12th annual
NEW MEXICO MINERAL SYMPOSIUM

November 9 & 10, 1991

NMIMT Campus, Socorro, New Mexico

Welcome to

THE TWELFTH ANNUAL

NEW MEXICO MINERAL SYMPOSIUM

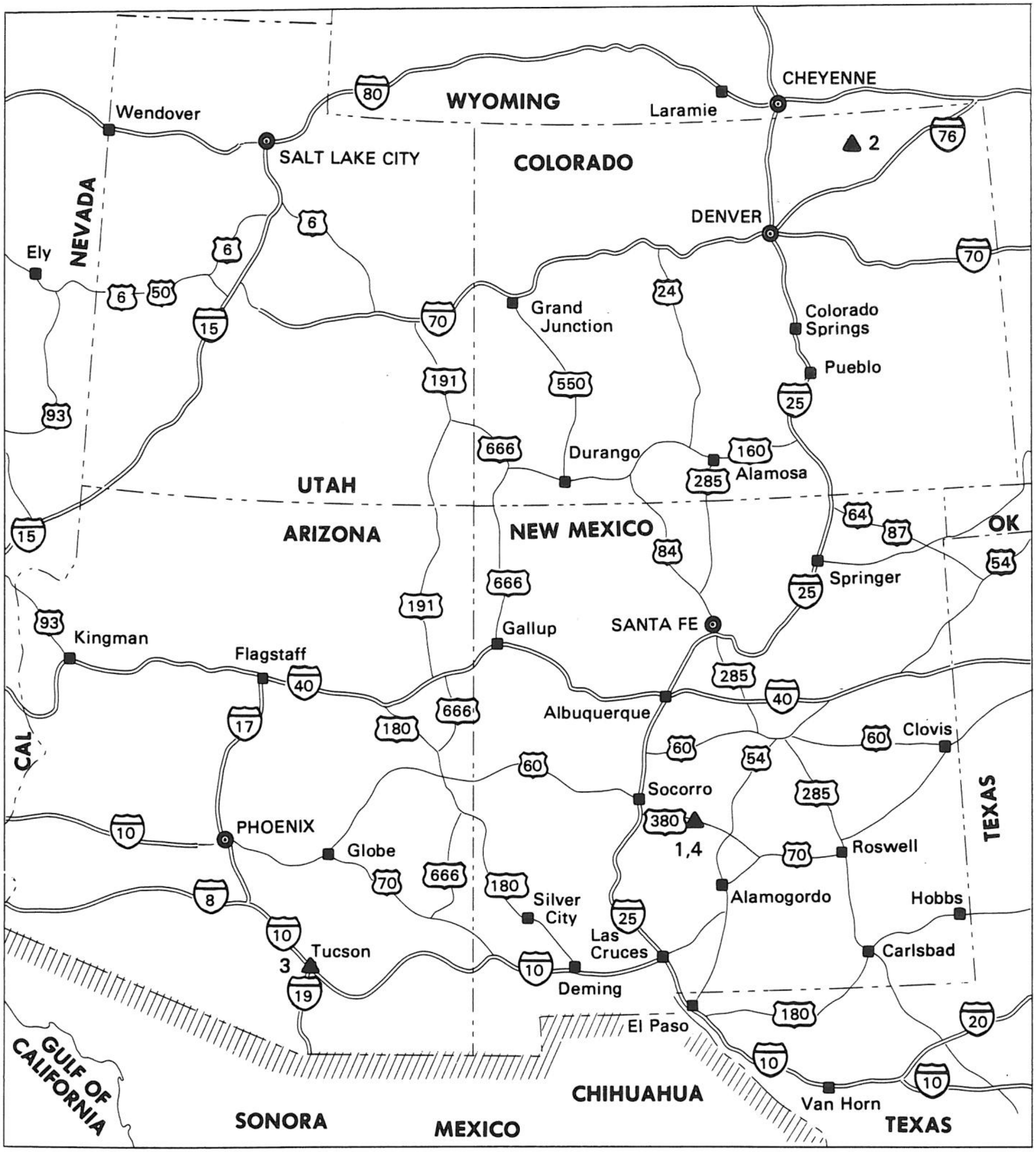
November 9 and 10, 1991

Macey Center Auditorium
New Mexico Institute of Mining and Technology
Socorro, New Mexico

sponsored by
New Mexico Bureau of Mines and Mineral Resources
Albuquerque Gem and Mineral Club
New Mexico Geological Society
Los Alamos Geological Society
Chaparral Rockhounds

The purpose of the New Mexico Mineral Symposium is to bring together for an exchange of ideas both professionals and amateurs interested in mineralogy. The sponsors hope that the Twelfth New Mexico Mineral Symposium will give both groups a forum to present their cumulative knowledge of mineral occurrences in the state. In addition to the formal papers, informal discussions among mineralogists, geologists, and hobbyists should benefit all.

Cover—MINERALS OF THE FOUR-CORNERS STATES. Scepter quartz from Kingston, New Mexico; rhodochrosite from Silverton, Colorado; topaz from the Thomas Mountains, Utah; and barite from Superior, Arizona represent the four-corners states in the cover design by Teresa Mueller.



Geographic Index Map
12th New Mexico Mineral Symposium

SCHEDULE

Numbers in parentheses refer to geographic location on map.

Friday, November 8

Informal tailgating and social hour, individual rooms, El Camino Motel

Saturday, November 9
Marc Wilson, NMBMMR, Chairperson

8:00 am Registration; coffee and donuts

9:30 *Opening remarks,* main auditorium

9:40 *Asbestos: mineralogy and misunderstanding—Cornelis* Klein

10:40 Coffee break

11:10 *New Mexico pseudomorphs: an introduction—Marc* Wilson

11:40 (1) *Recent developments at the Mex-Tex—Tom* Massis

12:10 pm Lunch, Museum tours

Steve Bringe, NMIMT, Chairperson

2:00 (2) *New digging at Stoneham, Colorado—Bryan* Lees

3:00 *The Earth as seen through the microscope—Dave* Mann

3:30 Coffee break

4:00 (3) *Care and feeding of a mineral museum collection: the permanent mineral collection at the Arizona-Sonora Desert Museum—Anna* Domitrovic

4:30 *Metamunirite, haynesite, and other microminerals from the four-corners states* 6:00 pm —Pat Haynes

5:30 Sarsaparilla and suds: cocktail hour (with cash bar)

6:30 Dinner at Garcia Opera House with keynote address, *Mineral classics of Shaba, Zaire,* by Gilbert Gauthier and an auction to benefit the New Mexico Mineral Symposium

Sunday, November 10
Paul Hlava, Sandia National Laboratories, Chairperson

9:00 am (4) *The amazing Sunshine #1 tunnel, Blanchard mine, Bingham, New Mexico—Ramon* DeMark and Paul Hlava

9:30 *Turquoise: imitation, adulteration, or natural—Gary* Werner

10:30 Coffee break

11:00 Facetable stones of New Mexico- Merrill Murphy

11:30 What's new—open forum

12:00 pm Lunch

1:15-3:00 Silent auction, upper lobby, Macey Center, sponsored by the Albuquerque Gem and Mineral Club

ASBESTOS: MINERALOGY AND MISUNDERSTANDING

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In accordance with U.S. Environmental Protection Agency (USEPA) publication no. 20T-2003 (1990), the term "asbestos" describes six naturally occurring fibrous minerals. Of these six, chrysotile is the fibrous (asbestiform) variety of the mineral serpentine, and the other five are fibrous (asbestiform) varieties of amphibole. Although chrysotile and its massive counterpart, serpentine, as well as members of the amphibole group are common in many geologic terranes, there are only a few localities worldwide where these asbestiform minerals are in sufficient concentration and of the required quality (that is, of highly fibrous habit) to be mined profitably.

The major asbestos-producing countries, in decreasing order of estimated production tonnage (as available in the literature, from many sources, for the years 1978-1981 and tabulated by Schreier, 1989), are as follows: USSR, Canada, Zimbabwe, Brazil, Italy, USA, Greece, Australia, western Germany, and small additional production from a few other countries. In most cases, except South Africa and Finland, the production is of "white asbestos," chrysotile. South Africa is the only current source of "blue asbestos" (asbestiform blue amphibole, crocidolite) and of "brown asbestos" (asbestiform brown amphibole, amosite). Western Australia, in the Wittenoom area of the Hamersley Range, was a major producer of "blue asbestos" until 1966 when all mining there was terminated (Trendall and Blockley, 1970). Approximately 95% or more of the world's production of asbestos is chrysotile from a relatively small number of commercial sources (Harben and Bates, 1984; Ross, 1981; Schreier, 1989). Noncommercial occurrences (in association with serpentinites) of chrysotile are estimated to be much more common, worldwide, than the well-known commercial deposits.

Most of the major commercial chrysotile deposits (mines) occur in the northern hemisphere; most serpentine occurrences plotted by Schreier (1989) are also in the northern hemisphere. (One exception is the relatively small Precambrian occurrence of anthophyllite asbestos, a fibrous variety of amphibole, in eastern Finland where production stopped in 1975; Ross, 1981.) In contrast, the largest asbestos producers in the southern hemisphere are those of two types of amphibole, crocidolite ("blue asbestos") and amosite ("brown asbestos"); both types are mined in the Transvaal Province of South Africa and large reserves of "blue asbestos" are still available in the Hamersley Range of Western Australia. Less chrysotile production in the southern hemisphere is from South Africa, Zimbabwe, Australia, and Brazil. Amphibole asbestos production and occurrence in the southern hemisphere is intimately tied to the vast Precambrian iron deposits, both in South Africa, and Western Australia.

Of the six asbestos types, only four have been used significantly in commercial applications. By 1980 90% of all asbestos mined worldwide was of the chrysotile ("white asbestos") variety (Ross, 1981), with the main suppliers being mines in the Thetford Mines area of the eastern townships of Quebec, Canada, and in the central and southern Urals of the USSR. Two to three percent of the world's asbestos production has been the crocidolite ("blue asbestos") variety, mainly from South Africa and Western Australia. Amosite ("brown asbestos") also accounts for only about 2-3% of all asbestos ever produced (Ross, 1981).

Although federal policy in the United States does not differentiate between different types of asbestos (Mossman et al., 1990), medical studies on the pathogenicity of the different forms of asbestos (Mossman et al., 1990; see also Ross, 1984, for an extensive review) show that "blue asbestos" (crocidolite) poses much greater health hazards *(in occupational settings)* than chrysotile. Occupational exposure to asbestos can cause the following types of disorders: asbestosis, lung cancer, mesotheliomas (cancer of the pleural and peritoneal membranes), and benign changes in the pleura (Mossman et al., 1989). Crocidolite ("blue asbestos") fibers appear to be most pathogenic, especially with respect to mesothelioma. Smoking is a strong contributor to incidence of the above diseases, especially lung cancer (Ross, 1984).

Although asbestos has caused disease *in the work place* (see Ross, 1984 for review), three questions need to be answered: 1) What is the main asbestos type in US buildings? 2) Does airborne asbestos dust present in schools and other buildings present a risk to the occupants? and 3) What does the natural ambient air (from outside the building) contribute to the fiber count inside a building? The answer to question #1, is simple: the asbestos fiber found in buildings is mainly chrysotile. The answer to question #2 is also simple: available data do not support the concept that low-level (nonoccupational) exposure to asbestos is a health hazard in buildings and schools (Mossman et al., 1990). The study of nonoccupational exposure of women (nonminers) to chrysotile fibers in the mining towns of the Thetford Mines region, Quebec (where these women lived for much of their lives in very heavy, nonoccupational exposure to chrysotile dust emitted from the mining operations and the waste dumps; Pampalon, 1979; report updated by Siemiatycki, 1982; see also Ross, 1984) and other Canadian health studies show that there is no excess mortality in these regions (in a nonoccupational setting) and that the air and water, both of which contain significant amounts of chrysotile fiber, are safe to breathe and drink. The answer to question #3 is more difficult, and the conclusions less well established. Normal geologic weathering processes of amphibole- and chrysotile-rich rocks worldwide contribute a natural background (of fiber content) to the atmosphere and hydrosphere. (In this regard, it must be noted that fiber counts of air and water samples include, as recommended by the U.S. Occupational Safety and Health Administration (OSHA), all naturally occurring acicular minerals with a length-to-width ratio of 3 for fibers having a length greater than 5 *Am.)* Studies of Antarctic ice cores (dated as older than 10,000 years; Kohyama, 1989) show fiber concentrations (expressed as fibers per liter of water) that are very similar to values commonly measured in modern waters that are generally unaffected by man-made fiber pollution. Careful studies of fiber count and fiber type in essentially nonpolluted air are very few, but Kohyama (1989) shows a geometric mean of 9.7 fibers/liter of air over the Pacific Ocean and some isolated, mainly volcanic islands about 600 mi to the southeast of Japan. Almost all of this fiber is chrysotile. This fiber count per liter may well represent a global and natural fiber background of something like 10 fibers/liter. The answer to question #3, therefore, is that there is a background contribution (resulting from natural erosional processes) to the global air mass. This was clearly stated by Abelson (1990): "We live on a planet on which there is an abundance of serpentine- and amphibole-containing rocks. Natural processes have been releasing fibers throughout Earth history. We breathe about 1 million fibers per year."

