STATE OF ARKANSAS

BULLETIN 23

MINERAL SPECIES OF ARKANSAS

A DIGEST

By

J. Michael Howard

1987
Revised 2007
Little Rock

ARKANSAS GEOLOGICAL COMMISSION
Norman F. Williams
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Dedication

By

E. J. Dwornik

In June of 1984, I had the pleasure of accompanying Dr. Charles Milton and 12 other geologists and mineralogists on an intensive three-day trip to the Little Rock, Hot Springs, and Magnet Cove areas of Arkansas. The trip was conducted by Mike Howard of the Arkansas Geological Commission. While at Magnet Cove, Charlie took me to a spot by the old school house and mentioned that he had stood there the first time in the summer of 1923 while a graduate student at the University of Illinois. During the intervening 63 years and some 150 plus publications later, it would seem that in returning to Magnet Cove, Charles had come full circle. Not necessarily so. The results of his work on samples collected during this field trip were presented by Dr. Milton at a symposium on alkalic rocks held in Fayetteville, Arkansas, in April of 1985.

Charles was born in New York City on April 25, 1896. He obtained his B. A. from the University of Illinois in 1923. After periods of employment with Gulf Oil and continuing graduate studies, a Ph. D. in geology from The John Hopkins University was conferred to C. Milton in 1929. He went to work for the Sinclair Oil Co. in Angola after graduation. In 1931 he began his career with the U. S. Geological Survey, first as a chemist and later as research mineralogist-petrologist until he reached mandatory retirement age in 1965. Retirement? There is no such word in his vocabulary. The geology department of George Washington University, Washington, D.C., judiciously retained him as adjunct and research professor through 1970 and he served as consultant to the Department of Interior, and as visiting research geologist with the University of California at Berkeley. Since 1975, he has served as an annuitant with the USGS while maintaining his association at George Washington University as Quondam Research Professor. His publication record attests to his versatility and proficiency in petrologic and mineralogic research. In this era of specialization it is difficult to find such a diversity of subjects of geologic interest from so many world-wide sources. They include the innovative petrographic approach to the study of slag fragments from ancient copper smelting sites near Timna, Israel; similarly, with the enthusiastic collaboration of archeologist associates, in the study of “scoriae” from Tal-E Malyan, Iran; and the unraveling of the complex mineralogy of chromium oxide and hydrated oxides and related species in merumite from Guyana. Perhaps the study for which he has been most cited is his mineralogy of the Green River Formation of Utah, Wyoming, and Colorado and the description of this occurrence of unusual authigenic species in a sedimentary environment. His contribution to the mineralogy of Arkansas began with his description of the zirconium garnet, kimzeyite, published in 1958 in collaboration with L. V. Blade.

His interest professionally in the State of Arkansas has proved doubly rewarding to Charlie because of his close personal relationship with the late Hugh D. Miser of the US Geological Survey and with Norman F. Williams, State Geologist. Hugh Miser had offered Charles a job with the USGS shortly after he had received his Ph. D. from John Hopkins in 1929, but unfortunately a previous commitment to the Sinclair Oil Company for work in Angola delayed his appointment until 1931. His admiration and respect for Hugh D. Miser is mirrored in Charlie’s countenance at the mere mention of his name, also giving rise to a few humorous Pea Ridge stories.

Dr. Charles Milton, mineralogist
(1896-1990)

It gave me great pleasure at the onset of our June field trip to watch N. F. Williams and Charlie come to agreement in a relatively short time on planned studies and funding for work in Arkansas in the coming year, a far cry from the bureaucratic process of today's management types. This was scientific administration at its best!

Most recently, and again in a study international in scope, Dr. Milton presented the results of his investigation of the 80-year history of moissanite (silicon carbide) and, hopefully, finally put to rest the idea that the reported occurrences in rocks were natural. The talk was extremely well received and acknowledged by many as a very important contribution to the 1984 International Geological Congress held in Moscow.

Charles' respect, consideration, and admiration for associates and friends is best exemplified by proclivity for naming new mineral species in their honor. I, for one, feel a deep sense of gratitude shared by Robert Garrels, Frank Grimaldi, Vincent McKelvey, John Straczek, Philip Abelson, R. B. McConnell, Henry deLinde, Lourens Wals, and Smith Bracewell, among others, for being so honored.

I cannot conclude my commentary on this remarkable personality without commenting on his enthusiastic participation in the annual Coon Creek excursions to mineral collecting localities in Arkansas. They provide an opportunity for Charlie to renew old acquaintances and to make new friends who share a mutual interest in the mineralogy of Arkansas.

Following this dedication is a list of Charlie's publications relating to the mineralogy of Arkansas. His many friends join me and the staff of the Arkansas Geological Commission in dedicating this issue to him.

E. J. Dwornik

Author's note: Charles Milton passed away in his home at Silver Spring, Maryland after a lingering illness on October 4, 1990. He is sorely missed by all his Arkansas friends. JMH

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Acknowledgments

It is with deep appreciation that I wish to recognize those individuals and companies who have been of greatest assistance to me in this project:

Dr. Charles Milton, Washington, DC, a tireless worker in the field of mineralogy. Initiator of this project and, I am proud to say, he was one of my best friends. He often told me that he collects people, not minerals.

Norman F. Williams, Little Rock, the former Arkansas State Geologist, without whose permission the project would never have started.

William V. Bush and Mac B. Woodward, both of Little Rock, two past Arkansas State Geologists, who allowed this revision of Bulletin 23 to proceed and Bekki White, present State Geologist, who encouraged me to complete the present revision.

Dr. Henry L. Barwood began work on the syenite minerals of central Arkansas while at Arkansas Tech University. Due to his efforts, these rocks have become some of the most interesting in the state from a collector's viewpoint.

Dr. Rene de Hon, Northeast Louisiana University, for his identification of several species new to Arkansas.

Dr. Albert L. Kidwell, Houston, Texas, retired research geologist/mineralogist, who worked on a number of company projects in Arkansas. Thanks for being able to look at your collection and photographs.

Henry S. de Linde, Hot Springs, Arkansas, a long time friend who never gets enough of looking at Arkansas' "mineral cafeteria." Through several "laymen's reviews" of this book, Mr. de Linde had a number of suggestions which were incorporated making it more usable to everyone.

Don R. Owens, Hot Springs, Arkansas, my professional friend with whom I have had the pleasure of working on some joint projects. Several discussions of the problems associated with the mineralogy of the vanadium deposits of Arkansas helped the project immensely. Use of his collection for photography is greatly appreciated.

Meredith P. York, Stephens, Arkansas, my collecting buddy for several years. He continues to discover more interesting species.

Arthur E. Smith, Jr., Houston, Texas, a long time collector of Arkansas minerals, more particularly those of Magnet Cove. Thanks for the use of many photographs and furnishing new data for this revision as it came along.

Ed J. Dwornik, Washington, DC, a friend and former co-worker of Charles Milton. Thank you so much for the dedication.

Ron and Cam Gates, St. Augustine, Florida, my mineral collecting friends who moved too far away. They rekindled my interest in mineralogy and my collecting hobby. Thanks for your continuing moral support on this book.

Several of my co-workers deserve credit for their assistance: John David McFarland for the black and white photography assistance and discussions, Benjamin F. Clardy for many discussions about the mineral deposits of Arkansas, William L. Prior for the use of specimens for photography and willingness to share new discoveries, Mrs. Loretta Chase and (my secretary for several years) who tirelessly brought the hand-written text to typed word, Mrs. Molly Anderson who went through countless computer revisions that brought the 1st edition of Bulletin 23 to printed format.

John Wiley and Sons, Inc., publishers, gave permission to use certain figures and line drawings from the following Dana mineralogies:

- *A System of Mineralogy*, 6th edition, 1892 (revised 1920), by E. S. Dana (DSM)
- *Dana's System of Mineralogy* (in 3 volumes), 1944, 7th edition, by Charles Palache, Harry Bergman, and Clifford Frondell (SM).
- *Dana's Textbook of Mineralogy*, 1932, 4th edition, by W. E. Ford (TM)

Line drawings used in this volume that were taken from the above mineralogical texts are identified by the initial sets following the titles above, by the appropriate page number, and by a drawing number, if one was used (example: TM - 642.966)

Line drawings were also used from J. Francis Williams' *The Igneous Rocks of Arkansas* (reference 94) for a number of the minerals from Magnet Cove which I was unable to photograph and from E. T. McKnight's *Zinc and Lead Deposits of Northern Arkansas* (reference 47).

Special appreciation to Susan Young and the Cartographic Section of the Arkansas Geological Commission for their efforts with the original and this revision of Bulletin 23.

A host of other people must also be thanked: Donald R. Heins (Arkansas) for the use of many excellent photographs, Clyde L. Hardin (Arkansas) for many interesting trades through the years, Perry M. McKimmey (Arkansas) who shared samples of millerite for photography, David New (Washington) who kindly proved a specimen of Arkansas meteorite, Dr. Carleton B. Moore (Arizona) who sent me information on Arkansas meteorites, George Megerle (New Jersey) who provided several photographs, William (Skip) Simmons and Al Fauster (Louisiana) who identified several new minerals listed in this revision. My sincere apologies to anyone I may have forgotten to thank. All revisions and changes in this Bulletin are the responsibility of the author.

JMH

Author's Note to the 1st Revision:

The 20 years since the publication of Bulletin 23 in 1987 were exciting times for the discovery of minerals in Arkansas, so much so that an Addenda that has been given out with every copy of the 1987 publication is now a burden to both the AGS and the user. It truly shows how dated printed material becomes with time. This revision incorporates two new species for science from Arkansas and many species known now to be present in the state. Additional literature research resulted in the inclusion of a few minerals that had been reported earlier, but that were not seen during the author's original literature research. References have been added in numerical order of use in the revision as was done in the original publication. Additional terms have been added to the Glossary to aid the reader. The book has been reformatted to a standard paper size for ease of reprinting and color plates added. I have no doubt that within a few years an additional addenda will be necessary for this revision as the discovery process for minerals continues.

The reader will note the use of Arkansas Geological Commission in the publication header, but the use of Arkansas Geological Survey in the text. The agency underwent a name change in July of 2007 and thus the use of the new name within the text.

JMH

PHOTOGRAPHY CREDITS

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CONTENTS

INTRODUCTION

Arkansas is notable for the number and variety of minerals within its borders. As of 2006, 342 individual mineral species have been reported, 72 additional entries relative to the 1st edition of this publication 20 years ago. Of these, 15 are of questionable identification. Arkansans should be proud to know that 13 species new to science have been described from our state: schorlomite (1846), rectorite (1891), laubmannite (1949, discredited 1990, P. Dunn), miserite (1950), kimzeyite (1961), benstonite (1962), kidwellite (1979), eggletonite (1984), strazcekite (1985), delindeite (1987), lourenswalsite (1987), mahlmoodite (1993), haggertyite (1998), and artsmithite (2003).

Arkansas' mineral wealth is directly related to its varied geology. The physiographic provinces of the Ozark Plateaus, the Arkansas Valley, the Ouachita Mountains, the West Gulf Coastal Plain, and the Mississippi River Alluvial Plain (fig. 1) reflect the underlying geology. The types and distribution of minerals in a given province are a function of the varying lithology and the region's geologic history. Arkansas' geologic history has resulted in greater than 99 percent of the surface exposures being of sedimentary origin. Igneous and metamorphic rocks together comprise less than 1 percent of the total surface area of the state.

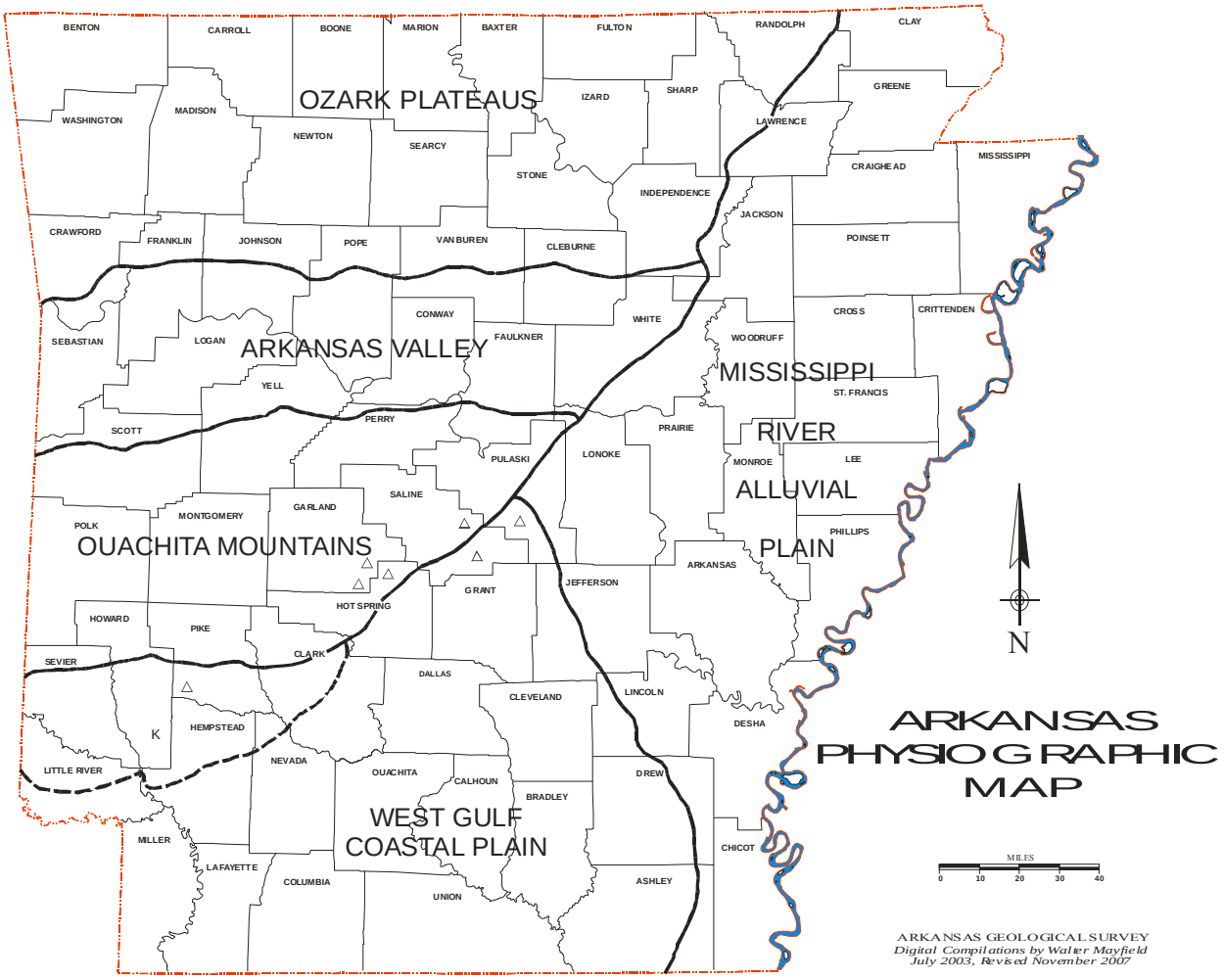


Figure 1 – Physiographic provinces of Arkansas. Outcrop of Cretaceous (K) rocks is outlined. Major outcrops of igneous rocks are designated by triangles (△).

The Ozark Plateau province is underlain predominantly by limestone, shale, dolostone, and sandstone of Paleozoic age. Minerals may be collected from deposits of zinc, lead, iron, manganese, dolomite, and copper in north Arkansas.

The Arkansas Valley province is underlain by folded shales and sandstones of Paleozoic age. Though rich in coal, natural gas, and aggregate materials, this area has few collecting sites for minerals.

The structurally complex sedimentary rocks of the Ouachita Mountain province are predominantly shales, sandstones, and cherts of Paleozoic age. These rocks host many different mineral deposits, including barite, quartz, antimony, mercury, zinc, copper, lead, iron, manganese, and iron and aluminum phosphates.

In the relatively flat lying Cretaceous sedimentary rocks of southwest Arkansas (Figure 1), deposits of gypsum, chalk, marl, barite, celestite, greensand, ilmenite, and sand and gravel are present. Although containing important mineral resources, the flat-lying, poorly consolidated sediments of the West Gulf Coastal Plain and the Mississippi River Alluvial Plain rarely provide mineral collecting localities. Intrusive igneous rocks are exposed in all provinces except the Mississippi River Alluvial Plain. Stocks, pipes, dikes, or sills have scattered exposures principally in central and west-central Arkansas. Based on worldwide abundance, the igneous rocks of Arkansas are populated by unusual types such as syenite, ijolite, jacupirangite, carbonatite, lamprophyre, kimberlite-lamproite, metagabbro, peridotite, and serpentinized peridotite. Many of the igneous rocks and their associated contact alteration zones have been outstanding collecting areas. Some minerals known from the igneous rocks are diamonds, titanium-bearing species (brookite, perovskite, titanite), rare earth-bearing species (eudialyte, fergusonite), zeolites and their associates, serpentine, and some presently undescribed species. The alteration/metasomatic zones adjacent to the igneous intrusions contain vanadium, titanium, niobium, uranium, and lithium mineralization as well as some metamorphic/metasomatic minerals.

EXPLANATION OF THE MINERAL LIST

The alphabetical tabulation of mineral species known from Arkansas has been compiled from an examination of published literature, unpublished data, and personal communications with geologists, mineralogists, collectors, and knowledgeable individuals. Most species have been identified by x-ray and/or chemical analysis. Those few which have not are considered as questionable. A number of commonly used and recognizable terms (e.g., *wad*) are given, but not recognized as species. Group names (e.g., *mica*, *amphibole*, *pyroxene*, *feldspar*, *zeolite*) are listed with reference to the specific species existing in Arkansas. However, the group names *olivine* and *tourmaline* are used as species headings because species within these groups have not been described in the literature on Arkansas minerals.

At best, the availability of minerals for specimens is difficult to estimate. Nevertheless, some indication of the relative abundance of the various minerals as specimens is provided and may prove useful to the collector. The terms *very rare*, *rare*, *scarce*, *common*, and *abundant* give an indication of the long-term availability of given minerals to the collector.

Few or no specimens may be discovered until construction or mining exposes mineralized areas. During active mining, specimens may be scarce or plentiful, depending principally on discovery and accessibility. After activity ceases, sporadic specimen production

from particular locations is the general rule. However, certain minerals in Arkansas, such as quartz and wavellite, are so widespread that they have been, and apparently will be, available for years to come. Diamonds, although narrowly restricted in their area of occurrence, also should be available for collectors far into the future. Other species are not only scarce, but require magnification to recognize. Those species that are very difficult to identify consist of minute single crystals, clusters, grains, films, or masses of intergrown minerals. They must be examined by x-ray, microprobe, or thin-section techniques for correct identification to be made. The manganese minerals (see *bementite*, *hausmannite*, *braunite*), the complex sulfides and sulfosalts (see *bournonite*, *fülöppite*, *freibergite*), hydroscopic secondary minerals (see *chalcanthite*, *melanterite*), and certain minerals present in miarolitic cavities in igneous rocks are examples.

In the text, a symbol (⊕) is used for those species which may be readily collected and identified in the field. A small box (□) preceding the species name is provided should the users wish to catalogue their collection of Arkansas specimens. A question mark (?) immediately after the species name indicates doubt or uncertainty as to the presence of the reported species. This situation may exist because x-ray data or chemical analyses are lacking, or because the reported mineral appears to be alien to the known geologic environment of the region (see *diaspore*).

The chemical formulae and crystal systems presented in the tabulation are from the Glossary of Mineral Species, by Michael Fleischer (1995, 7th edition), with updates from *The First List of Additions and Corrections to the Glossary of Mineral Species (1995)* (Fleischer and Mandarino, Mineralogical Record, 1997, v.28, p.425-438). Other physical data are from the Encyclopedia of Minerals by Roberts, Campbell, and Rapp (1990, 2nd edition). An abbreviated glossary of terms used in mineralogy and geology appears at the end of the text. After the glossary is a listing of the important mineral-forming elements and their chemical symbols.

Information is given under each photograph in the following order: mineral name, county location, scale, and, in parentheses, the initials of the collector, owner of the collection, and the photographer. When the collector, owner, and photographer are one and the same, only one set of initials is given. Refer to credits for individuals' names. Scanning electron micrographs are identified by the letters SEM.

Most collecting localities in Arkansas are on private lands or claims on public lands. The collector should ***always*** obtain permission from the owner or claimholder before entering any property. On certain public lands, collecting is forbidden. These include National Parks, the Buffalo National River, Wilderness Areas of the Ozark and Ouachita National Forests, and the preserves of the Arkansas Game and Fish Commission, and parks of the Arkansas Department of Parks and Tourism (with the exception of the Crater of Diamonds State Park).

Various publications are available describing mineral collecting, preparation and care of specimens, organization and cataloging of collections, and use of physical properties for identification. Because such information is outside the scope of this publication, the reader is referred to the following texts for this and other information pertaining to minerals:

- *Rocks and Minerals*, Golden Nature Guide, by H. S. Zim and P. R. Shaffer (1957), Golden Press, New York.
- *A Field Guide to Rocks and Minerals*, by F. H. Pough (1955), Riverside Press, Cambridge.
- *The Mineral Kingdom*, by Paul Desautels (1968), Ridge Press, New York.

- *Mineralogy: A First Course*, by John Sinkankas (1966), D. Van Nostrand Co., New Jersey.
- *Gemstone and Mineral Data Book*, by John Sinkankas (1981), Van Nostrand Reinhold, New York.
- *Mineralogy – Concepts, Descriptions, Determinations*, by L. G. Berry and Brian Mason (1959), W. H. Freeman and Co., San Francisco.
- *Dana's System of Mineralogy, - 16th edition*, (there are many editions) revised by C. S. Hurburt, Jr. (1957), John Wiley and Sons, Inc., New York.
- *An Introduction to the Rock-Forming Minerals*, by W. A. Deer, R. A. Howie, and J. Zussman (1969), John Wiley and Sons, Inc., New York.
- *Encyclopedia of Minerals*, by W. L. Roberts, T. J. Campbell, and G. R. Rapp, Jr.(1990), Van Nostrand Reinhold, New York.

NEW MINERAL SPECIES

New species for Arkansas and the world continue to be discovered. Newly discovered minerals from Arkansas will be added whenever this compilation is revised. The discovery of new species is dependent on a number of factors: the quantity of material available, the presence and size of individual crystals, the refinement of instrumentation available to the investigator, the collector's experience of what could be a new or unusual mineral, and whether or not the collector has contact with an experienced mineralogist having the equipment to confirm an identification. Certainly, new species and new localities will come to light. The author would like to suggest areas which, based on his experience, are most likely to be rewarding. These include bodies of igneous rock and their contact-alteration zones, sulfide-bearing quartz veins, and the iron and aluminum phosphates of the Ouachita Mountains; and hydroscopic efflorescences in mines, caves, and quarries of north Arkansas.

The discovery of a new mineral could be the result of a collector bringing a specimen to the Arkansas Geological Survey for identification or for the purpose of reporting a new find.

ALPHABETICAL LISTING OF SPECIES

ACMITE (See *Aegirine*)

□ **ACTINOLITE**

$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$. Monoclinic. Hardness: 5-6. Cleavage: 2 directions, [110] good, [100] parting. Fracture: fibrous or subconchoidal, brittle. Sp. Gr. 3.0-3.44. Color: light to dark green. Luster: vitreous, translucent. Streak: light green. Habit: bladed crystals and fibrous aggregates, splintery; embedded grains.

An amphibole formed in contact or regionally metamorphosed dolomites, Mg-rich limestones or low-grade ultrabasic rocks. Reported by Comstock (1888) in his mineral list as being in Hot Spring County, possibly misidentified felted green aggregates of acmite. Identified as present in a metagabbro from Pulaski County.

Ref.: 8, 107.

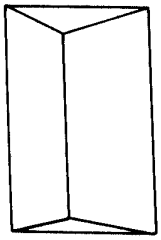
□ **ADULARIA*** ⊕

$KAlSi_3O_8$. Triclinic, monoclinic. Hardness: 6.0-6.5. Cleavage: 2 directions, [001] [010] perfect. Sp. Gr. 2.55-2.63. Color: white to gray. Luster: subvitreous to vitreous, transparent to translucent. Streak: white. Habit: short prismatic blocky crystals, often twinned.

A hydrothermal feldspar, crystals of which commonly occur as individuals or clusters in quartz veins in shales and arkosic sandstones in the Ouachita Mountains where they are associated with calcite and pyrite. Also forms as an authigenic mineral in limestones. Known from Garland, Hot Spring, Marion, Montgomery, and Saline Counties.

Ref.: 10, 46.

*A hydrothermal variety of orthoclase,
listed separately due to its distinctive hydrothermal origin.



Adularia (DSM – 316.7)

Figure 2 – Adularia, Hot Spring County,
1.5 x 3.1 mm. (JMH)

□ **AEGIRINE** (acmite) ⊕

$NaFe^{3+}Si_2O_6$. Monoclinic. Hardness: 6. Cleavage: 2 directions, [110] good, [100] parting. Fracture: uneven, brittle. Sp. Gr. 3.55-3.60. Color: light to dark green, black. Luster: vitreous, translucent to transparent on thin edges. Streak: pale yellowish gray. Habit: large striated prismatic crystals; radiating clusters of microscopic acicular needle-like crystals.

A common primary pyroxene of syenite, nepheline syenite, syenite pegmatite and lamprophyres where it may be associated with orthoclase, albite, analcime, pectolite, natrolite, calcite, nepheline, melanite and/or zircon. Known from Garland, Hot Spring, Pulaski, and Saline Counties.

Ref.: 8, 11, 33, 75, 94, 125, 127.

Figure 3 – Aegirine, Hot Spring County, 1.0 x 2.5 mm. (AES)

□ **AEGIRINE-AUGITE**

$(Na,Ca)(Fe^{3+},Fe^{2+},Mg,Al)(Si,Al)_2O_6$. Monoclinic. Hardness: 6. Cleavage: 2 directions, [110]; [010] [001] partings. Sp. Gr. 3.55. Color: green. Luster: vitreous, translucent on thin edges. Streak: white. Habit: euhedral stubby crystals, commonly zoned. Most commonly identified in thin sections.

A common primary pyroxene of syenites, feldspathoidal syenites, and phonolites where it may be associated with orthoclase, nepheline, albite and melanite. Known from Garland, Hot Spring, Pulaski, and Saline Counties.

Ref.: 1, 11, 48, 94.

□ **AENIGMATITE (?)**

$Na_2Fe^{2+}{}_5TiSi_6O_{20}$. Triclinic. Hardness: 5.5. Cleavage: 2 directions, [010] [100] perfect. Sp. Gr. 3.74-3.85. Color: black. Luster: subvitreous, nearly opaque. Streak: reddish brown. Habit: long minute prismatic crystals.

If present, a very rare silicate in pegmatitic veins and dikes in syenite. Associated minerals are unknown. Reported from Pulaski County.

Ref.: 105.

AENIGMATITE GROUP

Triclinic silicates with general formula $A_2B_6X_6O_{20}$ where A = Ca, Na; B = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Mg, Sb^{5+}, Ti; X = Al, B, Be, Si. See *aenigmatite*.

AGATE Cryptocrystalline banded quartz. See *quartz*.

ALABASTER A compact variety of gypsum. See *gypsum*.

□ **ALBITE** ⊕

$NaAlSi_3O_8$. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions, [001] perfect, [010] nearly perfect, [110] imperfect. Sp. Gr. 2.60-2.63. Color: colorless to white. Luster: vitreous, transparent to translucent. Streak: white. Habit: crystals tabular to platy, commonly as clear overgrowths on orthoclase in miarolitic cavities.

A relatively common primary feldspar of syenite and feldspathoidal syenites where it is associated with orthoclase, nepheline, melanite, acmite, and aegirine-augite. Known from Garland, Hot Spring, Pulaski and Saline Counties.

Ref.: 11, 19, 33, 48.

□ **ALLANITE-(Ce)**

$(Ce,Ca,Y)_2(Al,Fe^{2+},Fe^{3+})_3(SiO_4)_3(OH)$. Monoclinic. Hardness: 5.5-6. Cleavage: none. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 3.9-4.0. Color: dark brown. Luster: resinous, submetallic. Streak: no data. Habit: microscopic tabular plates, normally forming parallel crystal clumps.

A rare, late-forming silicate of miarolitic cavities in syenite where it is associated with orthoclase, albite, titanite, biotite, and riebeckite. Known from Hot Spring (La-rich variety) and Pulaski Counties.

Ref.: 29, 48, 127, 166.

Figure 4 – Allanite, Pulaski County, 0.2 x 0.3 mm. (HLB)

ALLEVARDITE Synonym for rectorite. See *rectorite*.

□ **ALLOPHANE**

$Al_2SiO_5 \cdot nH_2O$. Amorphous. Hardness: 2-3. Cleavage: none. Sp. Gr. 1.85-1.89. Color: colorless, white, various pastels. Luster: vitreous to waxy. Habit: massive; powdery aggregates; crusts resembling hyaline opal.

A relatively rare hydrothermal clay mineral (kaolinite group) which occurs in fissures and cavities in rutile-bearing veins and in coal deposits. Associated with quartz, rutile, and orthoclase. Known from Garland and Hot Spring Counties.

Ref.: 8, 19.

□ **ALMANDINE** (Almandite)

$Fe^{2+}{}_3Al_2(SiO_4)_3$. Cubic. Hardness: 7-7.5. Cleavage: none, [110] parting. Sp. Gr. 4.1-4.3. Color: deep red to brownish black. Luster: vitreous to resinous, transparent to translucent. Streak: white. Habit: as dodecahedral or trapezohedral crystals; embedded anhedral grains.

