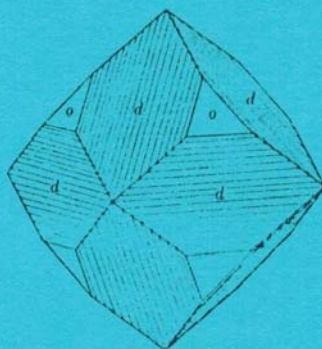


**Friends of Mineralogy
Mineralogical Society of America
Seventh Joint Symposium**

CLASSIC MINERAL LOCALITIES

Abstracts



Sponsored by
Friends of Mineralogy
Mineralogical Society of America
Tucson Gem and Mineral Society

February 10, 1985
Tucson, Arizona

PROGRAM AND ABSTRACTS

SEVENTH F.M.-M.S.A. MINERALOGICAL SYMPOSIUM

CLASSIC MINERAL LOCALITIES

Tucson Gem and Mineral Show
Tucson, Arizona
February 10, 1985

sponsored by
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- Feb. 10-11, 1974 Mineralogy and Paragenesis of Porphyry Copper Deposits,
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- Feb. 15-17, 1976 Crystal Chemistry and Paragenesis of the Gem Minerals
- Feb. 13-14, 1977 Crystal Habit and Growth
- Feb. 15-16, 1981 The Mineralogy of Pegmatites
- Feb. 13-14, 1983 Oxidation Mineralogy of Base Metal Deposits
- Feb. 12, 1984 Minerals of Mexico

cover illustration: dodecahedral crystal of franklinite
modified and striated by the octahedron, Sterling Hill,
New Jersey; fig. 48 from The Minerals of Franklin and
Sterling Hill, New Jersey, by Charles Palache, U.S.
Geological Survey Professional Paper 180, 1937.

schedule Sunday, Feb. 10, 1985

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*recipient of the Friends of Mineralogy 1985 award
for the best paper submitted by a student for
presentation at the FM-MSA Symposium

VANADINITE FROM MIBLADEN, MOROCCO

Victor Clay Yount
Rt. 5, Box 188
Warrenton, Virginia 22186

The mining area of Mibladen is located in central Morocco between the Middle Atlas and High Atlas mountains on the Oranaise Mesa. Approximately ten kilometers northeast of Midelt one can reach the now abandoned mines of Mibladen and about fifteen kilometers further, the mines of A'ouli. Both lead mines are in what is commonly referred to as the Haute-Moulouya basin (Haute means high and Moulouya refers to the river by that name that flows through the structure). The Haute-Moulouya is neatly divided between a granodiorite to the north, a metamorphosed schist (which encompasses A'ouli) and to the south a Jurassic dolomitic marble which hosts the lead orebody of the Midelt mines. Mibladen, as the general area is called, is situated 1400 meters above sea level with a clear view of the High Atlas mountains to the south. The principal mines to produce fine vanadinite crystals are Bou el Maden, Assif and Les T Ouest (west). Fine barite, cerussite and wulfenite crystals also occur at Les Dalles. These and other mines are strung out along about a five kilometer distance following the road from Midelt to Mibladen.

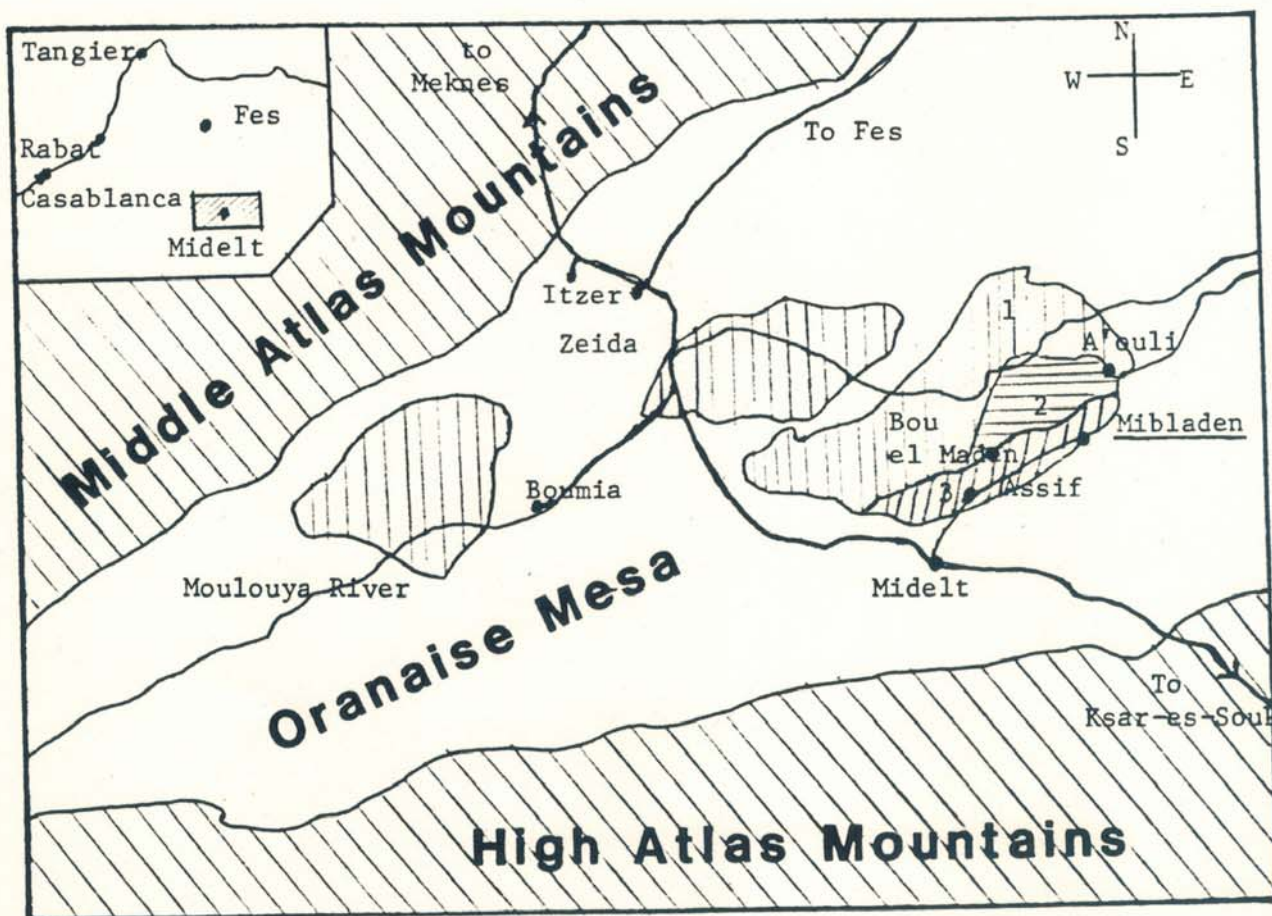
The Haute-Moulouya lead deposits were probably first worked by the Portuguese several hundred years ago. More recently, the Mineral Company of North Africa, in 1923, started exploration and began trenching to exploit the orebodies. In 1926, the continuing research was transferred to the A'ouli Society of Mines. In 1936, exploitation of the area began with 40,000 tons of known reserves. Shortly thereafter, Penarroya and BRPM (The Moroccan governmental Geological Service) jointly found investors to expand production and find buyers in European foundries. From 1939 to 1945 World War II caused a slowdown, with normal production resuming thereafter and reaching in 1962 21,057 metric tons of lead concentrate. This concentrate is treated locally and yields 75% lead with 250 grams of silver per ton.

