Carbonatites in the Lemitar Mountains, Socorro County, New Mexico

Virginia T. McLemore

New Mexico Geology, v. 2, n. 4 pp. 49-52, Print ISSN: 0196-948X, Online ISSN: 2837-6420.
https://doi.org/10.58799/NMG-v2n4.49

This page is intentionally left blank to maintain order of facing pages.

New Mexico GEOLOGY
• Science and Service
Volume 2, Number 4, November 1980

Carbonatites in the Lemitar Mountains, Socorro County, New Mexico

by Virginia T. McLemore, Geologist, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM

Introduction

A carbonatite is a carbonate-rich rock of apparent magmatic derivation or descent. Carbonatites are generally characterized by > 50% carbonate minerals, apatite, magnetite, pyroxenes, and various other minerals (Heinrich, 1966), and they may contain economic concentrations of U, Th, Nb, rare-earth elements, and phosphate. These rocks are generally associated with alkalic rocks, although there are rare occurrences of carbonatites not associated with any alkalic complexes (Heinrich, 1966).

Carbonatites generally form one or two small plugs or stocks situated more or less in the center of a ring complex of cone sheets or ring dikes. The carbonatite plug may or may not be exposed. Alkalic rocks are generally common around carbonatite complexes. A halo of fenites generally surrounds the entire complex, as well as the cone sheets and the ring dikes. Fenites are the products of fenitization, a distinctive alteration typically associated with carbonatite and alkalic complexes. This is the classic model for the emplacement of a carbonatite complex and includes examples such as Fen, Norway; Alnö, Sweden; and Magnet Cove, Arkansas (Heinrich, 1966). Carbonatites may also occur as dikes, stockworks, or sills, and be associated with alkalic complexes (McClure Mountain, Colorado; Heinrich, 1966). Rare occurrences of carbonatite dikes and sills without any associated alkalic rocks have also been found (Ravalli County, Montana, and Verity, British Columbia; Heinrich, 1966).

In thin section, many carbonatites can be differentiated as to primary magmatic and replacement carbonatites (Armbrustmacher, 1979). Texture and mineralogy are the primary criteria for this differentiation (Armbrustmacher, 1979). Primary magmatic carbonatites exhibit igneous textures, either hypidiomorphic-granular or porphyritic. Replacement carbonatites are characterized by fine- to coarse-grained carbonate that partially or completely replaced relict phenocrysts of feldspar, pyroxenes, and amphiboles and thus preserved the original texture of the rock. Apatite is generally more abundant in primary magmatic carbonatites, but magnetite is more abundant in replacement carbonatites. Other minerals are more likely to be present in one or the other type, and Armbrustmacher (1979) includes a table listing minerals found in both primary magmatic and replacement carbonatites.

The occurrence of carbonatite dikes in the Precambrian rocks of the Lemitar Mountains (7 mi northwest of Socorro, New Mexico) has been confirmed. Since the 1950's a controversy has existed as to the nature of these calcareous dikes. Several geologists have called these dikes carbonatites; others have called them altered lamprophyres or basaltic dikes. Mineralogic and chemical studies indicate that these dikes are carbonatites; they consist of > 50% carbonate minerals and display the chemistry and accessory minerals characteristic of such rocks. The Lemitar carbonatites occur as dike swarms and are not associated with any alkalic rocks, providing another example of this rare occurrence without any associated alkalic rocks. The exact age of the Lemitar carbonatites is unknown; however, Pennsylvanian and Tertiary faults have offset the dikes, indicating a pre-Pennsylvanian age.

The economic potential of the carbonatites in the Lemitar Mountains encouraged the New Mexico Bureau of Mines to undertake more detailed studies of the Lemitar carbonatites. This work was undertaken as part of a master's thesis that includes more detailed information on the geology and geochemistry of the area (McLemore, 1980). Highly radioactive carbonatites (100 times background) occur in secs. 6 and 7, T.2 S., R.1W. (fig. 1). Two of these highly radioactive samples were analyzed and found to contain 0.08 and 0.06% U_3O_8 (Christopher Rautman, personal communication, August 1979). Eight carbonatite samples collected by the author for this study were analyzed and found to range from 0.0011 to 0.0045% U_3O_8.