A rare garnet of xenoliths contained in lamproite breccia tuff and lamproite where it is associated with serpentine, phlogopite, olivine, and magnetite. Known from Pike County.

Ref.: 60.

□ **ALUNITE**

$K_2Al_6(SO_4)_4(OH)_{12}$. Trigonal. Hardness: 3.5-4. Cleavage: 1 direction, [0001]. Sp. Gr. 2.6-2.9. Color: white. Luster: earthy. Streak: white. Habit: nodular masses and microscopic crystals.

A hydrothermal sulfate associated with quartz. Reported from Newton County. Originally thought to be a new mineral species which was named newtonite, but later shown to be alunite.

Ref.: 16.

ALUNITE GROUP

Trigonal sulfates of general formula $AB_6(SO_4)_4(OH)_{12}$ where A = Ag^{1+}_2, Ca, $(H_3O)_2$, K_2, Na_2, $(NH_4)_2$, Tl_{1+}, Pb; B = Al, Cu, Fe^{3+}. See *alunite*, *jarosite, plumbojarosite*.

AMETHYST See *quartz* (crystalline).

AMPHIBOLE GROUP

An extremely complex group of silicates, orthorhombic or monoclinic, with the general formula $A_{0-1}B_2Y_5Z_8O_{22}(OH,F,Cl)_2$ where A = Ca, Na; B = Ca, Fe^{2+}, Li, Mg, Mn^{2+}, Na; Y = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Mg, Mn^{2+}, Ti; Z = Al, Be, Si, Ti. See *actinolite*, *arfvedsonite*, *barkevikite*, *edenite*, *ferrohornblende*, *hornblende*, *kaersutite*, *richterite*, *riebeckite*, *tremolite*.

□ **ANALCIME** (Analcite)

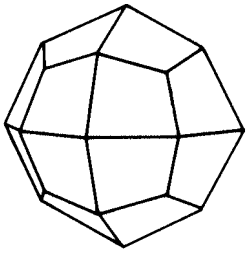
$NaAlSi_2O_6 \cdot H_2O$. Cubic. Hardness: 5-5.5. Cleavage: [001] traces. Sp. Gr. 2.22-2.29. Color: colorless, white to gray, sometimes with orange tinted core. Luster: vitreous to dull, transparent to translucent. Streak: white. Habit: trapezohedrons; intergranular grains.

A late-stage primary silicate in miarolitic cavities in syenite; intergranular grains in syenite and lamprophyres formed by the alteration of nepheline and/or sodalite. A minor but widespread secondary mineral in the Stanley Shale and Jackfork Sandstone in the Ouachita Mountains, formed by the action of connate water. Associated with orthoclase, albite, titanite, biotite, acmite, and quartz. Known from Garland, Hot Spring, Polk, Pulaski, Saline, Sevier, and Yell Counties.

Ref.: 11, 33, 34, 127.

Figure 5 – Analcime on acmite, Pulaski County, 0.3 mm diameter. (JMH)

Figure 6 – Analcime, Pulaski County, 1.5 mm diameter. (AES)



Analcime (TM – 75.131

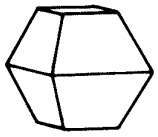
□ **ANATASE** (Octahedrite)

TiO_2. Tetragonal. Hardness: 5.5-6. Cleavage: 3 directions, [001] [011] perfect. Sp. Gr. 3.82-3.97. Color: black to dark blue, tan. Luster: adamantine to dull, transparent to opaque. Streak: colorless to white. Habit: crystals blocky to steep pyramidal, tabular, or prismatic.

A rare primary accessory oxide in miarolitic cavities in syenite; occurs in alteration zones in and adjacent to syenite intrusions. Also in various stages of replacement of perovskite or as pseudomorphs after perovskite in carbonatite. Associated with pyrite, sanidine, quartz, brookite, rutile, aragonite, orthoclase, calcite, carbonate-fluorapatite, and perovskite. Known from Garland, Hot Spring, and Saline Counties.

Ref.: 11, 29, 40, 48, 88, 94, 124, 125, 127, 142.

Figure 7 – Anatase, Hot Spring County, 1.0 x 1.5 mm. (AES)



Anatase (TM – 500,757)

□ **ANDESINE**

$(Na,Ca)Al(Al,Si)Si_2O_7$; An30-50. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions, [001] perfect, [010] near perfect, [110] imperfect. Sp. Gr. 2.66-2.68. Color: colorless, white to gray. Luster: vitreous, transparent to translucent. Streak: white. Habit: euhedral to anhedral grains recognized only in thin sections.

A primary groundmass feldspar of scarce trachyte dike rock; associated with sanidine and biotite. Known from Hot Spring County. Note: The name Andesine was not retained during revision of the Feldspar Group by a committee of the International Mineralogical Association. However, due to its extensive use in previous literature, it is retained herein.

Ref.: 11.

□ **ANDRADITE** ⊕

$Ca3Fe^{3+}{}_2(SiO_4)_3$. Cubic. Hardness: 6.5-7. Cleavage: none, [110] parting. Sp. Gr. 3.7-4.1. Color: black, reddish brown, dark brown, greenish brown, rarely green. Luster: vitreous, transparent to nearly opaque. Streak: white. Habit: euhedra are dodecahedral, trapezohedral, or a combination of the two forms; massive; embedded anhedral grains.

A primary garnet in alkaline igneous rock – the varieties schorlomite and zoned melanite occur in feldspathoidal syenite and ijolite; secondary veins and grains in lime-silicate rock and ijolite; rarely in pegmatitic dike rock. Associated with fluorapatite, nepheline, orthoclase, diopside, vesuvianite, and serpentine. Known from Garland, Hot Spring, Saline, Pike and Pulaski Counties.

Ref.: 8, 11, 30, 59, 105, 124, 125, 127.

Figure 8 – Andradite, Pulaski County, SEM. (HLB)

□ **ANGLESITE**

$PbSO_4$. Orthorhombic. Hardness: 2.5-3. Cleavage: 1 direction, [001] good, [210] present, but usually interrupted. Sp. Gr. 6.38±0.01. Color: white to gray. Luster: vitreous to dull, opaque. Streak: colorless. Habit: fine-grained concentric alteration layers enclosing galena; white chalky aggregates; massive.

A secondary sulfate formed by the oxidation of galena. Occurs with galena in limestones and silicified dolostone in the Ozark region of north Arkansas and in lead-zinc-copper-antimony-silver deposits in the Ouachita Mountains. Associated with galena, sphalerite, quartz, smithsonite, chalcopyrite, calcite, stibnite, siderite, cerussite, malachite, and azurite. Known from Marion, Montgomery, Pulaski, and Sevier Counties.

Ref.: 8, 31, 41, 47.

□ **ANHYDRITE**

$CaSO_4$. Orthorhombic. Hardness: 3.5. Cleavage: 2 directions at 90°, [010] perfect, [100] nearly perfect. Sp. Gr. 2.98. Color: colorless to white, gray, mottled. Luster: vitreous to greasy to pearly. Streak: white to grayish white. Habit: as microscopic crystals in a rare zirconium-bearing garnet – kimzeyite; as massive sedimentary beds in the subsurface in south Arkansas.

A rarely collectible sedimentary sulfate seen in many oil well cuttings from south Arkansas. A primary inclusion in kimzeyite, a rare constituent of carbonatite. Also, associated with acmite and stilbite in miarolitic cavities in syenite. Known from Hot Spring (surface exposure of carbonatite), Ashley, Columbia, Lafayette, Pulaski, and Union Counties.

Ref.: 49, 87, 105, 127.

□ **ANKERITE** ⊕

$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$. Trigonal. Hardness: 3.5. Cleavage: 3 directions, [1011] perfect, rhombohedral. Sp. Gr. 2.97. Color: white, weathering to tan or brown. Luster: vitreous to pearly, translucent. Streak: white to tan. Habit: simple rhombohedrons; discoids; intergrown grains; massive.

A relatively common hydrothermal carbonate of sulfide-bearing quartz veins, quartz-rectorite-cookeite veins, feldspar-rutile-carbonate veins. Rarely in carbonatite as a primary mineral. Associated with quartz, calcite, galena, sphalerite, jamesonite, cookeite, rectorite. Known from Garland, Hot Spring, Logan, Pike, Pulaski, Saline, and Sevier Counties.

Ref.: 8, 18, 19, 31, 58, 65, 72.

□ **ANORTHITE (?)**

$CaAl_2Si_2O_8$. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions, [001] perfect, [010] nearly perfect. Fracture: uneven, brittle. Sp. Gr. 2.74-2.76. Color: colorless to white. Luster: vitreous, transparent to translucent. Streak: white. Habit: intergrown anhedral grains.

A primary feldspar of mafic igneous rock associated with syenite. This species has only been reported by Comstock (1888) and not by later workers. Supposedly associated with acmite, nepheline, and microcline in Garland County.

Ref.: 8.

□ **ANORTHOCLASE**

$(Na,K)AlSi_3O_8$. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions, [001] [010] perfect. Fracture: uneven, brittle. Sp. Gr. 2.56-2.62. Color: colorless to gray. Luster: vitreous, transparent to translucent. Streak: white. Habit: anhedral microscopic grains.

In thin sections as primary corroded feldspar phenocrysts in trachyte dike rock; cores of some orthoclase. Associated with orthoclase, sanidine, andesine, and biotite. Known from Hot Spring and Pulaski Counties.

Ref.: 11, 109.

□ **ANTIGORITE** (Williamsite)

$(Mg, Fe^{2+})_3Si_2O_5(OH)_4$. Monoclinic. Hardness: 2.5-3.5. Cleavage: 3 directions, [001] perfect, [010] [100] distinct. Sp. Gr. 2.61. Color: white, various shades of green. Luster: greasy, resinous, earthy; nearly opaque. Streak: white. Habit: columnar, fibrous, fine-grained, compact.

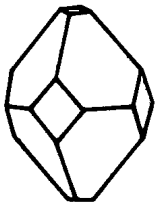
A silicate alteration of ferromagnesian minerals during serpentinization of basic igneous rock; commonly associated with serpentine, ankerite, calcite, dickite, and quartz. Known from Garland and Saline Counties.

Ref.: 11, 91.

APATITE GROUP

Phosphates, arsenates, and vanadates of general formula $A_5(XO_4)_3(F,Cl,OH)$ where A = Ba, Ca, Ce, K, Na, Pb, Sr, Y; X = As^{5+}, P^{5+}, Si^{4+}, V^{5+}; (CO_3) may partially replace (PO_4). See *carbonate-fluorapatite*, *hydroxylapatite*, *pyromorphite*.

APOPHYLLITE See *fluorapophyllite*.



(TM - 642.966)

Apophyllite

(TM - 642.968)

Figure 9 – Apophyllite, Pulaski County, 1.0 x 5.0 x 5.0 mm. (JMH)

□ **ARAGONITE** ⊕

$CaCO_3$. Orthorhombic. Hardness: 3.5-4. Cleavage: 3 directions, [010] distinct, [110] [011] indistinct. Sp. Gr. 2.94. Color: colorless to off-white, green (stained by malachite). Luster: vitreous to dull, transparent to translucent. Streak: white. Habit: acicular crystal sprays, elongated on the c-axis; encrusting coralloidal, fibrous masses.

A widely occurring, little-recognized, secondary carbonate of oxidized ore deposits. Occurs in north Arkansas as radiating acicular sprays and coralloidal crusts on smithsonite where it is also associated with quartz and calcite; also a principle constituent of limestone cave formations. In the Ouachita Mountains, it occurs as secondary acicular sprays with calcite on quartz; preserved shell material in some Cretaceous and Tertiary marine sediments; in amethyst veins as bundles of acicular fibers with anatase and pyrite; as late coralloidal crusts on carbonatite. Often fluorescent and phosphorescent blue white. Known from Garland, Hot Spring, Marion, and Stone Counties.

Ref.: 5, 29, 47, 48, 78, 126.

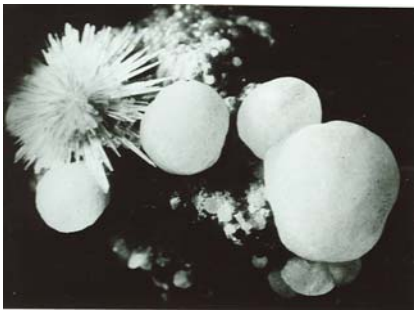


Figure 10 – Aragonite with calcite, Marion County, 3.8 x 3.8 x 3.8 cm. (WFH, DRH, DRH)

ARAGONITE GROUP

Orthorhombic carbonates of general formula ACO_3, where A = Ba, Ca, Pb, Sr. Compare with the calcite group. See *aragonite*, *cerussite*, *strontianite*, *witherite*.

□ **ARFVEDSONITE**

$Na_3(Fe^{2+},Mg)_4Fe^{3+}Si_8O_{22}(OH)_2$. Monoclinic. Hardness: 5-6. Cleavage: 3 directions, [110] perfect, [010] parting. Fracture: uneven, brittle. Sp. Gr. 3.37-3.50. Color: greenish black to black. Luster: vitreous, nearly opaque. Streak: dark bluish gray. Habit: well developed small prismatic crystals, prismatic aggregates.

A secondary amphibole formed by the alteration of pyroxene where it is associated with diopside-hedenbergite and sanidine; a primary mineral constituent of nepheline syenite. Known from Garland, Hot Spring, and Saline Counties.

Ref.: 29, 48, 94, 124, 125, 127.

ARKANSITE A discredited name. See *brookite*.

□ **ARSENOPYRITE**

FeAsS. Monoclinic, pseudo-orthorhombic. Hardness: 5.5-6. Cleavage: 2 directions, [101] well developed. Sp. Gr. 6.07. Color: silver-white to steel-gray. Luster: metallic, opaque. Streak: black. Habit: prismatic crystals, elongated parallel to c-axis.

A hydrothermal mineral which occurs in sulfide deposits. In north Arkansas, it is associated with galena, pyrite, quartz, and calcite. In the Ouachita Mountains, it occurs with ankerite, siderite, jamesonite, and calcite. Known from Independence and Sevier Counties.

Ref.: 31, 53, 72.

ARSENOPYRITE GROUP

Sulfides of general formula ABS where A = Co, Fe, Os, Ru; B = As, Sb. See *arsenopyrite*.

□ **ARTSMITHITE**

$Hg^{1+}4Al(PO_4)_{2-X}(OH)_{1+3X}$, where X +0.26. Monoclinic. Hardness: no data. Cleavage: none observed, irregular fracture. Sp. Gr. 6.4 calculated. Color: white. Luster: vitreous; transparent. Streak: white to cream. Habit: nest of randomly oriented microscopic acicular or feathery needles.

A secondary mineral thought to be formed by the breakdown of cinnabar and apatite. Associated with goethite, quartz, dickite, and cinnabar. Known from Pike County. Type locality.

Ref.: 154.

□ **ASTROPHYLLITE**

$(K,Na)_3(Fe^{2+},Mn)_7Ti_2Si_8O_{24}(O,OH)_7$. Triclinic. Hardness: 3. Cleavage: 1 direction, [010] perfect, [100] poor. Sp. Gr. 3.3-3.4. Color: bronze-yellow to orange. Luster: submetallic, pearly; translucent on thin edge. Streak: white. Habit: microscopic stellate groups, single bronze colored ragged mica-like flakes to . 5 inch diameter.

A late-phase primary silicate of miarolitic cavities in syenite, syenite pegmatites and contact rocks. Associated with orthoclase, albite, fluorite, eudialyte, fluorapatite, and pectolite. Known from Hot Spring, Pulaski, and Saline Counties.

Ref.: 11, 33, 48, 94, 127.

ASTROPHYLLITE GROUP

Triclinic silicates of general formula $A_3B_7C_2Si_8O_{24}(O,OH)_7$ where A = Ca, Cs, (H_3O), K, Na; B = Fe^{2+}, Mg, Mn^{2+}; C = Nb, Ti, Zr. See *astrophyllite*, *eggletonite*, *kupletskite*.

□ **AUGITE** (Titanaugite)

$(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$. Monoclinic. Hardness: 5.5-6. Cleavage: 2 directions, [110] good, [100] [010] partings. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.23-3.52. Color: shades of brown, greenish to black. Luster: vitreous to dull, translucent to nearly opaque. Streak: grayish green. Habit: short stout prismatic crystals, disseminated grains.

A primary pyroxene of ultrabasic igneous rocks, such as lamproite and lamprophyre. Associated with olivine, biotite, analcime, and serpentine. Known from Garland, Hot Spring, Pike and Pulaski Counties.

Ref.: 11, 19, 60, 78, 94.

□ **AURICHALCITE**

$(Zn,Cu^{2+})_5(CO_3)_2(OH)_6$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction, [010] perfect. Sp. Gr. 3.96. Color: pale green to sky blue. Luster: silky to pearly, transparent to translucent. Streak: no data. Habit: microscopic acicular crystals, tufted aggregates, encrustations.

A secondary carbonate occurring in the oxidized zones of zinc deposits where it is associated with sphalerite, smithsonite, dolomite, chalcopyrite, azurite, hemimorphite, malachite, gypsum, and aragonite. Known from Boone, Marion, Newton, and Searcy Counties.

Ref.: 29, 47, 126.

□ **AZURITE**

$Cu^{2+}{}_3(CO_3)_2(OH)_2$. Monoclinic. Hardness: 3.5-4. Cleavage: [011] imperfect, [100] fair. Sp. Gr. 3.77. Color: shades of blue. Luster: vitreous to dull, translucent to nearly opaque. Streak: light blue. Habit: earthy, films and stains.

A secondary carbonate occurring in the oxidized zone of copper sulfide-bearing deposits where it is associated with malachite, chalcopyrite, dolomite, anglesite, quartz, smithsonite, hemimorphite, sphalerite, chalcocite, and linarite. Known from Fulton, Marion, Montgomery, Polk, Pulaski, Saline, and Sevier Counties.

Ref.: 8, 41, 47, 87.

□ **BADDELEYITE**

ZrO_2. Monoclinic. Hardness: 6.5. Cleavage: 1 direction, [001] nearly perfect, [010] and[110] imperfect. Fracture: subconchoidal to uneven, brittle. Sp. Gr. 5.74. Color: tan to gray. Luster: dull, earthy, opaque. Streak: white to brownish white. Habit: fine-grained granular pseudomorphs after kimzeyite.

A rare oxide identified by XRD in 1996 by Henry Barwood as pseudomorphs of kimzeyite garnet. Associated with magnetite, hercynite, kimzeyite, and perovskite.

Ref.: 29, 105.

□ **BARITE** ⊕

$BaSO_4$. Orthorhombic. Hardness: 3-3.5. Cleavage: 3 directions, [001] perfect, [210] distinct, [010] imperfect. Sp. Gr. 4.50. Color: colorless to white, blue, yellow, tan, brown (crystals); gray (massive). Luster: crystals vitreous, transparent to translucent. Streak: white. Habit: most commonly massive; crystals thin to thick tabular, equant, sometimes highly modified and twinned; roses.

A relatively widespread sulfate occurring in numerous geologic settings: as hydrothermal or depositional replacement bodies in the Stanley Shale Formation, a gangue mineral in sulfide-bearing quartz veins, concretionary masses and roses in shale and sand, as crystals in shale concretions, veins in peridotite, crystalline veins in shale and novaculite, and in miarolitic cavities in syenite. Associated with many minerals, pyrite and quartz being the most common. Known from Clark, Garland, Hot Spring, Howard, Independence, Montgomery, Pike, Polk, Saline, Sevier and Washington Counties.

Ref.: 5, 6, 8, 21, 48, 76, 87, 125, 127.

Figure 11 – Barite, Hot Spring County, 1.6 x 4.0 mm. (HSdel, JMH, JMH)

Figure 12 – Barite, Montgomery County, 3.2 x 6.0 mm. (JMH)

Figure 13 – Zoned barite, Montgomery County, 6.0 x 7.2 mm. (JMH)

BARITE GROUP

Orthorhombic sulfates of general formula AXO_4 where A = Ba, Pb, Sr; X = S^{6+}, Cr^{6}+. See anglesite, barite, celestine.

BARKEVIKITE See *ferrohornblende*.

□ **BARYTOCALCITE**

$BaCa(CO_3)_2$. Monoclinic. Hardness: 4. Cleavage: 1 direction, [210] perfect, [001] imperfect. Sp. Gr. 3.66-3.71. Color: colorless, white to gray. Luster: resinous, transparent to translucent. Streak: white. Habit: prismatic, acicular.

A rare hydrothermal carbonate of barite deposits and a late forming mineral in miarolitic cavities in syenite. Associated with barite, witherite, quartz, albite, and pectolite. Known from Hot Spring and Montgomery Counties.

Ref.: 29, 48, 80, 125.

Figure 14 - Barytocalcite, Monrgomery County, 0.2 x 3.0 mm. (JMH)

□ **BARYTOLAMPROPHYLLITE**

$(Na,K)_2(Ba,Ca,Sr)_2(Ti,Fe)_3(SiO_4)(O,OH)_2$. Monoclinic. Hardness: 2-3. Cleavage: 2 directions, [011] perfect, [011] good, [[010] imperfect; brittle. Sp. Gr. 3.62-3.66. Color: pink. Luster: no data, normally vitreous. Streak: no data. Habit: embedded grain.

A single specimen of this mineral was identified as present in eudialyte syenite pegmatite. The authors infer that this mineral is an alteration product of eudialyte. Associated with eudialyte, aegerine, and nepheline.

Ref.: 141.

□ **BASALUMINITE**

$Al_4(SO_4)(OH)_{10} \cdot 5H_2O$. Hexagonal(?). Hardness: no data (soft). Cleavage: no data. Sp. Gr. 2.12. Color: white to tan. Luster: pearly, translucent. Streak: no data. Habit: radiating crystalline rosettes.

A rare secondary sulfate of barite deposits formed by the action of SO4-bearing waters on aluminous shales. Associated with barite and hyaline opal. Known from Hot Spring County.

Ref.: 36.

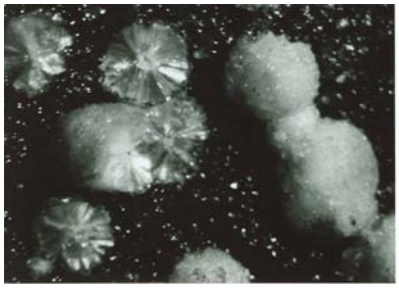


Figure 15 - Basaluminite, Hot Spring County, 0.5 mm diameter. (AES)

□ **BASTNÄSITE - (Ce)**

$(Ce,La)(CO_3)F$. Hexagonal. Hardness: 4.-4.5. Cleavage: [0001] parting, distinct to perfect, [1010] indistinct. Sp. Gr. 4.78-5.2. Color: yellow. Luster: vitreous to greasy, transparent to translucent. Streak: no data. Habit: microscopic, micaceous rosettes.

A very rare rare-earth carbonate occurring in late pegmatitic veins and dikes in syenite. A secondary mineral in carbonatite formed by the alteration of fluorapatite. Associated with acmite and orthoclase. Known from Hot Spring and Pulaski Counties.

Ref.: 29, 105, 127.

Figure 16 – Bastnasite, Pulaski County, SEM. (HLB)

□ **BASTNÄSITE – (La)**

$(La,Ce)(CO_3)F$. Hexagonal. Hardness: 4-4.5. Cleavage: [0001] parting, distinct to perfect, [1010] indistinct. Sp. Gr. 4.78-5.2. Color: white to brownish. Luster: vitreous to greasy, transparent to translucent. Streak: no data. Habit: microscopic, micaceous rosettes of micaceous plates.

A very rare rare-earth carbonate reported from thin alteration veins in baked Stanley Shale, adjacent to the Magnet Cove intrusion. Associated with quartz, feldspar, anatase, brookite, and fluorite. Known from Hot Spring County.

Ref.: 135.

□ **BEIDELLITE**

$(Na,Ca_{0.5})_{0.3}Al_2(Si,Al)_4O_{10}(OH)_2 \cdot nH_2O$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction, [001] perfect. Sp. Gr. 2-3. Color: white, reddish to brownish gray. Luster: waxy to vitreous, also dull. Streak: same as color. Habit: clay-like masses of extremely minute plates.

A relatively common, but not easily recognized, montmorillonite clay mineral which forms during hydrothermal activity in sulfide-bearing deposits. Associated with quartz, rectorite, sphalerite, dolomite, and rutile. Known from Hot Spring, Marion, Perry, Pulaski, and Searcy Counties.

Ref.: 19, 47, 78.

□ **BEMENTITE**

$Mn^{2+}{}_8Si_6O_{15}(OH)_{10}$. Monoclinic. Hardness: 6. Cleavage: 3 directions, [001] [010] [100] perfect. Sp. Gr. 2.9-3.1. Color: brown, yellow, gray. Luster: waxy to pearly, translucent. Streak: white. Habit: fibrous or lamellar crystals, massive.

A rare primary silicate in manganese deposits associated with hausmannite, pyrolusite, manganite, and braunite. Known from Independence County.

Ref.: 54.

□ **BENITOITE**

$BaTiSi_3O_9$. Hexagonal. Hardness: 6-6.5. Cleavage: [1011] indistinct. Fracture: conchoidal, brittle. Sp. Gr. 3.64-3.68. Color: sky blue. Luster: vitreous, transparent to translucent. Streak: colorless. Habit: microscopic anhedral grains.

A constituent of miarolitic cavities in syenite where it is embedded in pectolite fibers. Fluorescent bright blue in SW ultraviolet light. Associated with labuntsovite, barytocalcite, barite, fluorapophyllite, orthoclase, acmite, and eudialyte. Known from Hot Spring County.

Ref.: 105.

□ **BENSTONITE**

$(Ba,Sr)_6(Ca,Mn)_6Mg(CO_3)_{13}$. Trigonal. Hardness: 3-4. Cleavage:3 directions, rhombohedral, good; angles near those of calcite. Sp. Gr. 3.596-3.66. Color: white to ivory. Luster: vitreous, translucent. Streak: white. Habit: massive, cleavable.

A rare hydrothermal carbonate occurring in barite deposits with barite, calcite, and quartz. Known from Hot Spring County. Fluorescent pink. Original type locality.

Ref.: 44.

□ **BERAUNITE**

$Fe^{2+}Fe^{3+}_5(PO_4)_4(OH)_5 \cdot 4H_2O$. Monoclinic. Hardness: 3.5-4. Cleavage: [100] good. Sp. Gr. 3.01-2.96. Color: reddish brown to dark red; sage green. Luster: vitreous, translucent. Streak: yellow to greenish brown. Habit: radiating fibrous aggregates, foliated crusts; crystals tabular to elongate, vertically striated.

A scarce phosphate in manganese and iron mineralization in the Arkansas Novaculite. Associated with strengite, kidwellite, cacoxenite, laubmannite (discredited), dufrenite, rockbridgeite, and goethite. Known from Garland, Montgomery, and Polk Counties.

Ref.: 13, 37, 38, 39, 98, 124.

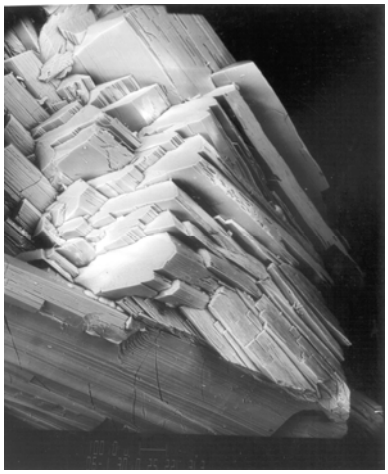


Figure 17 – Beraunite, Polk County, SEM. (CM, CM, EJD)

□ **BETAFITE**

$(Ca,Na,U)_2(Ti,Nb,Ta)_2O_6(OH)$. Cubic. Hardness: 3-5.5. Cleavage: none. Fracture: conchoidal. Sp. Gr. 4.15. Color: tan. Luster: dull; greasy on fracture. Habit: microscopic, pseudomorphs after unknown mineral.

A very rare pyrochlore group mineral in late pegmatitic dikes and veins in syenite. Associated with acmite and orthoclase. Known from Pulaski County.

Ref.: 105.

□ **BEUDANTITE**

$PbFe_3^{3+}(AsO_4)(SO_4)(OH)_6$. Trigonal, rhombohedral, often pseudocubic. Hardness: 3.5-4.5. Cleavage: [0001] easy. Sp. Gr. 4-4.3. Color: yellow to brownish. Luster: vitreous to resinous, transparent to translucent. Streak: greenish to grayish yellow. Habit: scattered individuals to clumps of microscopic crystals perched on quartz crystals.

A very rare lead iron hydrated sulfate-arsenate that occurs in oxidized zone of quartz-hosted antimony deposits. Reported from Sevier County.

Ref.: 136, 158.

BEUDANTITE GROUP

Trigonal sulfate-arsenates and sulfate-phosphates of the general formula: $AB_3(XO)(SO_4)(OH)_6$, where A=Ba, Ca, Ce, Pb, Sr, (H_3O); B= Al, Fe^{+3}; X= As^{5+}, P^{5+}. See beudantite.

□ **BINDHEIMITE**

$Pb_2Sb_2O_6(O,OH)$. Cubic. Hardness: 4-4.5. Cleavage: none. Sp. Gr. 4.6-7.32. Color: yellow to brown. Luster: dull, opaque. Streak: yellow to brown. Habit: porous earthy pseudomorphs after jamesonite.

A secondary oxidation product of lead antimony sulfosalts, restricted to oxidation zone of sulfide-bearing quartz veins. Associated with quartz, jamesonite, stibnite, and stibiconite. Known from Sevier County.