Misunderstanding and fear of asbestos and also mandates by the Environmental Protection Agency (EPA) have generated an explosive growth of asbestos identification and removal companies, working mainly in public schools, other public buildings, and hospitals. Extension of such EPA requirements to all public and commercial buildings containing asbestos will cost approximately $100-150 billion (Mossman et al., 1990). For example, New York City has 800,000 public and private buildings, of which 544,000 are estimated to contain significant amounts of asbestos (comment by A. F. Appleton, Environmental Protection Commissioner; *NY Times,* July 15, 1990). In this regard, an EPA report of 1990 "Managing Asbestos in Place," lists four pertinent "facts:" Fact 1: "Although asbestos is hazardous, the risk of asbestos-related disease depends upon exposure to airborne asbestos fibers" (note the continued lack of distinction of asbestos types); Fact 2: "Based upon available data, the average asbestos levels in buildings seem to be very low. Accordingly the health risk to most building occupants appears to be very low." Fact 3: "Removal is often not a building owner's best course of action to reduce asbestos exposure. In fact, an improper removal can create a dangerous situation where none previously existed." Fact 4: "EPA only requires asbestos removal to prevent significant public exposure to airborne asbestos fibers during building demolition or renovation activities." Unfortunately, because of asbestos fear and misinformation, asbestos removal (instead of encapsulating the wall or ceiling materials in place) is becoming a bigger and costlier business, not smaller. Buildings with known asbestos (even if material is found to be in sound condition), which are up for sale, lose much of their value because of the fear not only of the asbestos in them, but of future and open-ended litigation about the presence of asbestos.

Why the fear and panic? Statements such as "one fiber can kill you" are very effective, although completely untrue. Humankind is not being killed, nor has it been killed, by the globally known natural levels of fiber in the atmosphere. This must mean that there must be some threshold level (of fibers/liter) in the atmosphere below which there is no likelihood of disease. This is quite contrary to the linear dose models that lead to the statement ("one fiber theory") that one fiber of inhaled asbestos will cause cancer. Such statements are unsupported by available data.

Two important questions remain with regard to a fiber background level in the global atmosphere. Kohyama (1989) notes that 99% of all the fibers in sixteen air samples (taken over the Pacific Ocean and isolated, small volcanic islands off Japan) consist of chrysotile. 1) Why such a preponderance of chrysotile? It is very likely that the Coalinga chrysotile area in the San Benito Mountains of California is a unique natural supply source of micronsized chrysotile fibers for the global atmosphere as well as local water runoff. The chrysotile is the result of extensive chemical alteration and structural deformation of serpentine rock over an area of approximately 50 mi[1] (about 32,000 acres). Chrysotile asbestos fibers from this very large area of rock and soil exposures rich in chrysotile (range 1-10 *Am)* can travel many thousands of miles in the global atmosphere, and 1-i.cm particles carried to the top of a cloud could stay airborne for months if the particles were not cleansed out of the atmosphere by precipitation (R. C. Schell, pers. comm.). And 2) is there direct evidence for the presence of global-airborne amphibole fibers that have resulted from normal weathering processes? The most relevant study is by Paoletti et al. (1987), in which the mineral-particle content was determined by transmission electron microscope (TEM) techniques of lung tissues of ten residents who died in the Rome, Italy area of causes not related to occupational exposure to dust. In six of the ten cases amphibole was noted in the lung burden, and chrysotile was noted in only one. The amphiboles are considered to reflect part of the mineral component (in the atmosphere) that is the result of normal weathering processes.

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NEW MEXICO PSEUDOMORPHS: AN INTRODUCTION

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The term pseudomorph, literally meaning false shape, refers to a mineral that exhibits the external form of a different mineral species. There is some disagreement about what actually constitutes pseudomorphism in minerals, so for the sake of simplicity, the definitions of Edward S. Dana will be followed in this presentation. Dana (1907) described three classes of pseudomorphism with six subdivisions:

1) pseudomorphism by substitution
2) pseudomorphism by deposition
    A) pseudomorphism by incrustation
    B) pseudomorphism by infiltration
3) pseudomorphism by alteration
    A) paramorphism
    B) with loss of ingredients
    C) with gain of ingredients
    D) with exchange of ingredients

Pseudomorphism by substitution involves the gradual replacement of original material by an unrelated mineral without chemical reaction between the two. Petrified wood is a common example of this class of pseudomorph. New Mexico examples include opal or the agate variety of quartz after wood from various localities, chalcocite after wood from Sandoval County, and carnotite after wood from the Grants district, Cibola and Valencia Counties.

Pseudomorphs by incrustation form when one mineral coats another with or without the removal of that other. Quartz very commonly forms crusts on, or casts of, other mineral species and New Mexico examples include pseudomorphs of fluorite, barite, and galena from the Hansonburg district, Socorro County, and quartz and fluorite after calcite from the Cuchillo Negro district, Sierra County. Other examples include pseudomorphs of limoniteaurichalcite-calcite after calcite from the Magdalena district, Socorro County; turgite coatings on quartz from the Lordsburg district, Hidalgo County; and pyrite after sphalerite from the Hansonburg district, Socorro County.

Pseudomorphs by infiltration form when a cavity made by the removal of a mineral is filled by another mineral. This type of pseudomorphism is more important in paleontology than in mineralogy, and examples such as quartz or pyrite pseudomorphs of brachiopods, pelecypods, trilobites, etc., abound in New Mexico.

Paramorphism results when a mineral undergoes a change in internal structure without a change in chemical composition. Perhaps the best known example is the phase inversion of argentite (cubic) to acanthite (monoclinic) at temperatures below 177°C. New Mexico examples include calcite (hexagonal) after aragonite (ortho-rhombic) from numerous localities and pyrolusite (tetragonal) after ramsdellite (orthorhombic) from Lake Valley, Sierra County.

New Mexico examples of pseudomorphism by alteration with loss of ingredients include copper (Cu) after cuprite (Cu_2O) from Santa Rita, Grant County and malachite ($Cu_2(CO_3)(OH)_2$) after azurite ($Cu_3(CO_3)_2(OH)_2$) from the Magdalena and Hansonburg districts in Socorro County, the Lordsburg district in Hidalgo County, and the Organ district in Dona Ana County.

A New Mexico example of pseudomorphism by alteration with addition of ingredients is cuprite (Cu_2O) after copper (Cu) from the Santa Rita district in Grant County.

Pseudomorphism by alteration with exchange of ingredients is probably the most important type of pseudomorphism because most specimens commonly observed belong to this category. New Mexico examples abound and include rose muscovite after microcline from the Harding mine, Taos County; cerussite and anglesite after galena from many localities; malachite and/or limonite after chalcopyrite from the Orogrande district, Otero County and from the Hansonburg district, Socorro County; linarite, brochantite, cerussite, anglesite, and/or wulfenite after galena from the Hansonburg district; malachite and cerussite after linarite, also from the Hansonburg district; rosasite and/or malachite after cuprite from the Magdalena district, Socorro County; ramsdellite after groutite from Lake Valley, Sierra County; hematite and/or chalcocite after pyrite from Santa Rita, Grant County; and limonite after pyrite from numerous localities.

Often, pseudomorphs exhibit characteristics of more than one of these classes presented. Chrysocolla may pseudomorph any copper-bearing species by alteration and incrust adjacent minerals as well. Specimens of groutite from Lake Valley, Sierra County, are pseudomorphed first to ramsdellite by alteration and then to pyrolusite by paramorphism. Finally, azurite from the Rose mine, Grant County, has been pseudomorphed by a combination of copper and calcite. The copper forms microscopic arborescent crystal groupings that are partly to completely altered to cuprite. The cuprite is often further altered to malachite. They are thus copper, cuprite, and calcite, cuprite and calcite, cuprite and malachite, or malachite pseudomorphs of azurite. Classification is further complicated because the pseudomorphing materials filled azurite molds in the surrounding clays giving them aspects of both alteration and infiltration pseudomorphs.

Reference

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RECENT DEVELOPMENTS AT THE MEX-TEX

(Location 1 on index map)

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The 1990 New Mexico Mineral Symposium reported minerals of the Mex-Tex group, Bingham, New Mexico (Massis, 1990). This is a report on recent developments at the MexTex. During early February 1991, a major collapse at the main or upper workings covered and buried the most productive mineral-collecting area of the Mex-Tex group. The collapse occurred when nobody was present. It is felt that the increased aircraft activity over the area released a sonic boom nearby that started the collapse. This event, the collapse, was not expected.

A 60-70-ft section subsided, collapsed, and covered nearly all the familiar underground collecting sites. The only underground section remaining is the extreme backside, located in the southeast section of the mine. This section is still unstable with evidence of recent falls from the ceiling that continue to drop in various-sized sections. The outside surface above these workings is still observed to be settling, eight months after the initial collapse.

The collapse has significantly reduced the quantity of fine mineral specimens being collected. The 15-20-ft overburden now covering this area is essentially void of mineralization. Only one mineralized, specimen-producing zone has been found at the surface. This mineralized zone produced a small suite of fine fluorite, barite, and galena specimens. The forms and colors are new for the Mex-Tex group. At least four new fluorite crystal forms were found, highly modified cubic or octahedral forms. The colors are dark purple to gray blue with individual crystals exceeding three inches. A number of the fluorite specimens collected are museum quality. Barite specimens though small, less than two inches on a side, were free formed with no terminations, clear to light yellow, and many times quite "gemmy." Some modified cubic galena specimens, new forms for the Mex-Tex group, were also collected.

Though specimen production and collecting has diminished tremendously, small pockets throughout the Mex-Tex group continue to be found. Hard work moving significant quantities of overburden is now required to open pockets. This year, 1991 (including the latter part of 1990), the Mex-Tex group has produced significant finds that include fine light-green hex-octahedral and modified cubic fluorites, typical light-blue to clear hex-octahedral fluorites, showy murdochite on quartz, numerous combinations of spangolite, brochantite, and linarite with other unidentified colored minerals, a suite of creedite, small linarite crystals in association with fluorite and galena, and wulfenite crystals. Large plates of small quartz crystals, both smoky-tipped and amethystine, continue to be found.

There are no plans to remove the 15 to 20 ft of overburden covering the main specimen-producing area. Small significant finds will continue to occur elsewhere but it appears specimen production will diminish from this area. Collecting at the Mex-Tex, especially the upper workings, is extremely dangerous and is discouraged for the foreseeable future.

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NEW DIGGING AT STONEHAM, COLORADO

(Location 2 on index map)

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In July 1989, a project was mounted to explore for barite at the 100-yr-old Stoneham, Colorado collecting locality. The locality is famous for its aqua barites that have lured field collectors to the site for decades. Our recent project, the Leeson dig, consumed two weeks of field time followed by three months of specimen preparation. A large tractor was employed to remove overburden and tailings created by previous field collectors. A 50-fl-deep by 200-ft-long trench was opened to expose the barite-rich vein at depth. The final results yielded more than 900 numbered specimens. During the dig, extensive geologic data were collected on the barite depositional environment resulting in a predictive depositional model for future excavations.

THE EARTH AS SEEN THROUGH THE MICROSCOPE

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THE CARE AND FEEDING OF A MUSEUM MINERAL COLLECTION: BEHIND THE SCENES IN THE GEOLOGY DEPARTMENT OF THE ARIZONA-SONORA DESERT MUSEUM

(Location 3 on index map)

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The Arizona-Sonora Desert Museum Permanent Mineral Collections got its start in the early 1970s with a contribution of minerals that included some of the finest wulfenite and mimetite coming out of the San Francisco mine in Cucurpe, Sonora, Mexico. Since then, the collections have developed into the finest regional mineral collection maintained by a not-for-profit institution.

