

IST



# New Mexico Bureau of Mines & Mineral Resources

Socorro, New Mexico 87801

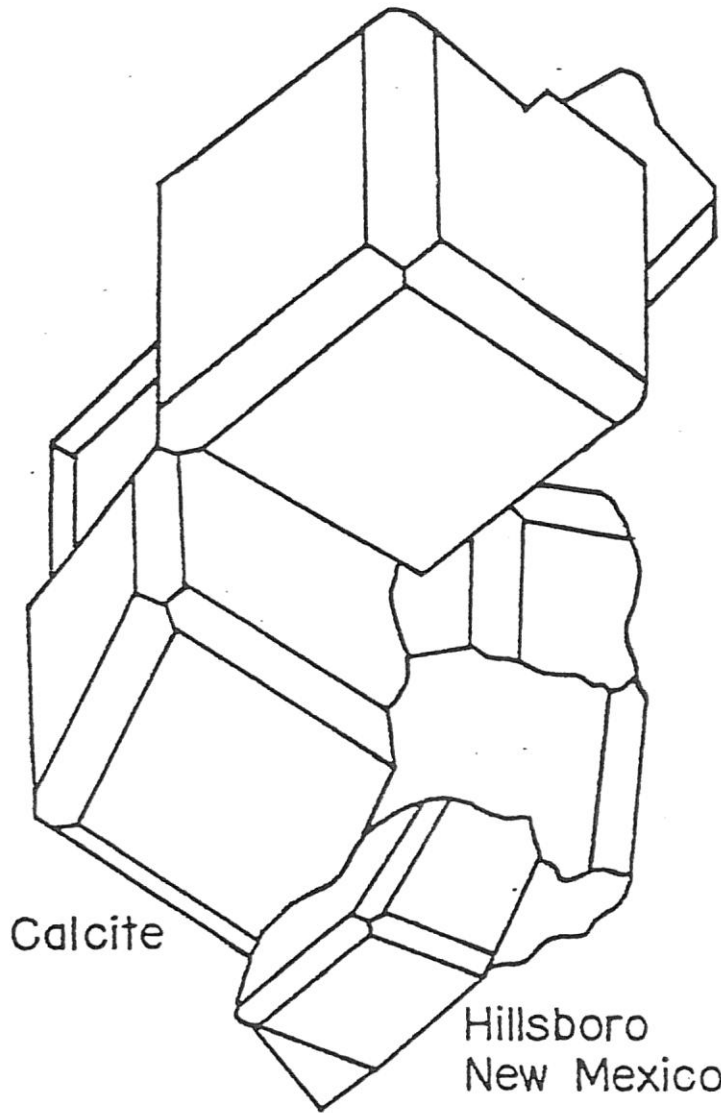
IST

*nm Mineral Symposium*  
**OPEN FILE REPORT** 1979



This report is preliminary and has not been edited or reviewed for conformity to New Mexico Bureau of Mines standards.

New Mexico Minerals Symposium



Northrop Hall  
University of New Mexico  
Albuquerque  
New Mexico

29-30 Sept., 1979

NEW MEXICO MINERALS SYMPOSIUM  
PROGRAM AND ABSTRACTS

September 29-30, 1979

Room 122, Northrop Hall (Geology Building)

Sponsored By: Albuquerque Gem and Mineral Club  
Geology Department, University of New Mexico  
Friends of Mineralogy

PROGRAM: Saturday, Sep. 29

8:15 - 8:45 Registration and coffee

1 8:45 Opening Remarks: Dr. Rodney Ewing

Dr. Stuart Northrop

MORNING:

1[9:00 The Harding Pegmatite: Summary of Recent Research, by Rodney C. Ewing, UNM

9:30 Melting Relations of the Harding Pegmatite, by Willam C. Luth, Sandia Laboratories

10:00 Pegmatite Mineralogy of the Petaca Mining District, New Mexico, by Robert M. North,  
N.M. Bureau of Mines and Mineral Resources

10:30 Microprobe Analyses of Columbites and Tantalites from the Globe and Harding Mines,  
by Paul Hlava, Sandia Laboratories

11:00 Uranium Minerals and the Mineralogy of the Grants Mineral Belt, by Douglas G.  
Brookins, UNM

11:30 - 1:30 break for lunch and discussion

AFTERNOON

1:30 A Review of Rare Mineral Species from the Hansonburg Mining District,

Bingham, N.M. by Joseph E. Taggart and Gene Foord, U.S.G.S.