Ref.: 8, 31, 87.

□ **BIOTITE** ⊕

$K(Mg,Fe^{2+})_3(Al,Fe^{3+})Si_3O_{10}(OH,F)_2$. Monoclinic. Hardness: 2.5-3. Cleavage: 1 direction, [001] perfect. Sp. Gr. 2.7-3.4. Color: black, dark brown, green. Luster: vitreous, translucent to opaque. Streak: colorless. Habit: crystals pseudo-hexagonal, hexagonal in outline; anhedral cleavable grains.

A primary igneous accessory mica common in syenite; in lamprophyre dike rock where it may be as groundmass and phenocrysts; in miarolitic cavities in syenite; detrital grains in clastic sedimentary rocks. Associated with feldspar, olivine, titanite, calcite, pyrite, acmite, quartz, titanaugite, and analcime. See Mica group; trioctahedral micas between, or close to the Annite-Phlogopite and Siderophyllite-Eastonite chemistry; dark micas without lithium. Now considered a series. Name retained due to common usage in previous literature. Known from many counties, occurring in sediments; most notably associated with igneous rock in Garland, Hot Spring, Pulaski and Saline Counties.

Ref.: 8, 11, 19, 33, 124, 125.

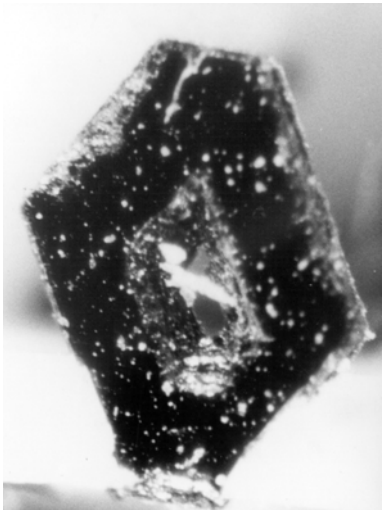


Figure 18 – Biotite, Pulaski County, 0.1 x 0.8 x 1.2 mm. (MPY, MPY, JMH)

□ **BIXBYITE**

$(Mn^{3+},Fe^{3+})_2O_3$. Cubic. Hardness: 6-6.5. Cleavage: [111] traces. Sp. Gr. 4.945. Color: black. Luster: brilliant, metallic to submetallic; opaque. Streak: black. Habit: minute grains intergrown with manganese minerals, observed only in polished sections.

A minor secondary oxide of manganese ore formed by oxidation of manganese carbonates. Associated with rancieite, cryptomelane, and psilomelane. Known from Independence County.

Ref.: 7.

□ **BÖHMITE** ⊕

AlO(OH). Orthorhombic. Hardness: 3. Cleavage: 1 direction, [010] good. Sp. Gr. 3.07. Color: white, brown. Luster: no data. Streak: no data. Habit: sub-microscopic grains in pisolitic aggregates; disseminated particles.

A major oxide constituent of bauxite, having formed from secondary lateritic weathering of aluminum-bearing minerals in syenite. Associated with gibbsite, kaolinite, siderite, and hematite. Known from Pulaski and Saline Counties.

Ref.: 21.

□ **BOKITE**

$(Al,Fe^{3+})_7(V^{5+},V^{4+},Fe^{3+})_{40}O_{100} \cdot 37H_2O$. Crystal system: Monoclinic. Hardness: 3. Cleavage: 1 direction, perfect parallel to elongation. Sp. Gr. 2.97-3.10. Color: black, brown. Luster: sub-metallic to dull. Streak: black, sometimes with a brownish tint. Habit: encrustations of fibers and films.

A scarce secondary vanadate occurring with duttonite as fracture fillings in metaquartzite in the oxidized zone of vanadium deposits. Associated with montmorillonitic, illitic and kaolinitic clays. Known from Garland County.

Ref.: 48, 98, 124.

□ **BOURNONITE**

$PbCuSbS_3$. Orthorhombic. Hardness: 2.5-3. Cleavage: [010] imperfect, [100] [001] poor. Sp. Gr. 5.83. Color: steel-gray to iron-black. Luster: dull metallic, opaque. Streak: steel-gray to iron-black. Habit: massive, granular to compact.

A rare hydrothermal sulfide of lead-zinc-antimony bearing quartz veins where it is associated with galena, sphalerite, stibnite, chalcopyrite, chalcocite, tetrahedrite, wurtzite, siderite, and calcite. Known from Sevier County.

Ref.: 31.

□ **BRAUNITE**

$Mn^{2+}Mn^{3+}_6SiO_{12}$. Tetragonal. Hardness: 6-6.5. Cleavage: 4 directions, [112] perfect. Sp. Gr. 4.72-4.83. Color: black, brownish black, steel-gray. Luster: submetallic, opaque. Streak: dark brownish black to steel-gray. Habit: massive.

A relatively common secondary silicate formed by the oxidation of manganese carbonate; occurs as fracture-filling veins and lenses associated with psilomelane, hausmannite, manganite, and pyrolusite. Known from Hot Spring, Independence, Izard, Montgomery, Pike, Polk, Pulaski, Sharp, and Stone Counties.

Ref.: 8, 53, 54, 86, 87.

□ **BRITHOLITE - (Ce)**

$(Ce,Ca)_5(SiO_4,PO_4)_3(OH,F)$. Hexagonal. Hardness: 5. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 3.86. Color: pink, rose-red, colorless to white. Luster: adamantine to resinous, translucent. Streak: no data. Habit: crystals small, tabular, hexagonal stout prisms or plates; bundles of fibers resembling pectolite.

Discovered in pegmatitic phases of nepheline syenite and in volatile-rich xenoliths and gas cavities. In pegmatites, associated with acmite, titanite, biotite, allanite, and eggletonite. In xenoliths and gas cavities associated with phlogopite and calcite.

Ref.: 105.

□ **BROCHANTITE**

$Cu^{2+}_4(SO_4)(OH)_6$. Monoclinic. Hardness: 3.5-4. Cleavage: 1 direction, [100] perfect. Sp. Gr. 3.97. Color: emerald-green to blackish green. Luster: vitreous, transparent to translucent. Streak: pale green. Habit: drusy crusts.

A rare secondary sulfate formed from the oxidation of primary hydrothermal copper sulfide minerals, principally chalcopyrite. Associated with quartz, galena, sphalerite, chalcopyrite, malachite, azurite, cerussite, and anglesite. Known from Pulaski County.

Ref.: 41, 48.

□ **BROOKITE** ⊕

TiO_2. Orthorhombic. Hardness: 5.5-6. Cleavage: indistinct. Fracture: subconchoidal to uneven. Sp. Gr. 4.14±.06. Color: commonly black (due to Nb), rarely brown, bluish, or reddish. Luster: adamantine to submetallic, sometimes iridescent red, green, blue or yellow; transparent to opaque (most commonly). Streak: white to light gray to yellowish. Habit: pyramidal, pseudo-hexagonal; tabular with vertical striations.

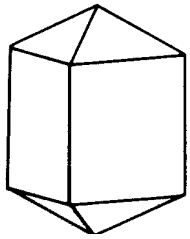
A primary hydrothermal-metasomatic, moderate-temperature oxide occurring in or adjacent to igneous intrusions in alteration zones of the Arkansas Novaculite; as loose crystals in saprolite; rarely as prismatic blades encased in clear quartz crystal. Associated with quartz, anatase, tainiolite, pyrite, and rarely sphalerite. Known in Garland, Hot Spring, and Polk Counties.

Ref.: 11, 19, 48, 88, 94, 125, 127, 147.

Figure 19 – Brookite, Hot Spring County, 1.9 x 1.9 x 1.9 cm. (DRH)

Figure 20 – Brookite, Hot Spring County, 1.0 mm diameter. (ALK)

Brookite



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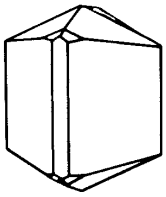

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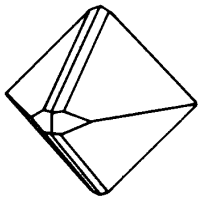

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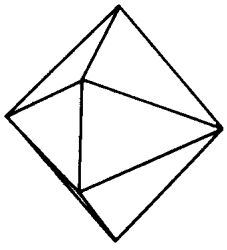

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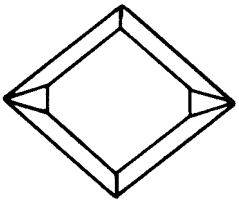

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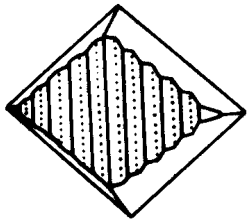


(JFW – 309.30)

□ **BRUCITE**

$Mg(OH)_2$. Trigonal. Hardness: 2.5. Cleavage: 1 direction, [0001] perfect. Sp. Gr. 2.39. Color: white, pale green, gray. Luster: pearly, waxy, translucent. Streak: white. Habit: massive foliated.

A mineral formed during serpentinization of peridotite and alteration of basic igneous rock. Associated with olivine, serpentine, talc, steatite, and calcite. Reported from Saline County.

Ref.: 8, 11, 15, 94.

BRUCITE GROUP

Trigonal hydroxides of general formula $M^{2+}(OH)_2$ where M^{2+} = Fe, Mg, Mn, Ni. See *brucite*.

□ **BURBANKITE**

$(Na,Ca)_3(Sr,Ba,Ce)_3(CO_3)_5$. Hexagonal. Hardness: ~3.5. Cleavage: prismatic [100] distinct to imperfect. Sp. Gr. 3.50. Color: light color. Luster: no data. Streak: no data. Habit: 1 mm long hexagonal terminated crystals.

A sodium calcium carbonate present in cavities associated with syenitic host rock. No information on associated minerals. Known from Hot Spring County.

Ref.: 171.

□ **CACOXENITE**

$(Fe^{3+},Al)_{25}(PO_4)_{17}O_6(OH)_{12} \cdot 75H_2O$. Hexagonal. Hardness: 3-4. Cleavage: no data. Sp. Gr. 2.26. Color: golden to reddish yellow. Luster: subvitreous to pearly, translucent. Streak: yellow. Habit: usually radial or tufted aggregates; crystals rare, minute, acicular.

A secondary fracture-filling phosphate in novaculite associated with laubmannite (discredited), rockbridgeite, lipscombite, beraunite, dufrenite, strengite, kidwellite, planerite, goethite, and siderite; rarely on rutile, fervanite, wavellite, or drusy quartz. Known from Hot Spring, Garland, Montgomery, Pike, and Polk Counties.

Ref.: 13, 29, 37, 38, 39, 48, 98, 123, 124, 181.

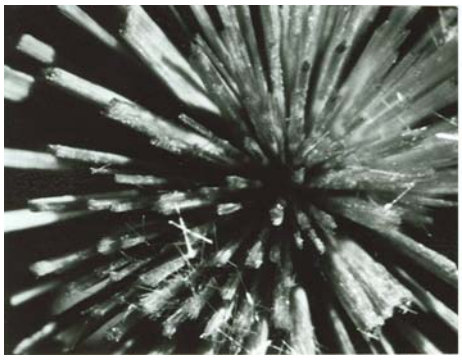


Figure 21 – Cacoxenite, Polk County, 1.5 mm. fibers. (AES)

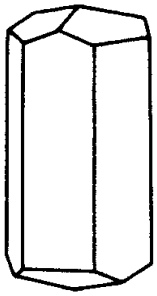
Figure 22 – Cacoxenite, Polk County, 2.0 mm. fibers. (ALK)

□ **CALCITE** ⊕

$CaCO_3$. Trigonal. Hardness: 3. Cleavage: 3 directions, [1011] perfect, rhombohedral. Sp. Gr. 2.7102. Color: colorless, amber, white. Luster: vitreous to pearly. Streak: white. Habit: crystals variable in habit – scalenohedral, rhombohedral, and hexagonal prisms with trigonal terminations most common; coarsely cleavable masses; fine-grained, massive bedded; cave formations.

A common hydrothermal and oxidation zone vein mineral; the major rock constituent of chalk and limestone; the primary magmatic mineral in carbonatite; in miarolitic cavities in syenite. Because of calcite's widespread geologic occurrence, it is associated with many mineral species, the most notable of which are sphalerite, galena, dolomite, stibnite, quartz, aragonite, cinnabar, barite, psilomelane, hausmannite, braunite, and rutile. Known from many counties in Arkansas, most notable are Baxter, Boone, Hot Spring, Independence, Lawrence, Marion, Newton, Saline, Sharp, Stone, and Washington; also from Clark, Garland, Howard, Logan, Montgomery, Pike, Polk, Pulaski, Scott, Searcy, and Sevier Counties.

Ref.: 6, 8, 10, 11, 31, 46, 48, 53, 54, 87, 125, 126, 127.



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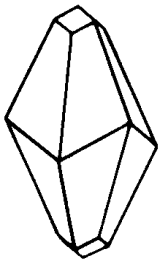


(DSM – 263.17)

CALCITE GROUP

Trigonal carbonates of general formula $A^{2+}CO_3$ where A^{2+} = Ca, Cd, Co, Fe, Mg, Mn, Ni, Zn. See *calcite*, *rhodochrosite*, *siderite*, *smithsonite*.

□ **CALOMEL**

Hg_2C_{l2}. Tetragonal. Hardness: 1.5. Cleavage: 1 direction, [110] good, [011] imperfect. Sp. Gr. 7.16. Color: white to yellowish gray, gray to brown. Luster: adamantine, transparent to translucent. Streak: pale yellowish white. Habit: earthy masses and coatings; minute crystals.

A rare secondary chloride formed by the alteration of mercury-bearing minerals. Associated with cinnabar, native mercury, quartz, dickite, metacinnabar, eglestonite, and livingstonite. Known from Clark, Howard, and Pike Counties. Readily identified as fluorescent films (orange) when associated with other mercury minerals.

Ref.: 6, 81.

□ **CANCRINITE**

$Na_6Ca_2Al_6Si_6O_{24}(CO_3)_2$. Hexagonal. Hardness: 5-6. Cleavage: 3 directions; [1010] perfect, [0001] poor. Sp. Gr. 2.42-2.51. Color: colorless, white, bluish gray. Luster: vitreous, pearly, greasy; transparent to translucent. Streak: colorless. Habit: usually massive, crystals rare.

A primary late-forming silicate in alkalic igneous rock; also, a secondary alteration product of nepheline. Associated with nepheline, orthoclase, titanite, and acmite. Known from Garland, Hot Spring, and Saline Counties.

Ref.: 11, 19, 94.

CANCRINITE GROUP

Hexagonal silicates of general formula $A_{6-9}(Si,Al)_{12}O_{24}[(SO_4),(CO_3),Cl_2,(OH)]_{2-4} \cdot nH_2O$, where A = Ba, Ca, K, Na. See *cancrinite*.

CARBONATE-APATITE See *carbonate-fluorapatite*.

□ **CARBONATE-FLUORAPATITE** (Francolite) ⊕

$Ca_5(PO_4,CO_3)_3F$. Hexagonal. Hardness: 5. Cleavage: [0001] indistinct, [1010] trace. Sp. Gr. 2.9-3.1. Color: yellowish to cream. Luster: vitreous to pearly, transparent to translucent. Streak: white. Habit: slender prismatic crystals and radiating masses.

A rare primary phosphate in carbonatite where it is associated with calcite, magnetite, hercynite, perovskite, monticellite, and kimzeyite. Known from Hot Spring County.

Ref.: 11, 45.

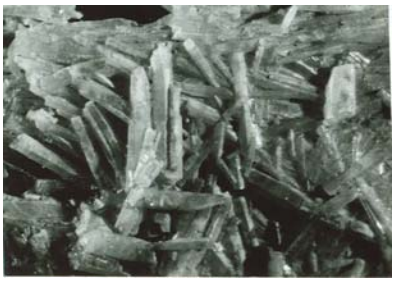


Figure 23 – Carbonate-fluorapatite, Hot Spring County, 0.3 x 2.0 mm. (CLH, JMH, JMH)

□ **CARLSBERGITE**

CrN. Cubic. Hardness: high; probably greater than 1000 on Vickers scale. Cleavage: not determined. Sp. Gr. 5.9-6.8. Color: light gray. Luster: metallic (?), opaque. Habit: observed as microscopic oriented platelets in polished sections.

An extremely rare, inadequately described, mineral of iron meteorites. Associated with kamacite. Noted as a probable constituent of the Norfork meteorite. Known from Baxter County.

Ref.: 114.

CARNOTITE Originally reported as carnotite, but later determined to be metatyuyamunite. See *metatyuyamunite*.

Ref.: 48, 50.

□ **CATAPLEIITE**

$Na_2ZrSi_3O_9 \cdot 2H_2O$. Hexagonal. Hardness: 5-6. Cleavage: 1 direction; [1010] perfect, [1011] [1012] imperfect. Sp. Gr. 2.65-2.8. Color: yellow to brown, colorless. Luster: vitreous to greasy, transparent to opaque. Streak: no data. Habit: microscopic hexagonal plates and clusters of plates.

A very rare primary silicate in miarolitic cavities and pegmatitic veins in syenite. Associated with orthoclase, acmite, eudialyte, lavenite, kupletskite, eggletonite, and sphalerite. Known from Hot Spring and Pulaski Counties.

Ref.: 15, 48, 125, 127.

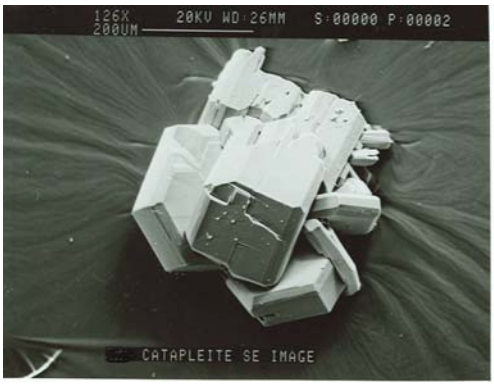


Figure 24 – Catapleiite, Pulaski County, SEM. (HLB)

□ **CELADONITE**

$K(Mg,Fe^{2+})(Fe^{3+},Al)Si_4O_{10}(OH)_2$. Monoclinic. Hardness: about 2. Cleavage: 1 direction, [001] perfect. Sp. Gr. 2.95-3.05. Color: green, blue-green. Luster: dull. Streak: no data. Habit: earthy; minute micaceous scales; lamellar; fibrous; pseudomorph replacement of pyroxene noted in thin section.

A rare metasomatic silicate formed in altered igneous rock; also, occurs in vanadium-bearing clay-rich zones in altered novaculite. Associated with various vanadium-bearing minerals. Known from Garland County.

Ref.: 48, 124.

□ **CELESTINE** (Celestite) ⊕

$SrSO_4$. Orthorhombic. Hardness: 3-3.5. Cleavage: 3 directions; [001] [210] good, [010] imperfect. Sp. Gr. 3.97. Color: white, colorless, pale blue. Luster: vitreous, pearly; transparent to translucent. Streak: white. Habit: crystals thin to thick tabular, blocky; fibrous veinlets.

A secondary sedimentary sulfate occurring in sedimentary concretionary layers and as thin beds interlayered with clay, limestone, and gypsum in the Trinity Group of Cretaceous age. Also, in calcite-siderite bearing concretions with liquid hydrocarbons in the Fayetteville Shale. Associated with calcite, siderite, pyrite, and gypsum. Known from Howard, Pike, Sevier, and Washington Counties.

Ref.: 59, 76, 87.

Figure 25 – Celestine, Pike County, 2.9 x 4.5 x 4.5 cm. (DRM)

□ **CERUSSITE**

$PbCO_3$. Orthorhombic. Hardness: 3-3.5. Cleavage: 3 directions; [110] [021] distinct. Sp. Gr. 6.55. Color: colorless, gray, white. Luster: vitreous to resinous, subtranslucent. Streak: white. Habit: massive; granular, dense to compact; rarely microscopic crystals, usually twinned.

A common secondary carbonate of the oxidation zone of lead-bearing sulfide deposits. In north Arkansas, associated with galena, quartz, sphalerite, and calcite. In quartz veins in the Ouachita Mountains, associated with galena, sphalerite, malachite, azurite, anglesite, and stibnite. Known from Baxter, Marion, Montgomery, Newton, Pulaski, and Sevier Counties.

Ref.: 31, 41, 43, 46.

□ **CERVANTITE(?)**

$Sb^{3+}Sb^{5+}O_4$. Orthorhombic. Hardness: 4-5. Cleavage: 2 directions at 90^o; [001] excellent, [100] distinct. Sp. Gr. about 6.5. Color: yellow. Luster: earthy. Streak: yellow. Habit: massive, fine-grained.

A secondary mineral of the oxidized zone of antimony-bearing quartz veins. Although reported from Sevier County by various authors, x-ray work on many specimens of "cervantite" from antimony deposits failed to discover cervantite in the several yellow to cream colored oxides present. It is probable that stibiconite is often mistaken for cervantite in hand specimens.

Ref.: 8, 24, 31, 48, 87.

□ **CHABAZITE**

$CaAl_2Si_4O_{12} \cdot 6H_2O$. Trigonal. Hardness: 4-5. Cleavage: 3 directions; [1011] distinct. Sp. Gr. 2.05-2.16. Color: colorless, white, reddish brown, various pastels. Luster: vitreous, transparent to translucent. Streak: uncolored. Habit: microscopic simple rhombohedrons resembling cubes; larger rhombohedral crystals to 0.5 inch across.

A zeolite identified from cavities in mafic igneous rock; also syenite pegmatites. In mafic rocks associated with natrolite and calcite. In syenite pegmatites, associated with orthoclase, acmite, stilbite, titanite, and biotite. The chemical formula is arbitrarily given for chabazite-(Ce) because no Arkansas specimens have been analyzed to determine which alkali element predominates. Known from Hot Spring and Pulaski Counties.

Ref.: 29, 48, 127.

□ **CHALCANTHITE**

$Cu^{2+}SO_4 \cdot 5H_2O$. Triclinic. Hardness: 2.5. Cleavage: [110] imperfect. Sp. Gr. 2.286. Color: pale to dark blue. Luster: vitreous to resinous, transparent to translucent. Streak: colorless. Habit: granular to massive.

A little-reported water-soluble secondary sulfate of the oxidation zone of copper-bearing sulfide deposits. Probably a relatively common mineral in these deposits. Known from Sevier County.

Ref.: 8.

CHALCANTHITE GROUP

Triclinic sulfates of general formula $A^{2+}SO4 \cdot 5H_2O$ where A^{2+} = Cu, Fe, Mg, Mn. See *chalcanthite*.

CHALCEDONY A variety of cryptocrystalline quartz. See *quartz*.

□ **CHALCOCITE**

Cu_2S. Monoclinic. Hardness: 2.5-3. Cleavage: [011] indistinct. Sp. Gr. 5.5-5.8. Color: blackish lead-gray. Luster: metallic dull, opaque. Streak: gray. Habit: massive, granular to compact.

A secondary alteration sulfide of primary copper sulfide mineralization formed in the supergene enrichment zone. Associated with malachite, azurite, and dolomite. Known from Fulton County.

Ref.: 87.

□ **CHALCOPYRITE** ⊕

$CuFeS_2$. Tetragonal. Hardness: 3.5-4. Cleavage: [011] sometimes distinct. Sp. Gr. 4.35. Color: brass-yellow, tarnishing to iridescent, altering to dull brown. Luster: metallic, opaque. Streak: greenish black. Habit: commonly as spheroidal crystals resembling tetrahedrons; massive; anhedral grains embedded in massive pyrite; as oriented crystal growths on sphalerite.

A widespread primary hydrothermal sulfide in low to high temperature sulfide deposits. In north Arkansas, associated with dolomite, sphalerite, and galena. In the Ouachita Mountains, a relatively common constituent of sulfide-bearing quartz veins, where it is associated with galena, sphalerite, stibnite, dickite, pyrophyllite, and tetrahedrite. Known from Baxter, Boone, Garland, Hot Spring, Howard, Lawrence, Marion, Montgomery, Newton, Polk, Pulaski, Searcy, Sevier, and Sharp Counties.

Ref.: 8, 10, 31, 41, 47, 87, 126.

Figure 26 – Chacopyrite, Lawrence County, 2.0 x 2.8 mm. (MPY, JMH, JMH)

CHALCOPYRITE GROUP

Tetragonal sulfides of general formula $CuBX_2$ where B = Fe, Ga, In; X = S, Se. See *chalcopyrite*.

□ **CHALCOSIDERITE**

$Cu^{2+}Fe^{3+}6(PO_4)_4(OH)_8 \cdot 4H_2O$. Triclinic. Hardness: 4.5. Cleavage: 2 directions; [001] perfect; [0101] good. Sp. Gr. 3.22. Color: green. Luster: vitreous to dull; transparent to translucent. Streak: no data. Habit: minute spheres coalescing into fish-roe like aggregates; encrustations.

Occurs as coatings and films on fractured novaculite in secondary iron and manganese deposits. Identified material gives identical chemistry to chalcosiderite, but has XRD pattern of planerite.

Ref.: 48, 12

□ **CHAMOSITE**, (Thuringite, iron variety) ⊕

$(Fe^{2+},Mg,Fe^{3+})_5Al(Si_3Al)O_{10}(OH,O)_8$. Monoclinic. Hardness: about 3. Cleavage: 1 direction; perfect. Sp. Gr. 3-3.4. Color: various shades of green. Luster: pearly, translucent. Streak: white. Habit: granular spheroids of compact platy crystals.

A relatively common accessory silicate in hydrothermal quartz veins (thuringite); a secondary alteration product of ferromagnesian minerals. Thuringite occurs with quartz, sphalerite, galena, dickite, cookeite, ankerite, rectorite, and jamesonite. Besides the above listed minerals, chamosite may also occur with phlogopite, calcite, talc, serpentine, olivine, biotite, and hornblende. It is presently unknown what variety of chlorite is present in phantom quartz from the Ouachita Mountains. Known from Garland, Hot Spring, Perry, Pike, Polk, Pulaski, Saline, and Sevier Counties.

Ref.: 10, 11, 31, 48, 58, 60, 96.

CHERT A variety of cryptocrystalline quartz. See *quartz*.

CHLORITE GROUP

Monoclinic or triclinic silicates of the general formula $A_{4\text{-}6}Z_4O_{10}(OH)_8$ where A = Al, Fe^{2+}, Fe^{3+}, Li, Mg, Mn^{2+}, Ni; Z = Al, B, Fe^{3+}, Si. See *chamosite (thuringite var.)*, *cookeite*.

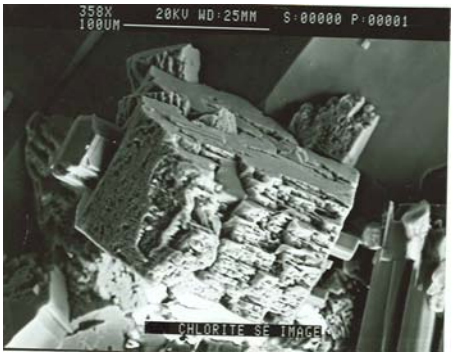


Figure 27 – Chlorite, Pulaski County, SEM. (HLB)

□ **CHROMITE**

$Fe^{2+}Cr_2O_4$. Cubic. Hardness: 5.5. Cleavage: none. Sp. Gr. 4.5-4.8. Color: black. Luster: metallic, opaque. Streak: brown. Habit: small octahedral crystals; anhedral grains.

A primary oxide in lamproite; moderately common as detrital grains in clastic sediments. Associated with talc, serpentine, magnetite, olivine, spinel, diamond, chlorite, and quartz. Known principally from Pike County.

Ref.: 3, 60.

□ **CHRYSOCOLLA**

$(Cu^{2+},Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$. Monoclinic. Hardness: 4. Cleavage: none. Fracture: conchoidal, translucent variety brittle. Sp. Gr. 2.0-2.4. Color: blue, blue-green, green. Luster: earthy, translucent to nearly opaque. Streak: when pure, white. Habit: cryptocrystalline, earthy.

A common silicate in the oxidized zone of copper-bearing sulfide deposits where it forms from the weathering of copper minerals. Associated with quartz, limonite, malachite, azurite, chalcopyrite, turquoise, and cuprite. Known from Montgomery, Pike, and Polk Counties.

Ref.: 86, 87.

□ **CHRYSOTILE** (var. Deweylite)

$Mg_3Si_2O_5(OH)_4$. Monoclinic. Hardness: 2.5. Cleavage: 2 directions; prismatic. Sp. Gr. 2.55. Color: white, gray, yellow, greenish. Luster: silky, translucent. Streak: no data. Habit: parallel flexible fibers.

A rare secondary silicate formed by the alteration of ferromagnesian minerals. Associated with pyroxene, amphibole, and olivine. Known from Garland (deweylite) and Hot Spring Counties.

Ref.: 11, 48.

□ **CHURCHITE - (Y)** (Weinschenkite)

$YPO_4 \cdot 2H_2O$. Monoclinic. Hardness: 3. Cleavage: 1 direction; [101] perfect. Sp. Gr. 3.265. Color: white. Luster: vitreous to silky, translucent. Streak: white. Habit: rosettes to $1/16^{th}$ inch diameter having radial-fibrous structure.

A rare phosphate in limonite-rich zones in a vanadium deposit. Associated with variscite, montmorillinite, smoky quartz, brookite, cacoxenite, wavellite, and various secondary iron minerals. Known from Hot Spring County.

Ref.: 122.