Geologic setting

The Precambrian rocks of the Lemitar Mountains consist of a sequence of metamorphosed and recrystallized sediments: the Corkscrew Canyon sequence, intruded sequentially by mafic dikes; a diorite/gabbro body; granitic rocks; and carbonatite dikes (fig. 1). The Corkscrew Canyon sequence is divided into a lower unit composed of massive arkose to subarkose and an upper unit composed of interbedded and foliated arkoses, subarkoses, and quartzites. The diorite/gabbro is a lithologically heterogeneous unit ranging in composition from gabbro and diorite to quartz gabbro and quartz diorite. Granitic rocks include a gneissic granite, a muscovite-biotite granite, a biotite granite, and the Polvadera granite. Mafic dikes, pegmatites, and quartz veins intrude all of the Precambrian rocks except the carbonatites.

Calcareous basic dikes that intrude the Precambrian rocks of the Lemitar Mountains were originally reported by Stroud and Collins (1954) and Anderson (1954, 1957). These dikes are distinct texturally, mineralogically, and geochemically from all other intrusive rocks of the area. Geologic, petrographic, mineralogic, and geochemical studies indicate that these calcareous basic dikes are carbonatites.

Description of carbonatite dikes

The carbonatite dikes strike dominantly north-south and east-west, dip steeply, and crosscut the entire exposed Precambrian sequence. The dikes range in thickness from a few centimeters to a few meters. Most dike exposures are presently discontinuous due to erosion and faulting; however, a few dikes can be traced for several hundred meters along strike. Flow structure or banding commonly parallels the contacts of the dikes. The dikes appear not to form any circular or elliptical patterns on a geologic map (fig. 1), suggesting that the carbonatite fluids followed preexisting fracture zones in the Precambrian rocks. The carbonatite fluids commonly followed earlier mafic dikes, partially or completely replacing them.

Petrologic variability is characteristic of the Lemitar carbonatites. Their mineralogy is shown in table 1. However, despite their variability, the Lemitar carbonatites can be subdivided as:

1) xenolith-bearing dikes (breccia and microbreccia dikes) and
2) xenolith-free dikes.

The xenolith-bearing breccia and microbreccia carbonatite dikes are light to medium gray, weathering to a medium- to dark-brown. The dikes consist of 10-40% xenoliths and >60% matrix consisting of carbonate (50-70%), biotite/phlogopite (5-15%), magnetite (5-10%), apatite (5-10%), feldspar (>2%), and trace amounts of fluorite, quartz, and chlorite. The xenoliths vary in size from a few millimeters to a meter across and include fragments of the host rock: foliated granite, foliated arkoses, quartzites, gray and green schists, phyllites, and red granitic