2:00 Mineralogy of the Red Cloud Mining District, Gallinas Mountains, N.M.,  
by Ramon S. DeMark, Albuquerque

2:30 Rare Earth Elements in Agardite and in Other Minerals from the Red Cloud District,  
New Mexico by Peter J. Modreski, Albuquerque

3:00 Vanadinite and Related Lead-Zinc Minerals, North Magdalena District Socorro Co.,  
New Mexico by Robert J. Narsavage, Jr., Socorro

113:30 An Occurrence of Red Beryls in the Black Range, New Mexico, by Frank S. Kimbler and  
Patrick Haynes, New Mexico Institute of Mining and Technology

4:00 - ? General discussion and viewing of mineral specimens 6:00 - 8:00 Cocktail

Party, Isabella Room, Kirtland Air Force Base. (west) Officers Club (go south to Gibson,

east on Gibson to Maxwell Ave. (just east of Carlisle), left

on Maxwell to the club (you do not have to pass through the Base gate to get to the  
club, spouses, etc. are invited, even if not registered for the symposium; no -  
admission charge; free snacks provided)

FIELD TRIP: Sunday Sep. 30 to the Blanchard Mine, Bingham, N.M.

7:45 a.m. Meet in the parking lot at the rear of Northrop Hall to pool transportation and  
to leave by 8 a.m. sharp. Travel to the mine will be by participants' own vehicles.  
The trip will be a surface tour of the mine area, courtesy of Hansonburg Mines,  
Inc. Participants will have the opportunity to collect specimens from the dumps and  
surface exposures at this galena-fluorite-barite mine, and several persons will be  
on hand who are familiar with the variety of rare copper and lead minerals which  
occur here. Please bring a hard hat, safety shoes, and safety glasses, if you have  
them. Round trip driving distance is about 275 miles. Bring lunch and water.

THE HARDING PEGMATITE: SUMMARY OF RECENT RESEARCH.  
Rodney C. Ewing, Department of Geology, University  
of New Mexico, Albuquerque, New Mexico 87131

The Harding pegmatite, located in the western part of the Picuris Range about 30 km southwest of Taos, lies 7 km southeast of the Rio Grande Canyon at an altitude of 2260 m (sec. 29, T. 23 N., R. 11 E.) and is readily accessible from a nearby point on State Highway 75 about 10 km east of Dixon. The locality is unique because it has yielded commercial quantities of beryl, lepidolite, spodumene and microlite over a period of a half a century. It also has become a widely known source of handsome mineral specimens, a provocative locality for scientific studies and a mine noted for its spectacular exposures of pegmatite. In 1974, Dr. Arthur Montgomery approached the University of New Mexico with an offer to donate the property to the University so that it might be preserved as one of the State's unusual natural assets. Since that time, the University has leased the property from Dr. Montgomery until the transfer of title could be completed. During the past five years, the University has done the yearly assessment work, modified the mine to insure the safety of the public, retained a caretaker for the mine property, designed and completed a walking tour of the mine's surface workings, established museum and research collections of pegmatite specimens and supported faculty and students in research programs concerning the pegmatite. The Harding pegmatite is now an integral part of the teaching and research program of the University of New Mexico.