The Desert Museum can afford to call its mineral collection the finest because of a distinct advantage it has over many other museums. The collection parameters are highly restricted with the boundaries including the state of Arizona, the state of Sonora, Mexico, and a large portion of the Baja Peninsula and the islands in the Sea of Cortez. This is the interpretive realm of the Arizona-Sonora Desert Museum, which includes the biology and the geology of what is defined as the Sonoran Desert Region.

About 2% of the entire mineral collection is exhibited either on the Museum grounds or in loan exhibits to other institutions. Other opportunities for exhibition afford themselves through invitations to gem and mineral shows. The majority of the 10,998 catalogued specimens is secured in a vault storage.

In addition to the main body of the mineral collections, about 6,500 micromounts and about 100 cut and polished stones are part of the Permanent Collections. There is also an assortment of meteorites and fossils that are growing in number as the collections are expanded to meet exhibit needs.

Acquisition is accomplished by purchase through the Earth Sciences Fund, by trade (which is done very judiciously), and by donation, as long as gifts are given with no restrictions attached.

The Arizona-Sonora Desert Museum Permanent Mineral Collections is not stagnant by any means. It is a very vital, growing collection of minerals from the most well known mineral localities within the Sonoran Desert Region. The Desert Museum can boast of having the widest variety or the finest of mineral specimens from locations known to collectors worldwide. A Tiger cerussite or a Bisbee azurite, Baja gold or San Francisco mine wulfenites conjure up in the collector's mind visions of exquisite minerals from classic localities. They all have a carefully maintained home in the Permanent Mineral Collections at the Arizona-Sonora Desert Museum.

METAMUNIRITE, HAYNESITE AND OTHER MICROMINERALS FROM THE FOUR-CORNERS STATES

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Metamunirite is a new mineral which was approved by the International Mineralogical Association (IMA) in early 1991. It is an orthorhombic, anhydrous sodium vanadate. Munirite, with two waters ($NaVO_3$ • [2-x] H_20), is found as an efflorescent crust at Azad Kashmir, Pakistan. I assume that the munirite from Pakistan is locally stable or that the researchers simply did not describe the dehydrated, or meta, form. The type locality for metamunirite is the Burro mine at Slick Rock, San Miguel County, Colorado. It occurs as an efflorescent crust of very tiny white acicular crystals and is associated with metarossite (hydrated calcium vanadate), pascoite (another hydrated calcium vanadate), and thenardite (sodium sulfate) on vanadium-rich ore on the dumps. On April 6, 1986, I was collecting samples of pascoite at the Burro mine with Arnold Hampson. I found a corner on one boulder that had what I assumed to be a microscopically crystallized sulfate mineral. I collected the material, all of a few square inches of crust, and saved it for a few years. Repeated trips to the mine for pascoite did not yield any more material until November 5, 1989. On that day I collected a few square inches of white acicular crusts. I finally had 10 to 12 samples of the material so I sent one for analysis. The results were surprising, and subsequent trips to the mine yielded only one other specimen. Collecting at the Burro mine can be extremely frustrating because common crusts of white thenardite seem to be everywhere; an entire carload of potential metamunirite can turn out to be nothing but thenardite. So, only about 12 samples have been collected at the type locality.

In the summer of 1990 I had the good fortune to meet Mr. Phillip Allen. He arranged for a collecting trip in the Deremo-Snyder mine, San Miguel County, Colorado. On August 2, 1990, I met him at the mine and we took a skip down 700-750 ft to a waiting diesel-powered buggy. Mr. Allen had already located variously colored crusts of secondary minerals in the mine. We collected blue crusts of chalconatronite (its fourth world locality?), bright-orange pascoite crusts, and one and a half flats of what may become a new olive-green uranium mineral, Phil's potential first! I spotted an odd patch of white acicular material in a very rich vanadium horizon. It formed attractive acicular crystals and was associated with pascoite and rossite. The white material collected filled one flat, about 20 specimens. It turned out to be metamunirite that was much superior to the Burro mine material. Unfortunately, the Deremo-Snyder mine ceased operating shortly afterward and the mine has been filling up with water. The colorful walls of efflorescent minerals are now under water.

In April 1991 I was in the vicinity of Naturita and took a quick look at the Long Park area, just north of Paradox Valley, Montrose County, Colorado. On the dumps of the Long Park #16 mine I found two boulders that had efflorescent white acicular crystals. They looked pleasantly identical to metamunirite. I collected about three quarters of a flat. Later examination showed it to be hexahydrite, a hydrated magnesium sulfate.

The Big Indian mine, south of La Sal, San Juan County, Utah, has been the site of azurite mining in the last 15 years or so. The microscopic arsenates have been mostly overlooked. Recent finds included drusy aggregates of fine-grained, sky-blue tyrolite. It resembles chrysocolla smears, and microcrystals have not been found. It can form relatively continuous coatings to 10x10 inches. Associated with it are flat round masses of black manganese oxides ("psilomelane") and occasional greenish-blue coatings of clinoclase. The clinoclase can liberally cover several square inches of surface, but unfortunately, like the tyrolite, does not readily form microcrystals. Some crystals have been collected, but it preferentially forms as aggregate coatings. Microscopic white acicular crystals of olivenite (var: leucochalcite) have been found associated with blue to green smears and spheres of cornwallite and microcrystals of azurite.

Haynesite was approved by the IMA in the summer 1990. It is an orthorhombic hydrated uranyl selenate and is found at the Repete mine in San Juan County, Utah. Marcelino and Marc Mendisco were mining uranium ore at the Repete mine in 1986. I snagged an invite to the mine and first visited it on August 2, 1986. I was looking over the high-grade ore pile and found three secondary uranium minerals. These turned out to be boltwoodite, andersonite, and haynesite. When the miners came out to dump some ore, I introduced myself. I pointed out to the miners some of their secondary minerals and asked if they could show me where they had gotten them. They gave me a mine tour and showed me the locations of the secondary minerals. They were extremely helpful.

About three months passed before I received analytical results on the material. It was microprobed almost simultaneously by Paul Hlava and by Pete Modreski. It was an apparent new mineral and I was able to visit the mine two more times to collect specimens before it closed in January 1987 because of caving problems. The high-grade pillars that contained the haynesite had been removed and sent to the mill. On my last visit I found one extremely poor sample of haynesite in the area where the ore had been stockpiled. Approximately 10 boxes and one 70-lb sample of haynesite had been collected.

On May 11, 1986 Arnold Hampson showed me where to find some things at the Monument #2 mine in Apache County, Arizona. We collected rauvite, metahewettite, tyuyamunite/metatyuyamunite, and several odd samples. Recently, I had some of the odd samples analyzed. One sample had microscopic black aggregates of bokite (a hydrated aluminum iron vanadate). Another had tiny golden-brown acicular crystals of fervanite (a hydrated iron vanadate) with very tiny dark-brown lustrous crystals of schubnelite (an iron vanadate hydroxide). This is apparently the only sample of schubnelite from elsewhere than Mounana, Gabon.

About December 8, 1988, Arnold Hampson and I took a quick look for zeolites on State Highway 78, 31/2 mi west of the New Mexico border in Greenlee County, Arizona. In the andesite flows of some of the roadcuts we found microcrystals of clinoptilolite, mordenite(?), and erionite.

In July 1990 Marc Wilson and I made two trips to the May Flower mine area on Socorro Peak, Socorro County, New Mexico. We found some microscopic minerals that had not been reported from this mine. These included linarite, caledonite, rosasite, anglesite, and fornacite. Nearly all of these minerals occurred as pretty poor samples, and they were all found in an approximately 1-ft^3 vein breccia fragment. The surrounding breccia fragments did not contain these minerals.

Acknowledgments—I wish to thank Marc Wilson for allowing me to use the microphotography equipment in his office. I wish to thank the following researchers for their help: Paul Hiava, Michel Deliens, Howard Evans, Jr., Marc Wilson, and Pete Modreski. I wish to thank Phillip Allen and the staff at the Deremo-Snyder mine for their hospitality. I especially wish to thank the Mendisco family: Marcelino, Marc, and their late father Felix, who granted me permission to collect at the Repete mine, but whom I was not fortunate enough to meet in person. I would also like to thank Will Moats for information about Socorro Peak and Ron Gibbs for information about zeolites along Highway 78.

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MINERAL CLASSICS OF SHABA, ZAIRE

Gilbert Gauthier
Paris, France

Keynote Address

The mineralization of the Shaba deposit belongs to the South Equatorial cupro-cobaltiferous metallogenic province in Central Africa. This province extends about 500 km in width from the town of Kolwezi in Zaire to the town of N'Dola in Zambia. The northern zone called "Shaba Crescent" is entirely in southern Shaba; the southern zone called "Zambia Copper belt" is nearby in Zambia but overlaps the southern Shaba a bit. The mineralization in Shaba and Zambia have the same sedimentary origin. They are of the same Upper Proterozoic era. They have the same distribution of copper and cobalt in mineralized patches. In both deposits the primary sulfides of copper and cobalt are the same. They were probably deposited at the same time but are completely different in their lithology and their tectonic structure. In Shaba, dolomite is abundant in the gangues of the mineral deposit while it is almost entirely lacking in those in Zambia. The local rocks belong to the Katanga System, is divided into three supergroups: Roan, Lower Kundelungu, and Upper Kundel-ungu.

The lower part of the Katanga System, called Roan Supergroup, has been deposited in a lagoonal environment. In the lower third of the Roan Supergroup the Cu and Co minerals are concentrated generally in two orebodies. In Shaba, the lower orebody is in a siliceous dolomite 10 to 15 m thick and the upper orebody is in a sandy dolomitic shale 5 to 10 m thick. The two orebodies are separated by a 10- to 15-m massive barren dolomite bed. Uranium is also found locally in some deposits. Generally the patches of Co mineralization are smaller and inside the patches of Cu mineralization. The average grade of the Cu of the Shaba mines is generally 4 to 5% while the average grade of the Co is about 0.5%.

More than 200 minerals are reported in the South Shaba. The principal sulfide minerals are chalcocite for copper and carrollite for cobalt; the sulfide minerals have been altered to carbonates, silicates, and phosphates. The oxidized zone goes generally from 50 to 200 m. The principal oxide minerals for copper are malachite, cuprite, cornetite, libethenite, pseudomalachite, chrysocolla, plancheite; for cobalt the principal minerals are heterogenite and kolwezite, accessory mineral is sphaerocobaltite. In the Shaba mines one exception is the Kijushi mine, which is an hypogene "chimney" deposit similar to Tsumeb with mainly lead, zinc, and copper with accessory cobalt, germanium, cadmium, gallium, and arsenic. The mine of Shinkolobwe is not considered as an exception but as a particular case.

Minerals from the Shaba mines

Agardite
Aikinite
Anglesite
Anhydrite
Aragonite
Arsenopyrite
Astrocyanite-(Ce)
Atacamite
Aurichalcite
Azurite
Barite
Beaverite
Becquerelite
Betekhtinite
Beryl
Bijvoetite
Billietite
Bismuthinite
Bornite
Briartite
Brochantite
Buttgenbachite
Cacoxenite
Calciovolborthite
Calcite
Carnotite
Carrollite
Cattierite
Cerussite
Chalcanthite
Chalcocite
Chalcomenite
Chalcopyrite
Chrysocolla
Claringbullite
Cobaltite
Cobaltomenite
Comblainite
Conichalcite
Connellite
Copper
Cometite
Cosalite
Covellite
Cuprite
Cuprosklodowskite
Cuzienite
Cuzite
Cyanite
Cyanotrichite
Demesmaekerite
Derriksite
Descloizite
Dewindtite
Digenite
Dioptase
Djurleite
Dolomite
Duhamelite
Dumontite
Emplectite
Enargite
Fourmarierite
Francevillite
Francoisite-(Nd)
Galena
Gallite
Gerhardtite
Germanite
Glaucosphaerite
Goethite
Gold
Goslarite
Guilleminite
Gysinite-(Nd)
Hematite
Hemimorphite
Heterogenite-2H
Heterogenite-3R
Hydrozincite
Ianthinite
Idaite
lodyrite
Julienite
Kamotoite
Kasolite
Kipusite
Kolwezite
Lepersonnite
Libethenite
Likasite
Linnaeite
Ludjibaite
Magnesite
Magnetite
Malachite
Marthozite
Massicot
Masuyite
Melanterite
Melonite
Metatorbernite
Metatyuyamunite
Metazeunerite
Miersite
Millerite
Mimetite
Molybdenite
Monazite-(La)
Mottramite
Muscovite
Nepouite
Olivenite
Oosterboschite
Oursinite
Parsonsite
Penroseite
Pentlandite
Phlogopite
Phosphuranylite
Phurcalite
Plancheite
Platinum
Posnjakite
Protasite
Pseudomalachite
Pyrite
Pyromorphite
Pyrrhotite
Quartz
Reichenbachite
Renardite
Renierite
Richetite
Roubaultite
Rutherfordine
Saleeite
Sayrite
Schmitterite
Schoepite
Schuilingite-(Nd)
Scorodite
Sengierite
Shabaite-(Nd)
Sharpite
Shattuckite
Siderite
Siegenite
Silver
Sklodowskite
Smithsonite
Soddyite
Spangolite
Sphalerite
Sphaerocobaltite
Stromeyerite
Strontianite
Studtite
Swamboite
Tennantite
Tenorite
Tetradymite
Torbernite
Trogtalite
Tungstenite
Turquoise
Umangite
Umohoite
Urancalcarite
Uraninite
Uranophane
Uranopilite
Vaesite
Valleriite
Vandenbrandeite
Vandendriesscheite
Vauquelinite
Vesignieite
Veszelyite
Vivianite
Volborthite
Willemite
Wittichenite
Wölsendorfite
Wulfenite
Wyartite
Zincite

THE AMAZING SUNSHINE #1 TUNNEL, BLANCHARD MINE, BINGHAM, NEW MEXICO

(Location 4 on index map)

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The Sunshine Mining Company began exploratory drilling, drifting, crosscutting, and rising in the vicinity of the Blanchard mine in November 1958. The Sunshine #1 was the first of six exploratory tunnels developed and it trends eastward. The tunnel dimensions are 12 ft by 12 ft by 405 ft long. No ore was marketed during this period.