☞

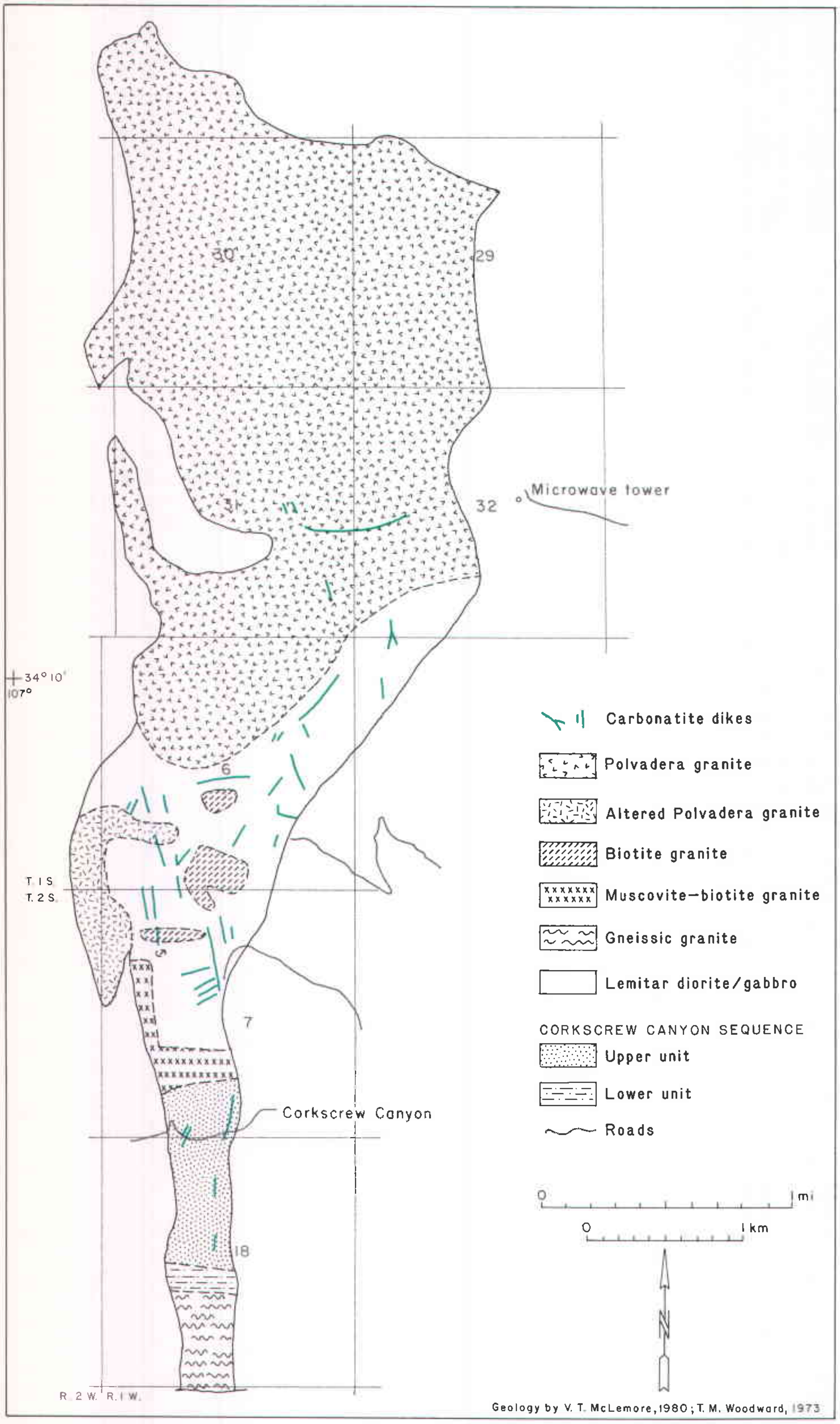

FIGURE 1—PRECAMBRIAN GEOLOGY OF THE LEMITAR MOUNTAINS.

fenites. Bastnaesite has been identified by x-ray diffraction methods in a dike occurring in the northwest corner of sec. 7 (McLemore, 1980).

Xenolith-free carbonatite dikes can be further grouped according to mineralogical composition:

a) calcite-dolomite carbonatite dikes and
b) ankeritic carbonatite dikes.

Calcite-dolomite carbonatite dikes are fine grained, light to medium gray, weathering to a brownish gray. These carbonatite dikes consist of carbonate (50-90%), magnetite (5-15%), biotite/phlogopite (5-15%), and apatite (0-10%). The ankeritic carbonatite dikes are light brown with a mineralogic composition of ankerite/dolomite (50-90%) and varying amounts of calcite, barite, hematite, and magnetite. These dikes generally crosscut the calcite-dolomite carbonatite dikes.

An additional minor variety of thin, light-brown dikelets and veins of barite, calcite, dolomite, ankerite, and hematite fill the fractures in the Polvadera granite and form a ☞

ALSO IN THIS ISSUE:

COMING SOON:

Barite on White Sands Missile Range
ERTS photomosaic map of New Mexico
Storrie Lake State Park

New Mexico GEOLOGY

• Science and Service

Volume 2, Number 4, November 1980

published quarterly by
New Mexico Bureau of Mines & Mineral Resources
a division of New Mexico Institute of Mining & Technology

Subscriptions: Issued quarterly, February, May, August, November; subscription price $3.00/yr.
Editorial matter: Contributions of possible material for consideration in future issues of NMG are welcome. Materials cannot be returned unless accompanied by return postage. Address inquiries to New Mexico Geology, New Mexico Bureau of Mines & Mineral Resources, Socorro, NM 87801
Circulation: 1,200
Printer: University of New Mexico Printing Plant

TABLE 1—MINERALOGY OF LEMITAR CARBONATITES BY WHOLE-ROCK X-RAY DIFFRACTION.

