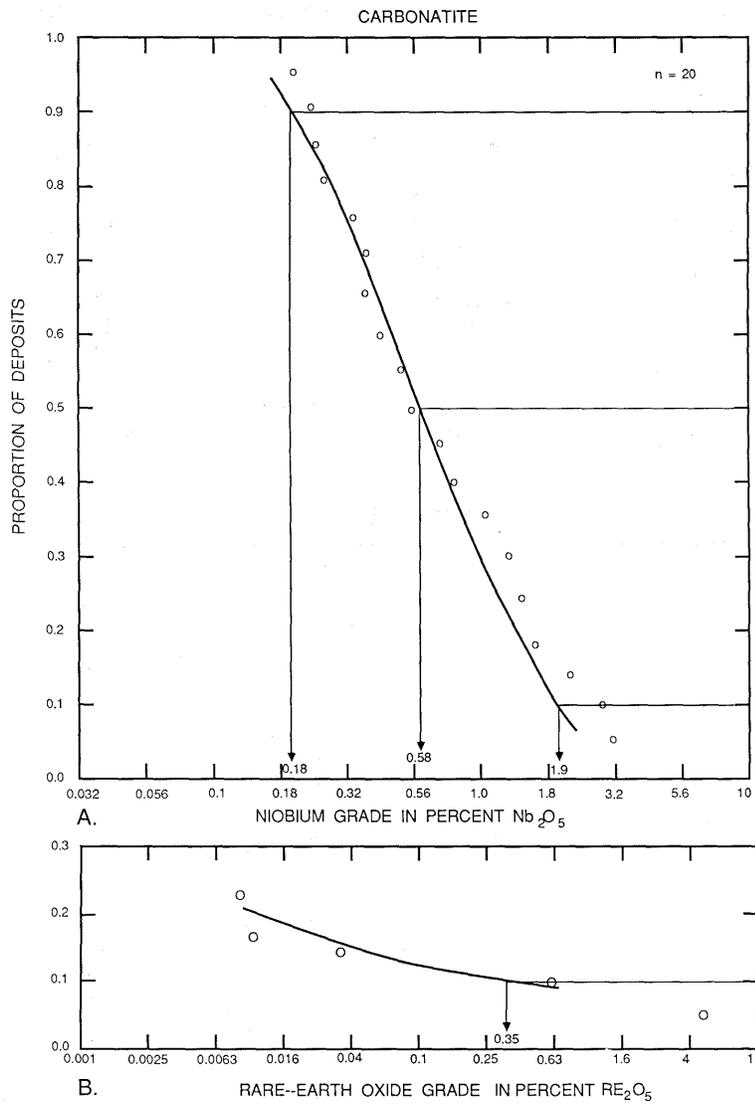
COMMENTS Locally these carbonatite complexes may contain economically interesting grades of uranium, thorium, titanium, iron, copper, vermiculite, zirconium or phosphorus; frequently, these other commodities are in different zones than the niobium-rich parts of the complex. See figs. 30, 31.

**DEPOSITS**

Name	Country	Name	Country
Araxa	BRZL	Mountain Pass	USCA
Bingo	ZIRE	Mrima Hill	KNYA
Dominion Gulf	CNON	Nemogos (Lackner Lake)	CNON
Catalao	BRZL	Oka	CNQU
Iron Hill	USCO	Salitre	BRZL
James Bay	CNON	Serra Negra	BRZL
Lueshe	ZIRE	Sove	NRWY
Mbeya	TNZN	Sukulu	UGND
Martison Lake	CNON	St. Honore (Soquem)	CNQU
Manitou Island	CNON	Tapira	BRZL



**Figure 30.** Tonnages of carbonatite deposits.



**Figure 31.** Grades of carbonatite deposits. A, Niobium. B, Rare-earth oxides.