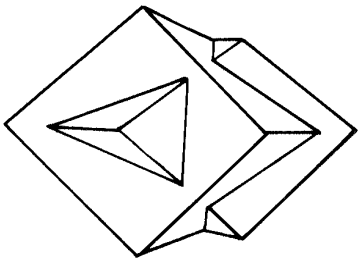
□ **CINNABAR** ⊕

HgS. Trigonal. Hardness: 2-2.5. Cleavage: 3 directions; [1010] perfect, rhombohedral. Sp. Gr. 8.090. Color: scarlet red. Luster: adamantine to submetallic, translucent. Streak: scarlet. Habit: crystalline crusts and anhedral grains in sandstone; rhombohedral crystals, commonly penetration twins.

A low-temperature primary sulfide mineral of hydrothermal quartz vein deposits; replacement grains in sandstone. Associated with quartz, dickite, stibnite, barite, pyrite, calomel, and metacinnabar. Known from Clark, Howard, and Pike Counties.

Ref.: 6, 81, 87.

Figure 28 – Cinnabar, Pike County, 0.5 x 3.5 mm. (JMH)



Twinned cinnabar crystal, Pike County, (JMH)

CLIFTONITE A variety of graphite. See *graphite*.

□ **COHENITE**

$(Fe,Ni,Co)_3C$. Orthorhombic. Hardness: 5.5-6. Cleavage: 3 directions at 90°; [100] [010] [001], very brittle. Sp. Gr. 7.20-7.65. Color: tin-white, tarnishing light bronze to golden yellow. Luster: metallic, opaque. Streak: no data. Habit: not described; noted in polished section.

An extremely rare, strongly magnetic mineral described from an iron meteorite from Hope, Hempstead County. Associated with taenite, schriebersite, and troilite.

Ref.: 114.

□ **COOKEITE** ⊕

$LiAl_4(Si_3Al)O_{10}(OH)_8$. Monoclinic. Hardness: 2.5-3.5. Cleavage: 1 direction; [001] perfect, micaceous. Sp. Gr. 2.58-2.69. Color: pale green, blue-green. Luster: pearly, translucent. Streak: no data. Habit: radial rosettes of plates to 1/8 inch, coalescing rosettes.

A primary hydrothermal chlorite-group mineral associated with quartz, rectorite, and ankerite. Occasionally included within quartz crystals. Known from Garland, Perry, Pulaski, and Sevier Counties.

Ref.: 29, 31, 41, 48, 58, 65.

□ **COPIAPITE**

$Fe^{2+}Fe^{3+}_4(SO_4)_6(OH)_2 \cdot 20H_2O$. Triclinic. Hardness: 2.5-3. Cleavage: 1 direction; [010] perfect, [101] imperfect. Sp. Gr. 2.08-2.17. Color: shades of yellow. Luster: pearly, translucent. Streak: no data. Habit: scaly loose aggregates; crusts; efflorescences.

A common secondary sulfate formed by the oxidation of iron sulfide minerals. Often confused with melanterite. Associated with melanterite and epsomite. More abundant than reported. Known from Marion County.

Ref.: 47.

COPIAPITE GROUP

Triclinic sulfates of formula $A^{2+}Fe^{3+}_4(SO_4)_6(OH)_2 \cdot 18\text{-}20H_2O$ or $B^{3+}_{2/3}Fe^{3+}_4(SO_4)_6(OH)_2 \cdot 20H_2O$ where A^{2+} = Ca, Cu, Fe, Mg, Zn; B^{3+} = Al, Fe. See *copiapite*.

□ **COPPER (NATIVE)**

Cu. Cubic. Hardness: 2.5-3. Cleavage: none. Fracture: hackly. Sp. Gr. 8.94. Color: copper red, tarnishing to brown. Luster: metallic, opaque. Streak: rose-red. Habit: thin sheet-like fracture fillings; crystals microscopic, complex.

A secondary fracture-filling native element in novaculite formed in the oxidation zone of copper-bearing sulfide deposits. Associated with limonite, cuprite, malachite, chrysocolla, chalcopyrite, and psilomelane. Known from Montgomery, Pike, and Polk Counties.

Ref.: 87.\

Figure 29 – Native copper, Montgomery County, 7.0 x 10.5 mm. (MPY, JMH, JMH)

□ **CORDIERITE (?)** (Iolite)

$Mg_2Al_4Si_5O_{18}$. Orthorhombic. Hardness: 7-7.5. Cleavage: 1 direction; [010] distinct, [001] [100] indistinct. Sp. Gr. 2.53-2.78. Color: blue, smoky blue. Luster: vitreous, transparent to translucent. Streak: uncolored. Habit: embedded grains.

A metamorphic silicate formed by the thermal metamorphism of Al-rich rock. Noted by Comstock (1888) in his mineral list from Hot Spring County. Not reported by numerous later workers; very questionable identification.

Ref.: 8.

□ **CORUNDUM**

Al_2O_3. Trigonal. Hardness: 9. Cleavage: none, parting on [0001] [1011]. Fracture: conchoidal to uneven, brittle. Sp. Gr. 4.0-4.1. Color: gray, bluish. Luster: vitreous to pearly, translucent. Streak: white. Habit: anhedral grains, identified from thin section.

A rare oxide known from one primary occurrence – an igneous dike. Associated with orthoclase, biotite, pyrite, and magnetite in Garland County. As a scarce detrital mineral from the Woodbine Formation (lower Upper Cretaceous). A single small tapering bi-color crystal (pale blue - pale brown) displaying some mechanical abrasion was noted in panned heavy mineral concentrates from near Locksburg in Howard County.

Ref.: 11, 29.

□ **COVELLITE**

CuS. Hexagonal. Hardness: 1.5-2. Cleavage: `1 direction; [0001] perfect, easy. Sp. Gr. 4.681. Color: light to very dark indigo blue. Luster: submetallic to dull, opaque. Streak: shining gray-black. Habit: microscopic grains in polished sections.

A rare secondary sulfide formed from the alteration of chalcopyrite in the supergene enrichment zone of chalcopyrite-quartz veins. Associated with malachite, azurite, cerussite, anglesite, smithsonite, brochantite, linarite, and hematite. Known from Montgomery and Pulaski Counties.

Ref.: 41, 43.

□ CRANDALLITE

$CaAl_3(PO_4)_2(OH)_5 \cdot H_2O$. Trigonal. Hardness: 5. Cleavage: 1 direction; [0001] perfect. Sp. Gr. 2.78-2.92. Color: white to cream. Luster: vitreous to dull, translucent to subtranslucent. Streak: white. Habit: microscopic trigonal prisms; elongate replacement of radiating fibers.

A secondary phosphate formed from the alteration of wavellite where it has either grown as microscopic crystals at right angles on wavellite fibers or is intergrown with wavellite; sometimes pseudomorphs after wavellite. Often mistaken for white wavellite. Associated with wavellite on quartz and with wavellite or turquoise group minerals. Known from Garland and Montgomery Counties.

Ref.: 48, 123.

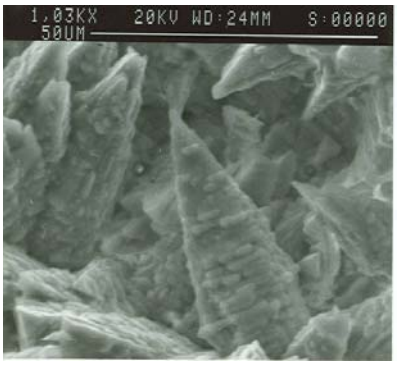


Figure 30 – Crandallite, Garland County, SEM. (HSdel, HLB, HLB)

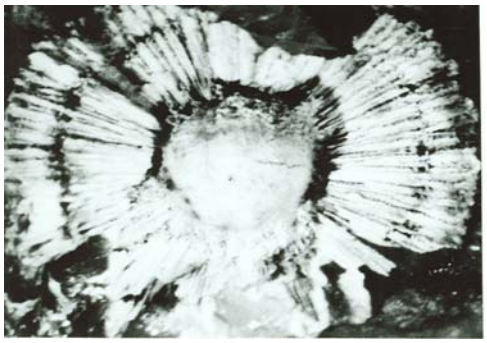


Figure 31 – Crandallite, Garland County, 7.0 mm diameter. (JMH)

CRANDALLITE GROUP

Trigonal phosphates and arsenates of general formula $AB_3(XO_4)_2(OH,F)_5$ or $AB_3(XO_4)_2(OH,F)_6$ where A = Ba, Bi, Ca, Ce, La, Nd, Pb, Sr, Th; B = Al, Fe^{3+}; X = As, P, Si. See *crandallite*, *florencite*, *gorceixite*.

□ CRISTOBALITE

SiO_2. Tetragonal. Hardness: 6.5. Cleavage: none, brittle. Sp. Gr. 2.33 ± .01. Color: white, milky white. Luster: vitreous to pearly, translucent. Streak: white. Habit: granular.

A rare SiO2 polymorph of quartz-bearing host rock where it is associated with various vanadium minerals. Known from Garland County.

Ref.: 48, 124.

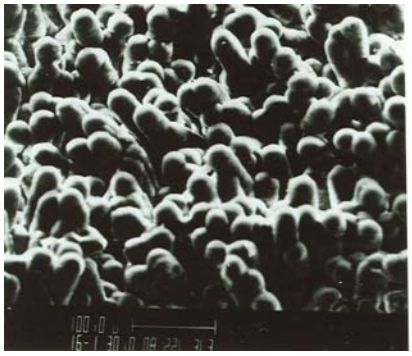


Figure 32 – Cristobslite, Garland County, SEM. (DRO, CM, EJD)

□ **CRYPTOMELANE**

$K(Mn^{4+},Mn^{2+})_8O_{16}$. Monoclinic. Hardness: variable, 1-6. Cleavage: no data. Fracture: conchoidal. Sp. Gr. about 4.3. Color: gray to black. Luster: metallic to submetallic, dull, opaque. Streak: brownish black. Habit: massive, fine-grained, often loose aggregates; botryoidal.

A secondary oxide occurring as fracture-fillings in novaculite and in fine-grained mixtures of other manganese oxides. Associated with pyrolusite, hausmannite, braunite, and lithiophorite. This species is probably more common than presently recognized. Known from Independence, Polk, and Pulaski Counties.

Ref.: 7, 48.

CRYPTOMELANE GROUP

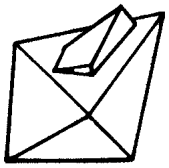
Complex oxides of general formula AB_8O_{16} where A = Ba, K, Mn^{4+}, Na, Pb, Sr; B = Cr^{3+}, Fe^{3+}, Mg, Mn^{2+}, Mn_{4+}, Ti, V^{3+}, Zn, Zr. See *cryptomelane*, *priderite*.

□ **CUPRITE**

$Cu^{1+}{}_2O$. Cubic. Hardness: 3.5-4. Cleavage: 4 directions; [111] octahedral, interrupted. Sp. Gr. 6.14. Color: red, brownish red to almost black. Luster: submetallic to earthy, translucent. Streak: shining reddish brown. Habit: compact massive, granular, earthy; rarely microscopic modified octahedral crystals.

A secondary oxide formed in the oxidation zone of copper-bearing deposits in fractured novaculite, and quartz veins. Associated with limonite, copper, and chrysocolla. Known from Montgomery, Pike, and Polk Counties.

Ref.: 29, 87.



Cuprite, Montgomery County, (JMH)

CUSPIDINE GROUP

Monoclinic and triclinic silicates of general formula $X_{16}(Si_2O_7)_4(O,OH,F)_8$ where X = Na, Ca, Zr, Ti, Nb, Mn^{2+}, Fe^{2+}, Y, and rare earth elements. See *låvenite*.

□ **DAUBREELITE**

$Fe^{2+}Cr_2S_4$. Cubic. Hardness: no data. Cleavage: 1 direction; distinct. Sp. Gr. 3.81. Color: black. Luster: metallic, brilliant, opaque. Habit: in polished section as irregular grains.

An extremely rare sulfide in iron meteorites. Noted intergrown with troilite and as irregular angular inclusions in kamacite in an iron meteorite from western Arkansas. The reported location is from Montgomery County.

Ref.: 114.

□ **DELINDEITE**

$Ba_2\{(Na,K,?)_3(Ti,Fe)[Ti_2(O,OH)_4Si_4O_{14}](H_2O,OH)_2\}$. Monoclinic. Hardness: no data. Cleavage: 1 direction; [001] good; irregular fracture. Sp. Gr. 3.70. Color: light pinkish gray. Luster: resinous, pearly. Streak: no data. Habit: microscopic aggregates of flake-like crystallites in compact spherules.

An extremely rare silicate in miarolitic cavities in xenolith-bearing garnet pseudoleucite syenite. Associated with orthoclase, acmite, titanite, labuntsovite, and lourenswalsite. Original type locality. Known from Hot Spring County.

Ref.: 117, 125, 152.

DEWEYLITE See chrysotile.

□ **DIADOCHITE**

$Fe^{3+}_2(PO_4)(SO_4)(OH) \cdot 5H_2O$. Triclinic. Hardness: about 3-4. Cleavage: none. Sp. Gr. 2.0-2.4. Color: deep yellowish brown, dark amber, reddish brown. Luster: vitreous to resinous, translucent. Streak: unknown. Habit: microscopic spheres; irregular grains.

A secondary phosphate occurring in manganese- or iron-bearing fractures in novaculite. Associated with cacoxenite, goethite, and strengite. Known from Garland and Polk Counties.

Ref.: 13, 48, 123, 124.

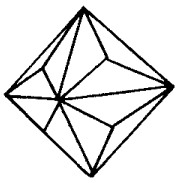
□ **DIAMOND**

C. Cubic. Hardness: 10. Cleavage: 4 directions; [111] perfect, octahedral. Sp. Gr. 3.514. Color: colorless, yellow, brown, rarely pink, black. Luster: adamantine, transparent. Streak: white. Habit: crystals, mostly rounded dodecahedroids mimicking trisoctahedrons and hexoctahedrons; distorted shapes; rarely sharp simple octahedrons.

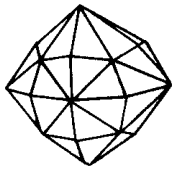
A primary, igneous xenocrystic component of lamproite breccia tuff; in detrital sands. Associated with olivine, phlogopite, serpentine, pyrope, perovskite, magnetite, chromite, chlorite, and spinel. Known from Pike County. A single stone has also been found in Searcy County (see ref. 100).

Ref.: 3, 42, 59, 66, 87, 100.

Figure 33 – Diamond crystals, Pike County, Largest crystal is 3.0 mm diameter. (JMH)



(DSM – xix. 17)



(DSM – xix.20)

□ **DIASPORE (?)**

AlO(OH). Orthorhombic. Hardness: 6-7. Cleavage: 1 direction; [010] perfect, [110] distinct. Sp. Gr. 3.3-3.5. Color: various; white to colorless, yellowish, greenish, lilac, pink, brownish. Luster: vitreous, pearly; transparent to subtranslucent. Streak: white. Habit: crystals striated, thin elongated plates, acicular, tabular; massive, foliated, scaly, disseminated.

A metamorphic oxide which occurs in schist, altered limestone and igneous rock. The single literature reference (Hot Spring County) lists anomalous optical properties and a blue color, possibly a misidentification of anatase.

Ref.: 77.

DIASPORE GROUP

Orthorhombic hydroxides of the general formula: XO(OH), where X= Al, Cr^{3+}, Fe^{3+}, Mn^{3+}, V^{3+}. See *diaspore, goethite, montroseite*.

□ **DICKITE** ⊕

$Al_2Si_2O_5(OH)_4$. Monoclinic. Hardness: 2-2.5. Cleavage: 1 direction; [001] perfect. Sp. Gr. about 2.60. Color: colorless, white, yellowish. Luster: satiny, transparent to translucent. Streak: same as color. Habit: minute scale-like crystals; massive compact, friable, or mealy.

A primary hydrothermal clay occurring in quartz veins and fault zones. Associated with quartz, cinnabar, sphalerite, galena, and stibnite. Widespread in the Ouachita Mountains and Arkansas Valley in numerous fault zones. Known from Clark, Garland, Hot Spring, Howard, Montgomery, Pike, Polk, Pulaski, Saline, Sevier, and Yell Counties.

Ref.: 6, 10, 41, 48, 61, 81.

□ **DIOPSIDE** (Diopside-hedenbergite, Aegirine-diopside)

$CaMgSi_2O_6$. Monoclinic. Hardness: 5.5-6.5. Cleavage: 2 directions; [110] good, [100] [010] partings. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.22-3.28. Color: gray, pale green to dark greenish black. Luster: vitreous, dull; translucent on thin edge. Streak: white or grayish. Habit: intergrown grains; crystals short prismatic.

A primary constituent of igneous rock; a common pyroxene in alteration zones adjacent to syenite intrusions (diopside-hedenbergite) and lamproites. Associated with orthoclase, sanidine, acmite, sphene, biotite, fluorapatite, arfvedsonite, pyrite, augite, serpentine, nepheline, calcite, and sodalite. Known from Garland, Hot Spring, Pike, and Pulaski Counties.

Ref.: 1, 11, 19, 33, 60, 98, 109, 124, 127.

Figure 34 – Diopside, Hot Spring County, 2.0 x6.0 mm. (JMH)

□ **DOLOMITE** ⊕

$CaMg(CO_3)_2$. Trigonal. Hardness: 3.5-4. Cleavage: 3 directions; [1011] perfect, rhombohedral. Sp. Gr. 2.85. Color: white to gray, pink, brown. Luster: pearly, translucent to subtranslucent. Streak: white. Habit: crystals commonly simple rhombohedrons with curved faces; aggregates composed of saddle-shaped forms; massive.

The major constituent of dolostone in north Arkansas; a widespread fracture-filling mineral in north Arkansas; a common gangue mineral in lead-zinc deposits of north Arkansas; a gangue mineral in sulfide-bearing quartz veins in the Ouachita Mountains; a constituent of veins cutting igneous rock. In north Arkansas, dolomite is associated with sphalerite, galena, smithsonite, chalcopyrite, quartz, and calcite. In the Ouachita Mountains, associated with quartz, calcite, sphalerite, and galena. In veins cutting igneous rock, associated with calcite, ankerite, rutile, talc, and serpentine. Known from many counties, most importantly Baxter, Boone, Fulton, Garland, Hot Spring, Lawrence, Marion, Newton, Saline, Searcy, and Sharp Counties.

Ref.: 11, 19, 47, 85, 87, 126, 182.

Figure 35 – Dolomite, Lawrence County, 11.5 cm. (ALK)

DOLOMITE GROUP

Trigonal carbonates of general formula $AB(CO_3)_2$ where A = Ba, Ca; B = Fe^{2+}, Mg, Mn^{2+}, Zn. See *ankerite*, *dolomite*, *kutnohorite(?)*.

□ **DUFRENITE**

$Fe^{2+}Fe^{3+}_4(PO_4)_3(OH)_5 \cdot 2H_2O$. Monoclinic. Hardness: 3.5-4.5. Cleavage: 1 direction; [100] perfect. Sp. Gr. 3.1-3.4. Color: dark green to greenish black, rarely bright green. Luster: vitreous to silky, translucent to opaque. Streak: green. Habit: botryoidal crusts and masses with radial fibrous structure; crystals microscopic blocky with a tendency to form clumps or clusters.

A secondary phosphate found as fracture-fillings in novaculite; easily confused with rockbridgeite. Associated with rockbridgeite, laubmannite (discredited), beraunite, strengite, cacoxenite, and iron and manganese oxides. Known from Montgomery and Polk Counties.

Ref.: 37, 38, 39, 87, 123.

□ **DUTTONITE**

$V^{4+}O(OH)_2$. Monoclinic. Hardness: about 2.5. Cleavage: 1 direction; [100] distinct. Sp. Gr. 3.2. Color: green, colorless, black, pale brown. Luster: submetallic, translucent. Streak: no data. Habit: submicroscopic platy crystals or hair-like fibers; crusts.

A rare oxide of problematical origin occurring in vanadium ores. Associated with bokite and/or orthoclase. Known in Garland County.

Ref.: 48, 124.

DYSANALYTE A Nb-bearing variety of perovskite. See *perovskite*.

□ **EDENITE**

$NaCa_2(Mg,Fe^{2+})_5Si_7AlO_{22}(OH)_2$. Monoclinic. Hardness: 5-6. Cleavage: 2 directions; [110] perfect, [001} and [100] parting. Sp. Gr. 3.0-3.06. Color: dark green, brown to black. Luster: vitreous to silky, transparent to almost opaque. Streak: no data. Habit: embedded crystals to over 1 inch, seldom forms free-growing examples.

A scarce amphibole found in some abundance in syenite pegmatites where it is often rimmed with radial growths of aegirine-augite and/or acmite.

Ref.: 105.

□ **EDGARBAILEYITE**

$Hg_6^{+1}Si_2O_7$. Monoclinic. Hardness: 4. Cleavage: none. Sp. Gr. 9.4. Color: yellow to orangish. Luster: Vitreous to resinous; waxy; translucent to opaque. Streak: yellow green. Habit: smooth waxy masses between quartz crystals.

An extremely rare mercury silicate reported from one locality in Pike County. Associated with quartz crystals and mercury minerals. Known from Pike County.

Ref.: 180.

□ **EGGLETONITE**

$(Na,K,Ca)_2(Mn,Fe)_8(Si,Al)_{12}O_{29}(OH)_7 \cdot 11H_2O$. Monoclinic. Hardness: 3-4. Cleavage:1 direction; [001] perfect, easy. Sp. Gr. 2.76. Color: dark brown to golden brown. Luster: vitreous, translucent. Streak: light brown. Habit: acicular radiating groups of prismatic crystals up to 1/16 of an inch, twinned on [001].

A rare astrophyllite group silicate occurring in late pegmatitic pockets and miarolitic cavities in syenite. Associated with albite, biotite, amphibole, titanite, fluorapophyllite, natrolite, acmite, zircon, analcime, and magnetite. Known from Pulaski County.

Ref.: 70, 127.

Figure 36 – Eggletonite, Pulaski County, 0.6 mm fibers. (JMH)

EGGONITE See *kolbeckite*.

Figure 37 – Unidentified mineral on eggonite, Garland County, SEM. (DRO, CM, EJD)

Figure 38 – Eggonite, Hot Spring County, 0.7 x 1.1 mm. (JMH)

□ **EGLESTONITE**

$Hg^{1+}_6Cl_3O(OH)$ or $Hg^{1+}_4Cl_2O$. Cubic. Hardness: 2.5. Cleavage: none. Fracture: conchoidal to uneven, brittle. Sp. Gr. 8.327. Color: yellow, yellow-orange to brownish yellow. Luster: adamantine to resinous, translucent. Streak: yellowish, turning black with time. Habit: encrusting; crystals dodecahedral, octahedral, or cubic.

A rare secondary mineral formed in the zone of oxidation of mercury deposits by the alteration of primary mercury minerals. Associated with cinnabar, quartz, dickite, livingstonite, calomel, metacinnabar, native mercury, and goethite. Known from Clark, Howard, and Pike Counties.

Ref.: 6, 81.

□ **ELPIDITE**

$Na_2ZrSi_6O_{15} \cdot 3H_2O$. Orthorhombic. Hardness: 5. Cleavage: 2 directions; perfect prismatic. Sp. Gr. 2.524-2.615. Color: white. Luster: vitreous to dull, translucent to opaque. Streak: white. Habit: crystals prismatic, small.

A rare metasomatic silicate formed in miarolitic cavities in quartz-bearing syenite. Associated with quartz, orthoclase, lorenzenite, acmite, richterite, and arfvedsonite. Known from Hot Spring County.

Ref.: 48, 108, 125.

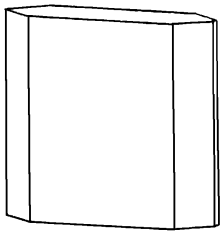
Figure 39 – Elpidite, Hot Spring County, 0.4 x 1.0 mm. (JMH)

□ **ENARGITE**

Cu_3AsS_4. Orthorhombic. Hardness: 3. Cleavage: 3 directions; [110] perfect, [100] [010] distinct. Sp. Gr. 4.45. Color: grayish black to iron-black. Luster: metallic, tarnishing dull; opaque. Streak: grayish black. Habit: single crystals $1/16^{th}$ inch across, striated lustrous plates.

A scarce, low-temperature, hydrothermal sulfide of lead-zinc-copper deposits in dolostone host rock. Associated with pink dolomite, chalcopyrite, and calcite. Known from Marion County.

Ref.: 46, 47, 124.



Enargite (ETM – 110.7)

□ **ENSTATITE** (and Ferroan Enstatite, Ferrosilite)

$(Mg,Fe^{2+})_2Si_2O_6$. Orthorhombic. Hardness: 5-6. Cleavage: 2 directions; [210] good, [100] [010] partings. Sp. Gr. 3.209-3.431. Color: colorless, yellowish or greenish white, gray, olive-green. Luster: vitreous to pearly, transparent to nearly opaque. Streak: uncolored to grayish. Habit: distinct crystals rare; massive, lamellar, or fibrous; embedded grains.

A common pyroxene associated with ultrabasic igneous rock; component of chondritic meteorites. Associated with olivine, phlogopite, serpentine, diopside, magnetite, chromite, and calcite. Known from Pike and Prairie Counties.

Ref.: 3.

□ **EPIDOTE**

$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$. Monoclinic. Hardness: 6-7. Cleavage: 2 directions; [001] perfect. Sp. Gr. 3.35-3.5. Color: yellowish green to green to brownish green. Luster: vitreous to pearly, transparent to nearly opaque. Streak: uncolored or grayish. Habit: massive, coarse to fine granular, fibrous, or parallel; crystals microscopic short prismatic with the tendency to form clusters and twins.

A silicate that is the product of retrograde metamorphism; occurs in miarolitic cavities in syenite; in metagabbro; in lamprophyre dikes; in lamproite. In syenite, associated with orthoclase, albite, titanite, biotite, and fluorapatite. In lamprophyre dikes, as a replacement mineral and perhaps as vescicle filling where it is associated with biotite, garnet, orthoclase, plagioclase, calcite, aegirine, chlorite, fluorapatite, titanite, and cancrinite. In lamproite, associated with olivine, phlogopite, pyrope, magnetite, chlorite, diopside, and tremolite. Known from Hot Spring, Pike, and Pulaski Counties.

Ref.: 19, 48, 60, 107, 127, 184.

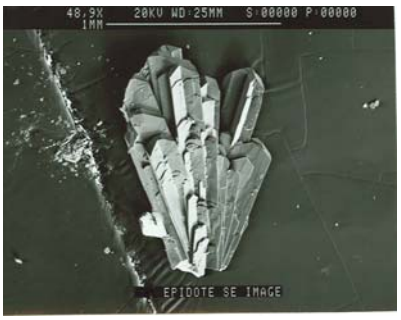


Figure 40 – Epidote, Pulaski County, SEM. (HLB)

EPIDOTE GROUP

Silicates of general formula $A_2B_3(SiO_4)_3(OH)$ or $A_2B_3Si_3O_{11}(OH,F)_2$ where A = Ca, Ce, Pb, Sr, Y; B = Al, Fe^{3+}, Mg, Mn^{3+}, V^{3+}. See *allanite*, *epidote*.

□ **EPSOMITE**

$MgSO_4 \cdot 7H_2O$. Orthorhombic. Hardness: 2-2.5. Cleavage: 2 directions; [010] perfect, [101] distinct. Sp. Gr. 1.677. Color: white, pinkish, greenish. Luster: silky to earthy, translucent. Streak: white. Habit: fibrous to acicular crusts, efflorescences.

A secondary water-soluble sulfate formed by the weathering of sulfide minerals and the evaporation of these fluids. Present on mine walls and in sheltered places on dolostone and black shale outcrops. Associated with sphalerite, quartz, calcite, dolomite, and smithsonite. Probably more common than presently recognized. Known from Marion and Searcy Counties.

Ref.: 47.

ETTRINGITE GROUP

Hexagonal sulfates of general formula $Ca_6X_2Y(O,OH)_{12} \cdot 24\text{-}26H_2O$ where X = Al, Cr^{3+}, Fe^{3+}, Mn^{2+}, Mn^{4+}, Si; Y = (SO_4,CO_3) or $(SO_4)B(OH)_4$. See *thaumasite*.

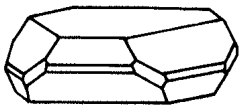
EUCOLITE See *eudialyte*.

□ **EUDIALYTE** (Eucolite)

$Na_{15}Ca_6(Fe^{2+},Mn^{2+})_3Zr_3(Si,Nb)(Si_{25}O_{13})(O,OH,H_2O)_3(Cl,OH)_2$. Trigonal. Hardness: 5-5.5. Cleavage: [0001] indistinct. Sp. Gr. 2.74-2.98. Color: ruby red, pink to brown. Luster: vitreous to pearly, transparent to translucent. Streak: colorless. Habit: crystals tabular, complex; broken grains in host rock.

A primary accessory mineral in acmite nepheline syenite pegmatite; in miarolitic cavities in syenite. Associated with orthoclase, nepheline, acmite, titanite, fluorapatite, thomsonite, and natrolite. Known from Hot Spring and Pulaski Counties.

Ref.: 11, 33, 48, 93, 94, 127.



Eudialyte (JFW – 243.15)

□ **EVANSITE (?)**

$Al_3(PO_4)(OH)_6 \cdot 6H_2O$ (?). Amorphous. Hardness: 3-4. Cleavage: none. Fracture: conchoidal, very brittle. Sp. Gr. 1.8-2.2. Color: shades of green to bluish green. Luster: vitreous to resinous or waxy. Streak: no data. Habit: opal-like encrustations; fish roe like films.

An inadequately described species. Reported infilling fractures in orthoclase fenite in vanadium-bearing alteration zone adjacent to igneous rocks. Reported from Garland County.