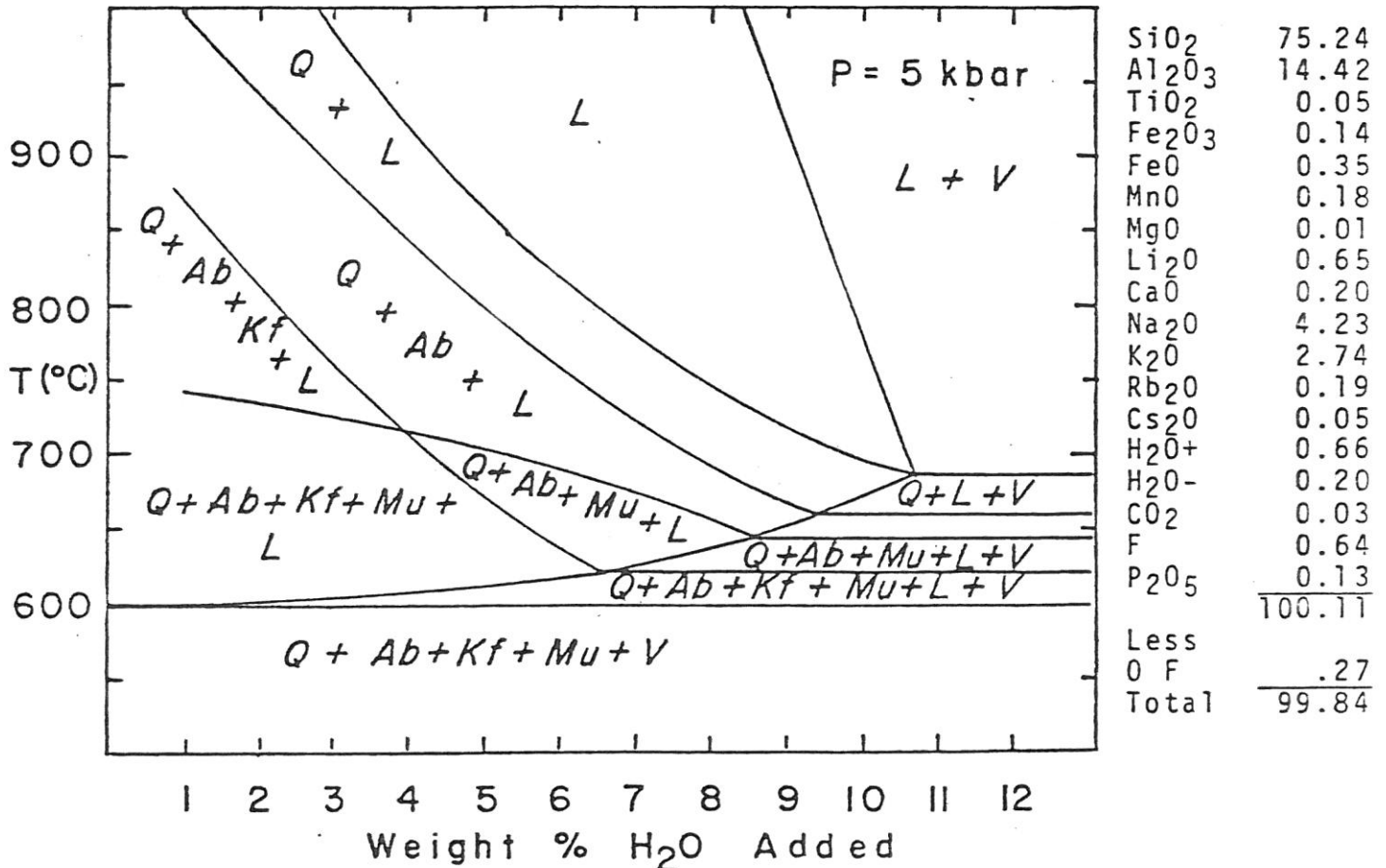
This paper is a brief summary of the work of students and faculty of the Geology Department at the University of New Mexico. A more extended discussion of this work may be found in the theses of Chakoumakos (microlite mineralogy, 1978), Cook (fluid inclusions, 1979) and Register (geochronology, 1979). For a detailed discussion of the geology, mineralogy and mining history of the Harding pegmatite see Jahns and Ewing (1976, 1977) and Brookins and others (1979).

- Jahns, R.H. and Ewing, R.C., 1976, The Harding mine, Taos County, New Mexico: New Mexico Geological Society Guidebook, 27th Field Conference, Vermejo Park, 1976, p. 263-276.
- Jahns, R.H. and Ewing, R.C., 1977, The Harding mine, Taos County, New Mexico: Mineralogical Record, v. 8, p. 115-126.
- Brookins, D.G. and others, 1979, The Harding Pegmatite: Summary of Recent Research: New Mexico Geological Society Guidebook, 30th Field Conference, Santa Fe Country, 1979, p. 127-133.