Vanadinite, $Pb_5Cl(VO_4)_3$, is a lead-chloro-vanadate and crystallizes in the hexagonal crystal system. It is very brittle, with uneven to conchoidal fracture, has a hardness of 2.5 to 3, a specific gravity of 6.5 to 7.1, and it is translucent to nearly opaque and rarely transparent. Vanadinite is usually a shade of red or brown or combinations of these, and sometimes brownish-yellow, yellow and rarely white. Crystals from Mibladen, which can be more than an inch in length, are usually sharp-edged and smooth-faced but are sometimes cavernous and curved or in parallel groupings or thin fans.

The mine of Assif is world famous for the striking combination of white to orange colored barite with brilliant red vanadinite crystals perched on top. The most famous strike of this material was found in March of 1980.

Bou el Maden is by far the largest producer of vanadinite at Mibladen; here the crystals are found growing on a tan dolomitic marble. Only rarely do these crystals exhibit the luster and brilliance of the more renowned Assif material. In October of 1975 through January of 1976 a rather large quantity of the finest quality brilliant red crystals was removed from Bou el Maden by the now deceased miner MohaBen-Ali. Another good strike was made in January of 1979.

The supply of vanadinites from Mibladen has always been sporadic. In my 58 trips to this area there have only been three major strikes, and with the mine closing in December of 1983 the production is all the more limited. From what I am told by the mining directors, the mine will never be reopened again as the reserve of ore has finally been depleted to the point where it is no longer economically viable to continue working what was always considered a marginal deposit.



1 - granodiorites

2 - metamorphosed schists

3 - Jurassic dolomites

THE MINERALS OF MUSONOI (KOLWEZI), SHABA-ZAIRE

Gilbert J. Gauthier
Mining Civil Engineer
7, avenue Alexandre III
78600 Maisons-Laffitte
France

Located at the west border of the Shaba copperbelt (former Katanga) near the town of Kolwezi, the Musonoi mine (Musonoi is the name of the river) has been one of the richest copper and cobalt mines in the world. The ore is concentrated in two main ore-bodies within a Precambrian sedimentary rock series. Folding and faulting have deformed the stratified deposit. In a highly tectonized area at the west side of the mine is the "Musonoi-Extension". Here, the lower cobalt and copper orebody includes uranium and selenium mineralization plus small amounts of precious metals (gold, platinum, and palladium). The extension of this uranium and selenium anomaly had a radius of approximately 100 meters and a thickness of 50 meters.

Uranium mineralization is not at all unusual in the Shaba copperbelt--the famous Shinkolobwe uranium mine is the best example--but in the case of the Musonoi-Extension, although the reserves of uranium in the pocket were not huge (several thousand tons of uranium metal at the utmost), some extraordinary uranium mineral samples have been mined. In fact, Musonoi-Extension has produced by far the best torbernite and cuprosklodowskite crystals in the world. These specimens are particularly aesthetic.

The torbernite crystals were in square plates up to two centimeters on edge, more or less transparent according to the thickness of the plates, with a good emerald-green or dark green color. The main discovery was reported in 1966. The transformation to metatorbernite which begins from the first contact with air after blasting is very slow on the high-quality crystals. Even after twenty years such crystals remain gemmy if the specimens have been well preserved (no heat, no sun). The best crystals were generally encountered in the fractures of a quartzitic rock which separates the two copper-cobalt orebodies.

The best crystals of cuprosklodowskite were acicular and had lengths up to 3 centimeters with a light green color, sometimes covering large vugs up to 20 cm in size in dolomitic rocks.

Among the selenium minerals, particularly noteworthy are the superb crystals of chalcomenite in small vugs. The crystals were of length up to 3 centimeters, gemmy blue, and translucent, with good terminations. We also note here the discovery of five new selenium minerals: guilleminite, demesmaekerite, derriksite, marthozite, and the rarest of all, oosterboschite.