The tunnel was virtually unknown as a specimen producer until February 1978 when several flats of galena crystals coated with a lustrous, blue druze of linarite first reached the public at the Tucson Gem and Mineral Show. This was followed by an even more stunning find of world-class linarite crystals in late 1979. Many of these marvelous specimens were brought to the Tucson Gem and Mineral Show in February 1980 and were soon purchased (reputedly for many thousands of dollars) by eager collectors.

Following the incredible 1979 linarite discovery, an effort to locate/recover additional linarite crystals was made by individuals under contract from Western General Resources, Inc. (the leaseholder at that time). This operation continued for several months but no large linarite crystals were found. The operation was closed down by OSHA.

The Blanchard mine including the Sunshine #1 tunnel was claimed (located) by mineral collectors in April 1987, and in September of that year an amazing pocket was opened by the claim owners. The pocket was behind a large gypsum mass near the roof of a raise developed in the search for linarite crystals and had to be reached using a ladder. Initial entry into the pocket revealed large blue and purple cubes of fluorite up to 9 cm on an edge and water-clear selenite crystals in spear-shaped and prismatic habits. The largest crystal was 44 cm long. The pocket dimensions were roughly 1-1.5 m wide by 0.8-1 m high by 5 m long. This pocket eventually yielded dozens of superb fluorite, selenite, and galena specimens.

More recently, the new mineral species, scrutinyite («$Pb0_2$), was described by Taggart et al. (1988) based on specimens from the Sunshine #1 tunnel. Scrutinyite is a dimorph of plattnerite that occurs as very small (less than 0.1 mm) reddish-brown micaceous crystals.

The following is a listing of some of the more noteworthy mineralogical events that have recently been recorded for the Sunshine #1 tunnel:

1) First positively identified location for caledonite at the Blanchard mine and largest crystal (7 mm).
2) First in situ occurrence of pyromorphite from the Blanchard mine. Colorless to slightly gray, transparent, hexagonal prisms were found.
3) Largest and brightest crystals of corkite known to occur at the Blanchard mine.
4) The finest occurrence of hydrozincite and the only known location for fluorescent green fluorite (short wave).
5) Only known occurrence of blue hemimorphite at the Blanchard mine.
6) One of only two significant sphalerite occurrences at the Blanchard mine and without doubt the producer of the finest specimens.
7) Largest known selenite crystals from the Blanchard mine.
8) Arguably, the producer of the finest fluorite specimens from the Blanchard mine.
9) Finest specimens of covellite replacing chalcopyrite.
10) Only known location at the Blanchard mine where corkite expitaxially overgrows jarosite.
11) Excellent anglesite crystals up to 6 mm, rarely found elsewhere at the Blanchard mine.

Confirmed Mineral List

Sunshine #1 Tunnel, Blanchard mine, Bingham, NM

<u>Sulphides</u>

Chalcocite
Chalcopyrite
Covellite
Galena
Pyrite
Sphalerite

<u>Oxides</u>

Goethite
Murdochite
Plattnerite
Scrutinyite
Scrutinyite

<u>Halides</u>

Fluorite

<u>Carbonates</u>

Aurichalcite
Calcite
Caledonite
Cerussite
Corkite
Hydrozincite
Malachite
Rosasite

<u>Sulphates</u>

Anglesite
Barite
Brochantite
Caledonite
Cyanotrichite
Gypsum
Jarosite
Linarite
Spangolite

<u>Phosphates</u>

Corkite
Pyromorphite

<u>Silicates</u>

Chrysocolla
Hemimorphite
Quartz

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TURQUOISE: IMITATION, ADULTERATION, OR NATURAL

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What turquoise is seems to be a matter of perception rather than fact. Turquoise to a geologist is a hydrous cupric aluminum phosphate, $CuA1_6(PO_4)_4(OH)_8.5H_20$, with additional trace constituents of iron and silica. Turquoise to a consumer is a traditional semiprecious stone, strong in color, that is hard enough to polish and not crumble, dense enough to not absorb skin oils when worn, and plentiful enough to be available at affordable prices.

Unfortunately turquoise will never meet all of these criteria. Many forms of imitation and adulteration have been used to capitalize on an insatiable demand for this misunderstood gem. So, to an opportunist, turquoise is an abundant commercial material of acceptable blue color and natural-appearing matrix, capable of retaining these qualities for the few months needed for marketing. Price should be negligible and would increase only if an observable but unverifiable quantity of genuine turquoise is incorporated in the material. More valuable, in increasing order, are materials that will pass routine quantitative analysis, genuine stone temporarily doctored with oils and sealer, permanently doctored polymerizations and silica-dons, and finally most expensive and least available, the unadulterated natural stone.

In an attempt to protect the public from opportunists, while still allowing producers of altered or imitation stone to enter their legitimate place in the market, the New Mexico legislature passed the Indian Arts and Crafts Act of 1973, revised 1978 (sections 30-33-3 through 30-33-8). Though the lawmakers' understanding of the technical aspects of the problems might have been limited or even erroneous, their intent I believe was apparent. Subclass K reads:

> "unnatural turquoise" means any substance which is not natural turquoise, including:
> (1) "stabilized turquoise" which means turquoise which has been chemically hardened but not adulterated so as to change the color of the natural mineral;
> (2) "treated turquoise" which means turquoise which has been altered to produce a change in the coloration of the natural mineral;
> (3) "reconstituted turquoise" which means dust and turquoise particles which are mixed with plastic resins and are compressed into a solid form so as to resemble natural turquoise; and
> (4) "imitation turquoise" which means any compound or mineral which is manufactured or treated so as to closely approximate turquoise in appearance.

All terms in this discussion that appear in quotes refer to this legal description.

In 1985, Bob North, Mineralogist for the New Mexico Bureau of Mines and Mineral Resources, and I collaborated to establish laboratory procedures for fractionating turquoise specimens in accordance with the Arts and Crafts Act. The logic we used in testing a specimen hinged on my theory that color and hardness depended on complete hydration, turquoise being a hydrated phosphate. The insufficiently hydrated forms of turquoise known as chalk are more abundant and less expensive than high-grade natural. Processes to regain hardness and color were what we needed to target when testing genuine turquoise for alteration.

In practice, a piece of chalk will return to its fully hydrated color when saturated not only with water but also with oils, waxes, and most other polymers. Polymerization or color stabilizing (trade jargon coined, I believe, by the L. W. Hardy Company of Kingman, AZ) is a laboratory procedure incorporating clear catalyzed resins that harden and permanently seal turquoise in the rough. I believe this process is recognized as "(1) stabilized." A specimen containing organic compounds would definitely be unnatural but may lack the permanence and hardness of stabilization. For more insight, a carbon-hydrogen analysis was run on our fifteen samples and the results are presented at the end of this article. Several processes are identifiable by their carbon content.

Fracture-sealed turquoise is unfortunately not addressed specifically by the Arts and Crafts Act. It is sold more often than not as natural but in reality is a poor man's stabilization of cut or finished stones. Unlike fracture-sealed vitreous gems, porous turquoise assumes the treatment generally and will gain rehydrated color levels. These in-shop formulations are usually adhesives or lacquers that harden once the carrier solvents evaporate. The compounds tend to be ultraviolet sensitive and degrade with time. Our carbon analysis of fracture-sealed stones indicates carbon content much less than stabilized samples and about twice that of oiled samples.

In (2) "treated turquoise," fully hydrated color levels can be exceeded and slightly off-blue tints can be corrected with the use of dyes. These processes are usually used in conjunction with polymerization and are quite difficult to detect because of the fixing qualities of the polymer. Visual examination for indications of dissimilar concentrations, such as dye line and spots, and a good eye for unnatural shades have proven the most effective tests. Microscopic inspection of an oil infusion of a pulverized sample has netted conclusive results in some instances. In the case of a fairly new secret process, known as natural enhanced, dyes were not analyzed because the normally corresponding organic additives were absent. The sample was erroneously classed as natural. In discussions with the owner of the formula it was divulged that an electrical process on hard chalks was used. I then tried oxalic acid to bleach dye stuffs on the assumption that copper phosphate or a similar mineral tint was either being a) electrowinned into the crystalline lattice of the stone, or b) valence bonded to sodium silicate (silica occurs naturally in turquoise), which was being hardened by an electrical field rather than with electrolytes. The results were positive, a bleached spot at the acid contact, and conclusive, similar tests on natural and stabilized specimens were negative. Carbon content places the natural-enhanced process lower than the fracture-sealed process but not notably higher than unaltered stones polished with wax- or oil-base polishes. These polishes are used extensively and impart a slight color gain on only the most absorbent pieces of natural turquoise. In contrast, saturating the stone with oils and waxes yields strong color gain but imparts neither hardness nor color permanence.

"(3) Reconstituted turquoise" has evolved into two major types. The first is naturally occurring nuggets of chalk compressed and then bound by stabilizing polymers. The value of this material is based on availability of a genuine-turquoise base component. The second type is reconstructed powders. Even with the use of dyes, stabilized turquoise powder becomes an unappealing gray. A pure, white mineral filler, aluminum hydroxide ($Al(OH)_3$), must be used in substantial proportions before a dyeable mix is attained. This compounded substance will be passed as turquoise by most assay labs. The content of filler can be as much as 100% as in the case of the German imports sold as synthetic or genuine reconstructed. In our procedure x-ray diffraction was run first to quickly detect most imitations. If a sample contained aluminum hydroxide, it was classed as imitation and no more tests were run.

"(4) Imitation" products frequently can be detected by visual examination, circumventing the need for further analysis. In the absence of readily available detection procedures, imitation has been lucrative and still spawns new formulations, as confirmed by Dr. Klein of the University of New Mexico. He had been sent a specimen of turquoise from Germany that had a beautiful lustrous deep Persian color and gemmy homogenous grain. On analysis, it was a carbon-calcium-nitrogen compound with minor amounts of phosphoric, titanium, and aluminum oxides.

Back in 1985 our intent was to implement the enforcement of a much-needed law. Today my hopes are that the State will fund continuing research in an effort to discourage fraudulent marketing. Informed, educated consumers help this effort by becoming more aware of what is being sold.