The results presented here represent a joint effort by Dr. R. H. Jahns (Stanford University), Dr. P. M. Fenn (University of California, Davis), and myself. The research was conducted at Stanford University and Los Alamos Scientific Laboratory. We acknowledge support from the National Science Foundation (Jahns and Fenn) and from the Department of Energy (Luth) through Los Alamos Scientific Laboratory. The bulk composition used in this study was prepared by Drs. R. H. Jahns and:-C. Wayne Burnham (Pennsylvania State Univ.) and is based on extensive diamond drilling and geologic mapping. It is a volumetrically weighted average of the various zones of the entire pegmatite, derived on the basis of the three-dimensional information.

The experimental study focused on the determination of equilibrium phase relations at a confining pressure of 5 kb (0.5 GPA) as a function of temperature and amount of water added to the essentially anhydrous bulk composition. The preliminary experimental results are illustrated below. In addition to the

### Harding Pegmatite Composition



\*This work supported in part by the U. S. Department of Energy, DOE, under Contract No. DE-AC04-76DP00789.

\*\*A U. S. Department of Energy Facility.

phases noted on the diagram (Q = quartz, ab = albitic feldspar, Kf = potassic feldspar, Mu = muscovite, L = silicate liquid as quenched glass, and V = aqueous vapor, fluid, or gas phase) spodumene and beryl were observed sporadically and in small amounts.

The phases encountered in the experimental study were analyzed using the CAMECA electron probe microanalyzer at Los Alamos Scientific Laboratory. Of particular importance was the change in composition of the equilibrium liquid accompanying crystallization at constant confining pressure. Such information is of considerable utility in evaluating the closed system crystallization of granitic compositions. Considerable difficulty was encountered in analyzing the liquids, represented as hydrous silicate glasses at the completion of the experiment, because of sodium mobility under the electron 'beam. However, an empirical correction procedure was developed which yields both precise and self-consistent results.

The experimental study of equilibrium phase relations also provided the base for additional studies of crystal nucleation, growth, and textural development in this particular silicate-water system. It was possible to simulate the various stages leading to the development of the graphic texture observed frequently in pegmatitic rocks.

PEGMATITE MINERALOGY OF THE PETACA MINING DISTRICT,  
NEW MEXICO. Robert M. North, New Mexico Bureau  
of Mines and Mineral Resources

The Petaca mining district in Rio Arriba County of north-central New Mexico includes probably the oldest systematically mined group of pegmatites in North America. Muscovite has been produced from the district since the 17th Century. More recently, muscovite as well as minor amounts of beryl, columbite-tantalite, and quartz have been mined sporadically from 1870 to the present. The pegmatites of the district are complex and zoned. The essential minerals are perthitic microcline, quartz, albite, and muscovite. Relatively common accessory minerals include garnet, fluorite, columbite-tantalite, monazite, bismutite, beryl, and samarskite. In addition, 36 other accessory minerals were identified from the district by R.H. Jahns in 1946. Two theories have been proposed for the genesis of the Petaca pegmatites. R.H. Jahns has proposed that they are due to the late-stage crystallization of a volatile-rich granitic magma associated with a larger granite body. The postulated large granite source does not outcrop in the area. The other possible genesis, as proposed by R.L. Gressens in 1967, is from an accompanying intergranular alkali-chloride fluid phase characterized by the reaction:  $qtz + musc + (K^+, Na) \rightarrow perthite + H^+$ . The necessary beryllium and rare earth elements are presumed to have been introduced by contamination from hydrothermal solutions. This theory is less tenable than genesis of the Petaca pegmatites from a deep-seated granitic intrusive.

MICROPROBE ANALYSES OF COLUMBITES, AND TANTALITES  
FROM THE GLOBE AND, HARDING MINES . Paul F. Hlava  
Sandia Laboratories Albuquerque, New Mexico 87185

Columbites and tantalites are among the most sought after series of minerals to be collected from the Globe and Harding pegmatite mines. The general chemical formula for the series is  $(\text{Mn,Fe})(\text{Nb,Ta})_2\text{O}_6$  and individual specimens may have any Mn:Fe or Nb:Ta ratio. Collectors often ask if there are consistent chemical differences between the morphological varieties at either Location, how the compositions of specimens from the Globe and the Harding differ, and what are the ratios present in their specimens (what end-member names are most appropriate). In this preliminary study a few selected specimens were examined in order to answer these questions, to determine the nature of any zoning in the crystals, and to identify any minor elements present (or specifically absent).