	305*	427a*	427b*	500*	506†	530†	531a°	531b°
Mineral								
biotite	x	x	x	x	x	x		
chlorite	x	x	x		x	x		
quartz	x	x	x	x	x	x	x	x
fluorite	x	x		x	x	x	x	
calcite	x	x	x	x	x	x	x	x
dolomite	x	x	x	x	x	x		
ankerite						x	x	x
apatite	x	x	x	x	x	x		
magnetite	x	x	x	x	x	x		
barite			x		x	x	x	
bastnaesite				x				

x—present
*—xenolith-bearing carbonatite dikes
†—xenolith-free calcite-dolomite dikes
°—xenolith-free ankerite dikes

stockwork pattern. Carbonatite fluids apparently intruded the granite and followed preexisting fractures or shatter zones. Original granitic textures and minerals are typically preserved in thin section. The stockwork carbonatites are rarely associated with xenolith-free carbonatite dikes.

The xenolith-bearing carbonatites generally are primary magmatic; primary hypidiomorphic-granular or porphyritic textures are present in thin section. The xenolith-free carbonatites are generally replacement carbonatites, although some xenolith-free primary magmatic carbonatites are found. Relict porphyritic or subophitic textures are preserved in thin sections of replacement carbonatites where carbonate minerals have replaced the original phenocrysts. Apatite is more abundant in the primary magmatic carbonatites, but magnetite is more abundant in the replacement carbonatites; however, both minerals may be present in either type.

Chemistry

A representative suite of samples from the various carbonatite dikes was analyzed for major and minor elements (tables 2 and 3). More detailed analyses that will include rare-earth elements are presently being undertaken.

The chemistry of the Lemitar carbonatites is quite different from the chemistry of Pettijohn's (1957) average limestone (table 2). The Lemitar carbonatites are higher in TiO_2, Fe_2O_3, and P_2O_5 than the average limestone. The Lemitar carbonatites are higher in Ni, Cu, Co, and Cr than Gold's average limestone (table 3). This lack of similarity in chemical composition suggests that the Lemitar carbonatites were probably not derived from remobilization of limestones. Experimental data from carbonatites similar in composition to the Lemitar carbonatites also support this conclusion (Heinrich, 1966).

The Lemitar carbonatites have chemistries similar to Heinrich's (1966) average carbonatite (tables 2 and 3). Some differences exist but can be attributed to variations in mineralogy. The presence of ankerite would account for the higher iron contents, and the absence of apatite in the ankeritic carbonatites would account for lower P_2O_5 contents. The presence of barite would account for the higher Ba contents, and the abundance of magnetite would account for the higher Ni, Co, and Cr.

Alteration

A distinctive alkali metasomatic alteration, termed fenitization, has occurred adjacent to some carbonatite dikes that intrude the diorite/gabbro. This fenitization is primarily characterized by the development of a thin zone that contains large, orange-pink albite phenocrysts. Phenocrysts in the unaltered diorite/gabbro are white andesine and labradorite. The reddish color of the altered plagioclases is common to other occurrences of carbonatites and is thought to be produced by the oxidation and exsolution of iron molecules originally within the feldspar lattice (Von Eckermann, 1948, p. 29). Oxidation is believed to be a result of the degassing of carbon dioxide from the carbonatite intrusive.

The change in plagioclase composition and other chemical differences between unaltered and altered diorite/gabbro reflect an increase in sodium with increase in fenitization (McLemore, 1980). This sodium increase is consistent with chemical trends during fenitization noted from other occurrences of carbonatites (Verwoerd, 1966; Currie and Ferguson, 1972; Robins and Tysseland, 1979).

TABLE 2—CHEMICAL ANALYSES OF LEMITAR CARBONATITES.