Description slang/trade	Description common	Test: x-ray	Test: carbon	Test: other	Description legal
natural	unadulterated	clean	0-0.15%	negative to oxalic acid, visual exam for synthetics	natural
sealed natural	A. lacquered low grade B. lacquered and dyed	clean clean	0.45% 0.45%	visual exam for surface puddling or coarse undis-solved pigments	stabilized treated
fracture sealed	polymerized fractures	clean	insufficient data for carbon, suspected 0.25-0.50%		stabilized
natural enhanced	mineral dying w/ or w/o silica or lacquer seal	clean	0-0.50%	positive to oxalic acid on unsealed stone	treated
color stabilized	catalyzed polymeri-nation of chalk and low-grade turquoise	clean	2.5-20% High carbon values in-dicate complete pene-tration by complex organic compounds.		stabilized
silicated	hardened with glass, process seldom used without dye because of almost no color gain	clean	0-0.15%	no conclusive tests at this time	stabilized
color shot	dyed and polymerized usually epoxy type	clean	2.5-20%	visual exam for surface puddling, internal con-centration lines and spots, epoxy craze lines	treated
waxed or oiled	paraffin-boiled low-grade hard turquoise	clean	0.27%	Extra deep colors may be seen along faults or fractures. Process is unstable, and oils will migrate into deeply dis-colored areas of concentration while leaving other areas almost colorless	treated?? no hardening as in as in stabilizing; color gain only motive

Description slang/trade	Description common	Test x-ray	carbon	other	Description legal
oil base polishes	commonly used process of polishing with oil- or wax-based polishes; minimal color gain on medium grade or better	clean	0.15-0.22%	visuals comparable to paraffined, but less obvious	natural?? judicial determination needed
enhanced matrix	black dye applied in exterior textures to cover chalky matrix and create "Sea Foam" effect	clean	Dyed black matrix typically makes up 0.05% of the carbon values in any specimen.	visual determination	treated?? judicial determination needed
compressed block	compressed turquoise nuggets, bound by polymerization with or without dye	clean	2.5-20%	visual determination	reconstructed
"recon" reconstruced or "block"	imitations spun off "German block" formulations containg aluminum hydroxide ($Al(OH)_3$) that have degraded to simply dyed plastics	contamination with $Al(OH)_3$ or no crystalline forms perceptible under x-ray; original German formula had no binders	Carbon may run well in excess of 20%. Some samples sustain combustion upon ignition		imitation
imitation	anything that looks like turquoise but is not	non-turquoise x-ray	carbon irrelevant		imitation
treated	A catch-all phrase that no longer indicates any particular process, an irrelevant term except for legal description.				

FACETABLE STONES OF NEW MEXICO

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(First printed in THE NEW MEXICO FACETER - newsletter of the NEW MEXICO FACETERS GUILD.)

Glenn and Martha Vargas, in "Faceting for Amateurs," listed more than 100 natural gem materials suitable for faceting by amateurs. Their book was printed in 1969 and does not include a few minerals now considered facetable or then unknown. We will add a few to their list. An asterisk (*) preceding a listing indicates no mention in Vargas. Quite a large number of these minerals are found in New Mexico. Stuart A. Northrop's "Minerals of New Mexico" lists most of those and supplies general to specific locations. I refer you to this fine book for a back-cover jacketed map of New Mexico mining districts and to the many text listings of technical papers and reports of mineral discoveries. Many technical papers and letters are available for examination at the U.N.M. library and at libraries on campus at Socorro and Las Cruces. Though now out of print, Northrop's book should occupy a place on your own book shelves.

As you will soon notice, I have added occasional bits of personal information and made some best guesses. I will appreciate comments and knowledgeable updates from readers.

DISCLAIMER - I do not always know about the legal aspects of entry into the various locations to be mentioned. I take no responsibility for you if you trespass, get lost, or injure yourself while trying to follow my directions. I will, however, supply the most accurate information available to me. Be sure to check state highway numbers on the most recent official map; these numbers are changed periodically.

MINERALS

ACTINOLITE - N.M. probability not great. Best chances appear to be: 1) Central and Fierro-Hanover mining districts in Grant County; perhaps the dumps of the old Philadelphia mine. 2) The Willow Creek mining district in San Miguel County.

ADULARIA - see FELDSPAR.

ALBITE - see FELDSPAR.

AMBER - (also see WHEELERITE) - N.M. probability very good. A possibility around any old coal dump. Has been reported from several locations such as: 1) the Gallup-Zuni coal basin near Ft. Wingate in McKinley County and San Mateo in Cibola County, 2) the Rio Puerco coal field in Sandoval and McKinley Counties, 3) the San Juan Basin mines in San Juan County. Many of these finds may be better classified as WHEELERITE.

AMBLYGONITE - N.M. probability low. Best chance seems to be the Pidlite deposits in the Rociada mining district of Mom County.

ANALCIME (a zeolite) - N.M. probability only fair. Easily found but facetable rough not reported. The best chances are: 1) Todilto Park south of Window Rock in McKinley County, 2) the White Rock Canyon of the Rio Grande in Sandoval County.

ANATASE - N.M. probability remote. Best chances are: 1) a strange deposit six miles west of Ladrone Peak in Socorro County, 2) the White Sands Proving Ground, Organ mining district, south of Highway 70, one mile east of San Augustin Pass in Dofia Ana County.

ANDALUSITE - N.M. probability "maybe." Best chances are: 1) the Capitan quadrangle of Lincoln County, 2) the Ojo Caliente No. 1 and Petaca mining districts of Rio Arriba County, 3) the Glenwoody, Harding Mine, Honda Canyon, and Picuris mining districts of Taos County.

ANGLESITE - N.M. probability fairly good. Best chances are the Bear Canyon and Organ mining districts of Dam Ana County.

ANHYDRITE - N.M. probability very good. Best chances are: 1) approximately one mile west of Canoncito in Cibola County - many pea-size crystals in gypsum, 2) around drilled water wells in Eddy, Chavez, and Lea Counties, 3) around any gypsum deposit.

APATITE - N.M. probability fair. Best chances are: 1) the Organ mining district of Doña Ana County—some large yellow crystals noted in the literature, 2) the Harding mine in Taos County—gray to greenish-blue crystals, generally only translucent.

APOPHYLLITE - N.M. probability very low. Best chance: small veinlets in the South Canyon mining district in Doña Ana County.

AQUAMARINE - (see BERYL)

ARAGONITE - N.M. probability low. Found all over New Mexico, but none reported of faceting size and clarity.

AUGELITE - N.M. probability low. Northrop doesn't list AUGELITE.

AXINITE - N.M. probability low. The best chance seems to be the Iron Mountain No. 2 mining district at Brown City Camp one to two miles east of NM-52, 10 miles north of Chloride.

AZURITE - N.M. probability low. The best chance seems to be the Magdalena area in Socorro County. Very nice specimen crystals have been found there, but most seem to be internally altered to mushy malachite. Other areas have produced masses of very tiny crystals unsuited to faceting.

BARITE - N.M. probability good. Barite has been found and even mined in many places in New Mexico. The sites listed by Northrop, however, are for large plates, clusters, sheaves, and nodules. No data indicate these occurrences included transparent material. Best chances for faceting rough appear to be at the various fluorite locations, the sedimentary rocks south of Cabezon to 1-40 and west to Gallup and including an arc south to west of San Ysidro.

BENITOITE - N.M. probability near zero. One small California occurrence produces the only known BENITOITE.

BERYL - N.M. probability excellent. Many New Mexico locations, mostly opaque to translucent ore grades. The best chances for faceting rough are: 1) the Ojo Caliente No. 1 and Petaca mining districts in Rio Arriba County. Rough runs from nearly colorless through shades of green, blue, yellow, and pink. A few small faceting bits have been cut. 2) The El Porvenir and Tecolote mining districts adjoining Young's Canyon, Burro Creek, and Gallinas Creek in San Miguel County—material is as described for Rio Arriba County. 3) The Harding mine in Taos County—generally colorless, greenish, or pale pink. A number of small stones have been cut. 4) *A reddish BERYL called BIXBITE (not to be confused with BIXBYITE found in the same area), A RELATIVELY NEW REPORT! Rumors have circulated for several years about BIXBITE in the Taylor Creek mining district of Sierra and Catron Counties (the Gila Wilderness east of Beaverhead). Recent information specifies two locations in Sierra County, one a small prospect near the old BIXBYTTE/TOPAZ diggings (center of S1/2 sec. 22, TlOS R11W). The second location, less specific, is against Round Mountain just north of Diamond Creek and a few miles southeast of the first site. Stones found are small and are much lighter colored than the classic Utah BIXBITE.

BERYLLONTTE - N.M. probability low. Has been reported from Rabb Canyon, Grant County, but this report is believed to be erroneous.

BORACITE - N.M. probability very low. No known reports for New Mexico.

BRAZILIANITE - N.M. probability very low. No known reports for New Mexico.

BYTOWNITE - (see FELDSPAR).

CALCITE - N.M. probability certain. CALCITE has been reported from every county in New Mexico, but is not usually of facetable quality. Best chances are: 1) in concretions along the Rio Puerco and its tributaries in Bernalillo, Sandoval, and Valencia Counties, 2) the Organ mining district of Dona Ana County, 3) clear scalenohedron and prism crystals of transparent, colorless CALCITE in a small prospect 3/4 mile west of the intersection of 1-25 and US-380 (just west of San Antonio in Socorro County). A great many crystals adhere to slabs of rock in the shallow prospect. The prospect is on the north side of the gulch just west of a low bluff.4) Harding mine and a large pit 1/2 mile northwest of the Harding mine in Taos County, 5) Cooke's Peak, Little Florida, and Tres Hermanas mining districts in Luna County.

CANCRINITE - N.M. probability very low. Best chance, the Chico phonolites of eastern Colfax County.

CASSITERITE - N.M. probability unlikely as faceting material. Opaque varieties of CAS-SITERITE have been reported from numerous prospects in the Taylor Creek mining district of Catron and Sierra Counties. No transparent material has been reported.

CELESITtE - N.M. probability good. Best chances are: 1) in concretions along the Rio Puerco and its tributaries in Bernalillo and Sandoval Counties, 2) an area west to south of San Ysidro in Sandoval County, 3) an area from northeast to northwest of Laguna in Cibola County.

CERUSSITE - N.M. probability good. Best chances are: 1) the Organ mining district of Dona Ana County, 2) the many mining districts surrounding Silver City in Grant County, 3) the Cerrillos and New Placers mining districts of Santa Fe County, 4) numerous mining districts along the lower east slopes of the Black Range from Chloride to Lake Valley in Sierra County, 5) several mining districts near Socorro, Magdalena, and Bingham in Socorro County, 6) any lead mine in the state.

*CHABAZITE - (a ZEOLITE) - N.M. probability fair. Best chances are: 1) Dry Leggett Canyon west of Reserve and just west of the intersection of US-180 and NM-12 in Catron County (small crystals in andesite), 2) Church Creek, Jemez Springs mining district, Sandoval County (3-mm cubic crystals in lava boulders behind the old Spanish mission).

*CHALCOPYRITE - (also see PYRITE) - N.M. probability certain. Found at most copper mines and prospects. Not normally considered a faceting mineral but produces bright, interesting faceted tablets.

CHONDRODITE - N.M. probability very unlikely. Northrop does not mention it.

CHRYSOBERYL - N.M. probability remote for faceting size and grade. Best chance is in Taos County. Northrop reports very tiny yellow crystals in a pegmatite on a ridge west of the head of the south fork of Rito de los Cedros about 5.2 miles south of the village of Costilla.

CINNABAR - N.M. probability near zero. CINNABAR has been many times reported in New Mexico but never verified.

CLINOZOISITE - N.M. probability low. Found as tiny, usually pale-green crystals in several New Mexico mines and prospects. The best chance appears to be on a ridge south of Discovery Gulch in the Iron Mountain No. 2 mining district of Sierra County.

COLMANITE - N.M. probability near zero. Northrop does not list COLMANITE although the potash mining areas of southeastern New Mexico are a remote possibility.

CORDIERITE - (see IOLITE).

CORUNDUM - N.M. probability for faceting size and quality is poor. There were numerous unverified early reports of CORUNDUM. Most of these were probably mistaken identification of PERIDOT or GARNET. Best chances are: 1) the Modoc mining district of Doña Ana County, 2) light-blue CORUNDUM in Lincoln County (check letter Ming-Shan to Northrop, 2/12/57), 3) there are persistent reports of small SAPPHIRES in various gravels of Santa Fe County.

CROCOITE - N.M. probability near zero. Northrop does not list CROCOITE. Chromium minerals are nearly nonexistent in New Mexico.

CUPRITE - N.M. probability for facetable rough is only fair. CUPRITE is a constituent of many New Mexico copper ores but is usually noted as a dusting of exceedingly tiny crystals. The best chances appear to be: 1) the Fierro-Hanover and Santa Rita mining districts of Grant County, 2) two dangerous prospects high on the west side of a small creek south of Placitas and northwest of the Sandia Man cave, Placitas mining district in Sandoval County.

DANBURITE - N.M. probability near zero. Northrop lists no DANBURITE occurrence in New Mexico.