As with most of the big Shaba copper-cobalt mines, we should also point out the extraordinary development of malachite in the oxidized zone.

Ornamental malachite was abundant during the forty years of operation:

- banded malachite filling fractures, with a thickness of up to 20 cm;
- kidney malachite on the walls of large fractures and on the walls and roofs of the numerous caves;
- stalactites hanging from the roofs of the caves, of different sizes, sometimes of more than one meter in length and more than 10 cm in diameter.

Such malachite specimens have been seen at each Tucson show for more than the past ten years. One long stalactite is displayed at the Smithsonian Institution Museum in Washington, D.C. The lapidary quality and beauty of the Musonoi malachite can be compared to that of the best Ural malachite produced in the last century.

Primary minerals of the uraniferous pocket:

- uraninite
- seleniferous digenite

Secondary uraniferous minerals:

- hydrated oxide: schoepite
- uranates: curite, vandenbrandeite
- uranocarbonate: rutherfordine
- uranophosphates: torbernite, metatorbernite
- uranosilicates: uranophane, sklodowskite, cuprosklodowskite, soddyite, kasolite
- uranovanadate: francevillite
- uranoselenites: guilleminite, demesmaekerite, derriksite, marthozite

Non-uraniferous secondary minerals:

- chalcocite
- cobaltocite
- oosterboschite
- malachite
- heterogenite
- sphaerocobaltite

THE MINERALOGY OF TSUMEB

Dwight Weber
c/o Nature's Treasures
P.O. Box 10136
Torrance, California 90505

The town and mine of Tsumeb, located in the north-central part of Southwest Africa (Namibia), has been one of the world's top producers of copper, lead, and zinc ore as well as of an exceptionally wide variety of fine mineral specimens for nearly 80 years. Up to the present time the gross income from the mine has probably exceeded that of the Comstock Lode in Nevada. In addition to these metals, several million pounds of cadmium, silver, and germanium have been produced

The rock formations of the Otavi Highland, where Tsumeb is situated, comprise a considerable thickness of late Precambrian sedimentary beds resting unconformably on metamorphic and igneous rocks. The most significant aspect of the mineral deposit is the concentration of metal ores in a steep pipe-like body (in cross-section about 200 meters by as much as 85 meters) extending to a depth of over 1500 meters. The ore is associated with a peculiar rock called pseudo-aplite with the petrographic characteristics of a feldspathic quartzite but apparently intrusive, although there is no evidence of thermal metamorphism along the contact with the limestone.

Complex hypogene ores are characteristic of Tsumeb. There is no regular zonal arrangement of ore minerals, and their high concentration is ascribed in part to the superposition of later ore on earlier, as a result of long-continued flows of ore solutions. Among the sulphides galena is the most common, but good crystals are quite scarce. Sphalerite is the second most abundant sulphide, and cadmium occurs in it as an impurity. The commercial importance of these minerals may explain why almost no good specimens are found on the market. Pyrite is widely distributed but usually occurs as tiny grains. Good crystals are relatively rare. Tennantite is the most common copper mineral, and sometimes fine crystals of it are found in vugs, frequently coated with other minerals.

There are two oxidation zones at Tsumeb, the first reaching to a depth of about 280 meters, and a second zone that descends from near level 26 at about 800 meters, to below 1000 meters. This deep-level oxidation is caused by rapid circulation of water flowing down along a fracture zone, where currents, coupled with the rise and fall of the ground-water table, contributed to the unusually deep oxidation of the ore. This has been a principal source of the vast number of secondary minerals found at Tsumeb. At last count, in the fine article on Tsumeb by Paul Keller in *Lapis* last summer (1984), there were over 205 different mineral species reported since the beginning of mining operations. This fact assures Tsumeb a place among the top mineral localities of the world.

HUANZALA, HUANUCO DEPT., PERU:
A CLASSIC MINERAL LOCALITY

Dennis O. Belsher
P.O. Box 636
Golden, Colorado 80402

The Huanzala mining district is located around the town of the same name, approximately 240 kilometers north of Lima, and exploits an orebody consisting of a sulfide replacement in Jurassic limestone. The mines of the district include Yolanda; Domingo Sabio, Recuperado, as well as Huanzala itself. The district is part of the Huallanca Silver Zone which was discovered in 1721. The mines produce silver, copper, lead, and zinc ores, which are concentrated on the site. Access to the district is possible by automobile via the Pan-American Highway north from Lima, and then east through the town of Conococha over unimproved dirt roads. No tourist facilities exist in Huanzala.

Over the past 15 years or so, the district has produced noteworthy mineral specimens. Pyrite specimens of virtually all habits have been produced--cubes (as much as 15 cm on edge), octahedra (as much as 6 cm in maximum dimension), and pyritohedra (as large as 6 cm).

Also quite noteworthy are the fluorite specimens from Huanzala. In November of 1980, pink, octahedral fluorite equalling or exceeding the quality of specimens from the Swiss Alps was produced from the Huanzala mine. Fluorite has recently been found which occurs as pale-pink to flesh colored, highly modified, tabular-shaped crystals up to 6 cm in diameter and 1 cm in thickness. Typically, they occur on a matrix of small sphalerite crystals. Other fluorite occurring at the Huanzala mine includes (1) light-green octahedra as much as 5 cm in maximum dimension; (2) dark-green octahedra as large as 10 cm across; (3) light-green cubes, as much as 2 cm across, on pearly-white dolomite; (4) purple dodecahedra to 4 cm; and (5) purple fluorite covering and partially replacing calcite; as well as other habits and colors.