	1	2	3	4	5
SiO_2	13.87	24.16	3.40	10.30	5.19
TiO_2	0.48	1.78	0.28	0.73	0.06
Al_2O_3	2.88	4.95	0.50	3.29	0.81
Fe_2O_3	3.39	7.68	3.04	3.46	0.54
FeO	4.80	6.87	11.75	3.60	—
MgO	9.56	6.80	7.05	5.79	7.89
CaO	29.9	17.2	28.7	36.1	42.57
Na_2O	0.37	0.75	0.01	0.42	0.05
K_2O	0.63	1.51	0.10	1.36	0.33
MnO	0.64	0.35	0.48	0.68	—
P_2O_5	3.44	1.32	0.06	2.09	0.04
CO_2	26.77	17.77	35.80	28.52	41.54
TOTAL	96.73	91.14	95.56	91.17	99.02

1—average xenolith-bearing carbonatite, Lemitar Mountains
2—average xenolith-free calcite-dolomite carbonatite, Lemitar Mountains
3—average xenolith-free ankeritic carbonatite, Lemitar Mountains
4—average carbonatite (Heinrich, 1966)
5—average limestone (Pettijohn, 1957)
Analyses are reported in weight %.

Discussion

The carbonatite dikes were emplaced probably at a great distance (laterally or vertically) from the source, as evidenced by:

1) the lack of any radial or conical patterns in the dike outcrop and
2) the lack of fenitized haloes about all of the dikes.

The lack of any radial or conical patterns in the dike outcrop in the Lemitar Mountains suggests that a carbonatite magma intruded the crust at depth beneath the present erosion surface. Carbonatite fluids apparently followed preexisting Precambrian fractures and zones of weakness in the crust (forming the present outcrop pattern). The lack of any carbonatites in the southern area (sec. 18, T. 2 S., R. 1 W.) may suggest that the carbonatite source is centered farther north in secs. 6 and 7, T. 2 S., R. 1 W.

The lack of fenitized haloes about most of the carbonatite dikes also suggests that the carbonatites were emplaced at a distance from the source. Fenitization is poorly developed in the Lemitar Mountains, partially because the carbonatite dikes were emplaced at a temperature too low to initiate fenitization in the host rock. Lower temperatures and pressures would be expected if the carbonatites were emplaced at a great distance from their source.

Only one other occurrence of carbonatites is reported from New Mexico and is located in the Monte Largo area, Bernalillo County (Lambert, 1961). This carbonatite is a massive dolomitic carbonatite dike with apatite, magnetite, and mica and is associated with a melteigite sill (alkalic rock containing $>50\%$ nepheline). Other occurrences of Precambrian alkalic rocks in New Mexico that have no reported carbonatites include the Pajarito Mountain syenite (1,120 m.y., Kelley, 1968); a syenite facies of the Priest pluton in the Manzano Mountains (1,470 m.y., Stark, 1956, Bolton, 1976); and the Florida Mountain syenite (420-700 m.y., Brookins, 1974). Seven small bodies of syenite intruded by Precambrian granite occur in the Burro Mountains (Gillerman and Whitebread, 1956). Precambrian radioactive syenite dikes, resembling fenites in the Wet Mountains, Colorado, have been reported from the southern Caballo Mountains (Staatz and others, 1965). Carbonatites are associated with the alkalic complexes in southern Colorado (Heinrich, 1966) ☞

TABLE 3—TRACE-ELEMENT CHEMISTRY OF LEMITAR CARBONATITES.

	1	2	3	4	5	6	7	8	9
Ba	1,294	2,490	2,155	450-1,120	830	1,000		5,300	15,000
Sr	297	355	130		3,200	3,000		880	3,200
Ni	44	286	59	8	85		20	200	51
Cu	13	63	13	2.5	51		4	39	43
Co	36	64	54	17	nil		0.1	470	110
Cr	16	231	15	48	nil-13		11	470	110
Li	36	40	7		8				
Zn	133	275	527		109				
U	8.7	8.4	4.7			40		5	26

1—average xenolith-bearing carbonatite, Lemitar Mountains
2—average xenolith-free calcite-dolomite carbonatite, Lemitar Mountains
3—average xenolith-free ankeritic carbonatite, Lemitar Mountains
4—average carbonatite (Heinrich, 1966)
5—average of 4 sovites, Sokli, Finland (Vartiainen and Woolley, 1976)
6—carbonatite, Magnet Cove, Arkansas (Erickson and Blade, 1963)
7—average limestone (Gold, 1963)
8—primary magmatic carbonatites, Wet Mountains, Colorado (Armbrustmacher, 1979)
9—replacement carbonatites, Wet Mountains, Colorado (Armbrustmacher, 1979)

Analyses are reported in parts per million (ppm).

and are approximately 520 m.y. old (Olson and others, 1977). This evidence suggests that the Lemitar carbonatites may have been emplaced between 1,400 m.y. and 420 m.y. ago, after the emplacement of the Polvadera granite.