DATOLITE - N.M. probability poor. In 1875, Loew reported DATOLITE from the headwaters of the Gila River. There are no other reports. The composition of DATOLITE, DANBURITE, and TOPAZ are sufficiently similar to make one wonder why TOPAZ is present but DANBURITE and DATOLITE are not.

DEMANTOID - (see GARNET).

DIAMOND - N.M. probability poor. DIAMONDS have been found in New Mexico but in no particular concentration at a given locality. The only exception "may" be a wide region west and south of Shiprock. Kimberlite and kimberlite-like pipes, which often produce DIAMONDS, are known to exist from the Four Corners area south to Window Rock.

DIOPSIDE - N.M. probability only fair for faceting rough. DIOPSIDE is common at several New Mexico mines, but faceting grades have not been reported. Best chances are: 1) the Organ and South Canyon mining districts of Doña Ana County (very occasional green or yellow crystals), 2) Green Knobs in western McKinley County (small, intensely green bits, may be colored by chromium).

DIOPTASE - N.M. probability very poor. Northrop cites minor finds at Santa Rita, Grant County and at Orogrande, Otero County.

DOLOMITE - N.M. probability very good. Faceting grade DOLOMITE of fine quality was once advertised from somewhere near Santa Rosa. Al Huebler of the New Mexico Faceters Guild recently cut a very fine stone from this material. Hint: research old Lapidary Journal ads and make local inquiries. Best chances are: 1) the Santa Rita area, 2) near Lake Arthur in Chaves County, 3) just south of Dunlap in De Baca County.

*DUMORTIERITE - N.M. probability poor for faceting grades. This material is translucent at best. Best chances are: 1) Tres Hermanas mining district of Luna County, 2) the Petaca mining district of Rio Arriba County, on the west slope of La Madera Mountain about 1/2 mile southeast of La Madera village.

ELBAITE - (see TOURMALINE).

EMERALD - (see BERYL). This BERYL variety has never been reported in New Mexico.

ENSTATite - N.M. probability poor for faceting grades. Best chance is probably in bits associated with DIOPSIDE at Green Knobs, McKinley County. Tiny, but spectacular, catseye cabochons are possible from this material.

EPIDOTE - N.M. probability fair. EPIDOTE is a very common New Mexico mineral but is usually found as a massive, granular, opaque rock. Faceting material is transparent, leek- or pistachio-green, crystalline rough. Best chances are: 1) in the Juan Tabo Park area of Bernalillo County against the first sharp rise of the Sandia Mountains about 1/2 mile south of the start of the La Luz Trail, 2) the Capitan mining district of Lincoln County.

EUCLASE - N.M. probability poor. Reported in the Cochiti mining district of Sandoval County (very doubtful) and in the vicinity of Taos - no specifics.

FAYALITE - (an OLIVINE) - N.M. probability "maybe." FAYALITE was reported (A. D. Zapp, 1941) in the Cornudas Mountains of Otero County. There is a bare possibility that some of the PERIDOT of the Green Knobs and Red Lake area of McKinley County is actually FAYALITE.

FELDSPAR - Numerous species as follows:

ANOTHOCLASE - (similar to orthoclase) - N.M. probability poor. Faceting grade is unknown.

MICROCLINE - N.M. probability poor. Not usually transparent. Best chancees are: 1) Petaca mining district in Rio Arriba County, 2) Harding mine in Taos County.

ORTHOCLASE - (includes ADULARIA, CRYPTOPERTHITE, MICROPERTHITE, PERTHITE, SANIDINE, SODA-SANIDINE, and MOONSTONE) - N.M. probability certain for SANIDINE, SODA-SANIDINE, MOONSTONE and ADULARIA. Best chances are: 1) SANIDINE, SODA-SANIDINE and possibly ADULARIA occur in the Rabb Canyon MOONSTONE pegmatites. The SANIDINE and SODA-SANIDINE are water-clear (though often marred by partial cleavages and fractures) and show a vivid blue or silvery adularescence - probably the best in the world. The material thought to be ADULARIA is about 1/4 mile south of the main SANIDINE site. It is "sleepy" translucent and exhibits no adularescence. Rabb Canyon is in Grant County, roughly 10 Miles northeast of Mimbres. 2). Small SANIDINES are found in the Jemez, Cochiti, and Bandelier areas of Sandoval County. Most are tiny, but a few to 1/4 inch have come from the Bandelier area. 3) The Albuquerque Volcanoes area and the Cerro Colorado south of 1-40 in Bernalillo County produce a few pieces of doubtful value.

ALBITE, OLIGOCLASE, ANORTHITE and ANDESINE appear to have no facetable value in New Mexico although microprobe tests of Catron County LABRADORITE indicate a very thin outer layer of ANDESINE.

LABRADORITE - N.M. probability certain. Best chances are: 1) a light straw to good yellow transparent rough is found in the basalts of the Pueblo Park area of Catron County about 25 miles southwest of Reserve, the location extending into Arizona, 2) Loew (1875) reported clear LABRADORITE in the glassy andesites of San Antonio Mountain in Rio Arriba County. (This is probably the 11,651-ft mountain now called Chicoma Mountain. It is about 17 airline miles west of Espanola.) These are described as relatively large and vividly colored. The location, if it existed, is no longer known. 3) Loew also described LABRADORITE like 2) above, in a basalt plug 5 miles southwest of Cabezon Peak in Sandoval County. 4) V. C. Kelley, geologist at U.N.M., displayed a transparent, light-amber cleavage block with brightest blue labradorescence from the Jemez area, Sandoval County. [Dr. Kelley died in 1988.—Editor]

BYTOWNITE - N.M. probability unlikely. When I found the FELDSPAR in the Pueblo Park area (1969), I had index of refraction tests run by two practicing gemologists. Their readings of 1.570 convinced me the FELDSPAR was BYTOWNITE. I called it that, and the name was accepted in the faceting world. Recent, far more extensive, and more accurate testing by Paul Hlava, Sandia Laboratories, proves that this material is LABRADORITE. BYTOWNITE is once again an unknown faceting material.

FIBROLITE - (see SILLIMANITE).

FLUORITE - N.M. probability certain. FLUORITE has been found and mined in dozens of places in New Mexico. Best chances are: 1) in and around the Doc Long Recreation Area on NM-536 northwest of Cedar Crest in Bernalillo County, pale-green cleavages to 3/4 inch, 2) in almost all the many mining districts around Las Cruces and Organ in Doña Ana County. Most of this rough is colorless to pale green. An easy location is some prospects 1/2 mile east of Organ and a lesser distance north of US-70. 3) In almost all mining districts in the Silver City and Burro Mountains region of Grant County, 4) in the Cooke's Peak mining district of Luna County, a spectacular lime green and other colors in large pieces, 5) in numerous mining districts in the southern part of Sierra County. Of particular interest is that in the Grandview Canyon district east of the villages of Arrey and Derry. 6) In most of the mining districts of Socorro County, particularly the Hansonburg district southeast of Bingham where large cleavages of blue, green and purple rough are found. These are very fragile and difficult to facet. 7) The Zuni Mountains mining district of Valencia County, particularly the Mirabal mine near Diener and Bluewater, 8) At least 12 mines in the Gila Fluorite district a few miles more or less east of Gila in Grant County, very nice material in a number of colors.

FRIEDELITE - N.M. probability near zero. FRIEDELITE is not mentioned by Northrop.

*GADOLINITE - N.M. probability poor to fair. This is a very rare mineral usually only translucent to opaque. Best chances appear to be: 1) in the Petaca mining district of Rio Arriba County, 2) in the Elk Mountain district of San Miguel County, the pegmatites east of Cow Creek.

GAHNITE - (see SPINEL).

GARNET - A number of varieties as follows:

ALMANDITE - N.M. probability poor. Deep red to purplish red. Best chance is in the Capitan quadrangle of Lincoln County.

ANDRADHE - N.M. probability good. Yellow or black, DEMANTOID, green. Best chances are: 1) in the Modoc, Organ, and South Canyon mining districts of Dofia Ana County, 2) in the Apache No. 2 and Sylvanite mining districts of Hidalgo County - DEMANTOID (Rosenzweig, 1957), 3) in the New Placers mining district of Santa Fe County, particularly in and near the San Pedro mine, 4) in the Glenwoody mining district of Taos County.

GROSSULARITE - N.M. probability good. Amber or pink, HESSONITE, orange. Best chances are: 1) in the Modoc, Organ, and South Canyon mining districts of Doi% Ana County, 2) in the Fierro-Hanover mining district of Grant County - large, beeswax-yellow crystals.

PYROPE - N.M. probability very good. Deep red. Best chances are: 1) in the Green Knobs/Red Lake area north of Window Rock in McKinley County. Many of these GARNETS are paler than normal PYROPES - some to light lavender - and may be RHODOLITE. 2) Red, raisin-size, appearing to be PYROPE, are found in a pink granite just north of I-25 and 2 or 3 miles southwest of Las Vegas in San Miguel County. Turn off 1-25 onto NM-283 and go 1/2 mile or so.

RHODOL1TE - N.M. probability good. Locations as for PYROPE. SPESSARTITE - N.M. probability good although faceting grade may be difficult to find. Orange, red, brown or yellow. Best chances are: 1) in the Rociada mining district of Mom County, 2) in the Elk Mountain, El Povenir and Willow Creek mining districts of San Miguel County. Samples cited by Northrop may contain titanium or yttrium.

UVAROVITE - N.M. probability fair to poor. This GARNET is emerald-green. Best chance is in the South Canyon mining district of Darla Ana County.

TSAVOR1TE - N.M. probability near zero. Unknown outside Tanzania, Africa.

*GLAUBER1TE - N.M. probability fair. GLAUBERITE is very soft and water soluble. Best chance is in the Carlsbad potash mining district of Eddy County.

*GYPSUM - (see SELENITE).

*HAUTE - (common table salt) - N.M. probability very good. Best chance is in the Carlsbad potash mining district of Eddy County. An intense blue variety is very occasionally seen.

HAMBERGITE - N.M. probability very low. Northrop does not list HAMBERG1TE.

*HEDENBERGITE - N.M. probability good. HEDENBERGITE is a PYROXENE, end member of the DIOPSIDE series and translucent at best. Best chances are: 1) at the Quickstrike and Ben Nevis mines in the Organ mining district of Doila Ana County, 2) in the Fierro-Hanover mining district of Grant County, 3) in the Iron Mountain No. 2 and Magdalena mining districts of Sierra and Socorro Counties.

*HELVITE - N.M. probability only fair for facetable crystals but the only known possible source. Best chances are: 1) the Iron Mountain No. 2 mining district of Sierra County - the best possibility, 2) the Morlock and Eloi claims in the Victorio mining district of Luna County.

HEMATITE - N.M. probability not very good. Northrop lists a large number of HEMATHE occurrences, but there is no indication of crystalline material suitable for faceting. The best chances might be: 1) in the Petaca mining district of Rio Arriba County - "numerous veins occur on the west slope of La Madera Mountain; most of these are near the base of the mountain, about a 1/2 mile southeast of Madera," 2) in the Cerrillos, New Placers, and Old Placers mining districts of Santa Fe County.

HEXAGON1TE - (see TREMOL1TE).

HODGKINSONITE - N.M. probability very low. Northrop does not mention it. It is a zinc mangano-silicate. Zinc, manganese, and silicates are prominent in New Mexico minerals and mining, so HODGKINSONITE is an unmentioned possibility.

*HORNBLENDE - N.M. probability fair. There are numerous possibilities. Best chances seem to be: 1) in the Black Hawk, Burro Mountains, Chloride Flat, Eureka, Fierro-Hanover, Pinos Altos, Santa Rita, Silver City, and Steeple Rock mining districts of Grant County - relatively large crystals but generally deep colored. The Pinos Altos district lists some colorless to pale-green crystals in granodiorite. 2) In the Green Knobs area northeast of Red Lake in McKinley County - "cores of large, colorless PYROXENE crystals in HORNBLENDES nearly one inch in diameter (Balk and Sun, 1954, p. 116)."

*HYPERSTHENE - N.M. probability questionable. HYPERSTHENE is the iron-rich end member of the ENSTATHE series. In 1969, I found crystals and broken pieces of a very deep red-brown mineral associated with yellow OLIGOCLASE FELDSPAR in the Pueblo Park area of Catron County. I guessed this to be the iron-rich end member, HYPERSTHENE. Recent determinations by Paul Hlava, of Sandia Laboratories, identifies this mineral as BRONZITE, the somewhat less iron-rich intermediate member of the ENSTATUE series. Northrop does not list this occurrence. The BRONZITE can be cut into cabochons with a weak catseye or faceted into tablets.