Also found in the district are sphalerite crystals, both single and twinned, as much as 3 cm across. Galena occurs in large, distorted, shiny crystals as large as 5 cm across, with barite.

INDIAN ZEOLITES AND ASSOCIATED SPECIES

Rock H. Currier
Jewel Tunnel Imports
P.O. Box 267
Arcadia, California 91006

The Indian zeolite specimens most commonly seen in the United States and Europe are from the Cretaceous amygdaloidal basalts of the Deccan formation. These sheet basalts lie predominately in the Indian state of Maharashtra and cover an area of approximately 200,000 square miles. The specimens are found in a roughly 4,000 square mile area bounded by the cities of Bombay, Pune (Poona is the old spelling) and Nashik (Nasik is the old spelling).

Zeolite specimens from this part of India have been known for more than one hundred years and were first brought to the attention of the western world by the British. Large quantities of specimens have become available only during the last ten years.

The localities given for most specimens will correspond to the name of the nearest large population center, Bombay, Poona, or Nasik. Less commonly, the name of a nearby village will be given. Quarries producing road metal and building material are responsible for more than 90% of Indian zeolite specimens. These quarries are commonly known by the name of the nearest village. Some common names of villages/quarries in the Bombay area are Kandivli, Dampada, Uran, Jasai, Panvil and Patanwadi; in the Poona area, Lonavla, Chinchwad and Pashan; in the Nasik area, Junner, Owni, Pathardi, Odha, Pimplas and Ekhlahara. Specimens are also encountered during the course of any type of construction that requires the removal of rock. Road cuts, dams, canals, railway cuts and tunnels, wells, and building foundations have all produced good specimens.

The variety and beauty of specimens produced from the Deccan formation are rarely excelled by those from other localities. The production of specimens is prolific. Each year many tons of specimens are sent to the United States and Europe. The mineral associations, crystal habits and colors are always changing as new ground is worked. The minimum quality of the specimens saleable today is considerably higher than it was ten years ago and tons of formerly saleable specimens are now crushed with the basalt for road metal. The future production of specimens appears to be unlimited and growing.

This past year, crystals of goosecreekite, the largest crystal measuring 30 mm, were identified from the Nasik region and ilvaite(?) crystals as much as 5 mm long and rose-like aggregates of hematite as much as 10 mm in maximum dimension were reported from the "Bombay" quarry (sometimes known as Malad, the nearest train station or Kandivli, the nearest village).

Because the market created by collectors demands ever more spectacular and perfect specimens it is almost certain that small, unspectacular crystals of rare and perhaps unknown species are being overlooked. It is only because of the vigilant eyes of a few local and foreign dealers who carefully examine the material brought in by the runners that new, rare and interesting things come to light. Without the existence of the collector market, however, few of these things would ever be known to the scientific community.

MINERALOGY OF THE CONTACT METAMORPHIC ROCKS
OF CERRO MAZAHUA, MICHOACAN, MEXICO

Jorge Diaz de Leon
Investigation y Desarrollo Industrial, S.A.
Tehuacan, Puebla, Mexico
(to be presented by Miguel Romero)

A new occurrence of minerals characteristic of contact metamorphic rocks of the sanidinite facies has been found at Cerro Mazahua, 4.2 kilometers northeast of the village of Susupuato de Guerrero in the state of Michoacan in central Mexico. The mineralogy is representative of the spurrite-melillite assemblage, accompanied by other species typical of this association, and by sulfides, including the rarely reported potassium iron sulfide, bartonite. Cerro Mazahua is the first known occurrence of this species in contact metamorphic rocks. It is the description of the rare, but locally abundant, mineral species and their environment that is the subject of this report.

Cerro Mazahua lies at the transition between the Mexican Neovolcanic Axis and the Balsas Basin. The "axis" is of Tertiary age and consists of extrusive and hypabyssal igneous rocks. The "basin" consists of an embayment of Paleozoic or Mesozoic schists, Lower and Upper Cretaceous carbonate rocks, and terrigenous sedimentary rocks, all intruded by various plutons, probably differentiates of a batholith.

The intrusive relationships among these plutons are generally not clear. The several igneous rocks known in the area of study are: 1) monzonite, which is the most abundant; 2) granodiorite, which is present as stocks; 3) gabbro-diorite, which crops out as a zone of isolated blocks up to 40 meters in size, lying at the contact-metamorphic boundary described herein; 4) a silicified felsite, possibly a rhyolite porphyry; 5) porphyritic andesite; 6) dacite; and 7) a volcanic breccia which overlies all the other rock types.

The carbonate rocks can be divided into three units as follows: 1) dolomitized argillaceous limestone with abundant calcite- and zeolite-filled fractures; 2) a fossiliferous, reefal limestone which is sometimes replaced by iron oxides, and which may contain volcanic fragments and minerals of the chlorite group; and 3) arenaceous to conglomeratic limestone containing abundant andesitic, basaltic, and, principally, trachytic volcanic fragments which may contain up to ten percent of sulfides and which are cemented by carbonate. This latter rock is the parent of the contact metamorphic calc-silicate suite. These rocks are of Aptian (Lower Cretaceous) age.

The metamorphic aureole has an elliptical outcrop whose east-west trending major axis is 200 meters in length and whose minor axis is 70 meters long. Texturally and mineralogically it is possible to distinguish two concentric assemblages: 1) an endomorphic assemblage consisting of a wollastonite-hedenbergite-potash feldspar-sphene skarn, and 2) an exomorphic assemblage of calc-silicate rocks, spurrite-tilleyite marbles, and calcite.