The Lemitar carbonatites are similar in chemistry and mineralogy to the carbonatites in Wet Mountains, Colorado (Armbrustmacher, 1979; McLemore, 1980). Carbon and oxygen isotopic studies in the Wet Mountains, Colorado, carbonatite complex clearly indicate that those carbonatites are from a deep-seated source (Armbrustmacher, 1979). Other carbon, oxygen, sulfur, and strontium isotope studies from throughout the world also indicate a deep-seated or upper-mantle source for carbonatites (Hayatsu and others, 1965; Powell and others, 1966; Heinrich, 1966; Taylor and others, 1967; Suwa and others, 1975; Mitchell and Krouse, 1975). The Lemitar carbonatites are probably also derived from a deep-seated or upper-mantle source. The Lemitar carbonatites may be derived from a mafic source that gave rise to the mafic dikes and the diorite/gabbro, although preliminary geochemical studies appear not to exhibit any genetic relationships. An extensive geochemical and isotopic study of these rocks would have to be undertaken before constraints can be placed on the composition of the source.

Experimental evidence confirms that melts with a variety of compositions can produce the wide variance in mineralogy and chemistry seen in carbonatites similar to those found in the Lemitar Mountains (Heinrich, 1966; Wyllie, 1966; Watkinson and Wyllie, 1971). The evidence suggests that carbonatites similar in composition to those in the Lemitar Mountains may have been emplaced at temperatures of 450°-600° C and pressures ranging from 1-1000 bars (Heinrich, 1966).

ACKNOWLEDGMENTS—This study was financed in part by a grant from the New Mexico Geological Society and by an assistantship from the New Mexico Bureau of Mines and Mineral Resources. The manuscript was greatly improved by critical reviews and comments by J. M. Robertson, J. R. Renault, F. E. Kottlowski, and R. H. Weber.

References

Anderson, E. C., 1954, Occurrences of uranium ores in New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circ. 29, 27 p.

———, 1957, The metal resources of New Mexico and their economic features through 1954: New Mexico Bureau of Mines and Mineral Resources, Bull. 39, 183 p.

Armbrustmacher, T. J., 1979, Replacement and primary magmatic carbonatites from the Wet Mountains area, Fremont and Custer Counties, Colorado: Economic Geology, v. 74, p. 888-901

Bolton, W. R., 1976, Precambrian geochronology of the Sevillita metarhyolite and the Los Pinos, Sepultura, and Priest plutons of the southern Sandia Uplift, New Mexico: M.S. thesis, New Mexico Institute of Mining and Technology, 45 p.

Brookins, D. G., 1974, Radiometric age determinations from the Florida Mountains, New Mexico: Geology, v. 2, p. 555-557

Currie, K. L., 1976, The alkaline rocks of Canada: Geological Survey of Canada, Bull. 239, 228 p.

Currie, K. L., and Ferguson, J., 1972, A study of fenitization in mafic rocks with special reference to the Callander Bay complex: Canadian Journal of Earth Sciences, v. 9, p. 1254-1261

Erickson, R. L., and Blade, L. V., 1963, Geochemistry and petrology of the alkalic igneous complex at Magnet Cove, Arkansas: U.S. Geological Survey, Prof. Paper 425, 95 p.

Gillerman, E., and Whitebread, D. H., 1957, The uranium-bearing nickel-cobalt-native silver deposits in the Black Hawk district, Grant County, New Mexico: U.S. Geological Survey, Bull. 1009-K, p. 282-311

Gold, D. P., 1963, Average chemical composition of carbonatites: Economic Geology, v. 58, p. 988-991

Hayatsu, A., York, D., Farquhar, R. M., and Gittins, J., 1965, Significance of strontium isotope ratios in theories of carbonatite genesis: Nature, v. 207, p. 625-626

Heinrich, E. W., 1966, The geology of carbonatites: Chicago, Rand McNally and Co., 555 p.