An automated electron microprobe was used to qualitatively and quantitatively analyze polished samples from the two mines. Analyses were performed using a variety of natural and synthetic standards of known composition. All analyses were automatically corrected for instrumental effects, and matrix effects were corrected using the Bence-Albee procedures.

The results of the analyses are summarized below:

1. A large crystal from the Globe mine was found to be homogeneous and to have the composition of  $(\text{Mn}_{.84}\text{Fe}_{.15}\text{Y}_{.01})(\text{Nb}_{.86}\text{Ta}_{.11}\text{Ti}_{.03})\text{O}_6$ . This is a manganocolumbite.
2. A "feathery" crystal from the Globe mine was also homogeneous and had a composition of  $(\text{Mn}_{.63}\text{Fe}_{.3}\text{Y}_{.02})(\text{Nb}_{.93}\text{Ta}_{.05}\text{Ti}_{.01})$ . This is a columbite
3. Large alluvial crystals from the are complexly zoned and a thick Homogeneous zone of  $(\text{Mn}_{.65}\text{Fe}_{.95}\text{Y}_{.00})(\text{Nb}_{.43}\text{Ta}_{.54}\text{Ti}_{.01})\text{O}_6$  (manganotantalite) may change to another thick, homogeneous zone of  $(\text{Mn}_{.95}\text{Fe}_{.03}\text{Y}_{.01})(\text{Nb}_{.72}\text{Ta}_{.26}\text{Ti}_{.01})\text{O}_6$  (manganocolumbite) in the space of a few micrometers. This zoning is roughly concentric in some cases and irregular or sector-zoned in others.
4. A small crystal from the interior of the pegmatite was zoned in a similar fashion but was richer in Mn and Nb with one area having the composition  $(\text{Mn}_{.99}\text{Fe}_{.01}\text{Y}_{.01})(\text{Nb}_{.83}\text{Ta}_{.16}\text{Ti}_{.01})\text{O}_6$
5. Checks for the presence of minor elements revealed that all of the specimens had small amounts of Ti and Y, as listed, and Si. In the Harding specimens Fe is essentially a minor element, varying between 0.12 and 0.50 wt. %. Harding specimens also contain about 0.3 wt. %  $\text{WO}_3$ . Specifically not detected in any specimens were Mg, Al, Ca, V, Cr, Zr, 811, Sb, La, Ce, Pb, Bi, Th or U.

The major conclusion of this study is that there are consistent chemical differences between morphological varieties of these minerals obtained from the Globe and Harding Mines. This work supported by the U.S. Department of Energy (DOE) under contract No. DE-AC-04-75DP00789.A U.S. DOE facility.



## URANIUM MINERALS AND THE MINERALOGY OF THE GRANTS MINERAL BELT

Douglas G. Brookins, Department of Geology  
University of New Mexico, Albuquerque, New Mexico 87131

The Grants Mineral Belt, New Mexico, which may contain as much as one quarter of the World's total uranium reserve, has been actively mined since the 1950's. Over one hundred minerals have been identified from the Grants Mineral Belt, about thirty of which are uranium minerals. Granger (1963) has compiled an expensive list of the minerals found to that time. Primary minerals which are found in dark, organic-rich, pyrite-bearing sandstones include both coffinite ( $USiO_4$ ) and lesser amounts of pitchblende ( $UO_2 \cdot 6H_2O$ ). These minerals are so fine grained as to make identification difficult. Accessory minerals include vanadium-bearing clay minerals, pyrite or marcasite, selenium-bearing minerals, and jordisite ( $MoS_2$ ). Most of these have to be identified by petrographic means or by x-ray inspection. Secondary minerals formed by oxidation include brightly colored minerals such as uranophane, tyuyamunite, metatyuyamunite, carnotite, autunite, zellerite, etc. Not only are these minerals easy to spot in outcrop, but many are fluorescent as well. Uranium minerals found as "bloom" on mine or pit walls include soluble minerals such as zippeite, andersonite, bayleyite, uranopilite, etc. These minerals must be treated with care as they dehydrate readily when exposed to air. Secondary minerals of vanadium, selenium, and molybdenum are also common but more difficult to identify.