Paragenetically, two distinct stages are recognizable. The first, characterized by a high carbon dioxide to water ratio at the time of intrusion, is responsible for the formation of the spurrite association. The principal associations of this stage are:

grossular-wollastonite	spurrite-melilite
spurrite-melilite-calcite	spurrite-wollastonite
spurrite-melilite-merwinite	spurrite-calcite
spurrite-wollastonite-cuspidine	tilleyite-melilite
potash feldspar-wollastonite	tilleyite-spurrite-calcite
wollastonite-diopside-sphene	

A later stage, in which water was the dominant fluid, altered and replaced the previously formed calc-silicates with numerous additional species, many of them hydrated.

Contact metamorphism of the sulfides contained in the igneous fragments of the limestones has produced the assemblage:

pyrrhotite-bartonite-magnetite-goethite-hematite.

Other sulfides, outside this contact metamorphic zone, are found as disseminations of lead, copper, zinc, and iron minerals in other rocks of Cerro Mazahua.

Species of the Cerro Mazahua

afwillite	galena	merwinite	spinel
andradite	gehlenite	microcline	spurrite
apatite	goethite	parawollastonite	thaumasite
aragonite	grossular	portlandite	tilleyite
bartonite	hedenbergite	pyrite	tobermorite
biotite	hematite	pyrrhotite	tremolite
calcite	hornblende	perovskite	vesuvianite
cuspidine	jennite	rutile	zircon
diopside	killalaite	sphalerite	
ettringite	melilite	sphene	

MINERALS OF THE RAPID CREEK - BIG FISH RIVER AREA,
YUKON TERRITORY: A REVIEW PLUS NEW INFORMATION

H. Gary Ansell
Geological Survey of Canada
601 Booth Street, Ottawa, Ontario, Canada K1A 0E8

and

George W. Robinson
Mineral Sciences Division, National Museum of Natural Sciences
1926 Merivale Road, Ottawa, Ontario, Canada K1A 0M8

The Rapid Creek Formation is an extensive Lower Cretaceous sequence of interbedded phosphatic ironstones and shales, exposed in the Rapid Creek-Big Fish River area of the northeastern Yukon Territory. An unique assemblage of phosphate minerals occurs within the formation, in quartz veins and fracture fillings, in nodules, and as late-stage products of alteration and weathering. Ten new species have been described to date: baricite, gary-anstellite, gormanite, kulanite, maricite, nahpoite, penikisite, satterlyite, wicksite, and rapidcreekite - all are phosphates except rapidcreekite. Other phosphate minerals include alluaudite (group), apatite (group), arrojadite, augelite, brazilianite, childrenite, collinsite, diadochite, gorceixite, gordonite, goyazite, kryzhanovskite, lazulite, ludlamite, messelite, meta-vivianite, phosphosiderite, souzalite, vivianite, wardite, whiteite and wolfeite. The Rapid Creek area has yielded the world's finest specimens for some of these minerals. Non-phosphates include aragonite, barite, dypingite, epsomite, goethite, gypsum, halotrichite, hexahydrate, hydromagnesite, jarosite, natrojarosite, nesquehonite, pyrite, quartz, siderite and sphalerite.

Preliminary electron microprobe analyses of bjarebyite group minerals from the area and elsewhere show that:

- (i) several relatively distinct chemical populations of kulanite exist in the Rapid Creek Formation;
- (ii) penikisite is very rare in the area;
- (iii) bjarebyite probably occurs at one locality;
- (iv) a mineral labelled bjarebyite, from the Palermo Mine, New Hampshire, was found to be kulanite; and
- (v) a second occurrence of penikisite, close to the end-member in composition, has been found near Swan Lake, Hess River area, central Yukon Territory.

Rapidcreekite, $\text{Ca}_2(\text{SO}_4)(\text{CO}_3) \cdot 4\text{H}_2\text{O}$, is a new mineral found in 1983. It occurs as a secondary mineral with gypsum and aragonite on dilated joints and bedding planes in a quartzite bed within the iron formation. Rapidcreekite is white to colorless, found as acicular crystals as much as 2 mm long, most commonly in radial aggregates. The mineral has a hardness of 2, density 2.2, and is orthorhombic, space group Pcnb. The mineral and name have been approved by the I.M.A. Commission on New Minerals and Mineral Names; other mineralogical data on rapidcreekite are available in a paper recently submitted to the Canadian Mineralogist.

GEOLOGY AND MINERALOGY OF THE RED BERYL OCCURRENCE IN
THE SOUTHERN WAH WAH MOUNTAINS, BEAVER COUNTY, UTAH

James E. Shigley
Gemological Institute of America
1660 Stewart Street
Santa Monica, Ca. 90404

and

Eugene E. Foord
M.S. 905
U.S. Geological Survey
Box 25046, Denver Federal Center
Denver, Co. 80225

Among the varieties of beryl perhaps the rarest is the deep red variety occurring in rhyolite from the southern Wah Wah Mountains, Utah. Although a few brief papers have been published on this locality, only partial geological and mineralogical data have been presented. Red beryl occurrences in western Utah are almost unique as beryl of any kind is rare in rhyolites and similar although smaller deposits have been found only in New Mexico and in San Luis Potosi, Mexico. Our studies have concentrated on the red beryl deposit at the Violet Claims west of Milford in Beaver County.

The Wah Wah Mountains, a site of major rhyolitic vulcanism which began about 23 million years ago, are in the Basin and Range province in western Utah. Red beryl occurs at the Violet Claims in massive rhyolite, or inmiarolitic cavities and fractures in the rhyolite, in association with minor bixbyite, other dark manganese oxides, and secondary clay minerals (smectite, kaolinite). Chemical analyses of the rhyolite indicate that it contains about 0.3 wt. % F but no Cl, and it has notable amounts of Mn, Be, Nb, Zr, Ti, and Li. The chemical data suggest that this rhyolite is very similar to other topaz-bearing rhyolites known from several areas in the western United States.