IDOCRASE - N.M. probability not very good. Best chance appears to be in the Fierro-Hanover and Pinos Altos mining districts of Grant County.

INDERITE (KURNAKOVITE) - N.M. probability near zero. INDERITE is a magnesium borate not mentioned by Northrop.

IOLITE (CORDTERITE) - N.M. probability not very good as faceting rough. Best chances are: 1) in a gully southeast of the Merrimac mine, Organ and South Canyon mining districts of Doña Ana County, 2) not far from the Harding mine in Taos County (Montgomery, 1953). Coloradoans, ask me about four prospects in western Colorado!

JADEITE - N.M. probability very low. Northrop questions a report of JADEITE in the Jicarilla mining district of Lincoln County (F. A. Jones, 1904).

KORNERUP1NE - N.M. probability near zero. Northrop lists no reported finds of KORNERUPINE in New Mexico.

KYANITE - N.M. probability good. Best chances are: 1) in the Bromide No. 2, Ojo Caliente No. 1, and Petaca mining districts of Rio Arriba County - very large crystals were mined in quantity - no statements of clarity or color. 2) Glenwoody, Hondo Canyon, Picuris, and Red River mining districts - broad, bladed fans of large crystals.

LABRADORITE - (see FELDSPAR).

LAZULITE - N.M. probability not good for faceting rough. Best chance is the South Canyon mining district of Doña Ana County, in Rucca Canyon north of the east end of Soledad Canyon (Dunham, 1935 - 36).

LEGRANDITE - N.M. probability poor. Northrop does not mention this mineral, which has been mined in Mexico.

*LEPIDOLITE (a MICA) - N.M. probability good. Best chance is in the dumps of the Harding mine in Taos County. Vaguely crystalline-appearing lumps to 1/2 inch are occasionally found. They are sub-transparent, deep raspberry colored, waxy. These may be pseudomorphs. It should be noted that much of the pink MICA of the Harding mine is not LEPIDOLITE but ROSE MUSCOVITE.

LEUCHE - N.M. probability only fair. The best chance seems to be near Todilto Park in McKinley County.

*LINARITE - N.M. probability only fair for faceting rough but the best chance known. Crystals have been faceted. A very rare mineral found in some quantity in the mines southeast of Bingham in the Hansonburg mining district of Socorro County. Most specimens are only a bright blue "sugaring" of tiny crystals, but very occasionally a crystal has been found large enough to yield a small faceted stone.

LUDLAMITE - N.M. probability near zero. Northrop mentions no LUDLAMITE in New Mexico.

MAGNESITE - N.M. probability poor. Best chances are: 1) several locations in the White Sands Missile Range east of Las Cruces in Dofia Ana County, 2) on a steep hillside west of Ash Creek, two miles above its junction with the Gila River and about 30 miles north of Lordsburg in Grant County. All reported material appears amorphous and unsuited for faceting.

MARCASITE - (see PYRITE).

MICROLITE - (often radioactive) - N.M. probability fair. Best chances are: 1) in the Pidlite deposit of the Rociada mining district in Mom County. Reportedly to 3/8 inch in honey-yellow to yellow-brown octohedrons. 2) Honey-yellow crystals from the Harding mine in Taos County. Crystals may be large enough to facet but opaque or very fractured. The Harding mine is, supposedly, the largest MICROLITE orebody in the world.

MOLDAVITE, TEKHIE, etc. - A stray obsidian-like rock of extraterrestrial or meteor-impact origin - might be found in New Mexico but not likely. Only a real expert can make a determination between a TEKTliE and the ubiquitous Apache tear-type obsidians. (Technically speaking, all MOLDAVITES are from Moldavia.)

*MONTICELLITE - N.M. probability poor. The only possibility seems to be in the Tres Hermanas mining district of Luna County where it is associated with SPURRITE in limestone (field notes of Robert Balk, N.M. Bureau of Mines and Mineral Resources, via A. Rosenzweig, May 1957). Small crystals and grains reported are probably too small to permit faceting.

NATROLHE - N.M. probability low for faceting rough. Best chances are: 1) in several places in the Jemez Mountains region of Sandoval County, particularly the Valle Grande area, 2) in vesicles (gas-bubble holes) in the basalts of Canjilon Hill, three miles north of Bernalillo in Sandoval County.

OBSIDIAN - (Technically a rock, not a mineral) - N.M. probability certain. OBSIDIANS are found in many parts of New Mexico, particularly west of the Rio Grande. In most occurrences, the OBSIDIAN is sub-transparent at best, but there are also a few sources of nearly transparent rough. Best chances are: 1) in the Jemez Mountains of Sandoval County at the Tent Rocks about four miles northwest of Cochiti Pueblo on National Forest Road 266. The tears are quite transparent but small, to 1/4 inch. 2) In the Jemez Mountains on the same road noted in 1), about 12 miles northwest of Cochiti Pueblo and about 3/4 mile north of the old Bear Canyon ranch site. More or less transparent tears to 1 1/2 inches can be found in the roadbed and in shallow diggings (for PERLitE) on the east side of the gulch. About 10% of these tears contain flow-oriented, glittering, blue, inclusions of unknown composition. Properly oriented and cut, these obsidians make spectacular gems. NOTE! We are investigating these inclusions. Under the microscope, they appear to be perfect hexagonal plates with strange, internal star-like markings. We are trying for microprobe examination to determine the nature of these inclusions.

OL1GOCLASE - (see FELDSPAR).

OLIVINE - (see PERIDOT).

OPAL - N.M. probability fair if you care to investigate old records. Best chances are: 1) in Doña Ana County southwest of Hatch - hint: see articles by Mildred Sanders in early issues of the Lapidary Journal. 2) High on the north fork of Percha Creek north of Kingston in Sierra County - reported as orange to red transparent opal, see M. Sanders, 3) in the Jemez Mountains of Sandoval County, off National Forest Road 266 about 5 miles northwest of Cochiti Pueblo and 1/2 mile north of Tent Rocks. White-base and transparent opal was reported mined here around 1900. The actual site was on the west side of Colle Canyon 1/4 mile north of its junction with Peralta Canyon. 4) In the Central and Burro Mountains mining districts of Grant County, particularly near Fort Bayard - "precious opal of good quality."

ORTHOCLASE - (see FELDSPAR) - the group of FELDSPARS containing potassium but little or no sodium or calcium.

*PERICLASE - N.M. probability fair. The only chance seems to be in the South Canyon mining district of Doña Ana County. Dunham (1936) reported PERICLASE as "fairly abundant in the large BRUCITE marble masses south of the ridge."

PERIDOT - N.M. probability quite good. Best chances are: 1) in Kilbourne Hole and other similar features near Afton in Dofia Ana County and near the Mexican border - small but good greens, 2) in McKinley County in the Red Lake, Green Knobs, Todilto Park and Zilditloi Mountain areas - some good rough, 3) rumor has it that good finds are presently being made at a volcanic neck south of Engle in Sierra County, 4) an occasional find is possible in a number of other counties where large phenocrysts have been noted in volcanic rocks.

PETALITE - N.M. probability poor. PETALITE has been reported but not verified in the Glenwoody, Harding Mine, Hondo Canyon and Picuris mining districts of Taos County.

PHENAC1TE or PHENAKITE - N.M. probability very low. PHENAKITE has been reported but not verified from the Petaca mining district of Rio Arriba County.

PHOSGEN1TE - N.M. probability very low. A few fine crystals to 1 1/2 or two inches long were found long ago at the old Stevenson-Bennett mine about a mile south of Organ in Doiia Ana County. The mine itself has recently been open-pitted and operated as a building-stone quarry.

PHOSPHOPHYLLITE - N.M. probability near zero. Northrop does not mention this mineral.

PLAGIOCLASE - (see FELDSPAR). - All sodium/calcium FELDSPARS. POLLUCITE -

N.M. probability near zero. Northrop does not mention this mineral.

PREHNITE - N.M. probability fair. Best chance is two locations in the Nogal mining district of Lincoln County; 1) about 6 1/2 miles southeast of Carrizozo as pale bluish-green botryoidal masses in cavities and 2) a locality 1 3/4 miles northwest of Nogal.

PROUS1TE - N.M. probability poor. Best chances appear to be: 1) in the Black Hawk, Georgetown, and Pinos Altos mining districts of Grant county, 2) in the Kingston and Lake Valley mining districts of Sierra County. PROUSITE was mined in these areas long ago but almost all of this valuable silver ore went to the refineries.

*PSILOMELANE - N.M. probability certain. The ore, PSILOMELANE, is almost always a combination of several oxides of manganese. A number of years ago, a highly silicious PSILOMELANE was imported from Mexico and cut into interesting, banded cabochons. The New Mexico PSILOMELANE has little silica and less banding. It can be faceted into bright, metallic tablets. The best location is the Luis Lopez mining district about 12 miles southwest of Socorro.

PYRITE and MARCASITE - N.M. probability certain. PYRITE or MARCASITE is found in almost every mining district in New Mexico. The two are chemically identical minerals with a differing crystal habit.- MARCASITE tends to form in coal veins and other high-carbon rocks; PYRITE usually accompanies metallic ores. Either mineral may be faceted into glittering tablets. Beware of "PYRITE" of nearly silver color. It may be ARSENOPYRITE, which may be poisonous to work with or wear. One easy-to- reach source of PYRITE is some prospects north of US-70 and about 1/2 mile east of Organ in Doña Ana County.

PYROXMANGITE - N.M. probability poor. Northrop does not mention this mineral.

QUARTZ - N.M. probability certain. Northrop names 70 varieties of QUARTZ found in New Mexico. Most of these varieties are cryptocrystalline, i.e., made up of interlocking, fibrous crystals - agates and jaspers are examples. Many cryptocrystalline QUARTZ stones can be faceted as interesting tablets, but in the interest of brevity, I shall mention only the more outstanding sources of transparent crystalline QUARTZ. Some good possibilities are: 1) in the Mogollon, Taylor Creek and Wilcox mining districts of Catron County (see Ferguson, 1927; Alfredo, 1951; Rocks and Minerals, 1952, v. 27, p. 35). Also in Catron County, "an area five miles wide by 30 miles long near Grass Lake in the southern San Augustin Plains, crystals, casts and banded agate," (news item, 1947). 2) "Pecos Diamonds" in GYPSUM beds for 100 miles along the Pecos River in Chaves, De Baca, and Eddy Counties - sharp, doubly terminated but seldom clear crystals. A particularly good locale is about five miles east of Ramon in De Baca County. 3) In Baldy, Cimarroncito, and Elizabethtown mining districts and widely scattered through the Cimarron Range in Colfax County. 4) Widespread in virtually all the mining districts of Doña Ana and Grant Counties. Particularly fine faceting rough (colorless, smoky, amethystine, and smoky-amethystine) is found at the SANIDINE MOONSTONE claims in Rabb Canyon, Grant County). 5) In virtually all the mining districts of Rio Arriba, San Miguel, Santa Fe, Sierra, and Taos Counties. AMETHYST has been noted in a number of counties as follows: 1) in the Mogollon mining district of Catron County, 2) at the Ben

Nevis mine in the Organ mining district of Doha Ana County, 3) in the Chloride (abundant), Kingston, and Tierra Blanca mining districts of Sierra County, also recently reported from somewhere near Wall Lake in western Sierra County, 4) in the Council Rock, Ladron, San Jose, and San Lorenzo mining districts of Socorro County, also an interesting AMETHYST occurrence in a decayed FELDSPAR (clay) dike on the lower, southwest slopes of Ladron Peak, also in Socorro County. This one was once well known to university students at Socorro but has, apparently, passed from common knowledge. Crystals were clear, stubby, to 1 1/2 inches across. Only the tops were amethystine, never deep purple. Smoky QUARTZ of fine quality and considerable quantity has been taken, in the past few years, from a long, slender occurrence on the north slope of Sierra Blanca Peak southeast of Carrizozo and north of Ruidoso in Lincoln County. A heavy incrustation must be removed from these specimens. Many are of museum quality. The entire length of this site is, apparently, a National Wilderness or Primitive Area. Federal authorities have confiscated several "for sale" collections and threatened severe fines, claiming the crystals are a "national treasure." A considerable controversy still simmers over collecting in this area. As I understand, surface collecting for one's private collection is okay, but digging or collecting for sale is bad.

REALGAR - N.M. probability near zero. Northrop does not list REALGAR as a New Mexico mineral.