Ref.: 48, 124.

FAYALITE The Fe end member of the olivine group. See *olivine*.

FELDSPAR GROUP

Silicates of general formula XZ_4O_8 where X = Ba, Ca, K, Na, NH4, Sr; Z = Al, B, Si. See *albite*, *adularia*, *andesine*, *anorthoclase*, *labradorite*, *microcline*, *orthoclase*, *sanidine*.

□ **FERGUSONITE-(Ce)**

$(Ce,La,Y)NbO_4$. Monoclinic. Hardness: 5.5-6.5. Cleavage: [111] traces. Sp. Gr. 5.38. Color: pinkish brown to orangish brown. Luster: dull to brilliant vitreous, metallic on fracture; opaque. Streak: pale brown. Habit: microscopic globules or spherical aggregates.

A rare niobate of alkalic pegmatites. Associated with orthoclase, acmite, biotite, nepheline, titanite, analcime, and natrolite. Known from Pulaski County.

Ref.: 105, 106, 127.

Figure 41 – Fergusonite (Ce), Pulaski County, SEM. (HLB)

□ **FERROHORNBLENDE** (Barkevikite, hornblende)

$Ca_2(Fe^{2+},Mg)_4Al(Si_7Al)O_{22}(OH,F)_2$ where Mg/(Mg+Fe+2) = 0.0-0.49. Monoclinic. Hardness: 5-6. Cleavage: 2 directions; [110] perfect, [001] [100] partings; brittle. Sp. Gr. 3.35-3.44. Color: brown. Luster: vitreous, translucent. Streak: white. Habit: prismatic crystals and crystal aggregates.

A rare primary amphibole of fourchite and monchiquite igneous dikes where it is associated with biotite, analcime(?), and titanaugite. Known from Hot Spring County.

Ref.: 11,19, 48, 124, 125.

□ **FERSMITE**

$(Ca,Ce,Na)(Nb,Ta,Ti)_2(O,OH,F)_6$. Orthorhombic. Hardness: 4-4.5. Cleavage: none. Fracture: uneven to subconchoidal. Sp. Gr. 4.69-4.79. Color: tan. Streak: grayish brown. Habit: pseudomorphic spheres after unknown mineral; by scanning electron microscope as euhedral prismatic crystals.

An extremely rare niobate in pegmatitic syenite. Associated with orthoclase. Known from Pulaski County.

Ref.: 105, 127.

□ **FERVANITE** (Inadequately described species)

$(Fe^{3+})_4(VO_4)_4 \cdot 5H_2O$. Monoclinic. Hardness: no data. Cleavage: none apparent. Sp. Gr. no data. Color: dark brown to black, golden brown. Luster: brilliant. Streak: no data. Habit: small, stubby, prismatic crystals; may coalesce to form crusts.

A rare secondary mineral occurring as crystalline crusts in nodular masses in the zone of oxidation of vanadium deposits; associated with cacoxenite. Known from Garland County.

Ref.: 48, 124.

Figure 42 – Fervanite, Garland County, SEM. (DRO, CM, EJD)

FLINT A variety of cryptocrystalline quartz. See *quartz*0

□ **FLORENCITE-(Ce)**

$CeAl_3(PO_4)_2(OH)_6$. Trigonal. Hardness: 5-6. Cleavage: 1 direction [0001] good, [1120] traces. Sp. Gr. 3.457-3.71. Color: white to colorless. Luster: subvitreous. Streak: white. Habit: microscopic.

A rare secondary phosphate occurring in pegmatitic veins and dikes in syenite. Associated with acmite and orthoclase. Known from Pulaski County.

Ref.: 105, 127.

□ FLUORAPATITE

$Ca_5(PO_4)_3F$. Hexagonal. Hardness: 5. Cleavage: 3 directions, prismatic, [1010];[0001] indistinct. Sp. Gr. 3.1-3.2. Color: colorless, yellow, pale violet, pink, white. Luster: vitreous to subresinous, transparent to translucent. Streak: white. Habit: crystals prismatic to tabular; compact to coarse granular; round to ovoid pellets.

A primary accessory phosphate in igneous rock; as organically-derived pellets in Paleozoic sediments in north Arkansas; in veins and miarolitic cavities in syenite; in alteration zones adjacent to syenite intrusions; rarely, in hydrothermal sulfide-bearing quartz veins. In igneous rock, associated with orthoclase, biotite, nepheline, titanite, melanite, acmite, pyrite, ankerite, and albite. In quartz veins, associated with chlorite, pyrite, sphalerite, galena, rutile, rectorite, cookeite, and ankerite; in wollastonite-miserite contact zone adjacent to syenite intrusion. Known from Garland, Hot Spring, Independence, Izard, Montgomery, Perry, Pike, Pulaski, Saline, Searcy, Stone, and Van Buren Counties.

Ref.: 1, 8, 11, 19, 33, 48, 58, 124, 125, 127, 179.

Figure 43 – Fluorapatite, Pulaski County, SEM. (HLB)

□ FLUORAPOPHYLLITE

$KCa_4Si_8O_{20}(F,OH) \cdot 8H_2O$. Tetragonal. Hardness: 4.5-5. Cleavage:1 direction; [001] perfect, [110] imperfect. Sp. Gr. 2.3-2.4. Color: colorless to white, pale pink. Luster: vitreous to pearly, transparent to translucent. Streak: white. Habit: crystals are pseudocubic, modified by [111]; also tabular; massive. See pictures under Apophyllite listing.

A late fluid phase primary silicate of miarolitic cavities in syenite. Also, a late mineral associated with contact metamorphic effects adjacent to syenite intrusions. Associated with analcime, albite, orthoclase, biotite, titanite, acmite, wollastonite. Known from Garland, Hot Spring, and Pulaski Counties.

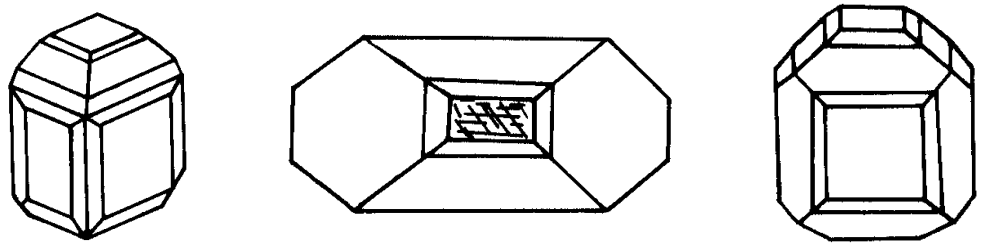
Ref.: 11, 29, 33, 48, 124, 125, 127.

□ **FLUORITE** ⊕

CaF_2. Cubic. Hardness: 4. Cleavage: 4 directions, [111] perfect, octahedral. Sp. Gr. 3.18. Color: purple, blue, colorless, green. Luster: vitreous on cleavage, transparent to translucent. Streak: colorless. Habit: anhedral grains; rarely modified cubic or octahedral crystals to ½ inch.

A widespread fluoride occurring as a late primary mineral in nepheline syenite, in miarolitic cavities in syenite, as chalcedony-fluorite veins, and as calcite vein fracture-fillings in dolostone. Associated with pyrite, sodalite (hackmanite), orthoclase, wollastonite, nepheline, dolomite, albite, titanite, acmite, analcime, rutile, calcite, ankerite, galena, sphalerite, and chalcedony. Known from Garland, Hot Spring, Independence, Pike, Pulaski, Saline, and Searcy Counties.

Ref.: 3, 11, 33, 48, 54, 57, 85, 98, 124, 125, 127.



Fluorite, Pulaski County. (JMH)

FORSTERITE The Mg end member of the olivine group. See *olivine*.

□ **FREIBERGITE**

$(Ag,Cu,Fe)_{12}(Sb,As)_4S_{13}$. Cubic. Hardness: 3-4. Cleavage: none. Sp. Gr. 4.85-5.0. Color: steel-gray. Luster: metallic, opaque. Streak: reddish. Habit: compact, granular.

A difficult-to-recognize primary hydrothermal sulfide of quartz veins. Associated with galena, sphalerite, and stibnite. Most modern identifications are from polished sections. Known from Montgomery and Pulaski Counties.

Ref.: 8, 41, 43.

□ **FÜLÖPPITE**

$Pb_3Sb_8S_{15}$. Monoclinic. Hardness: 2.5. Cleavage: none. Sp. Gr. 5.22-5.23. Color: lead-gray, tarnishing bronze or steel-blue. Luster: metallic, opaque. Streak: reddish gray. Habit: compact feathery masses.

A primary sulfide of lead-zinc-antimony-bearing hydrothermal quartz veins. Impossible to identify in hand specimen since it forms with other "feather" ores: jamesonite, zinkenite, bournonite, meneghinite(?), semseyite, and stibnite. Known from Sevier County.

Ref.: 31, 48.

□ **GAIDONNAYITE**

$Na_2ZrSi_3O_9 \cdot 2H_2O$. Orthorhombic. Hardness: 5. Cleavage: none. Sp. Gr. 2.67. Color: orange to yellow. Luster: vitreous, transparent to translucent. Streak: no data. Habit: microscopic spherical aggregates to 1/16ths inch diameter.

A very rare silicate in pegmatitic veins and pockets in syenite. Associated with acmite and orthoclase. Known from Pulaski County.

Ref.: 105, 127.

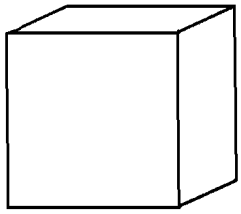
Figure 44 – Gaidonnayite, Pulaski County, SEM. (MPY, HLB, HLB)

□ **GALENA** ⊕

PbS. Cubic. Hardness: 2.5. Cleavage: 3 directions at 90°; [001] perfect, easy. Sp. Gr. 7.58. Color: lead-gray. Luster: of cleavage – metallic, opaque. Streak: lead-gray. Habit: crystals, cubic or octahedral; anhedral fracture-filling grains.

A widespread primary hydrothermal sulfide. Occurs in north Arkansas in lead-zinc deposits in limestone-dolostone host rock with calcite, sphalerite, quartz, and dolomite. In the Ouachita Mountains, occurs in sulfide-bearing quartz veins associated with sphalerite, pyrite, stibnite, calcite, chalcopyrite, tennantite, tetrahedrite, and cinnabar. Rarely, in coalified logs in Cretaceous sediments and syenite pegmatite. Known from Benton, Boone, Carroll, Clark, Garland, Hot Spring, Howard, Independence, Lawrence, Marion, Montgomery, Newton, Pike, Polk, Pulaski, Saline, Sevier, Sharp, and Washington Counties.

Ref.: 5, 6, 8, 10, 29, 31, 41, 46, 47, 53, 54, 72, 85, 87, 105, 127.



Galena (TM – 70.110)

□ **GANOPHYLLITE**

$(K,Na)_2(Mn,Al,Mg)_8(Si,Al)_{12}O_{29}(OH)_7 \cdot 8\text{-}9H_2O$. Monoclinic. Hardness: 4-4.5. Cleavage: I direction, perfect, easy; brittle. Sp. Gr. 2.84-2.878. Color: orange to tan. Luster: vitreous, translucent. Streak: no data. Habit: rosettes of microscopic pseudohexagonal prisms.

In cavities in thin veins in pulaskite; often with acmite, orthoclase, and britholite-(Ce).

Ref.: 130.

GARNET GROUP

Cubic silicates with the general chemical formula: $A_3B_2(SiO_4)$ where A = Ca, Fe^{+2}, Mg, Mn^{2+}; B = Al, Cr^{3+}, Fe^{3+}, Mn^{3+}, Si, Ti, V^{3+}, Zr; Si partly replaced by Al, Fe^{3+}.

A sometimes locally abundant silicate in igneous rocks in Arkansas, either as a primary mineral or due to late stage hydrothermal activity. See *andradite*, *grossular (?)*, *kimzeyite*, *melanite*, *pyrope, schorlomite*.

□ **GIBBSITE** ⊕

$Al(OH)_3$. Monoclinic. Hardness: 2.5-3.5. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.40. Color: white, light brown. Luster: vitreous to pearly, translucent. Streak: no data. Habit: microscopic crystals; principally massive cryptocrystalline.

The principal constituent of bauxite; formed by the lateritic weathering of aluminum-bearing minerals in syenite and nepheline syenite. Associated with bohmite, kaolinite, siderite, and hematite. Known from Pulaski and Saline Counties.

Ref.: 21.

□ **GLAUCONITE** ⊕

$(K,Na)(Fe^{3+},Al,Mg)_2(Si,Al)_4O_{10}(OH)_2$. Monoclinic. Hardness: 2. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.4-2.95. Color: olive-green to dark green. Luster: dull, translucent to nearly opaque. Streak: no data. Habit: small rounded grains composed of platy aggregates.

A widespread sheet silicate (mica) formed in rocks of near-shore marine origin (greensands). Associated with quartz sand. Principally known from Clark, Hempstead, Howard, and Sevier Counties.

Ref.: 87.

□ **GOETHITE** ⊕

α-$Fe^{3+}O(OH)$. Orthorhombic. Hardness: 5-5.5. Cleavage: 1 direction; [010] perfect, [100] indistinct. Sp. Gr. 3.3-4.3. Color: crystals – brownish black; massive – reddish to yellowish brown; earthy – brownish yellow to ocher-yellow. Luster: adamantine to metallic to dull, opaque. Streak: variable, shades of orange to brownish yellow. Habit: crystals, microscopic prismatic, often as inclusions in quartz crystals; colloform, massive, compact, concretionary, pisolitic, oolitic, earthy, films.

A widespread secondary mineral formed under oxidizing conditions: secondary after iron-bearing minerals (e.g. pseudomorphs after pyrite); in "bog" manganese and iron deposits; films in fractured rock formations; primary hydrothermal crystals in quartz-calcite veins in altered pyroxenite; as pseudomorphs after cacoxenite. Associated with pyrite, limonite, hematite, quartz, phosphate minerals, manganese minerals. Widespread, but notable deposits in Garland, Hot Spring, Lafayette, Montgomery, Nevada, Pike, Polk, Pulaski, and Saline Counties.

Ref.: 8, 29, 48, 86, 87, 124.

□ **GONNARDITE**

$Na_2CaAl_4Si_6O_{20} \cdot 7H_2O$. Orthorhombic, pseudo-tetragonal. Hardness: 4.5-5. Cleavage: no data. Sp. Gr. 2.26. Color: white. Luster: silky, translucent. Habit: microscopic radial fibrous sprays and bundles; alteration replacement of nepheline in some syenitic rocks.

A rare zeolite in cavities in jacupirangite. Associated with pyroxene. Known from Hot Spring County.

Ref.: 29, 48, 108, 122, 148.

Figure 45 – Gonnardite, Hot Spring County, 0.05 x 1.3 mm. (MPY, JMH, JMH)

□ **GORCEIXITE**

$BaAl_3(PO_4)(PO_3OH)(OH)_6$. Monoclinic, pseudo-trigonal. Hardness: 6. Cleavage: none. Sp. Gr. 3.323. Color: whitish to brownish. Luster: vitreous to dull, translucent. Streak: no data. Fracture: porcelaneous. Habit: radial fibrous aggregates, often confused with light colored wavellite or crandallite.

A scarce hydrothermal phosphate occurring in fractured novaculite, associated with goethite. Known from Garland County.

Ref.: 39, 97.

□ **GOYAZITE (?)**

$SrAl_3(PO_4)_2(OH)_5 \cdot H_2O$. Trigonal. Hardness: 4.5-5. Cleavage: 1 direction; (0001) perfect. Sp. Gr. 3.22. Color: white. Luster: resinous to greasy, pearly on base. Streak: no data. Habit: coatings.

In late-formed veins in weathered syenite. Associated with, and as an alteration product of, fluorapatite. Known from Pulaski County.

Ref.: 123.

□ **GRAPHITE** (variety cliftonite)

C. Hexagonal. Hardness: no data. Cleavage: no data. Sp. Gr. 2.26. Color: black. Luster: no data. Streak: black. Habit: microscopic grains.

Cubic pseudomorphs of graphite found in some meteorites. Noted in an iron meteorite from Hope, Hempstead County, as microscopic grains (polished section) in kamacite.

Ref.: 114.

□ **GREENOCKITE**

CdS. Hexagonal. Hardness: 3-3.5. Cleavage: 3 directions; [1122] distinct, [0001] imperfect. Sp. Gr. 4.77. Color: bright yellow. Luster: adamantine to resinous, translucent. Streak: orange-yellow to brick-red. Habit: powdery coatings; rarely as crystalline crusts.

A scarce secondary sulfide of zinc deposits. Associated with smithsonite, dolomite, and quartz. Known from Marion County.

Ref.: 9, 48, 126.

□ **GROSSULAR(?)**

$Ca_3Al_2(SiO_4)_3$. Cubic. Hardness: 6.5-7. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 3.4-3.6. Color: white, gray, green, pink. Luster: vitreous to resinous, translucent. Streak: white. Habit: crystals usually dodecahedral or trapezohedral; massive, compact.

A garnet of contact metamorphic zones. Grossular forms a solid solution series with andradite; therefore, a certain percentage of the andradite reported in Arkansas contain grossular chemistry. Although several locations have yielded green garnets, all have proven to be andradite. Therefore, no true grossular as a species has yet been identified.

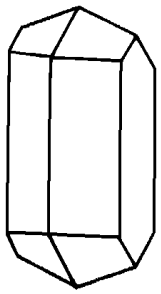
Ref.: 8.

□ **GYPSUM** ⊕

$CaSO_4 \cdot 2H_2O$. Monoclinic. Hardness: 2. Cleavage: 1 direction; [010] perfect, easy; [100] [011] distinct. Sp. Gr. 2.32. Color: crystals – colorless (selenite); massive – white, gray, pinkish (alabaster); satin spar – white. Luster: subvitreous to pearly, silky; transparent to translucent. Streak: white. Habit: crystals – thin to thick tabular, prismatic; planar radial clusters; massive – fine to coarse granular; fibrous; twinning common on [100] (fishtail or swallowtail twins).

A common sulfate formed under diverse geologic conditions and distributed throughout much of Arkansas: as sedimentary bedded deposits; in the oxidized zone of sulfide-bearing ore bodies; as an efflorescence in and on certain soils; and as a scarce late mineral in miarolitic cavities in syenite. Associated with calcite, celestine, marcasite, pyrite, quartz, sphalerite, fluorite, albite, orthoclase, smithsonite, malachite, and various clay minerals. Known from Cross, Garland, Howard, Hot Spring, Independence, Marion, Pike, Pulaski, Saline, Searcy, and Washington Counties.

Ref.: 29, 33, 46, 54, 59, 76, 85, 87, 125, 126, 127.



Gypsum (SM II – 483.0)

HACKMANITE A sulfur-bearing variety of sodalite. See *sodalite*.

□ **HAGGERTYITE**

$Ba(Fe6Ti5Mg)O_{19}$. Hexagonal. Hardness: no data. Cleavage: no data. Sp. Gr. 2.30 calculated. Color: black. Luster: non-metallic, opaque. Streak: no data. Habit: microscopic hexagonal plates seen in thin sections.

A very rarely identified barium magnetoplumbite-type titanate. Present in alteration zones around xenoliths in lamproite. Associated with jeppeite, diopside, olivine, phlogopite, Ti-K-richerite, chrome spinel, ilmenite, and priderite. Known from Pike County.

Ref.: 137.

□ **HALITE**

NaCl. Cubic. Hardness: 2.5. Cleavage: 3 directions at 90°; [001] perfect, brittle. Sp. Gr.: 2.16. Color: colorless, white, gray. Luster: vitreous to greasy, transparent to translucent. Streak: white. Habit: massive bedded in subsurface; cubic crystals; most commonly present in shakers on dining tables.

Halite is highly soluble and not present at the surface in Arkansas. Thick bedded deposits are known in the subsurface in southern parts of the state, including all of Lafayette, Columbia, and Union Counties, and underlying portions of Miller, Hempstead, Nevada, Ouachita, Calhoun, Bradley, and Ashley Counties. Salt brines are present in some shallow wells and springs in other counties of the state, particularly the Gulf Coast region.

Ref.: 87.

□ **HALLOYSITE**

$Al_2Si_2O_5(OH)_4$. Monoclinic. Hardness: 2-2.5. Cleavage: none. Sp. Gr. no data. Color: colorless, white, tinted by impurities. Luster: dull earthy, translucent. Streak: white. Habit: compact, massive.

A secondary weathering product or hydrothermal alteration product of feldspar or aluminous wall rock adjacent to sulfide ore bodies; in bauxite, as a lateritic weathering product of syenite; in hydrothermal quartz mineralization as a reddish-orange clay tinted by iron oxide; as an alteration zone mineral developed in shale. Associated with kaolinite, alunite, quartz, rutile, gibbsite, and bohmite. Known from Garland, Hot Spring, Montgomery, Newton, Pulaski, and Saline Counties.

Ref.: 5, 19, 21, 48.

□ **HALOTRICHITE**

$Fe^{2+}Al_2(SO_4)_4 \cdot 22H_2O$. Monoclinic. Hardness: 1.5. Cleavage: [010] poor. Sp. Gr. 1.89-1.95. Color: colorless, white, yellowish, greenish. Luster: non-metallic, transparent to translucent. Streak: white, pale yellow, pale green. Habit: crystals acicular, rarely terminated; aggregates of fibers or acicular crsystals; as an encrustation or effluorescence; powdery.

A water-bearing iron sulfate which is commonly present as a white powdery coating where pyrite or marcasite are weathering. Probably a common mineral in Arkansas, but only presently reported from White County where it formed as encrustations on pyritic shale.

Ref.: 123.

HALOTRICHITE GROUP

Monoclinic sulfates of general formula $AB_2(SO_4)_4 \cdot 22H_2O$ where A = Fe^{2+}, Mg, Mn^{2+}, Ni, Zn; B = Al, Cr^{3+}, Fe^{3+}. See *halotrichite, pickeringite*.

□ **HAUSMANNITE**

$Mn^{+2}Mn^{3+}{}_2O_4$. Tetragonal. Hardness: 5.5. Cleavage: 1 direction; [001] nearly perfect, [112] [011] indistinct. Sp. Gr. 4.84. Color: brownish black. Luster: submetallic, opaque. Streak: brown. Habit: coherent granular masses; small crystals pseudo-octahedral.

A primary hydrothermal oxide associated with psilomelane, braunite, manganite, pyrolusite, and barite. Known from Independence, Izard, and Stone Counties.

Ref.: 7, 53, 54, 56.

□ **HAWLEYITE**

CdS. Cubic. Hardness: no data. Cleavage: no data. Sp. Gr. 4.87. Color: bright yellow. Streak: same as color. Habit: yellow earthy powder.

A scarce sulfide, dimorphous with greenockite. Associated with smithsonite, often incorporated along with greenockite by the carbonate yielding an overall yellow color. Only recently reported, probably also present intergrown with greenockite in powdery coatings on quartz in zinc mines.

Ref.: 134.

□ **HEDENBERGITE**

$CaFe^{2+}Si_2O_6$. Monoclinic. Hardness: 6. Cleavage: [110] good, [010] parting. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.5-3.56. Color: pale tan. Luster: vitreous to resinous or dull, translucent. Streak: white or grayish. Habit: microcrystals.

This member of the Pyroxene group has been identified from an occurrence in a quartz vein in the contact zone between the Magnet Cove intrusion and the Stanley Shale. It is associated with milky quartz. Known from Hot Spring County.

Ref.: 178.

□ **HELVITE**

$Mn^{2+}{}_4Be_3(SiO_4)_3S$. Cubic. Hardness: 6. Cleavage: 4 directions; [111] distinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.17-3.37. Color: yellow. Luster: vitreous to resinous, transparent to opaque. Streak: no data. Habit: microscopic octahedrons.

A scarce silicate occurring in pegmatite zones in syenite, rarely in gas cavities. Associated with orthoclase and acmite. Known from Pulaski County.

Ref.: 105, 119.

□ **HEMATITE** ⊕

α-Fe_2O_3. Trigonal. Hardness: 5-6. Cleavage: none. Sp. Gr. 5.26. Color: crystals – steel-gray to iron-black; massive – brownish red to bright red. Luster: metallic, submetallic, dull; opaque except in thin flakes. Streak: deep red or brownish red. Habit: usually massive, compact, earthy, columnar, concretionary, reniform, or botryoidal; also micaceous to platy, granular; crystals occur as plates or rosettes (iron roses).

An oxide which is widespread as a secondary weathering product of iron-bearing minerals; a primary accessory mineral in igneous rock; in vein deposits, often as a gossan; in contact metamorphic deposits. Associated with quartz, goethite, limonite, pyrite, barite, siderite, calcite, galena, gibbsite, bohmite, psilomelane, malachite, rutile, orthoclase, acmite, serpentine, and linarite. Known from many counties, but most notably in Franklin, Garland, Hot Spring, Independence, Montgomery, Pike, Pulaski, Saline, and Scott.

Ref.: 7, 8, 11, 21, 41, 54, 60, 69, 87, 94.

Figure 46 – Hematite, Hot Spring County, 6.5 mm diameter. (WLP, WLP, JMH)

Hematite (DSM – 215.4)

HEMATITE GROUP

Trigonal oxides of general formula R_2O_3 where R = Al, Cr^{3+}, Fe^{3+}, V^{3+}. See *corundum*, *hematite*.

□ **HEMIMORPHITE**

$Zn_4Si_2O_7(OH)_2 \cdot H_2O$. Orthorhombic. Hardness: 4.5-5. Cleavage: 2 directions; [110] perfect, [101] imperfect. Sp. Gr. 3.4-3.5. Color: colorless, white, gray, yellowish. Luster: vitreous, transparent to translucent. Streak: uncolored. Habit: crystals thin tabular, vertically striated, encrusting.

An uncommon secondary silicate in oxidized portions of lead-zinc deposits. Associated with quartz, sphalerite, smithsonite, dolomite, calcite, chalcopyrite, pyrite, malachite, azurite, galena, limonite, cerussite, aurichalcite, and pyromorphite. Known from Boone, Marion, Newton, and Searcy Counties.

Ref.: 47, 126.

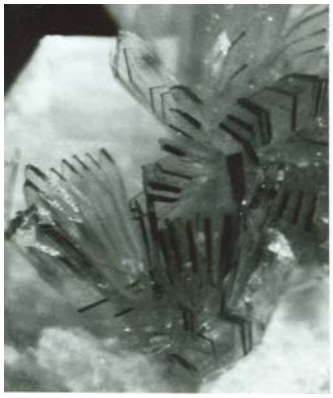


Figure 47 – Hemimorphite, Marion County, 0.5 x 1.5 mm. (AES)

□ **HERCYNITE**

$Fe^{2+}Al_2O_4$. Cubic. Hardness: 7.5-8. Cleavage: none. Fracture: uneven to conchoidal. Sp. Gr. 4.32. Color: black. Luster: dull to bright, metallic, opaque. Streak: dark green. Habit: granular; oriented growths on the surface of magnetite crystals.

A rare oxide in carbonatite, as exsolved lamellae in magnetite or as oriented growths on the surface of magnetite crystals. Associated with magnetite, magnesioferrite(?), carbonate-fluorapatite, perovskite, and calcite. Known from Hot Spring County.

Ref.: 105, 145.

Figure 48 – Hercynite with Perovskite, Hot Spring County, SEM. (HLB)

□ **HEULANDITE**

$(Na,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}O_{36} \cdot 12H_2O$. Monoclinic. Hardness: 3.5-4. Cleavage: 1 direction; [010] perfect. Sp. Gr. 2.1-2.2. Color: colorless, brown. Luster: vitreous, transparent. Streak: colorless. Habit: microscopic equant blocky or rhombic crystals.

A rare zeolite occurring as microscopic crystals in clay-filled fractures in novaculite or shale adjacent to igneous intrusions; as vug wall coatings in phonolite; in miarolitic cavities in syenite. Associated with an unidentified greenish clay, ankerite, acmite, analcime, and pyrite. Indistinguishable from clinoptilolite without a chemical analysis for alkali metals. Known from Hot Spring, Howard, and Pulaski Counties.

Ref.: 36, 99, 105, 127.

Figure 49 - Heulandite, Hot Spring County, 0.6 x 0.6 mm. (MPY, JMH, JMH)

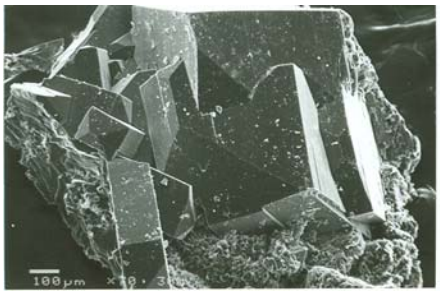


Figure 50 – Heulandite, Hot Spring County, SEM. (MPY, ALK, MS)

□ **HEWETTITE** (inadequately described species)

$CaV^{5+}{}_6O_{16} \cdot 9H_2O$. Orthorhombic. Hardness: no data. Cleavage: no data. Sp. Gr. 2.55-2.62. Color: deep red, bright red, iridescent. Luster: dull to silky. Streak: no data. Habit: acicular sheaves or bundles of fibers.

Bundles of iridescent red needles. Often associated with sincosite in vanadium ores adjacent to igneous rocks. Known from Garland County.

Ref.: 103, 124.

□ **HEXAHYDRITE**

$MgSO_4 \cdot 6H_2O$. Monoclinic. Hardness: no data. Cleavage: 1 direction, [100] perfect; conchoidal fracture. Sp. Gr. 1.745-1.757. Color: pale blue-green to white to colorless. Luster: vitreous to pearly, transparent to opaque. Streak: no data. Habit: effluorescent bloom.