The red beryl crystals are generally well formed and exhibit a simple morphology. They vary in transparency owing to differences in contained inclusions and fractures. They are elongate, and as much as 2 cm long or more. Some doubly-terminated or multiple crystal groups occur, but no twinned crystals have yet been found. Some crystal terminations may have slight growth spirals, or may have additional crystals attached in a parallel arrangement, but in general the crystals lack striations, etch figures, or corrosion features commonly seen on other types of beryl.

Most red beryl crystals are a uniform purplish-red color. However, some are distinctly color-zoned with brownish-orange cores and purplish-red rims. In these, the width of the lighter-colored core decreases along the c axis from the end toward the center of the crystal, so that in doubly-terminated crystals there is an 'hourglass' internal color zonation. Prom-

inent bixbyite inclusions in some crystals are located at the edge or basal parts of crystals at the point of attachment with the host rock, and the bixbyite may have acted as 'seeds' for subsequent crystal growth. For a color-zoned crystal, calculated unit-cell dimensions (utilizing a 114.6 mm Debye-Scherrer camera) are core: $a = 9.229(1)\text{\AA}$, $c = 9.212(1)\text{\AA}$; rim: $a = 9.234(1)\text{\AA}$, $c = 9.204(3)\text{\AA}$. Measured refractive indices (epsilon = 1.567 to 1.568; omega = 1.574) and specific gravity (2.66 to 2.70) are lower than for most other beryls.

In chemistry, the red beryl is distinctly rich in Mn, Ti, Sn, Zn, Li, B, Nb, Pb, Sc, Cs, Zr, Ga, and Rb, and it is essentially anhydrous (about 0.2 wt. % water). In the color-zoned crystals, K, Na, Al, and Zn are higher in the cores; whereas Mn, Fe, Ti, Si, and Sn are higher in the rims. The red color of the rims correlates directly with an increased content of Mn and Ti. Manganese is thought to be the primary coloring agent.

The similarity in trace elements in both the rhyolites and the red beryl crystals substantiates their common origin. Topaz- and/or red beryl-bearing rhyolites are derived from silica-rich magmas that originate in the lower portions of the crust by partial-melting. These magmas rise to upper levels in the crust where they are often erupted on the surface as lavas or ash flows. Where crystallization proceeds at the surface under conditions of low pressure, high temperature (about 800°C or less), low water content, and relatively high fluorine content, a gas or vapor phase is released from the rhyolite, from which red beryl crystallizes in cavities, fractures, and in some instances, within the massive rhyolite itself.

PHOSPHATE MINERALS FROM THE TIP TOP PEGMATITE AND SOME
NEW PHOSPHATES FROM THE BLACK HILLS, SOUTH DAKOTA

Thomas J. Campbell and W. L. Roberts
Museum of Geology
South Dakota School of Mines and Technology
Rapid City, South Dakota 57701

The Hudsonian age Tip Top pegmatite is a large, lenticular, zoned body emplaced discordantly into a gray, fine-grained, quartz-mica schist of the Precambrian Mayo Formation. The pegmatite trends roughly N45°W and dips 40° SW. The Tip Top is considered to be a pegmatite of intermediate depth of formation (3.5 to 7 km). Production has consisted of microcline-perthite, beryl and mica with subordinate amounts of columbite-tantalite. This pegmatite also yields a wide variety of well crystallized, remarkably aesthetic secondary phosphate minerals and may hold the "best of species" title for many.

Fifty-four phosphate species are represented at the Tip Top; of these, twenty-four were encountered within the last two years, and five of the twenty-four proved to be new species (see list below). These new species are fransoletite $H_2Ca_3Be_2(PO_4)_4 \cdot 4H_2O$, tinsleyite $KAl_2(PO_4)_2(OH) \cdot 2H_2O$, tiptopite $(Li, K, Na, Ca)_3Be_2(PO_4)_4(OH)_4$, ehrleite $Ca_4Be_3Zn_2(PO_4)_6 \cdot 9H_2O$, and Mineral X which is presently under investigation. Tip Top is also the type locality for three other species: jahnsite, robertsite and segelerite.

alluaudite	*frondelite-	phosphoferrite
autunite	rockbridgeite	robertsite
*barbosalite	*gordonite	rockbridgeite
*beraunite	heterosite	*roscherite
bermanite	hureaulite	*scholzite
carbonate-	*hurlbutite	segelerite
hydroxylapatite	hydroxylapatite	stewartite
collinsite	*hydroxyl-	*strengite
*crandallite	herderite	strunzite
*diadochite	jahnsite	*switzerite
*dufrenite	kryzhanovskite	tavorite
*ehrleite	laueite	*tinsleyite
*englishite	leucophosphate	*tiptopite
*eosphorite-	*lithiophosphate	triphylite
childrenite	ludlamite	vivianite
fairfieldite	messelite	*whiteite
ferrisicklerite	mitridatite	whitlockite
fluorapatite	montebrasite	xanthoxenite
*fransoletite	*montgomeryite	*Mineral X
	*parascholzite	

*Minerals previously unreported from the Tip Top pegmatite

Phosphate minerals from the Tip Top were formed in three stages:

- 1) crystallization of primary phosphates (about $700^{\circ} - 600^{\circ}\text{C}$)
- 2) metasomatism and initial oxidative reactions ($600^{\circ}\text{C} - 300^{\circ}\text{C}$)
- 3) hydrothermal attack and remobilization ($300^{\circ} - 25^{\circ}\text{C}$)

All of the secondary phosphates formed during stage three at temperatures below 250°C . Above this temperature H_2O ligands, which play an essential role in secondary phosphate formation, are no longer stable. The secondary phosphates can be divided into two types:

- 1) products of direct solution, oxidation and recrystallization of primary phosphates.
- 2) products resulting from the hydrothermal attack of silicate minerals along with triphylite.