The common gangue minerals include various clay minerals, barite, calcite, quartz, feldspars, gypsum, and lesser amounts of many others. The clay minerals are of special importance, especially as related to ore formation, but they must be identified by x-ray or other laboratory techniques.

Field collecting is best done in groups by arranging with various mine managers to visit properties; and this can be done without **too** much inconvenience if enough advance notice is given.

This paper will summarize some of the research which has been conducted at UNM over the past five years on mineral deposits in the Grants Mineral Belt; some of which has been truly pioneering.

Granger, H. C., 1963, Mineralogy: in Geology and Technology of the Grants Uranium Region: New Mexico Bureau of Mines and Mineral Resources Memoir 15 (V. C. Kelley, Editor), p. 21-37.

A REVIEW OF RARE MINERAL SPECIES FROM THE HANSONBURG  
MINING DISTRICT, BINGHAM, NEW MEXICO. J.E. Taggart  
and E.E. Foord. U.S. Geological Survey, Box 25046  
MS 928, DFC Denver, Colorado 80225

The Hansonburg Mining District, located near Bingham, New Mexico, is host to a large number of minutely-crystallized, late stage oxidation minerals. Because of the rarity of some of these species, many misidentifications have been made by investigators who rely on sight identification. A review of rare minerals verified from this locality by X-ray diffraction, X-ray fluorescence, scanning electron microscopy with energy dispersive X-ray analysis, and optical mineralogy is presented with a brief discussion of species erroneously reported from the area.

In addition to the review, recently gathered data will be presented that verifies tsumebite from the Hansonburg district. This is the first reported occurrence of this mineral in New Mexico.

MINERALOGY OF THE RED CLOUD MINING DISTRICT, GALLINAS MOUNTAINS,  
NEW MEXICO. Ramon S. DeMark

The Red Cloud Mining District, situated in the Gallinas Mountains of central New Mexico, is of considerable interest to both mineralogists and collectors due to the occurrence of rare and colorful mineral species. Of particular interest are the Red Cloud Fluorite and Copper Mines located in the center of the district. The Gallinas Mountains occupy a part of the southern section of the divided Cibola National Forest, west of the town of Corona. They were formed by Tertiary intrusives which penetrated a basement of Precambrian granite overlain by Permian sedimentary rocks.

Mining for iron, copper and fluorite in the Red Cloud District has taken place sporadically from near the turn of the century until the late 1940's when mining operations ceased. From all available indications, the low reserves of ore in this district will probably preclude any future significant mining activity.

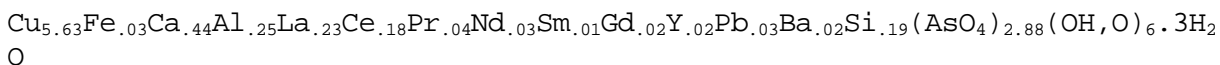
The Red Cloud Copper Mine was originally mined for lead, copper, silver and some gold. All that remains of the original mine workings is a fenced vertical shaft and the mine dumps. Access to the underground workings is not possible. The host rock for the ore was a fractured sandstone breccia.

The Red Cloud Fluorite Mine, also known as Conqueror No. 9, was operated as an underground mine from 1943-1944 but was subsequently operated as a surface working. Fluorite and bastnaesite were mined from a mineralized fracture breccia along a fault zone. Surprisingly, the minerals from these adjacent mines are quite distinctive, and include minerals not previously described from New Mexico.

RARE EARTH ELEMENTS IN AGARDITE AND IN OTHER MINERALS  
FROM THE RED CLOUD DISTRICT, NEW MEXICO. Peter J. Modreski,  
Sandia Laboratories, Div. 5835 Albuquerque, N.M. 87185

A hydrous rare earth copper arsenate mineral of the agardite group occurs as green needles in cavities of fluorite-rich rock from the Red Cloud district, Gallinas Mountains, N.M. The mineral was first recognized by Ramon DeMark, and its identity as an agardite-group mineral was confirmed via X-ray powder diffraction by Bob North of the New Mexico Bureau of Mines.