This effluorescence forms as a “bloom” on serpentine rocks from the oxidation of pyrite, which produces sulfuric acid. The acid in turn dissolves magnesium carbonate present. Evaporation of these solutions produces the hexahydrite. X-ray analysis indicates that about 40 mole % of any given sample is nickelhexahydrite. Known from Saline County.

Ref.: 91, 92.

HEXAHYDRITE GROUP

Monoclinic sulfates of general formula $M^{2+}SO_4 \cdot 6H_2O$ where M^{2+} = Co, Fe, Mg, Mn, Ni, Zn. See *hexahydrite*, *nickelhexahydrite*.

HORNBLENDE See *ferrohornblende*.

HYALINE (Hyalite) A water-clear variety of opal. See *opal*.

HYDROTITANITE A discredited name. See *anatase*.

□ **HYDROXYLAPATITE**

$Ca_5(PO_4)_3(OH)$. Trigonal. Hardness: 5. Cleavage: [0001] indistinct, brittle. Fracture: uneven to conchoidal. Sp. Gr. 3.08. Color: white to cream. Luster: earthy to resinous. Streak: White. Habit: fine-grained vein-filling masses.

A scarce vein-forming phosphate in magmatic lamproite. Present as fine-grained claylike vein fillings in late fractures in magmatic lamproite and lamproite breccia tuff. Often mistaken for secondary clay minerals. Known from Pike County.

Ref.: 144.

□ **HYDROZINCITE**

$Zn_5(CO_3)_2(OH)_6$. Monoclinic. Hardness: 2-2.5. Cleavage: 1 direction; [100] perfect, very brittle. Sp. Gr. 3.5-3.8. Color: white, gray. Luster: dull to silky, opaque. Streak: no data. Habit: massive, compact to earthy, powdery as films or thin coatings.

A scarce secondary alteration product of zinc mineralization. Occurs in the oxidized zone of sulfide deposits. Sometimes interlayered with or as an alteration of smithsonite. Associated with sphalerite, quartz, malachite, azurite, smithsonite, and anglesite. Known from Marion and Sevier Counties. Often fluorescent blue.

Ref.: 29, 31, 47, 48, 126.

□ **HYPERSTHENE (?)**

$(Mg,Fe^{2+})_2Si_2O_6$. Orthorhombic. Hardness: 5-6. Cleavage: 2 directions; [210] good, [100] [010] partings. Sp. Gr. 3.42-3.84. Color: brownish green, grayish black, greenish black, brown. Luster: vitreous, pearly, silky; translucent to nearly opaque. Streak: grayish to brownish gray. Habit: massive.

A primary constituent of basic igneous rock. Identified by Comstock (1888), not found by numerous later workers. Reported from Hot Spring County.

Ref.: 8.

□ **ICE**

H_2O. Hexagonal. Hardness: 1.5. Cleavage: none. Sp. Gr. 0.9167. Color: colorless, white due to flaws or bubbles. Luster: vitreous, transparent. Streak: colorless. Habit: crystals very thin, flattened, six-rayed stellate, skeletal hexagonal forms (snow flakes); concretionary forms and agglomerates (hailstones); delicate forms; massive.

At times a common species that few people recognize as a mineral; coatings over bodies of water; crystalline atmospheric water as snow, hail, sleet; frost.

Ref.: 2, 9, 14, 29.

IDOCRASE See *vesuvianite*.

□ **ILLITE**

$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,H_2O]$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction, [001] perfect. Sp. Gr. 2.6-2.9. Color: white, various pastel shades. Luster: dull. Streak: not given. Habit: massive, extremely fine grained.

A constituent of certain vanadium ores; the dominant clay-like mica in shales and many other sediments; a hydrothermal mineral in ore deposits. Often associated with kaolin, quartz, and muscovite. Known as a clay mineral from practically every county in Arkansas. As a hydrothermal clay, known from Garland and Hot Spring Counties.

Ref.: 2, 11.

□ **ILMENITE** ⊕

$Fe^{2+}TiO_3$. Trigonal. Hardness: 5-6. Cleavage: none; [0001] [1011] partings. Sp. Gr. 4.68-4.76. Color: iron-black. Luster: metallic to dull, opaque. Streak: black. Habit: as residual sand grains; crystals, thin plates to thick tabular.

A primary accessory mineral in many igneous rock types; as resistant detrital grains in clastic and lateritic sediments. Associated with quartz (sand), magnetite, zircon, monazite, pyrite, titanite, rutile, chromite, diamond, phlogopite, pyrope. Known from Hot Spring, Howard, Pike, Pulaski, and Saline Counties.

Ref.: 3, 11, 21, 26, 48, 105, 127.

Figure 51 – Ilmenite, Pulaski County, SEM. (HLB)

ILMENITE GROUP

Trigonal oxides of general formula $M^{2+}TiO_3$ where M^{2+} = Fe, Mg, Mn, Zn. See *ilmenite*, *pyrophanite*.

□ **ILMENORUTILE**

$(Ti,Nb,Fe^{3+})_3O_6$. Tetragonal. Hardness: 6-6.5. Cleavage: [110] distinct, [100] imperfect, fracture conchoidal. Sp. Gr. 4.35-4.92. Color: black. Luster: adamantine, resinous; opaque except very thin flakes. Streak: dark greenish brown to greenish black. Habit: microscopic clusters of stubby crystals, acicular rosettes, and sparse microscopic single crystals.

A rarely identified titanium niobium oxide present in contact zone adjacent to Magnet Cove. Associated minerals: no data given. Known from Hot Spring County.

Ref.: 174.

□ **ILVAITE**

$CaFe^{2+}{}_2Fe_{3+}Si_2O_7O(OH)$. Orthorhombic/monoclinic. Hardness: 5.5-6. Cleavage: 2 directions; [001][010] distinct. Fracture: uneven, brittle. Sp. Gr. 3.8-4.1. Color: black to grayish black. Luster: glossy to submetallic, opaque. Streak: black with greenish or brownish tint. Habit: prismatic crystals embedded in syenite.

An intermediate alteration material formed during the weathering series: acmite → ilvaite → goethite. Identified in a sample during exploration of vanadium deposits. Known from Garland County.

Ref.: 124.

IOLITE See *cordierite*.

□ **IRON**

α-Fe. Cubic. Hardness: 4. Cleavage: 3 directions at 90°; [001]. Sp. Gr. 7.3-7.87. Color: steel-gray to iron-black. Luster: metallic, opaque. Streak: gray to black. Habit: small anhedral grains.

A very rare secondary constituent of soapstone bodies formed during the serpentinization of peridotite. Associated with soapstone, talc, pentlandite, pyrrhotite, pyrite, and hexahydrite. Known from Saline County, meteorites.

Ref.: 92.

□ **JAMESONITE**

$Pb_4FeSb_6S_{14}$. Monoclinic. Hardness: 2.5. Cleavage: 1 direction; [001] good. Sp. Gr. 5.63. Color: gray-black, iridescent blue. Luster: metallic, opaque. Streak: gray-black. Habit: crystals needle-like to fibrous; felt-like aggregates.

A primary hydrothermal mineral of low- to medium-temperature quartz veins. Associated with quartz, ankerite, siderite, stibnite, sphalerite, and chlorite. Known from Sevier County.

Ref.: 22, 24, 31, 48, 72, 87.

Figure 52 – Jamesonite, Sevier County, 0.1 x 5.0 mm. (AES)

□ **JAROSITE**

$K_2(Fe^{3+})_6(SO_4)_4(OH)_{12}$. Trigonal. Hardness: 2.5-3.5. Cleavage: 1 direction; [0001] distinct. Sp. Gr. 2.9-3.26. Color: pale yellow to yellowish brown to brown. Luster: vitreous to resinous, translucent. Streak: pale yellow. Habit: microscopic films and coatings filling voids in rock.

A rarely reported secondary alteration of iron-bearing minerals in sedimentary rock and hydrothermal veins associated with igneous rock. Probably more common than presently recognized. Associated with chalcedony, pyrite, fluorite, tainiolite, sphalerite, limonite, witherite, galena, brookite, and glauconite. Known from Cross and Garland Counties.

Ref.: 63, 85.

JASPER A red or brown variety of cryptocrystalline quartz. See *quartz*.

□ **JEPPEITE**

$(K,Ba)_2(Ti,Fe^{3+})_6O_{13}$. Monoclinic. Hardness: 5-6. Cleavage: [100] and [201] perfect. Brittle. Sp. Gr. 3.94-3.98. Color: black. Luster: submetallic. Streak: pale brown. Habit: intergrown microscopic grains.

A rare alkali titanium iron oxide that is associated with haggertyite in reaction zones around small mafic xenoliths in lamproite. Known from Pike County.

Ref.:137, 139, 140.

□ **JOAQUINITE - (Ce)**

$Ba_2NaCe_2Fe^{2+}(Ti,Nb)_2Si_8O_{26}(OH,F) \cdot H_2O$. Monoclinic. Hardness: 5.5. Cleavage: no data, brittle. Sp. Gr. 3.89. Color: orangish brown. Luster: vitreous, transparent to translucent. Streak: no data. Habit: microscopic crystals, thick tabular elongate; subparallel growths.

A rare silicate in a quartz-rich xenolith in pulaskite. Associated with potassium feldspar, pectolite, quartz, narsarsukite, and yellow titanite. Known from Pulaski County.

Ref.: 105, 127.

JOAQUINITE GROUP

Orthorhombic and monoclinic titanosilicates of general formula $A_6(Ti,Nb)_2Si_8(O,OH)_{26} \cdot H_2O$ where A = Ba, Ce, Fe^{2+}, Mn_{2+}, Na, Sr. See *joaquinite -(Ce)*.

□ **KAERSUTITE**

$NaCa_2(Mg,Fe^{2+})_4Ti(Si_6Al_2)O_{22}(OH)_2$ where Mg/(Mg+Fe+2) = 0.5-1.0. Monoclinic. Hardness: 5-6. Cleavage: 2 directions; [110] perfect, [001] [100] parting. Sp. Gr. 3.2-3.28. Color: dark brown to black. Luster: vitreous to resinous, translucent to nearly opaque. Streak: no data. Habit: anhedral embedded grains.

A rare amphibole in syenite, commonly rimmed with acmite. Associated with orthoclase, fluorapatite, and acmite. Known from Pulaski County.

Ref.: 109.

□ **KAINOSITE – (Y) (Cenosite)**

$Ca_2(Y,Ce)_2(SiO_4)_3(CO_3) \cdot H_2O$. Orthorhombic. Hardness: 5-6. Cleavage: 2 cleavages at 90o. Fracture: uneven, brittle. Sp. Gr. 3.34-3.61. Color: not given, usually colorless to yellowish brown. Luster: vitreous, transparent to translucent. Streak: no data. Habit: microscopic tufts formed on the tips of aegerine needles.

A rare mineral occurring in miarolitic cavities as microscopic tufts oriented on the tips of aegerine crystals. Associated with aegerine, astrophyllite, phlogopite, pectolite, pyrite and zeolites. Known from Pulaski County.

Ref.: 143.

□ **KAMACITE**

α-(Fe,Ni), alpha-nickel-iron. Cubic. Hardness: 4. Cleavage: no data. Sp. Gr. no data. Color: iron gray. Streak: gray. Habit: massive.

Meteoric iron containing nickel. Associated with carlsbergite. Known from several iron meteorites discovered in Arkansas. Magnetic.

Ref.: 113, 114.

Figure 53 – Kamacite in a section of Arkansas meteorite, Prairie County, 0.5 mm diameter white grains. (DN, JMH, JMH)

□ **KAOLINITE** ⊕

$Al_2Si_2O_5(OH)_4$. Triclinic. Hardness: 2-2.5. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.6-2.63. Color: colorless, white, tinted by impurities. Luster: pearly to dull earthy, transparent to translucent, opaque when massive. Streak: no data. Habit: usually massive, compact, friable, or mealy; crystal platelets to 3/32nds of an inch.

A common clay mineral formed principally by the weathering or hydrothermal alteration of feldspar or other aluminous silicate minerals; commonly in bedded deposits. Associated with montmorillonite, quartz, halloysite, illite, limonite, and dickite. Known from many counties in Arkansas, but principally from Clark, Dallas, Garland, Grant, Hot Spring, Montgomery, Perry, Pike, Polk, Pulaski, and Saline Counties.

Ref.: 10, 48, 95.

KAOLINITE – SERPENTINE GROUP

Silicates of general formula $M_{2-3}Z_2O_5(OH)_4 \cdot nH_2O$ where M = Al, Fe^{2+}, Fe^{3+}, Mg, Mn^{2+}, Ni, Zn; Z = Al, Fe^{3+}, Si. See *antigorite*, *dickite*, *halloysite*, *kaolinite*.

□ **KASSITE**

$CaTi_2O_4(OH)_2$. Orthorhombic. Hardness: 5. Cleavage: 3 directions at 90°; [010] perfect, [101] distinct. Sp. Gr. 3.42. Color: yellow. Luster: adamantine, translucent. Streak: no data. Habit: microscopic crystals and clusters.

An extremely rare metasomatic mineral in miarolitic cavities in quartz-bearing syenite. Associated with elpidite, lorenzenite, orthoclase, and quartz. Also, in xenolithic syenite associated with labuntsovite, barite, fluorapophyllite, and pectolite. Known from Hot Spring County.

Ref.: 48, 110, 118, 125.

□ **KAZAKSTANNITE**

$Fe_5^{3+}V_3^{4+}V_{12}^{5+}O_{39}(OH)_9 \cdot 9H_2O$. Monoclinic. Hardness: ~2.5. Cleavage: [001] perfect. Sp. Gr. 3.4-3.6. Color: black, dark brown. Luster: adamantine, dull in aggregates, translucent. Streak: black with slight brownish tint. Habit: encrusting aggregates of microscopic platey spheres.

An extremely rare hydrated iron vanadate present in vanadium deposits. Associated with fervanite, sincosite, and metatyuyamunite in fractures on altered novaculite. Known from Garland County.

Ref.: 150, 159.

□ **KIDWELLITE**

$Na(Fe^{3+},M)_{9+x}(OH)_{11}(H_2O)_3(PO_4)_6$, where M = Fe^{3+}, Cu^{2+} or other metal cation, and x ~0.3. Monoclinic. Hardness: 3. Cleavage: no data. Sp. Gr. 3.04-3.3. Color: pale green to greenish yellow, dark green. Luster: silky to dull, translucent to opaque. Streak: yellow. Habit: minute acicular crystals; radiating spherical masses; alteration coating iron phosphates; feathery to fibrous fracture fillings.

An uncommon secondary phosphate occurring as fracture-fillings in novaculite. Associated with beraunite, dufrenite, laubmannite (discredited), rockbridgeite, strengite, cacoxenite, lipscombite, turquoise, and goethite. Known from Montgomery and Polk Counties. Type locality.

Ref.: 38, 39, 64, 123, 155.

Figure 54 – Kidwellite, Polk County, 0.2 mm tufts. (JMH)

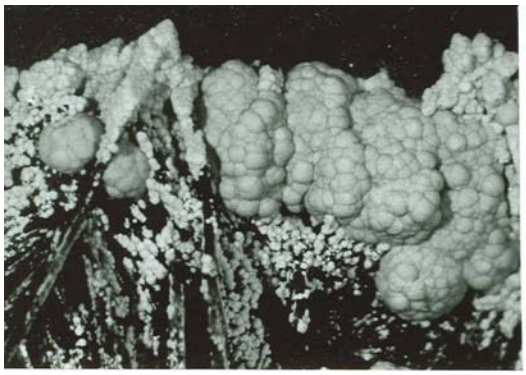


Figure 55 – Kidwellite on beraunite, Polk County, 1.5 mm diameter. (MPY, MPY, JMH)

Figure 56 – Kidwellite, Polk County, 3.2 x 4.5 x 6.3 cm. (MPY, DRH, DRH)

□ **KIMZEYITE**

$Ca_3(Zr,Ti)_2(Si,Al,Fe^{3+})_3O_{12}$. Cubic. Hardness: about 7. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 4.0. Color: dark brown. Luster: vitreous, translucent to opaque. Streak: light brown. Habit: crystals, dodecahedral modified by trapezohedral form; usually less than 1/16th inch.

A primary igneous garnet occurring in carbonatite. Associated with calcite, carbonate-fluorapatite, monticellite, magnetite, melanite, perovskite, hercynite, and anhydrite. Known from Hot Spring County. Original type locality.

Ref.: 11, 49, 52.

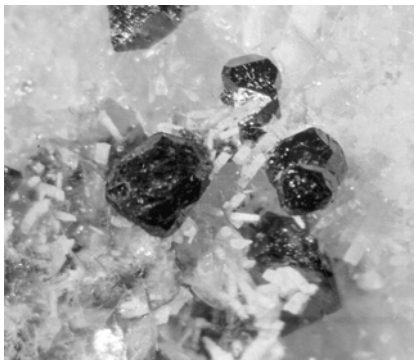
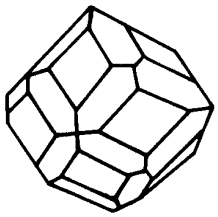


Figure 57 – Kimzeyite, Hot Spring County, 1.7 mm diameter. (JMH)



Kimzeyite, Hot Spring County, (JMH)

□ **KINGITE** (Vashegyite)

$Al_3(PO_4)_2(OH,F)_3 \cdot 9H_2O$. Triclinic. Hardness: 2-3. Cleavage: no data. Sp. Gr. 2.21-2.30. Color: colorless; whitish to bluish green. Luster: no data, translucent. Streak: white. Habit: fish-roe appearing aggregates.

A rare mineral coating fractured novaculite in vanadium ore bodies. Associated with opal and sanidine. Known from Garland County.

Ref.: 51, 124.

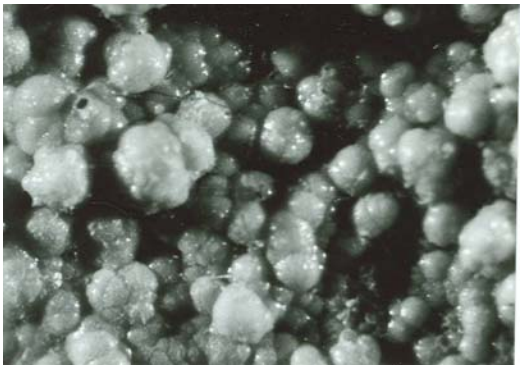


Figure 58 – Kingite, Garland County, 1.0 mm diameter. (DRO, JMH, JMH)

□ **KOLBECKITE** (Eggonite, Sterrettite)

$ScPO_4 \cdot 2H_2O$. Monoclinic. Hardness: 5. Cleavage: [110] fair; [100] [001] poor. Fracture: conchoidal, brittle. Sp. Gr. 2.39-2.44. Color: yellow to lime green. Luster: vitreous to pearly; transparent to translucent. Streak: no data. Habit: microscopic clusters of platy radiating crystals and as pseudo-rhombohedral crystals to 1/16th inch. See images under Eggonite.

A rare secondary phosphate formed in interstices and cavities of diopside-hedenbergite; in alteration zones in the Arkansas Novaculite adjacent to igneous intrusions. Associated with vanadium-bearing minerals, brookite, and quartz. Known from Garland and Hot Spring Counties.

Ref.: 25, 116, 124.

□ **KUPLETSKITE**

$(K,Na)_3(Mn,Fe^{2+})_7(Ti,Nb)_2Si_8O_{24}(O,OH)_7$. Triclinic. Hardness: about 3. Cleavage: 1 direction; [100] perfect. Sp. Gr. 3.201-3.229. Color: amber, brown to golden yellow. Luster: subvitreous, transparent to translucent. Streak: brown. Habit: microscopic prismatic layered sheets to ¾ inch in length, radiating crystal clusters, glassy single crystals.

A rare primary silicate of miarolitic cavities in nepheline syenite. Associated with albite, orthoclase, pyrophanite, and acmite. Known from Hot Spring and Pulaski Counties.

Ref.: 12, 48, 105, 125, 127, 176.

Figure 59 - Kupletskite, Pulaski County, 0.05 x 1.3 mm. (JMH)

Figure 60 – Kupletskite with acmite, Pulaski County, 0.1 x 2.0 mm. (JMH)

□ **KUTNOHORITE(?)**

$Ca(Mn^{2+},Mg,Fe^{2+})(CO_3)_2$. Trigonal. Hardness: 3.5-4. Cleavage: 3 directions; [1011], rhombohedral. Sp. Gr. 3.12. Color: white. Luster: no data, translucent. Streak: no data. Habit: anhedral intergrown grains.

A problematical carbonate reported by x-ray identification from an inclusion in peridotite (lamproite). Intergrown with calcite. Associated with quartz and native copper. Known from Pike County.

Ref.: 35.

□ **LABRADORITE**

Between $CaAl_2Si_2O_8$ - $NaAlSi_3O_8$; Ab50An50 to Ab30An70. Triclinic. Hardness: 6-6.5. Cleavage: [001] perfect, [010] nearly perfect, [110] imperfect. Sp. Gr. 2.69-2.72. Color: colorless, white, gray. Luster: vitreous, transparent to translucent. Streak: white. Habit: grains in thin sections.

A minor primary plagioclase feldspar in mafic igneous rock. Associated with andradite, titanite, cancrinite, titanaugite, aegirine-diopside, diopside-hedenbergite, salite, and augite. Known from Hot Spring, Pulaski, and Saline Counties.

Ref.: 8, 11.

□ **LABUNTSOVITE**

$(K,Ba,Na)(Ti,Nb)(Si,Al)_2(O,OH)_7 \cdot H_2O$. Monoclinic. Hardness: about 6. Cleavage: [102]. Sp. Gr. 2.90-2.96. Color: orange. Luster: vitreous, transparent. Streak: no data. Habit: microscopic crystals, pseudo-rhombohedral.

A rare, late fluid phase silicate of miarolitic cavities in syenite. Associated with albite, acmite, pectolite, and barite. Known from Hot Spring County.

Ref.: 48, 125.

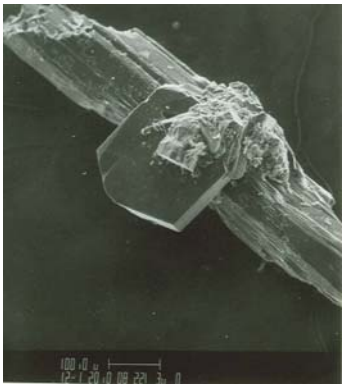


Figure 61 – Labuntsovite, Hot Spring County, SEM. (JMH, CM, EJD)

□ **LAMPROPHYLLITE**

$Na_2(Sr,Ba)_2Ti_3(SiO_4)_4(OH,F)$. Monoclinic. Hardness: 2-3. Cleavage: [100] perfect, micaceous; fracture uneven, brittle. Sp. Gr. 3.44-3.53. Color: yellow brown. Luster: vitreous to semi-metallic, translucent. Streak: no data. Habit: flattened elongate crystsals in pegmatite, easily mistaken for astrophyllite.

A sodic titanium silicate present as a rock-forming mineral in pegmatite. Associated with nepheline, orthoclase, and acmite. Known from Hot Spring County.

Ref.:172.

LAUBMANNITE*

$Fe^{2+}_3Fe^{3+}_6(PO_4)_4(OH)_{12}$. Orthorhombic. Hardness: 3.5-4. Cleavage: parallel to fibers. Sp. Gr. 3.33. Color: greenish brown to brown. Luster: vitreous to silky, subtranslucent to opaque. Streak: no data. Habit: botryoidal and mammillary aggregates with radial fibrous structure.

A primary phosphate filling fractures in novaculite. Associated with rockbridgeite, beraunite, strengite, cacoxenite, and kidwellite. Known from Montgomery and Polk Counties.

Ref.: 13, 37, 38, 39, 132.

*This species discredited by P. Dunn, 1990. Found to be a mixture of dufrenite, kidwellite, and beraunite. Reference 132.

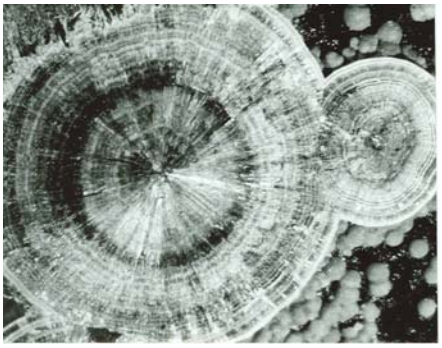


Figure 62 – Laubmannite, Polk County, 6.0 mm diameter. (MPY, MPY, JMH)

□ **LÅVENITE**

$(Na,Ca)_2(Mn^{2+},Fe^{2+})(Zr,Ti)Si_2O_7(O,OH,F)_2$. Monoclinic. Hardness: 6. Cleavage:1 direction; [100] perfect. Fracture: uneven, brittle. Sp. Gr. 3.51-3.547. Color: light yellow. Luster: dull, translucent. Streak: no data. Habit: microscopic prismatic acicular crystals and clusters of crystals; fibrous masses.

A very rare late-forming silicate of pegmatitic veins in syenite. Associated with acmite, orthoclase, eudialyte, catapleiite, rinkite, and sphalerite. Known from Pulaski County.

Ref.: 48, 105.

□ **LAWRENCITE**

$(Fe^{2+},Ni)Cl_2$. Trigonal. Hardness: no data, soft. Cleavage: 1 direction; [0001] perfect. Sp. Gr. 3.162. Color: green to brown. Luster: no data. Streak: no data. Habit: massive.

An extremely rare fracture-filling constituent of iron meteorites; extraterrestrial. Associated with native iron. Known from Jackson County.

Ref.: 67.

□ **LAZURITE**

$(Na,Ca)_{7-8}(Al,Si)_{12}(O,S)_{24}[(SO_4),Cl_2,(OH)_2]$. Cubic. Hardness:5-5.5. Cleavage: [110] imperfect. Fracture: uneven, brittle. Sp. Gr. 2.38-2.45. Color: deep blue. Luster: dull, translucent. Streak: bright blue. Habit: massive, granular.

A very rare constituent of xenoliths in pulaskite, a variety of nepheline syenite. Associated with pyrite. Known from Pulaski County.

Ref.: 29, 105, 127.

□ **LENOBLITE** (inadequately described species)

$V^{4+}{}_2O_4 \cdot 2H_2O$. Orthorhombic. Hardness: no data. Cleavage: no data. Sp. Gr. no data. Color: bluish violet. Luster: subvitreous, transparent to translucent. Streak: no data. Habit: a matte of extremely fine microscopic needles.

A poorly described, extremely rare vanadium mineral in a late-formed drusy quartz-lined vugs in carbonate-siliceous matrix rock. Associated with drusy quartz, siderite, and several yet-to-be identified species.

Ref.: 105, 122.

□ **LEPIDOCROCITE**

γ-$Fe^{3+}O(OH)$. Orthorhombic. Hardness: 5. Cleavage: 3 directions at 90^o; [010] perfect, [100] less perfect, [001] good; brittle. Sp. Gr. 3.854. Color: deep red to reddish brown. Luster: submetallic, transparent. Streak: dull orange. Habit: usually massive; bladed to micaceous; fibrous.

A rare secondary constituent of manganese deposits. Associated with bixbyite, rancieite, cryptomelane, hausmannite, pyrolusite, lithiophorite, braunite, and hematite. Known from Independence County.

Ref.: 7.

□ **LEPIDOLITE**

$K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$. Monoclinic. Hardness: 2.5-3. Cleavage: 1 direction; [001] perfect, [110] [010] imperfect. Sp. Gr. 2.8-3.3. Color: colorless to white. Luster: pearly, transparent to translucent. Streak: uncolored. Habit: fine scaly aggregates; micaceous, flexible.

A rare primary hydrothermal mica of quartz veins. Known from Pulaski County.

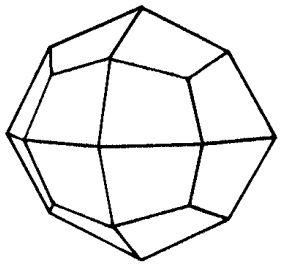
Ref.: 48.

□ **LEUCITE** (Pseudoleucite) ⊕

$KAlSi_2O_6$. Tetragonal, pseudo-cubic. Hardness: 5.5-6. Cleavage: [110] very imperfect. Sp. Gr. 2.47-2.50. Color: white to gray. Luster: dull, translucent to opaque. Streak: colorless. Habit: crystals trapezohedral; embedded masses.

An uncommon primary rock-forming silicate in certain varieties of syenite. Due to the instability of leucite at surface temperature and pressure, all leucite is actually intergrown alkali feldspar and nepheline. Associated with nepheline, orthoclase, and pyroxene. Known from Hot Spring County.

Ref.: 11, 94.



Leucite (TM – 75.131)

□ **LEUCOSPHENITE**

$BaNa_4Ti_2B_2Si_{10}O_{30}$. Monoclinic. Hardness: 6.5. Cleavage: [010] distinct, [001] fair; brittle. Sp. Gr. 3.05-3.09. Color: pale yellow. Luster: vitreous, transparent. Streak: no data. Habit: minute prismatic to equant crystals.

A scarce mineral in cavities formed in nepheline syenite adjacent to contact zones with the Stanley Formation. Associated with orthoclase. Known from Hot Spring County.

Ref.: 177.

LEUCOXENE A general term for fine grained alteration products of TiO_2 minerals. See *rutile*.

LIMONITE A general term for hydrous iron oxides, mostly goethite. See *goethite*.