It is suggested that the majority of the metasomatic and secondary phosphate minerals from the Tip Top mine are produced largely by hydrothermal attack of primary minerals by percolating meteoric waters at depth and/or by an aqueous residual liquid remaining after core consolidation. Most of these phosphates are restricted to the inner-intermediate zone.

Other new minerals recently described from the Black Hills include sinkankasite, walentaite and an unnamed wicksite-like mineral. Sinkankasite, $\text{H}_2\text{MnAl}(\text{PO}_4)_2(\text{OH}) \cdot 6\text{H}_2\text{O}$, occurs as colorless to white, elongate, bladed, prismatic polysynthetically twinned crystals in altered pods of triphylite from the Barker pegmatite, near Keystone. Walentaite, $\text{H}_4(\text{Ca}, \text{Mn}, \text{Fe})_4\text{Fe}_3(\text{AsO}_4)_{10}(\text{PO}_4)_6 \cdot 28\text{H}_2\text{O}$, is found at the White Elephant pegmatite near Pringle where it is found as bright yellow crusts and aggregates of 0.5 mm, bladed crystals. Walentaite occurs as an alteration product of triphylite and loellingite. The unnamed wicksite-like mineral, $(\text{Mn}, \text{Fe}^{+3}, \text{Fe}^{+2}, \text{Na}, \text{Ca}, \text{Mg})_7\text{Ca}_2(\text{PO}_4)_6(\text{OH}, \text{H}_2\text{O})_4$?, was discovered at the Bull Moose mine near Custer, where it occurs as green, compact, lamellar aggregates associated with pyrite in barboselite nodules.

A PERSPECTIVE OF THE FRANKLIN-OGDENSBURG
AND LANGBAN MINING DISTRICTS

Richard Hauck
47 Montgomery St.
Bloomfield, New Jersey 07003

The history, geology, and mineralogy of the Franklin-Ogdensburg and Langban mineral districts has been well covered by many writers for over 100 years. Most of this material is readily available to interested parties; the purpose of this paper is to report updated activities at the two areas. The author has had the opportunity to visit the Franklin-Ogdensburg area throughout over thirty years and has traveled to Langban in the summers of 1982 and 1984.

Science and research at Franklin-Ogdensburg is receiving very active attention by Dr. Pete Dunn of the Smithsonian Institution, with results being published in leading professional journals. The Franklin area has an active mineral group, the Franklin-Ogdensburg Mineral Society, with an interested and diversified membership numbering over 300. The club publication, The Picking Table, edited by Bernard Kozykowski, provides an excellent presentation of science, history, and activities in the Franklin area. Outstanding Franklin collections and collectors include:

- Ewald Gerstmann and the Gerstmann-Spex Collection, in Franklin, N.J.
- The Paterson Museum, in the old Rogers Locomotive Building of Paterson, N.J.; Tom Peters, Director.
- The Franklin Mineral Museum, on Evans Street in Franklin, N.J.; John Baum, Curator.
- The Smithsonian Institution, in Washington, D.C.
- The Harvard Mineralogical Museum, in Cambridge, Massachusetts.

The Franklin mine ceased operation in 1954; mining at the Sterling mine in Ogdensburg, N.J. continues at present. Material for study and for the collector is obtained from "inspired" miners, recycled collections, or from field collecting. Two areas are maintained for field collecting on a regular basis; the first is the Buckwheat dump area controlled by the Franklin Mineral Museum, and the second is the Trotter Shaft dump area managed by Nick Zipco. Currently, the most active collecting area is at the old Franklin mill site. This area has been made available for field collecting by an effort of the Franklin-Ogdensburg Mineral Society in cooperation with the property owner. Since the mill site is slated for construction in 1985, every effort is being made to collect and preserve as much available material as possible before building begins. No surface dumps are available at the Sterling mine in Ogdensburg; all waste material is used for backfill in the mining operation.

At the present time, the Franklin-Ogdensburg area is very active. There is scientific attention, current publication of articles, a unique mineral society devoted to area mineralogy, a well-established and growing mineral museum, and an ever-increasing list of minerals (over 300) described from the area.

The Langban area is a group of a half-dozen mining locations that share a similar mineralogy. They represent a rare combination of iron and manganese mineral associations in limestone. Of the more than 1000 iron mines in Sweden, only these few have the "Langban combination". They share with the Franklin-Ogdensburg area many unique and rare minerals but do not contain the zinc which gave the New Jersey deposits a third element with which to create their mineral oddities. There is no active mining in the Langban district but there are many places available for collecting. Certain areas are off-limits to nonprofessional mineral collecting but these represent only a small percentage of the total.

Scientific attention to Langban is limited; in recent years, more has been produced by Dr. Paul Moore and Dr. Pete Dunn than by European scientists. A small, select group of about twenty serious collectors has formed a club devoted to the study and preservation of the Langban area minerals. Unfortunately, membership is limited to invitation, which curtails the activities which might otherwise be possible. There are museums and collectors in the Langban area; two are the Roland Eriksson Museum in Langban and the Bergsskolan Museum in Filipstad, Sweden. In America there is the collection at Harvard University in Cambridge, Mass., the collection of William Pinch in Rochester, N.Y., and the collection of Joseph Cilen in Hawthorne, N.J. Excellent articles about Langban have been published in The Mineralogical Record.