The general formula for minerals in the agardite group is  $Cu_6R(AsO_4)_3(OH)_6 \cdot 3H_2O$ . Three members were previously known, in which R dominantly bismuth (mixite), yttrium (agardite), or aluminum (goudeyite). Previously analyzed specimens of agardite from Bou-Skour, Morocco and other locations contained dominantly yttrium plus lesser amounts of the rare earth elements and calcium. Microprobe analysis of the agardite from the Red Cloud district, however, shows that it contains calcium, aluminum, silicon, and rare earth elements as the dominant components, with only a trace of yttrium. Lanthanum and cerium are the most abundant rare earths in the agardite, with lesser amounts of praseodymium, neodymium, gadolinium, and samarium. The empirical formula of agardite from the Red Cloud fluorite mine is (assuming the water content to be stoichiometric):



The rare-earth fluorocarbonate, bastnaesite,  $(Ce,La)CO_3F$  from the fluorite mine contains dominantly cerium and lanthanum (with Ce slightly > La) plus about 4-5 wt. %  $Pr_2O_3$ , 3%  $Nd_2O_3$ , 3%  $Gd_2O_3$  and 0.5%  $Sm_2O_3$ . Fluorite from the mine contains just a trace of yttrium (0.00 to 0.10 wt. %  $Y_2O_3$ ), with apparently up to a few hundredths of a percent of lanthanum and cerium oxides. The low yttrium content is in contrast to that of green fluorite from the Globe pegmatite, Rio Arriba Co., N.M., which contains up to about 0.9 wt. %  $Y_2O_3$ .

presently with United States Geological Survey, Central Mineral Resources Branch, Lakewood, CO 80225

AN OCCURRENCE OF RED BERYLS IN THE BLACK RANGE, NEW MEXICO.  
Frank S. Kimbler and Patrick Haynes, New Mexico Institute  
of Mining & Technology.

A deposit of rare red beryl (bixbite) crystals has recently been discovered near Paramount Canyon in the Black Range, Sierra County, New Mexico. The beryls, sparsely distributed along a small fracture zone in the lithophysal cavities of a pink rhyolite, occur as tabular hexagonal crystals less than 3 mm in diameter and shortened along the c-axis. Small pseudobrookites, hematites, or quartz crystals are commonly perched on the beryl crystals or occur within the same cavity. Hyaline opal is also an associated mineral, and bixbyite, topaz, and cassiterite are present in other nearby rhyolite flows (Fries and others, 1942).

In addition to the New Mexico occurrence, red beryl is found at only two other areas in the world. These sites are in the Thomas and Wah-Wah Mountain Ranges of Utah. At both locations, the bixbite crystals are found as an accessory mineral in rhyolite. A suite of accessory minerals similar to those found in the Black Range of New Mexico occur with the Utah bixbites. Topaz, pseudobrookite, bixbyite, hematite, garnet, and hyaline opal form small, scattered crystals within grey lithophysal rhyolites (Palache, 1934).

Although numerous studies have been undertaken concerning the mineralogy of the rhyolites in the Taylor Creek district of the Black Range, none have ever reported the presence of red beryl as an accessory mineral in the rhyolite. Experimental data collected on bixbite from the other two U.S. localities seem to indicate that the red coloration is due primarily to high concentrations of  $Mn^{2+}$  within the beryl (Nassau and other, 1968).

Several deposits of gem and specimen-grade red beryls are presently being mined on a small scale from the rhyolites of the Wah-Wah Mountains and the Thomas Range. The Black Range bixbite locality, presently under claim by the Virgin Mining Company of Socorro, New Mexico, is being evaluated for quality red beryls. Currently, no gem-grade beryls have been discovered at the site, and no bixbite crystals have exceeded 3 mm in diameter. Continued operations may yield larger crystals of the mineral. For those interested in obtaining further information, write Virgin Mining Company, P.O. Box 2439, Campus Station, Socorro, N.M. 87801.

Fries, C., Glass, J.J., and Sheller, W.T., 1942, Bixbyite and pseudobrookite from the tin-bearing rhyolite of the Black Range, New Mexico: American Mineralogist, v. 27, p. 305-322.  
Nassau, K., and Wood, D.L., 1968, An examination of red beryl from Utah: American Mineralogist, v. 53, p. 801-806

Palache, C., 1934, Minerals from Topaz Mountain, Utah: American Mineralogist, v. 19, p. 14-15