□ **LINARITE**

$PbCu^{2+}(SO_4)(OH)_2$. Monoclinic. Hardness: 2.5. Cleavage: 1 direction; [100] perfect, [001] imperfect. Fracture: conchoidal, brittle. Sp. Gr. 5.30. Color: dark azure blue. Luster: vitreous to sub-adamantine, transparent to translucent. Streak: pale blue. Habit: crusts and aggregates of minute crystals.

A secondary sulfate of the oxidized zone of lead-zinc-copper deposits. Associated with quartz, galena, sphalerite, chalcopyrite, pyrophyllite, cerussite, anglesite, smithsonite, brochantite, and hematite. Known from Pulaski County.

Ref.: 41, 48.

LINNAEITE GROUP

Cubic sulfides of general formula $A^{2+}B^{3+}{}_2X_4$ where A^{2+} = Co, Cu, Fe, Ni, Zn; B^{3+} = Co, Cr, Fe, In; X = S, Se. See *violarite*.

□ **LIPSCOMBITE**

$(Fe^{2+},Mn)(Fe^{3+})_2(PO_4)_2(OH)_2$. Tetragonal. Hardness: no data. Cleavage: no data. Sp. Gr. 3.66. Color: blue-black. Luster: brilliant, opaque. Streak: no data. Habit: thin coatings or crusts.

A secondary phosphate coating on other iron phosphate minerals in fractured novaculite. Associated with laubmannite (discredited), dufrenite, and rockbridgeite. Known from Montgomery and Polk Counties.

Ref.: 37, 38, 123.

□ **LITHIOPHORITE** ⊕

$(Al,Li)Mn^{4+}O_2(OH)_2$. Monoclinic, pseudo-hexagonal. Hardness: 3. Cleavage: 1 direction; [001] perfect. Sp. Gr. 3.14-3.4. Color: bluish black to black. Luster: dull to metallic, opaque. Streak: blackish gray to black. Habit: massive, compact, botryoidal, dendritic; thin films and coatings.

A secondary oxide of manganese deposits and as thin films in quartz veins. Associated with quartz, psilomelane, pyrolusite, limonite, and hematite. Known from Independence, Garland, Montgomery, Pike, Polk, and Pulaski Counties.

Ref.: 7, 48, 86.

□ **LIVINGSTONITE**

$HgSb_4S_8$. Monoclinic. Hardness: 2. Cleavage: 2 directions; [010] [100] perfect, [001] poor; flexible. Sp. Gr. 5.00. Color: blackish gray. Luster: metallic to adamantine; nearly opaque. Streak: red. Habit: globular masses.

A rare primary hydrothermal sulfide of stibnite-cinnabar-bearing quartz veins. Associated with cinnabar, stibnite, dickite, and quartz. Known from Clark, Howard, and Pike Counties.

Ref.: 6.

□ **LOPARITE-(Ce)**

$(Ce,Na,Ca)(Ti,Nb)O_3$. Orthorhombic ?, pseudocubic. Hardness : 5.5. Cleavage: no data. Sp. Gr. 4.77-5.26. Color: black. Luster: non-metallic, opaque. Streak: dark red-brown. Habit: within igneous rock type as accessory grains; when it forms crystal, they are complex cubic or pseudo-cubic twins.

A scarse alkaline titanoniobate present in carbonatite, ijolite, and jacupirangite of alkaline rock intrusions. Associated with monticellite, eudialyte, and kimzeyite. Known from Hot Spring County.

Ref.: 160.

□ **LORENZENITE** (Ramsayite)

$Na_2Ti_2Si_2O_9$. Orthorhombic. Hardness: 6. Cleavage: 1 direction; [010] distinct. Sp. Gr. 3.43. Color: pinkish tan. Luster: vitreous, transparent to translucent. Streak: no data. Habit: microscopic bundles of acicular crystals.

A very rare late hydrothermal or pneumatolytic silicate in cavities in syenite. Associated with orthoclase, elpidite, brookite, and quartz. Known from Hot Spring County.

Ref.: 48, 125.

Figure 63 – Lorenzenite, Hot Spring County, 0.1 x 0.8 mm. (HSdeL, HSdeL, JMH)

□ **LOURENSWALSITE**

$(K,Ba)_2(Ti,Mg,Ca,Fe)_4(Si,Al,Fe)_6O_{14}(OH)_{12}$. Monoclinic (?), pseudohexagonal. Hardness: no data. Cleavage: 1 direction; [001] good, platy. Fracture: irregular, micaceous. Sp. Gr. 3.19. Color: silvery gray to light brownish gray. Luster: pearly to dull. Streak: no data. Habit: microscopic rosette-like clusters of very thin hexagonal flakes.

An extremely rare silicate in miarolitic cavities in xenolith-bearing garnet pseudoleucite syenite. Associated with orthoclase, acmite, titanite, labuntsovite, and delindeite. Known from Hot Spring County. Original type locality.

Ref.: 117, 125.

□ **MAGHEMITE**

α-Fe_2O_3. Cubic. Hardness: 5. Cleavage: no data. Sp. Gr. 4.90. Color: brown. Luster: dull, nearly opaque. Streak: brown. Strongly magnetic. Habit: fracture-fillings in naturally magnetic magnetite (lodestone); described as fine veinlets irregularly penetrating massive magnetite.

Present in nearly every specimen of naturally magnetic magnetite, this mineral is what makes the rock so magnetic as to be termed lodestone. Known from Hot Spring County.

Ref.: 133.

□ **MAGNESIOFERRITE (?)**

$MgFe^{3+}{}_2O_4$. Cubic. Hardness: 5.5-6.5. Cleavage: none. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4.436. Color: black to brownish black. Luster: splendent-metallic to dull, opaque. Streak: black. Habit: massive; crystals are minute octahedrons.

A primary oxide of magmatic segregation deposits; occurs in basic igneous rock and carbonatite. Associated with calcite, carbonate-fluorapatite, perovskite, nepheline, pyroxene, and melanite. Reported from Hot Spring County. Because spinel (MgAl2O4) is often intergrown with magnetite from the Hot Spring locality, magnesioferrite may not actually be a valid species from Arkansas. Compare with magnetite and maghemite.

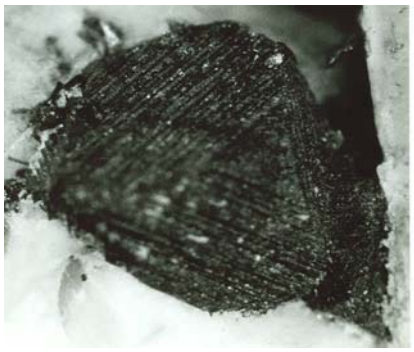
Ref.: 11, 87.

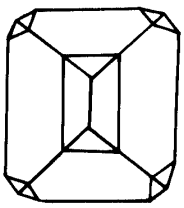
□ **MAGNETITE** ⊕

$Fe^{2+}Fe^{3+}{}_2O_4$. Cubic. Hardness: 5.5-6.5. Cleavage: none, [111] octahedral parting. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 5.175. Color: iron-black, grayish black, brown. Luster: metallic to dull, opaque. Streak: black. Habit: crystals usually octahedral; massive; disseminated grains.

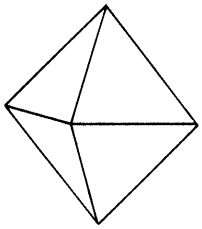
A widespread detrital oxide in sediments; a primary accessory mineral in igneous rocks; magmatic segregations and veins. When naturally magnetic, known as lodestone. Associated with quartz (sand), calcite, olivine, orthoclase, nepheline, pyroxene, phlogopite, melanite, vesuvianite, kimzeyite, carbonate-fluorapatite, chromite, serpentine, gibbsite, and bohmite. Known from many counties, in particular Cleveland (in core samples), Garland, Hot Spring, Pike, Pulaski, Saline, and Scott.

Ref.: 3, 11, 18, 21, 40, 59, 60, 76, 87, 94, 127.





Magnetite,
Garland County. (JMH)



Magnetite (TM – 71.111)

Figure 64 – Magnetite, Pulaski County, 2.6 mm diameter. (JMH)

□ **MAHLMOODITE**

$Fe^{2+}Zr(PO_4)_2 \cdot 4H_2O$. Monoclinic. Hardness: 3. Cleavage: no data, brittle. Sp. Gr. 2.877. Color: cream-white. Luster: surface of spheres resinous to dull. Streak: no data. Habit: tiny white to cream compact spheres; spheres consist of thin flat radiating fiber crystals, fibers are lath-like.

In vugs and fractures in pyroxenite from vanadium deposits. Often perched on diopside-hedenbergite and associated with kolbeckite, strontiopyrochlore, titanite, and orthoclase. Original type locality.

Ref.: 124, 128, 129.

□ **MALACHITE**

$Cu^{2+}{}_2(CO_3)(OH)_2$. Monoclinic. Hardness: 3.5-4. Cleavage: 2 directions; [201] perfect, [010] fair; crystals brittle. Sp. Gr. 3.6-4.05. Color: bright to dark green. Luster: dull to earthy; translucent to opaque. Streak: pale green. Habit: films and stains; massive; crystals as small bladed clusters.

A scarce secondary carbonate in the oxidation zone of copper-bearing sulfide deposits. In north Arkansas, in limestone- or silicified dolostone-hosted bodies with azurite, quartz, dolomite, chalcopyrite, smithsonite, pyrite, limonite, and calcite. In the Ouachita Mountains occurring in oxidized sulfide-bearing quartz veins with azurite, covellite, chalcopyrite, cerussite, pyrite, calcite, sphalerite, and galena. Known from Baxter, Boone, Fulton, Marion, Montgomery, Newton, Pike, Polk, Pulaski, Searcy, and Sevier Counties.

Ref.: 41, 46, 87, 126.

□ **MANGANITE** ⊕

$Mn^{3+}O(OH)$. Monoclinic. Hardness: 4. Cleavage: 1 direction; [010] perfect, [110] [001] imperfect. Fracture: uneven, brittle. Sp. Gr. 4.33. Color: black to dark steel-gray. Luster: submetallic to dull, opaque. Streak: reddish brown to black. Habit: crystals small, short to long prismatic, striated vertically; massive; fibrous to columnar; granular.

A constituent of low-temperature hydrothermal veins; a secondary oxide of bog manganese deposits. Associated with psilomelane, pyrolusite, rhodochrosite, hausmannite, and braunite. Known from Independence, Izard, Montgomery, Pike, Polk, Sharp, and Stone Counties.

Ref.: 53, 54, 56, 86, 87.

MANGANOPECTOLITE A discredited species. See *pectolite*.

□ **MARCASITE** ⊕

FeS_2. Orthorhombic. Hardness: 6-6.5. Cleavage: 3 directions; [101] distinct, [110] traces. Fracture: uneven, brittle. Sp. Gr. 4.92. Color: pale brass-yellow to tin-white. Luster: metallic, opaque. Streak: greenish black. Habit: tabular, pyramidal, capillary, pseudotetrahedral; massive globular with internal radial structure; fossil replacement; massive bedded.

A relatively common low-temperature sulfide formed in a reducing environment in clay, shale, chalk, limestone, and coal; fossil replacement in north Arkansas; a supergene mineral in sulfide vein deposits. Associated with quartz, kaolinite, organic material, pyrite, sphalerite, galena, calcite, and dolomite. Occasionally present in vanadium ores. Known from Carroll, Garland, Hot Spring, Howard, Independence, Little River, Marion, Pike, Saline, and Sevier Counties.

Ref.: 5, 8, 29, 47, 48, 78, 124.

Figure 65 - Marcasite, Hot Spring County, 1.2 x 1.7 mm. (JMH, JMH. JDM)

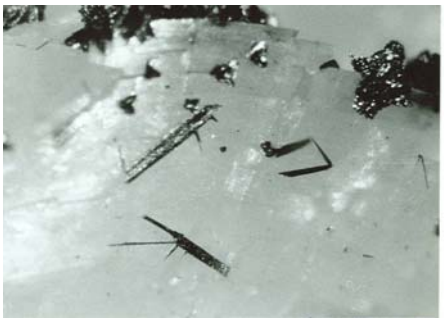


Figure 66 – Marcasite, Lawrence County, 0.1 x 1.0 mm. (MPY, JMH, JMH)

MARCASITE GROUP

Orthorhombic sulfides and tellurides of general formula AX_2 where A = Co, Fe, Ni; X = S, Se, Te. See *marcasite*.

MELANITE Titanian andradite. See *andradite*.

□ **MELANTERITE** ⊕

$Fe^{2+}SO_4 \cdot 7H_2O$. Monoclinic. Hardness: 2. Cleavage: 3 directions; [001] perfect, [110] distinct. Fracture: conchoidal, brittle. Sp. Gr. 1.90. Color: greenish to white. Luster: vitreous to silky, translucent. Streak: colorless. Habit: stalactitic, fibrous, or pulverulent crusts or aggregates.

A weathering product of iron sulfide minerals. Associated with pyrite and marcasite. Widespread in Arkansas.

Ref.: 5, 29.

MELANTERITE GROUP

Monoclinic sulfates of general formula $A^{2+}SO_4 \cdot 7H_2O$ where A^{2+} = Co, Cu, Fe, Mn, Zn. See *melanterite*.

□ **MELILITE**

$(Ca,Na)_2(Al,Mg)(Al,Si)_2O_7$. Tetragonal. Hardness: 5. Cleavage: 1 direction; [001] distinct, [100] indistinct. Sp. Gr. 2.9-3.1. Color: white, pale yellow, brown. Luster: vitreous to resinous, translucent. Streak: no data. Habit: anhedral grains.

Occasionally observed in thin section as a scarce constituent of silica-deficient igneous rock. Melilite is a silicate mineral in the series akermanite-gehlenite. Associated with leucite and nepheline. Known from Hot Spring County.

Ref.: 11, 48.

MELILITE GROUP

Tetragonal silicates of general formula A_2BZSiO_7 where A = Na, Ca; B = Al, Be, Mg, Zn; Z = Al, Si. See *melilite*.

□ **MENEGHINITE (?)**

$Pb_{13}CuSb_7S_{24}$. Orthorhombic. Hardness: 2.5. Cleavage: 1 direction; [010] perfect, interrupted; [001] difficult. Fracture: conchoidal, brittle. Sp. Gr. 6.40-6.42. Color: blackish lead-gray. Luster: bright metallic, opaque. Streak: black, shining. Habit: granular massive.

A rare primary sulfosalt in antimony-bearing quartz veins. Identified in polished section. Associated with quartz, jamesonite, fuloppite, tetrahedrite, and semseyite. Reported from Sevier County.

Ref.: 31, 71.

□ **MERCURY**

Hg. Hexagonal at -38o F.; liquid at room temperature. Hardness: not determined. Cleavage: none. Sp. Gr. 14.382. Color: tin-white. Luster: brilliant metallic, opaque. Streak: not determined. Habit: spherical globules.

A scarce native element of cinnabar-quartz-dickite veins filling fractures in sandstone. Known from Howard and Pike Counties.

Ref.: 6, 29, 81.

Figure 67 – Native mercury, Pike County, 0.2 mm diameter. (MPY, JMH, JMH)

□ **MESOLITE**

$Na_2Ca_2Al_6Si_9O_{30} \cdot 8H_2O$. Monoclinic. Hardness: 5. Cleavage: 2 directions; [101], [101] perfect. Fracture: conchoidal, brittle. Sp. Gr. 2.259. Color: colorless, white. Luster: vitreous, transparent. Habit: microscopic tabular to radiating clusters of bladed crystals.

A scarce zeolite in miarolitic cavities in syenite. Associated with orthoclase, acmite, pectolite, and titanite. Known from Pulaski County.

Ref.: 105, 127.

Figure 68 – Mesolite, Pulaski County, 0.4 x 0.5 mm. (JMH)

□ **META-AUTUNITE**

$Ca(UO_2)_2(PO_4)_2 \cdot 2\text{-}6H_2O$. Tetragonal. Hardness: 2.25. Cleavage: 1 direction; [001] perfect, [100] indistinct. Sp. Gr. 3.45-3.55. Color: yellow. Luster: pearly to dull. Streak: yellowish. Habit: micaceous flakes; fluorescent yellowish green.

A rare constituent of black organic-rich sandstone. A dehydration product of autunite. Known from Crawford County.

Ref.: 120.

META-AUTUNITE GROUP

Tetragonal or orthorhombic uranyl phosphates and arsenates of general formula $A(OU_2)_2(XO_4)_2 \cdot nH_2O$ where A = Ba, Ca, Co, Cu^{2+}, Fe^{2+}, $(H_3O)_2$, K_2, Mg, $(NH_4)_2$,Zn; X = As^{5+}, P^{5+}. See *meta-autunite*.

□ **METACINNABAR**

HgS. Cubic. Hardness: 3. Cleavage: none. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 7.65. Color: grayish black. Luster: metallic, opaque. Streak: black. Habit: massive, granular.

A scarce primary hydrothermal mineral of mercury deposits. Associated with cinnabar, dickite, and quartz. Known from Clark, Howard, and Pike Counties.

Ref.: 6, 81.

METASTRENGITE See *phosphosiderite*.

□ **METATYUYAMUNITE**

$Ca(UO_2)_2V^{5+}{}_2O_8 \cdot 3H_2O$. Orthorhombic. Hardness: about 2. Cleavage: 3 directions at 90°; [001] perfect, [010] [100] distinct. Sp. Gr. 3.8-3.9. Color: greenish yellow to yellowish green. Luster: adamantine to waxy. Streak: no data. Habit: microscopic flattened scales; globular aggregates to 0.5 mm.

A very rare late-stage vanadate in oxidized zones of metasomatic areas adjacent to igneous intrusions. Associated with various vanadium minerals, including straczekite. Known from Garland County.

Ref.: 48, 124.

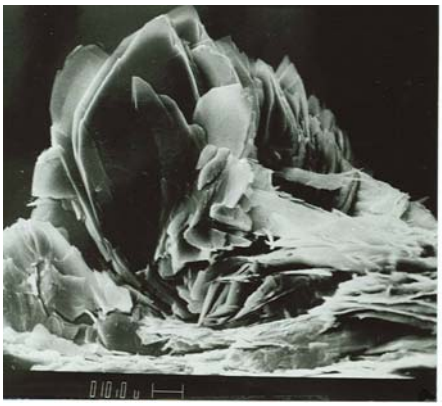


Figure 69 – Metatyuyamunite, Garland County, SEM. (DRO, CM, EJD)

□ **METAVARISCITE**

$AlPO_4 \cdot 2H_2O$. Monoclinic. Hardness: about 3.5. Cleavage: 1 direction; [010]; brittle. Sp. Gr. 2.54. Color: pale green. Luster: vitreous. Streak: white. Habit: drusy mixture with variscite.

A scarce phosphate in the Bigfork Chert formation. Associated with variscite, wavellite, planerite, and crandallite. Known from Montgomery County.

Ref.: 121.

MICA

A group name for monoclinic (pseudohexagonal) silicates, characterized by very perfect basal cleavage, of general formula: $XY_{2-3}Z_4O_{10}(OH,F)_2$ or $XY_3Si_4O_{12}$, where X = Ba, Ca, Cs, (H_3O), K, Na, (NH_4); Y = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Li, Mg, Mn^{2+}, Mn^{3+}, V^{3+}, Zn; Z = Al, Be, Fe^{2+}, Si. See *biotite*, *celadonite*, *glauconite*, *lepidolite*, *muscovite*, *phlogopite*, *siderophyllite*, *tainiolite, zinnwaldite*.

□ **MICROCLINE**

$KAlSi_3O_8$. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions; [001] [010] perfect. Fracture: uneven, brittle. Sp. Gr. 2.55-2.63. Color: white, gray. Luster: vitreous, transparent to translucent. Streak: white. Habit: euhedral to anhedral crystalline grains.

A common primary feldspar of plutonic igneous rock and in hydrothermal vein systems. Associated with calcite, fluorapatite, ankerite, orthoclase, rutile, and quartz. Known from Garland, Hot Spring, and Marion Counties.

Ref.: 8, 11, 18, 19, 47.

MILKY QUARTZ See *quartz* (crystalline).

□ **MILLERITE**

NiS. Trigonal. Hardness: 3-3.5. Cleavage: 6 directions, [0112] [1011] perfect. Fracture: uneven, brittle. Sp. Gr. 5.41-5.42. Color: brass to bronze-yellow. Luster: metallic, opaque. Streak: greenish black. Habit: slender to capillary needles, tufted masses, small clusters of crystals in limestone insolubles.

A hydrothermal sulfide of calcite and quartz veins. Associated with calcite, violarite, quartz, and goethite. Known from Benton, Saline, Sharp, and Washington Counties.

Ref.: 8, 48, 84, 101.

Figure 70 – Millerite, Benton County, 0.05 x 9.2 mm. (PMM, JMH, JMH)

□ **MINNESOTAITE (?)**

$(Fe^{2+},Mg)_3Si_4O_{10}(OH)_2$. Monoclinic. Hardness: 3. Cleavage: 1 direction, [100] perfect. Sp. Gr. 3.01. Color: greenish gray. Luster: greasy to waxy to dull. Streak: no data. Habit: compact aggregates.

A silicate of problematical origin reported from vanadium ore bodies. Associated with nontronite. Reported from Garland County.

Ref.: 48.

□ **MISERITE**

$K(Ca,Ce)_6Si_8O_{22}(OH,F)_2$. Triclinic. Hardness: 5.5-6. Cleavage: 1 direction, [001] perfect, [010] imperfect. Sp. Gr. 2.84-2.926. Color: pinkish to lavender. Luster: vitreous to pearly, translucent. Streak: no data. Habit: massive fine-grained aggregates.

A rare silicate formed in the contact metamorphic zone of syenite with novaculite. Intimately intergrown with wollastonite. Also, associated with diopside-hedenbergite, acmite, fluorapatite, fluorapophyllite, and quartz. Known from Garland County. Fluorescent pale yellow with short wave UV. Original type locality.

Ref.: 48, 75, 94, 124.

□ **MOLYBDENITE**

MoS_2. Hexagonal. Hardness: 1-1.5. Cleavage: 1 direction; [0001] perfect. Sp. Gr. 4.62-5.06. Color: lead-gray. Luster: metallic, opaque. Streak: greenish. Habit: scales, disseminated grains; compact vein fillings.

A constituent of hydrothermal veins crosscutting jacupirangite. Associated with orthoclase, pyrite, quartz, rutile, brookite, and fluorapatite. Feels greasy. Known from Hot Spring and Saline (in well core) Counties.

Ref.: 11, 19, 26, 79, 125.

□ **MONAZITE - (Ce)**

$(Ce,La,Nd,Th)PO_4$. Monoclinic. Hardness: 5-5.5. Cleavage: 1 direction; [100] distinct, [010] less distinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 4.6-5.4. Color: pale yellow-green. Luster: resinous, waxy, vitreous; translucent. Streak: white to slightly colored. Habit: fine-grained earthy; anhedral grains.

A scarce detrital mineral in sedimentary rock; a secondary phosphatic weathering product in veins crosscutting fluorapatite-pyrite veins; a constituent of saprolite overlying carbonatite; component of carbonate veins in syenite. Associated with carbonate-fluorapatite, limonite, goethite, ilmenite, and zircon. Known from Hot Spring, Howard, and Saline Counties.

Ref.: 11, 26, 29, 74.

MONAZITE GROUP

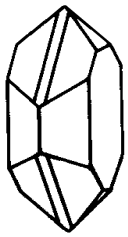
Monoclinic arsenates, phosphates, and silicates of general formula ABO_4 where A = Bi, Ca, Ce, La, Nd, Th; B = As^{5+}, P^{5+}, Si^{4+}. See *monazite (Ce)*.

□ **MONTICELLITE**

$CaMgSiO_4$. Orthorhombic. Hardness: 5.5. Cleavage: [010] indistinct. Fracture: conchoidal, brittle. Sp. Gr. 3.08-3.27. Color: pale brown. Luster: vitreous, transparent to translucent. Streak: white to pale brown. Habit: usually disseminated grains; crystals short prismatic.

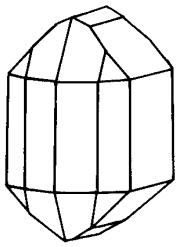
A primary igneous silicate of carbonatite. Associated with calcite, carbonate-fluorapatite, perovskite, magnetite, hercynite, spinel, and kimzeyite. Known from Hot Spring and Cleveland (well core) Counties. See olivine.

Ref.: 11, 29, 48, 94.



(JFW – 339.39)

Monticellite



(JFW – 341.40)

□ **MONTMORILLONITE**

$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2-3. Color: white, gray, pastel shades. Luster: dull. Streak: no data. Habit: massive, very fine grained; bedded.

A widespread clay mineral present in soils and sedimentary rock. Formed principally from the weathering of silicate minerals, alteration of volcanic ash, or hydrothermal processes. Associated with kaolinite and quartz. Sauconite is a variety reported associated with zinc deposits in north Arkansas. Known from many counties, but principally Clark, Dallas, Garland, Grant, Hot Spring, Pulaski, and Saline

Ref.: 48, 95, 117.

MONTMORILLONITE GROUP Same as Smectite Group.

□ **MONTROSEITE**

$(V^{3+},Fe^{3+})O(OH)$. Orthorhombic. Hardness: no data. Cleavage: 3 directions; [010] [110] good. Sp. Gr. 4.0. Color: black. Luster: submetallic, opaque. Streak: black. Habit: unreported for Arkansas, probably small striated, bladed crystals like paramontroseite.

This vanadium-bearing species was first reported in Garland County, but has not been independently confirmed. However, it was identified from Hot Spring County associated with kolbeckite, brookite, and smoky quartz.

Ref.: 103, 105, 122.

□ **MONTROYDITE**

HgO. Orthorhombic. Hardness: 2.5. Cleavage: 2 directions; [010] perfect, sectile; flexible, inelastic. Sp. Gr. 11.2. Color: dark red, brownish red; vitreous to adamantine. Streak: yellowish brown. Habit: tiny crystals, slender, prismatic, may be bent or twisted; rounded aggregate grains.

A mineral matching the physical characteristics of montroydite, and having other mercury minerals in association with it, was recently reported from a single discovery in Pike County.

Ref.: 135.

□ **MORDENITE**

$(Ca,Na_2,K_2)Al_2Si_{10}O_{24} \cdot 7H_2O$. Orthorhombic. Hardness: 4-5. Cleavage: 2 directions at 90^o; [100] perfect, [010] distinct. Sp. Gr. 2.12-2.15. Color: colorless, white. Luster: vitreous to silky, transparent to translucent. Streak: colorless to white. Habit: crystals prismatic, vertically striated, minute.

A rare zeolite in alkali pegmatites. Associated with orthoclase, acmite, biotite, nepheline, titanite, analcime, and natrolite. Known from Pulaski County.

Ref.: 105,106.

MOSANDRITE An alteration product of rinkite. See *rinkite*.

□ **MUSCOVITE** ⊕

$KAl_2(Si_3,Al)O_{10}(OH,F)_2$. Monoclinic. Hardness: 2.5 parallel to [001], 4 perpendicular to [001]. Cleavage: 1 direction; [001] perfect, easy. Sp. Gr. 2.77-2.88. Color: colorless, gray. Luster: vitreous to pearly, transparent to translucent. Streak: colorless. Habit: crystals usually tabular, hexagonal or diamond shaped in cross-section; commonly scaly, massive, or as disseminated grains in sandstone (often mistaken for gold).

A widespread mica occurring in many geologic environments: a primary igneous mineral; authigenic or detrital mineral in sediments; sericite is a low-temperature, fine-grained, scaly variety characterized by silky luster. Often associated with quartz, kaolinite, orthoclase, and dickite. Known from many counties, including Garland, Hot Spring, Miller, Perry, Polk, Pulaski, Saline, and Sevier.

Ref.: 5, 19, 48, 105, 124.

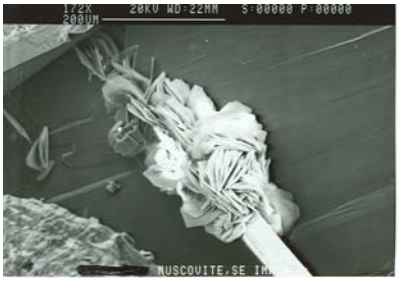


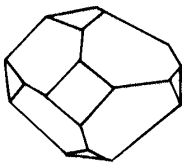
Figure 71 – Muscovite, Pulaski County, SEM. (AES, HLB, HLB)

□ **NARSARSUKITE**

$Na_2(Ti,Fe^{3+})Si_4(O,F)_{11}$. Tetragonal. Hardness: 6-7. Cleavage: 3 directions; [100] [110] perfect. Fracture: uneven, brittle. Sp. Gr. 2.783. Color: yellow. Luster: vitreous, transparent. Streak: no data. Habit: microscopic, short prismatic or blocky crystals, anhedral grains to 0.25 inch.

A rare primary silicate of miarolitic cavities in syenite. Associated with orthoclase, acmite, analcime, pectolite, quartz, and natrolite. Known from Hot Spring and Pulaski Counties.

Ref.: 48, 125, 127.



Narsarsukite, Hot Spring County. (JMH)

□ **NATROLITE**

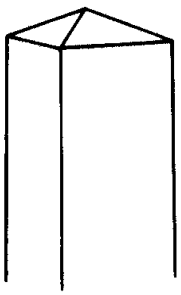
$Na_2Al_2Si_3O_{10} \cdot 2H_2O$. Orthorhombic. Hardness: 5-5.5. Cleavage: 2 directions; [110] perfect, [010] parting. Fracture: uneven, brittle. Sp. Gr. 2.20-2.26. Color: colorless, white, gray. Luster: vitreous to dull, transparent to translucent. Streak: white. Habit: crystals prismatic slender to acicular; fibrous.