Interest in Langban is alive. Serious efforts by the collectors and the Swedish government have preserved the mining history and the mineralogy of the area. Good collecting is still possible, with a seemingly endless list of 250-plus minerals having been described from the area.

It is the author's opinion that the Franklin-Ogdensburg, New Jersey, and Langban, Sweden areas have sufficient materials and projects to last the scientist and collector for at least the next several generations.

PERTHITE AND PERISTERITE
-A COMEDY OF ERRORS-

Mabel I. Corlett
Department of Geological Sciences
Queen's University
Kingston, Ontario

The best known feldspar intergrowths, perthite and peristerite, were first collected by Dr. James Wilson of Perth, Ontario and sent to Scotland (perhaps by W. E. Logan) for examination by Professor Thomas Thomson. The results of Thomson's examination were published in 1843 in Philosophical Magazine; this publication opened the curtain on a comedy of errors--a long history of confusion about the physical properties, chemical properties and type locations for these materials. In many dramas the disclaimer is made that "only the names have been changed..."; in this case only the names have been unchanged from Thomson's original report. The tangled history is an object lesson in the need for careful procedures and attention to detail in the examination of minerals and mineral material.

Perthite from the type locality contains coarse (to 1 mm wide) white to pale pink albite lamellae in a reddish-brown microcline host. These lamellae are oriented in two directions, neither of which appears to be a rational crystallographic plane, although they are close to (100) and (120). The microcline, in turn, contains microscopic albite lamellae in a third orientation, apparently parallel to the b axis of the host; this is the so-called Murchison orientation. The host mineral also contains small euhedral hematite flakes, giving a sun-stone or aventurine lustre to many specimens. The approximate proportions of the three constituents are 59% microcline, 40% albite, and 1% hematite.

Peristerite from what I believe to be the main contender for the type locality is white to pale pinkish-brown. It displays the characteristic pale blue iridescence, and there is associated quartz.

The type locality for perthite is an outcrop on the eastern limit of lot 4, concession VI of North Burgess Township (Lanark County, Province of Ontario). The pegmatite dike in which the perthite is found strikes north and also crops out extensively in lot 3 of the same concession, on land owned in the 1840's by Thomas Dobbie. In these northern outcrops, however, the perthitic intergrowth is not obvious, and the rock has a more normal potash feldspar-quartz pegmatite appearance.

The peristerite location stated by Hunt (1848) is in lot 19, concession IX of Bathurst township. Unfortunately there is very poor access to this lot; one road follows the ninth concession line, but there are no roads crossing the lot or following the other lot boundaries. There are some large pits in the northeastern part of the lot, where potash feldspar was quarried early in the twentieth century by the Perth Feldspar and Mining

Company, but I found no peristerite on the quarry dumps. Thus they seem unlikely candidates for the type locality. It now seems that this lot number is incorrect, and that the outcrop in question is actually in the west half of lot 20.

The practice of associating minerals and mineralogical material with the authors who first supplied the names has in this case led to an inequitable situation. The perthite "of Thomson" and the peristerite "of Thomson" owe only their names to Thomson. The recognition of these as feldspars, the first accurate chemical data, the correct and lucid descriptions of their physical properties, and the valiant, although apparently flawed, attempt at a precise recording of the type localities are all due to T. Sterry Hunt, yet his name rarely appears in the relevant mineralogical literature. I suggest it would be appropriate to recognize his important role in the study of feldspars.

References

- Hunt, T. Sterry (1848) in: Annual Report of Geol. Survey Canada 1847-1848, p. 137.
- Thomson, Thomas (1843) Notice of some new minerals. Philosophical Magazine, vol. 22, pp. 188-194.

THE CELESTITE OF NORTHWESTERN OHIO

Ernest H. Carlson
Department of Geology
Kent State University
Kent, Ohio 44242

Northwestern Ohio has been noted worldwide for celestite crystals of high quality ever since the early 1800's. The most famous of the localities include Crystal Cave on South Bass Island and quarries at Clay Center, Genoa, Lime City, and Woodville. In addition to its mineralogical interest, celestite was extracted commercially from South Bass Island in the late 1890's and from Genoa in the early 1940's. Over fifty localities are known in northwestern Ohio and adjacent parts of southeastern Michigan which together form a northerly trending belt of strontium-rich mineralization that is over 160 km long and 90 km wide. The celestite occurs chiefly in dolostones as fillings in caves, irregular-shaped vugs, fossil cavities, fractures, and breccias; it also selectively replaces thin beds and isolated crystals of anhydrite and gypsum. The mineral appears in bladed, tabular, and prismatic, white to sky-blue crystals that occasionally attain lengths of up to 45 cm. It occurs in networks of crystals, either alone or intergrown with calcite, fluorite, galena, pyrite, sphalerite, and strontianite, with the last mineral usually appearing as an alteration of the celestite. With the exception of pyrite, these associated minerals are later than the celestite and occur as perched crystals or as fillings in the networks of celestite.

The celestite deposits, which are hosted by middle Silurian to middle Devonian sedimentary rocks, are situated near the crest of the Findlay Arch. At Clay Center, Genoa, and Woodville, the celestite is localized in porous reef-like buildups of the Lockport Dolomite that form structural and topographic highs. Deposits at Lime City are found along the Lockport-Salina contact in caves and brecciated rock that are associated with algal mounds. At and near Crystal Cave, mineralization occurs in caverns and breccias of the Bass Islands Dolomite that are due to the dissolution of underlying Salina evaporites. A source of strontium for deposits of the district would be provided by the solution of bedded gypsum, which is notably enriched in strontium and displays a close areal association with the celestite. Small but notable amounts of barium in the celestite and depositional temperatures of about 100° C, however, suggest that mixing of surface waters and deeper brines occurred.