RHODIZUE - N.M. probability near zero. Northrop does not mention RHODIZ1TE in New Mexico.

RHODOCHROSITE - N.M. probability poor for faceting rough. Best chance appears to be at the Comstock and Lady Franklin mines in the Kingston mining district of Sierra County.

RHODONITE - N.M. probability poor for faceting rough. Best chance is the same locations noted for RHODOCHROSITE.

RUTILE - N.M. probability near zero. Rutile appears as microscopic or very tiny crystal threads in a number of New Mexico mines and prospects, but there is no mention of anything of facetable size.

SCAPOL1TE - N.M. probability low. Best chance seems to be near Sylvanite in the Sylvanite mining district of Hidalgo County. There is a large deposit of SCAPOL1TE just across the border from Sylvanite into Texas. The location is in Fusselman Canyon, the Franklin Mountains, south of Las Cruces and north of El Paso.

SCHEEL1TE - N.M. probability possible but not very likely in faceting size and quality. Best chances are: 1) in the Organ mining district of Dona Ana County at the Memphis, Memphis King, and Merrimac mines. (I have seen rich, ore-grade SCHEELITE claimed to come from just inside the White Sands Proving Grounds.) 2) In the Bound Ranch, Carpenter, and Eureka mining districts of Grant County, 3) in the Apache No. 2, Fremont, and Sylvanite mining districts of Hidalgo County. The Granite Pass prospect south of Sylvanite looks like a best bet. 4) In a deposit near Dolores in the Ortiz Mountains, which is in the Old Placers mining district of Santa Fe County, 5) in the Grandview mining district of Sierra County - "museum specimens." SCHEEL1TE has also been reported from the Iron Mountain No. 2 mining district of Sierra County.

*SELENITE - N.M. probability certain. This mineral is evident in almost every county in New Mexico. It is the crystalline form of GYPSUM and might be found at any GYPSUM location. It is extremely soft, easily cleavable, and partially water soluble. It offers a real challenge to the competitive faceter.

SERPENTINE - N.M. probability not very good for faceting rough. Best chance seems to be in the "Ricolite deposit" which is up Ricolite Gulch about six miles northeast of Red Rock post office and west of the Gila River in western Grant County. The two main deposits produce great quantities of banded decorative material. A third deposit 1/2 mile west produces a sulfur-yellow SERPENTINE with needles of ASBESTOS. It may provide the best chance of faceting rough.

*SERPIERTTE - N.M. probability not good but the best U.S. chance extant if the minerals found prove to be SERPIERTTE. The possible location is near Bingham in the Hansonburg mining district of Socorro County. Northrop (1959) indicates that a sky-blue mineral found with LINAR1TE had not been positively identified as SERPIERITE. I have no later information.

SIDERITE - N.M. probability poor. SIDERTTE has been verified at a fairly large number of New Mexico locations, but there is no indication of anything approaching transparency. As good a possibility as any might be in nodules found along Galisteo Creek near Galisteo village in Santa Fe County.

SILLIMANITE - N.M. probability only fair. Best chance seems to be in the Manzano Mountains of Torrance County where it may be found in laths 1/4 inch wide by 2 inches long. The SILLIMANITE is in a schist, and the area may be large, because Northrop specifies no particular site.

SINHAL1TE - N.M. probability low. Northrop makes no mention of SINHALITE, but recognition of this mineral as a species separate from PERIDOT may have occurred after publication of "Minerals of New Mexico." There is, therefore, a possibility that some of the brownish Red Lake and Green Knobs "PER1DOT" is, actually, SINHALITE.

SMITHSONITE - probability the best in the U.S. The translucent to nearly transparent variety called HERRERITE was found in at least two mining districts in New Mexico. Best chances are: 1) in the Stevenson-Bennett mine about a mile south of Organ and a small series of prospects about 1/2 mile east of Organ in Doi% Ana County, 2) just south of the village of Magdalena in the old Kelly and Graphic mines, the Magdalena mining district of Socorro County. Vast tonnages of gem- and specimen-quality HERRERTTE were shipped and milled as zinc ore. Neither mine can be entered at present, but occasional small finds are made on the dumps. Either mine may be open sporadically, but entry is extremely dangerous. Mining was done in fractured limestone, and the mines have been flooded for a long time.

SODALITY - N.M. probability near zero. Microscopic grains have been identified in rocks, but there is no promising New Mexico location.

SPHALERITE - N.M. probability certain. Northrop lists a large number of SPHALERTTE locations in New Mexico. Unfortunately, most of our SPHALERITE is very dark to nearly opaque, and even the best pieces will yield only small stones. Best chances appear to be: 1) in the Modoc, Organ, and Rincon mining districts of Doña Ana County, 2) all of the many mining districts in the area around Silver City, Grant County, 3) all of the many mining districts around Hatchita and Lordsburg in Hidalgo County, 4) in the Cerrillos mining district of Santa Fe County, 5) all of the many mining districts of Sierra County. Of the above possibilities, I would select the old mines and prospects of the Cerrillos mining district a few miles nearly due north of the town of Cerrillos and just south of the ancient Indian turquoise pit. A second choice would be the old mines in the Hermosa mining district of Sierra County. Both locations seem to yield honey-colored SPHALERITE.

SPHENE - N.M. probability poor. There are several SPHENE locations in New Mexico, but most specimens are microscopic to 3.0 mm maximum size. The best chances are: 1) in the Picuris mining district at a locality described as being several miles east of the Harding mine in Taos County, 2) in the Rabb Canyon moonstone prospects of Grant County (see SANIDINE MOONSTONE FELDSPARS). Tiny yellow bits of SPHENE are abundant in the sands, and an occasional wedge-shaped crystal to 3/4 inch long is found near the prospects. These large crystals are invariably nearly opaque.

SPINEL - N.M. probability fair. Northrop lists no crystals large enough to facet, but I have seen shiny black opaque crystals (PLEONASTE variety) to 1/2 inch. These are said to come from a location several miles east to southeast of Truth or Consequences in Sierra County.

SPODUMENE - N.M. probability very poor. SPODUMENE in huge, opaque, lath-like crystals has been mined as lithium ore at the Harding mine in Taos County and elsewhere. There is no indication of translucent or transparent faceting material, however.

STIBIOTANTALITE - N.M. probability near zero. Northrop does not mention this mineral.

*STILBITE - (a ZEOLITE) - N.M. probability good. This mineral is probably much more widespread than New Mexico records indicate. Several ZEOLITES form in the cavities of volcanic rocks, particularly rhyolite and basalt. One possibility is in the volcanic rocks surrounding the Rabb Canyon moonstone prospects in Grant County.

SULFUR - N.M. probability fair. Best chances are in several locations in the vicinity of Jemez Springs, Battleship Rock, and La Cueva Junction in Sandoval County. Two possibilities are the seepage springs just downstream from Battleship Rock (about 11 miles north of Jemez Springs) and a SULFUR springs location a mile or two northeast of La Cueva Junction.

*THOMSONITE - (a ZEOLITE) N.M. probability fair. This rare gem mineral is normally considered a cabochon material. It does, however, occasionally occur as a transparent mineral. There are these possible locations: 1) in the Nogal mining district of Lincoln County southeast of Carrizozo and "is common around Cub Mountain and Church Mountain where it occurs as spherulitic aggregates and radiating sheaves up to 3 inches in diameter, also with PREHN1TE 1 3/4 miles northwest of Nogal." 2) in an andesite flow on the west side of the Valle del Ojo de la Parida, about ten miles north-northeast of Socorro in Socorro County, also in bentonitic tuff along the north side of Blue Canyon west of Socorro.

TOPAZ - Probability good. Three locations in Taylor Creek mining district of Sierra County have produced clear, colorless topaz large enough for small gems. Several other locations have produced very tiny crystals or large, barely translucent masses. The Taylor Creek possibilities are: 1) two very close together prospects at the S1/2 sec. 22 TlOS R11W. These are only a few hundred yards off paved NM-52, leading to Beaverhead in the Gila Wilderness. 2) A third location is about seven or eight airline miles southeast of the other two locations at the west base of Round or Maverick Mountain some 1,300 yards north of Main Diamond Creek. I have two clean crystals from this location. The best one is about 5/8 inches long by 1/4 inches wide by 3/16 inches thick.

TOURMALINE - N.M. probability for opaque black (SCHORLITE) good, poor for green or pink transparent material. The best location for SCHORLITE appears to be 11/2 miles east of Picuris in Taos County where large, black crystals to 6 inches long have been reported. Northrop lists several other SCHORLITE locations, but most of these seem to be in the form of masses of slender needles. A possibility for transparent, colored TOURMALINE is the Pidlite deposit in the Rociada mining district of Mora County. A few pink to pale-green crystals 1/4 to 2 inches long were reported (Jahns, 1953b). I have a way-out long shot for pink TOURMALINE. About 30 years ago, my two sons and I were following the gas pipeline road which then skirted Mesa Prieta about 15 miles southwest of San Ysidro. At the point closest to the abrupt rise of Mesa Prieta and about 15 miles southeast of Cabezon Peak, we stopped to check surface debris. Despite geological survey claims that the region is volcanic with an overlay of sedimentary material in some places, we found a considerable amount of pink granite tending toward pegmatite. And one son picked up two small crystals of pink TOURMALINE that appeared identical to Pala, California material. The area is now private property "KEEP OUT" status, and the pipeline and road no longer skirts Mesa Prieta. The location is in Sandoval County. I theorize that the Nacimiento Mountains granites lie only a short distance below the surface at this point.

TREMOLITE - N.M. probability poor. Northrop lists several TREMOLITE locations but all appear to be relatively loose masses of needle-like or hair-like crystals. The best chance may be in the Capitan mining district of Lincoln County at the west end of West Capitan Mountain where it is noted as appearing in some quantity in limestone.

*TURQUO1SE - N.M. probability very good. TURQUOISE is not, normally, considered a faceting material. It can, however, be faceted into interesting tablet forms as is done with several other opaque minerals. There are many New Mexico locations. Best chances are: 1) in the Burro Mountains, Eureka, Santa Rita, and White Signal mining districts of Grant County, 2) in the Orogrande mining district of Otero County, 3) in the Cerrillos mining district of Santa Fe County, 4) any copper mining area may, on occasion, produce turquoise.

VIVIANITE - N.M. probability very poor. VIV1ANITE in the form of ONDONTTOLITE (fossil materials impregnated with VIVIANITE) have been noted in the Nacimiento Mountains mining district of Sandoval County, but there is no reason to believe that facetable material is to be found.

*WHEELERITE - (also see AMBER) N.M. probability fair. This mineral is a fossil resin closely related to AMBER and may be found in the same locations.

WILLEMITE - N.M. probability almost zero. Northrop notes significant amounts of

WILLEMITE, a rare zinc ore, at a number of New Mexico locations. The largest crystals seen, however, did not exceed 2.0 millimeters. These came from the Hillsboro mining district in Sierra County (Dough, 1941, P. 96).

WITHERTTE - N.M. probability almost zero. Northrop lists three reports of WITHERTTE in New Mexico, but these were of insignificant amounts.

WULFENITE - N.M. probability fair. Best chances are: 1) in the Bear Canyon and Organ mining districts of Doria Ana County. The old Stevenson-Bennett mine just south of Organ was a good source but is now being worked as a source of building stone. 2) In the Caballo Mountains, Hermosa, Hillsboro, Iron Mountain No. 2, Lake Valley, and Macho mining districts of Sierra County. Tabular museum specimens to 1.0 inch wide were once plentiful at the Miner's Dream claim 2 1/2 miles northeast of Hillsboro (Jones, E.L., Jr., 1919).

ZEOLITES - These consist of ANALCIME, CHABAZITE, HEULANDI1E, NATROLITE, STILBITE, and THOMSONITE. Where appropriate, these minerals have been listed separately on preceding pages. In New Mexico, the ZEOLITE mineral group is probably more plentiful than reports would indicate.

ZINCITE - N.M. probability near zero. Northrop lists no significant New Mexico sources of ZINCITE.

ZIRCON - N.M. Probability near zero. Northrop lists a number of New Mexico locations that yield evidence of ZIRCON, but the mineral bits have always been microscopic.

*ZOISITE - N.M. probability very low for faceting material. Northrop lists two possible sources of the pink to rose-red variety, THULITE. These are: 1) in prospects in the cliffs just south to southeast of Pilar in Taos County, 2) in a bed about 12 inches thick about 1/2 mile north and a mile northeast of the Harding mine in Taos County. Massive pink THUL1TE in pale-green EPIDOTE was specified (Montgomery, 1953).