Kelley, V. C., 1968, Geology of the alkaline Precambrian rocks at Pajarito Mountain, Otero County, New Mexico: Geological Society of America, Bull., v. 79, p. 1565-1572

Lambert, P. W., 1961, Petrology of the Precambrian rocks of part of the Monte Largo area, New Mexico: M.S. thesis, University of New Mexico, 91 p.

McLemore, V. T., 1980, Geology of the Precambrian rocks of the Lemitar Mountains, Socorro County, New Mexico: M.S. thesis, New Mexico Institute of Mining and Technology; also New Mexico Bureau of Mines and Mineral Resources, Open-file Rept., 169 p.

Mitchell, R. H., and Krouse, H. R., 1975, Sulfur isotope geochemistry of carbonatites: Geochimica et Cosmochimica Acta, v. 39, p. 1505-1513

Olson, J. C., Marvin, R. F., Parker, R. L., and Mehnert, H. H., 1977, Age and tectonic setting of lower Paleozoic alkalic and mafic rocks, carbonatites, and thorium veins in south-central Colorado: U.S. Geological Survey, Journal of Research, v. 5, p. 673-687

Pettijohn, F. J., 1957, Sedimentary rocks: New York, Harper and Row, 718 p.

Powell, J. L., Harley, P. M., and Fairbairn, H. W., 1966, The strontium isotopic composition and origin of carbonatites, *in* Carbonatites, O. F. Tuttle and J. Gittens, eds.: London, Interscience Publishing, p. 365-378

Robins, B., and Tysseland, M., 1979, Fenitization of some mafic igneous rocks in the Seiland Province, northern Norway: Norsk Geologisk Tidsskrift, v. 59, p. 1-23

Staatz, M. H., Adams, J. W., and Conklin, N.M., 1965, Thorium-bearing microcline-rich rocks in the southern Caballo Mountains, Sierra County, New Mexico: U.S. Geological Survey, Prof. Paper 525D, p. 48-51

Stark, J. T., 1956, Geology of the south Manzano Mountains, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bull. 34, 116 p.

Stroud, R. B., and Collins, G. E., 1954, Preliminary reconnaissance report: Energy Research and Development Administration, Open-file Rept., DEC-RRA-1410, 4265, 1 p.

Suwa, K., Oana, S., Wada, H., and Osaki, S., 1975, Isotopic geochemistry and petrology of African carbonatites, *in* Physics and chemistry of the Earth, v. 9, L. H. Ahrens, J. B. Dawson, A. R. Duncan, and A. J. Erlank, eds.: Great Britain, Pergamon Press, p. 735-745

Taylor, H. P., Jr., Frechen, J., and Degens, E. G., 1967, Oxygen and carbon isotope studies from the Laacher Sea district, West Germany and the Alnö district, Sweden: Geochimica et Cosmochimica Acta, v. 31, p. 407-430

Vartiainen, H., and Woolley, A. R., 1976, The petrology, mineralogy, and chemistry of the fenites of the Sokli carbonatite intrusion, Finland: Geological Survey of Finland, Bull. 280, 87 p.

Verwoerd, W. J., 1966, Fenitization of basic igneous rocks, *in* Carbonatites, O. F. Tuttle and J. Gittins, eds.: London, Interscience Publishing, p. 295-308

von Eckermann, H., 1948, The alkaline district of Alnö Island: Sveriges Geologiska Undersokning Årsbok, no. 36, 176 p.

Watkinson, D. H., and Wyllie, P. J., 1971, Experimental study of the composition join $NaAlSiO_4$-$CaCO_3$-H_2O and the genesis of alkalic rock-carbonatite complexes: Journal of Petrology, v. 12, p. 357-378

Woodward, T. M., 1973, Geology of the Lemitar Mountains, Socorro County, New Mexico: M.S. thesis, New Mexico Institute of Mining and Technology, 73 p.

Wyllie, P. J., 1966, Experimental studies of carbonatite problems: The origin and differentiation of carbonatite magma, *in* Carbonatites, O. F. Tuttle and J. Gittins, eds.: London, Interscience Publishing, p. 311-352 □