A late fluid-phase zeolite of miarolitic cavities; fracture fillings, and alteration products in igneous rock, particularly syenite. Associated with orthoclase, acmite, analcime, chlorite, and fluorapophyllite. Known from Garland, Hot Spring, and Pulaski Counties.

Ref.: 1, 11, 29, 33, 48, 125, 127.

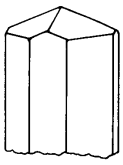
Figure 72 – Natrolite, Pulaski County, 3.0 x 3.0 x 15 mm. (DRH)

Figure 73 – Natrolite, Pulaski County, 0.5 x 3.0 mm. (JMH)



(DSM – 600.1)

Natrolite



(JFW – 252.19)

NATROXONOTLITE A discredited name. See *miserite*.

□ **NAVAJOITE (?)**

$(V^{5+},Fe^{3+})_{10}O_{24} \cdot 12H_2O$. Monoclinic. Hardness: 2. Cleavage: not observed. Sp. Gr. 2.56. Color: dark brown. Luster: adamantine on broken surface. Streak: brown. Habit: fibrous, encrusting.

A rare oxide occurring in clay-rich zones on vanadium deposits. Associated with fluorapatite, sanidine, and various vanadium minerals. Questionable occurrence because the mineral that matches this description has been confirmed to be bokite. See bokite. Reported from Garland County.

Ref.: 48.

□ **NENADKEVICHITE (?)**

$(Na,Ca,K)(Nb,Ti)Si_2O_6(O,OH) \cdot 2H_2O$. Crystal system: Orthorhombic. Hardness: 5. Cleavage:[010] poor; fracture: uneven. Sp. Gr. 2.83-2.88. Color: orange. Luster: vitreous to dull. Streak: pale rose. Habit: pseudohexagonal crystals.

A rare hydrated alkali titanosilicate occurring in the alteration zone adjacent to major igneous intrusions. Associated with calcite. No XRD available presently of the Arkansas mineral. Known from Hot Spring County.

Ref.: 156.

□ **NEOTOCITE (?)** (inadequately described species)

$(Mn^{2+},Fe^{2+})SiO_3 \cdot H_2O(?)$. Crystal system: unknown. Hardness: 3-4. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 2.43. Color: black, dark brown. Luster: resinous, nearly opaque. Streak: no data. Habit: not reported for Arkansas, normally massive to compact.

A rare secondary alteration product of manganese silicates. Associated with psilomelane, hausmannite, braunite, manganite, pyrolusite, and bementite. Known from Independence County.

Ref.: 54

□ **NEPHELINE** ⊕

$(Na,K)AlSiO_4$. Hexagonal. Hardness: 5.5-6. Cleavage: [1010] [0001] indistinct. Fracture: subconchoidal, brittle. Sp. Gr. 2.55-2.665. Color: colorless, gray, pinkish tan, pink. Luster: greasy, transparent to nearly opaque. Streak: white. Habit: anhedral embedded grains and masses; crystal simple hexagonal prism, often coated with analcime.

A primary silicate formed late during crystallization of alkalic igneous rock, particularly syenite. Associated with orthoclase, melanite, acmite, diopside, magnetite, analcime, fluorapatite, biotite, and sodalite. Often fluorescent orange. Known from Garland, Hot Spring, Pulaski, Saline, and Scott Counties.

Ref.: 8, 11, 60, 94, 127.

NEWTONITE A discredited name. See *alunite*.

□ **NICKELHEXAHYDRITE**

$(Ni,Mg,Fe^{2+})SO_4 \cdot 6H_2O$. Monoclinic. Hardness: no data. Cleavage: 1 direction; [100] perfect. Sp. Gr. 1.757. Color: colorless, white, pale greenish. Luster: vitreous to pearly, opaque. Streak: no data. Habit: coarse columnar to fibrous.

A secondary hydrothermal alteration product in serpentinized peridotite bodies. Associated with pentlandite, iron, pyrrhotite, pyrite, serpentine, and talc. Known from Saline County.

Ref.: 92.

□ **NITER**

KNO_3. Orthorhombic. Hardness: 2. Cleavage: 3 directions; [011] nearly perfect, [010] good, [110] imperfect. Fracture: subconchoidal, brittle. Sp. Gr. 2.109. Color: colorless, white. Luster: vitreous, transparent. Saline taste. Streak: white. Habit: fine-grained, admixture.

A difficult-to-identify mineral mixed with laminated clays in caves in Marion, Newton and Washington Counties. Saline taste.

Ref.: 5, 111, 112.

□ **NONTRONITE**

$Na_{0.3}Fe^{3+}_2(Si,Al)_4O_{10}(OH)_2 \cdot nH_2O$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2-3. Color: pale yellow to apple-green. Luster: waxy to dull; nearly opaque. Streak: no data. Habit: very fine grained; films or massive.

A hydrothermal clay mineral occurring as a late-forming mineral in various deposits; often associated with igneous rock. Also, as a low temperature hydrothermal mineral in the Fernvale Limestone. Associated with quartz, fluorite, dolomite, opal, sanidine, pyroxene, brookite, fluorapatite, rutile, orthoclase, and vanadium minerals. Known from Garland, Hot Spring, and Pulaski Counties.

Ref.: 19, 29, 48.

□ **NOSEAN** (Noselite)

$Na_8Al_6Si_6O_{24}(SO_4) \cdot H_2O$. Cubic. Hardness: 5.5. Cleavage: [110] indistinct. Sp. Gr. 2.3-2.4. Color: colorless, white to gray. Luster: vitreous, transparent to translucent. Streak: no data. Habit: small dodecahedral crystals embedded in host rock.

A minor primary silicate of feldspathoidal syenite and phonolite. Associated with orthoclase, nepheline, and aegirine-augite. Known from Garland and Hot Spring Counties.

Ref.: 19, 30, 127.

NOVACULITE A microcrystalline variety of quartz. See *quartz*.

OCTAHEDRITE See *anatase*.

□ **OLIGOCLASE**

Between $NaAlSi_3O_8$ – $CaAl_2Si_2O_8$ in the range Ab90An10 to Ab70An30. Triclinic. Hardness: 6-6.5. Cleavage: 2 directions; [001] perfect, [010] nearly perfect, [110] imperfect. Fracture: uneven, brittle. Sp. Gr. 2.63-2.67. Color: colorless, white, gray. Luster: vitreous, transparent to translucent. Streak: white. Habit: embedded grains in host rock.

A minor primary feldspar of syenite. Associated with orthoclase, acmite, and nepheline. Known from Hot Spring County. Note: The nomenclature of the feldspar group was revised by a subcommittee of the Commission on New Minerals and Mineral Names of the International Mineralogical Association. The term oligoclase was not retained after the revision. It is used in this publication due to its widespread use in literature prior to this decision.

Ref.: 8, 19.

□ **OLIVINE** ⊕

$(Mg,Fe^{2+})_2SiO_4$. Orthorhombic. Hardness: 6.5-7. Cleavage: [010] [100] imperfect to moderate. Fracture: conchoidal; brittle. Sp. Gr. 3.22-4.39. Color: green to yellow-amber. Luster: vitreous, transparent to translucent. Streak: white. Habit: embedded subhedral to anhedral grains.

A primary rock-forming silicate occurring in peridotite, kimberlite, lamproite, and lamprophyre. Associated with serpentine, phlogopite, augite, acmite, titanaugite, biotite, analcime, calcite, nepheline, and magnetite. Olivine in Arkansas has rarely been reported as the end member species (fayalite or forsterite). Olivine reported from peridotite-kimberlite should be close to forsterite (Mg-rich), while olivine reported from lamprophyres and lamproites should be intermediate in composition between forsterite and fayalite (Fe-rich). Ca-Mg olivine is monticellite and occurs in carbonatite. Known from Garland, Hot Spring, Pike, Saline, and Scott Counties.

Ref.: 11, 60, 89, 94, 127.

□ **OPAL** ⊕

$SiO_2 \cdot nH_2O$. Amorphous. Hardness: 5.5-6. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 1.99-2.25. Color: colorless, tan, amber, greenish, gray. Luster: vitreous to pearly, transparent to translucent. Streak: colorless. Habit: films and crusts of botryoidal to globular forms; massive.

A widespread mineral formed in a variety of geologic environments: usually as a low temperature mineral deposited from fluids in a near-surface environment; a hydrothermal mineral. Associated with too many minerals to list individually, but most importantly sulfides, quartz, iron and aluminum phosphates, weathering products of sulfides, and miarolitic cavity minerals in syenite. Sometimes seen as a coating on petrified wood, where it is fluoresces orange. Colorless hyaline often fluoresces green. Known from Clark, Dallas, Garland, Hot Spring, Howard, Lonoke, Montgomery, Pike, Polk, Pulaski, and Sevier Counties.

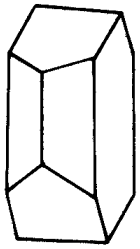
Ref.: 6, 30, 31, 38, 48, 101, 124, 127.

□ **ORTHOCLASE** ⊕

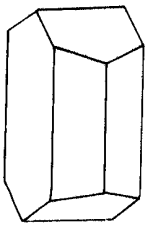
$KAlSi_3O_8$. Monoclinic. Hardness: 6-6.5. Cleavage: 2 directions; [001] [010] perfect. Fracture: uneven, brittle. Sp. Gr. 2.55-2.63. Color: white, gray, reddish. Luster: vitreous to pearly, translucent. Streak: white. Habit: crystals short prismatic, blocky; tabular; massive, interlocking grains.

A common rock-forming silicate in igneous rock; a detrital or authigenic mineral in sediments. Associated with nepheline, acmite, titanite, quartz, calcite, and biotite. Known principally from Garland, Hot Spring, Montgomery, Pulaski, and Saline Counties.

Ref.:1,11, 19, 30, 33, 47, 48, 75, 94, 124, 125, 127.



Orthoclase



(DSM – 316.1) (DSM – 316.2)

OZARKITE A discredited species. Probably either natrolite, pectolite, or thomsonite.
Ref.: 90.

□ **PALYGORSKITE** (Attapulgite)

$(Mg,Al)_2Si_4O_{10}(OH) \cdot 4H_2O$. Monoclinic, orthorhombic. Hardness: no data, soft. Cleavage: 2 directions; [110] easy. Sp. Gr. 2.217. Color: white, gray. Luster: dull, translucent to nearly opaque. Streak: no data. Habit: bundles of fibers; pseudomorphs after sodalite group minerals.

An uncommon secondary clay occurring in igneous rock. Associated with sanidine, olivine, phlogopite, serpentine, magnetite, tremolite, and calcite. Known from Garland, Pike and Saline Counties.

Ref.: 29, 32, 60.

□ **PARAMONTROSEITE**

VO_2. Orthorhombic. Hardness: no data. Cleavage: 1 direction; [010]. Sp. Gr. 4. Color: black. Luster: submetallic, opaque. Streak: black. Habit: as pseudomophs after microscopic blades of montroseite.

Results from the oxidation of montroseite. In fine-grained vanadium ores in and on quartz-brookite and kolbeckite. Known from Hot Spring County.

Ref.: 105, 131.

□ **PARAUMBITE**

$K_3Zr_2HSi_6O_{18} \cdot nH_2O$. Orthorhombic. Hardness: 4.5. Cleavage: [010] perfect micaceous, [100] good. Sp. Gr. 2.59. Color: colorless to white. Luster: vitreous to pearly on cleavages, translucent to transparent. Streak: no data, probably white. Habit: microscopic grains in the alteration rims of eudialyte crystals.

A rarely identified alteration product of eudialyte. Associated with eudialyte, catapleiite, and lavenite, rarely baddeleyite. Known from Hot Spring County.

Ref.: 141,161.

PARAVAUXITE GROUP

Triclinic phosphates of general formula $AB_2(PO_4)_2(OH)_2 \cdot 8H_2O$, where A=Mg, Fe^{2+}, Mn^{2+}, Fe^{3+}; B=Al, Fe^{3+}, Cr^{3+}. See *sigloite*.

□ **PARISITE - (Ce)**

$Ca(Ce,La)_2(CO_3)_3F_2$. Trigonal. Hardness: 4.5. Cleavage: 1 direction; [0001] distinct. Fracture: subconchoidal, brittle. Sp. Gr. 4.33 to 4.39. Color: not given. Luster: vitreous to resinous; [0001 parting pearly. Streak: yellowish white. Habit: microscopic acute double hexagonal pyramids; powdery coatings.

Present coating minerals in miarolitic cavities in syenitic rocks. Very rare. Known from Pulaski County.

Ref.: 127.

□ **PECTOLITE**

$NaCa_2Si_3O_8(OH)$. Triclinic. Hardness: 4.5-5. Cleavage: 2 directions; [001] [100] perfect. Sp. Gr. 2.74-2.88. Color: colorless, white. Luster: vitreous to silky, transparent to translucent. Streak: white. Habit: radiating and parallel bundles of fibrous needles; globular masses.

A primary late-phase silicate in miarolitic cavities in syenite and syenite pegmatite. Associated with orthoclase, titanite, acmite, analcime, natrolite, biotite, eudialyte, and fluorapophyllite. Known from Hot Spring and Pulaski Counties.

Ref.: 33, 48, 125, 127.

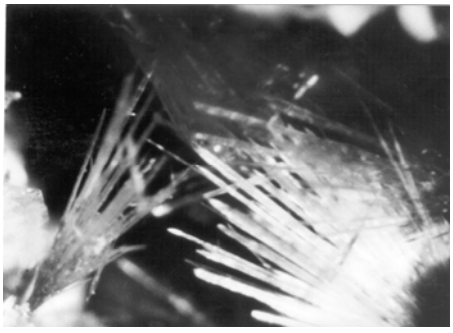


Figure 74 – Pectolite, Hot Spring County, 0.1 x 1.0 mm. (AES)

PEGANITE A discredited name. See *variscite*.

□ **PENTLANDITE**

$(Fe,Ni)_9S_8$. Cubic. Hardness: 3.5-4. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 4.6-5.0. Color: light bronze-yellow. Luster: metallic, opaque. Streak: bronze brown. Habit: embedded grains in host rock.

A primary sulfide formed during the serpentinization of peridotite. Associated with serpentine, iron, quartz, calcite, and antigorite. Known from Saline County.

Ref.: 92.

PENTLANDITE GROUP

Cubic sulfides of general formula AB_8X_8 where A = Ag, Cd, Co, Fe, Mn, Ni, Pb; B = Co, Cu, Fe, Ni; X = S, Se. See *pentlandite*.

□ **PERHAMITE**

$Ca_3Al_7(SiO_4)_3(PO)_4(OH)_3 \cdot 16.5\ H_2O$. Hexagonal. Hardness: 5. Cleavage: no data. Sp. Gr. 2.53-2.64. Color: brown. Luster: non-metallic. Streak: no data. Habit: microscopic spherulitic masses of platey crystals.

An extremely rare hydrated alkali aluminosilicate phosphate. Reported associated with siderite, cinnabar, and dickite in quartz veins. Known from Pike County.

Ref.: 154, 168.

□ **PERICLASE**

MgO. Cubic. Hardness: 5.5. Cleavage: 3 directions at 90°; [001] perfect, [111] imperfect. Sp. Gr. 3.58. Color: colorless, white, yellow, gray, brownish yellow, green, black. Luster: vitreous, transparent. Streak: white. Habit: microscopic inclusions in diamond.

A high-temperature primary oxide of igneous or metamorphic origin. Associated with diamond, olivine, and serpentine. Known from Pike County.

Ref.: 66.

PERICLASE GROUP

Cubic oxides of general formula $M^{2+}O$ where M^{2+} = Cd, Fe, Mg, Mn, Ni. See *periclase*.

PERIDOT A gem variety of forsterite. See *olivine*.

□ **PEROVSKITE**

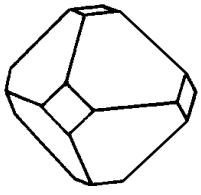
$CaTiO_3$. Orthorhombic, pseudocubic. Hardness: 5.5. Cleavage: [001] imperfect. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4.01. Color: black. Luster: adamantine, opaque. Streak: colorless to pale gray. Habit: crystals are cubo-octahedral, cubic, octahedral; anhedral embedded grains.

A primary and secondary alteration mineral in igneous rock, principally carbonatite and mafic rock types. Associated with calcite, carbonate-fluorapatite, magnetite, monticellite, kimzeyite, serpentine, olivine, and phlogopite. Dysanalyte is a variety containing greater than 1% Nb. Known from Cleveland (well cuttings only), Garland, Hot Spring, and Pike Counties.

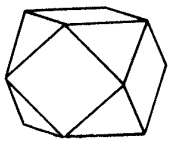
Ref.: 8, 11, 19, 48, 60, 94.

Figure 75 – Perovskite, Hot Spring County, 2.5 mm on edge. (JMH)

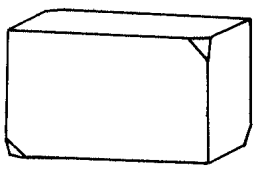
Perovskite



(JFW – 311.35)



(JFW – 311.36)



(JFW – 311.37)

PEROVSKITE GROUP

Pseudocubic oxides of general formula ABO_3 where A = Ca, Ce, Na, Sr; B = Nb, Ti, Fe. See *perovskite, loparite-(Ce)*.

PHENGITE A high silica variety of muscovite. See *muscovite*.

□ **PHILLIPSITE**

$(K,Na,Ca)_{1-2}(Si,Al)_8O_{16} \cdot 6H_2O$. Monoclinic. Hardness: 4-4.5. Cleavage: [010] and [100] distinct, fracture uneven, brittle. Sp. Gr. 2.20. Color: colorless, white, yellowish. Luster: Vitreous, transparent to translucent. Streak: no data. Habit: noted in thin sections of syenitic and lamprophyric rocks.

A scarce zeolite rarely reported in igneous rocks. Associated with potassium feldspar, plagioclase, aegirine, calcite, dolomite, natrolite, and nepheline in alkalic igneous rocks. Associated with clinopyroxene, amphibole, plagioclase, hornblende, biotite, natrolite, cancrinite, chlorite, pyrrhotite, fluorapatite, leucite, olivine, titanite, and nepheline in various lamprophyric igneous rocks. Known from Hot Spring County.

Ref.: 184.

□ **PHLOGOPITE** ⊕

$KMg_3Si_3AlO_{10}(F,OH)_2$. Monoclinic. Hardness: 2-2.5. Cleavage: 1 direction; [001] perfect, flexible, elastic, micaceous. Sp. Gr. 2.76-2.90. Color: colorless, white, yellowish-brown. Luster: pearly, submetallic on cleavage; transparent to translucent. Streak: colorless. Habit: subhedral to anhedral plates and scales.

A primary mica of mafic igneous rocks, like lamproite, lamproite tuff, peridotite, and kimberlite. Associated with serpentine, olivine, and magnetite. Known from Hot Spring, Pike, Pope, and Scott Counties.

Ref.: 3, 5, 48, 60, 125, 127.

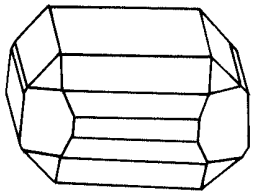
□ **PHOSPHOSIDERITE** (Metastrengite)

$Fe^{3+}PO4 \cdot 2H_2O$. Monoclinic. Hardness: 3.5-4. Cleavage: 1 direction; [010] good, [001] indistinct. Fracture: uneven, brittle. Sp. Gr. 2.76. Color: reddish violet. Luster: vitreous, transparent. Streak: no data. Habit: crystals, microscopic blocky equant.

A rare secondary phosphate which occurs in fractures in novaculite. Associated with strengite, kidwellite, beraunite, cacoxenite, and laubmannite (discredited). Known from Polk County.

Ref.: 36, 123.

Figure 76 – Phosphosiderite, Polk County, 0.4 x 0.6 mm. (MPY, JMH, JMH)



Phosphosiderite (DSM – 823.1)

□ **PICKERINGITE**

$MgAl_2(SO_4)_4 \cdot 22H_2O$. Monoclinic. Hardness: 1.5. Cleavage: [010] poor. Fracture: conchoidal. Sp. Gr. 1.79. Color: white. Luster: silky to pearly, translucent. Streak: yellowish white. Habit: fibrous.

A hydrated magnesioaluminum sulfate. Samples recovered from an old barite underground mine from a depth of ~600 feet. No mention of associated minerals. A secondary effluorescence on mine wall.

Reported from Hot Spring County.

Ref.: 156, 162.

PLAGIOCLASE A series name for triclinic feldspars of the general formula $(Na,Ca)Al(Al,Si)Si_2O_8$. Relatively uncommon feldspars in the alkalic igneous rock suite of Arkansas. See *albite*, *andesine*, *anorthite*, *labradorite*, and *oligoclase*.

□ **PLANERITE** ⊕

$Al_6(PO_4)_2(PO_3OH)_2(OH)_8 \cdot 4H_2O$. Triclinic. Hardness: 5. Cleavage: none, brittle. Sp. Gr. 2.5-2.7. Color: shades of pale green. Luster: dull to subvitreous, translucent to opaque. Streak: white to pale green. Habit: minute spherical aggregates coalescing into crusts.

A primary mineral occurring in fractures in chert and novaculite. Often confused with turquoise, variscite, wavellite, or chrysocolla. Associated with wavellite. Known from Montgomery and Polk Counties.

Ref.: 36, 48, 121, 123.

Figure 77 – Planerite, Polk County, SEM. (HLB)

PLEONASTE

A ferroan variety of spinel. See *spinel*.

□ **PLUMBOJAROSITE**

$PbFe^{3+}_6(SO_4)_4(OH)_{12}$. Trigonal. Hardness: not determined, soft. Cleavage: [1014] fair. Sp. Gr. 3.64. Color: yellow. Luster: shiny bright non-metallic. Streak: no data. Habit: tiny bright yellow masses.

A secondary lead iron sulfate, an efflorescence. Associated with tiny grains of molybdenite. Known from Hot Spring County.

Ref.: 163.

□ **PREHNITE**

$Ca_2Al_2Si_3O_{10}(OH)_2$. Orthorhombic. Hardness: 6-6.5. Cleavage: 1 direction; [001] distinct, [110] indistinct. Fracture: uneven, brittle. Sp. Gr. 2.90-2.95. Color: pale pink. Luster: dull, pearly on cleavage; translucent. Streak: colorless. Habit: small tabular groups.

A late phase primary silicate of miarolitic cavities in syenite. Associated with orthoclase, titanite, biotite, and natrolite. Known from Pulaski County.

Ref.: 29, 48, 127.

Figure 78 – Prehnite, Pulaski County, 2.5 x 4.0 mm. (JWB, JMH, JMH)

□ **PRIDERITE**

$(K,Ba)(Ti,Fe^{3+})_8O_{16}$. Tetragonal. Hardness: no data. Cleavage: 1 direction; basal, perfect; parallel to prism, fair. Sp. Gr. 3.86. Color: reddish black. Luster: adamantine. Streak: gray. Habit: anhedral microscopic plates intergrown with amphibole (in thin section).

A primary igneous mineral reported from xenoliths in peridotite-lamproite. Associated with diopside and richterite. Known from Pike County.

Ref.: 62.

PROTOVERMICULITE A discredited species. See *vermiculite*.

PSEUDOLEUCITE A discredited name. See *leucite*.

PSILOMELANE ⊕

A general term for massive, not specifically identified, hard manganese oxides. Widely reported in the literature from Independence, Izard, Montgomery, Pike, Polk, Pulaski, Sharp, and Stone Counties.

Ref.: 53, 54, 86, 87.

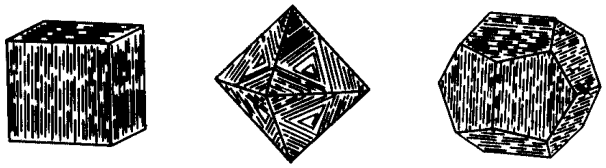
□ **PYRITE** ⊕

FeS_2. Cubic. Hardness: 6-6.5. Cleavage: [100] indistinct, [311] very indistinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 5.00-5.028. Color: pale brass-yellow. Luster: metallic, opaque. Streak: greenish to brownish black. Habit: crystals usually cubic, pyritohedral, octahedral (frequently distorted); massive; stalactitic.

The most widespread abundant sulfide – formed during reducing conditions in low- to high-temperature veins; a minor accessory in igneous rock; magmatic segregations; alteration zones adjacent to igneous bodies; in coal beds, shale, clay, limestone, chalk, and other sedimentary deposits. Associated with many mineral species, most importantly quartz, calcite, galena, sphalerite, barite, rutile, orthoclase, fluorite, chalcopyrite, dolomite, molybdenite, stibnite, cinnabar, dickite, marcasite, and kaolinite. Known from many counties, more importantly Baxter, Benton, Boone, Garland, Hot Spring, Howard, Independence, Lawrence, Logan, Marion, Montgomery, Newton, Pike, Polk, Pulaski, Saline, Searcy, Sevier, Sharp, and Washington Counties.

Ref.: 6, 8, 11, 21, 31, 41, 47, 53, 60, 72, 87, 126, 127.

Figure 79 – Pyrite, Montgomery County, 1.2 mm on edge. (JMH)



Pyrite (SM 1-283)

Figure 80 – Pyrite, Pulaski County, 0.3 mm on edge. (HLB)

PYRITE GROUP

Cubic sulfides, arsenides, etc., of general formula AX_2 or AXY where A = Au, Co, Cu, Fe, Mn, Ni, Os, Pd, Pt, Ru; X and Y = As, Bi, S, Sb, Te. Compare with Marcasite Group. See *pyrite*.

□ **PYROCHLORE**

$(Ca,Na)_2Nb_2O_6(OH,F)$. Cubic. Hardness: 5-5.5. Cleavage: 4 directions; [111] sometimes distinct. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4..2 - 6.4. Color: yellowish brown. Luster: vitreous to resinous, translucent to opaque. Streak: light brown to yellowish brown. Habit: crystals minute octahedral, embedded grains.

A primary niobate in alkalic igneous rock, particularly nepheline and/or feldspathoidal syenite and carbonatite. Associated with orthoclase, sanidine, fluorapatite, titanite, and vanadium minerals. Compare with strontiopyrochlore. Known from Garland, Pulaski, and Saline Counties.

Ref.: 1, 29, 48, 98.

Figure 81 - Pyrochlore, Garland County, 0.2mm diameter. (DRO, DRO, JMH)

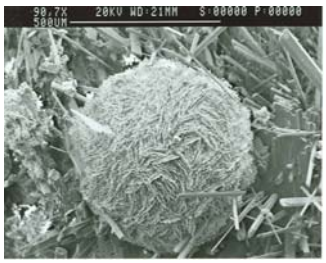


Figure 82 – Pyrochlore, Pulaski County, SEM. (AES, HLB, HLB)

PYROCHLORE GROUP

Cubic complex oxides of general formula $A_{1-2}B_2O_6(O,OH,F) \cdot nH_2O$ where A = Ba, Bi, Ca, Ce, Cs, K, Na, Pb, Sb^{3+}, Sn, Sr, Th, U, Y, Zr; B = Fe, Nb, Sn, Ta, Ti, W. Compare the closely related Stibiconite Group. See *betafite*, *pyrochlore*, *strontiopyrochlore*.

□ **PYROLUSITE** ⊕

$(Mn^{4+})O_2$. Tetragonal. Hardness: crystal 6-6.5, massive 2-6. Cleavage: 2 directions; [110] perfect. Sp. Gr. 5.06. Color: black or dark steel-gray. Luster: metallic to dull, opaque. Streak: black or bluish black. Habit: massive; dendritic, stalactitic, columnar; pseudomorphs after manganite crystals.

A relatively common secondary oxide of the oxidized zone of manganese deposits, due to the alteration of manganite or other manganese-bearing minerals. Associated with psilomelane, hausmannite, lithiophorite, bixbyite, rancieite, cryptomelane, braunite, rhodochrosite, lepidocrocite, manganite, neotocite(?), quartz, calcite, and siderite. Known from, but not restricted to Garland, Hot Spring, Independence, Izard, Montgomery, Pike, Polk, Pulaski, Saline, Sharp, and Stone Counties.

Ref.: 7, 8, 53, 54, 56, 87, 127.

Figure 83 – Pyrolusite, Pulaski County, 0.1 x 0.8 mm. (JMH)

□ **PYROMORPHITE**

$Pb_5(PO_4)_3Cl$. Hexagonal. Hardness: 3.5-4. Cleavage: [1011] trace. Sp. Gr. 7.04. Color: shades of green. Luster: subadamantine to resinous, translucent. Streak: white. Habit: microscopic barrel-shaped crystals; granular.

A scarce secondary product of the oxidation of galena. Associated with galena, calcite, quartz, and psilomelane. Known from Independence, Marion, and Newton Counties.

Ref.: 29, 47, 53.

□ **PYROPE**

$Mg_3Al_2(SiO_4)_3$. Cubic. Hardness: 7-7.5. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 3.5-3.8. Color: pinkish red. Luster: vitreous to dull, transparent to translucent. Streak: colorless. Habit: anhedral or rounded grains.

A scarce primary garnet of peridotite, lamproite, and kimberlite; a detrital mineral in sediments. Associated with olivine, chromite, diamond, phlogopite, serpentine, perovskite, and magnetite. Known from Pike County.

Ref.: 60.

□ **PYROPHANITE**

$(Mn^{2+})TiO_3$. Trigonal. Hardness: 5-6. Cleavage: 6 directions; [0221] perfect, [1012] distinct. Sp. Gr. 4.54. Color: deep brownish red to black. Luster: metallic to submetallic, translucent on thin edge. Streak: no data. Habit: microscopic single crystals are simple hexagonal plates; rosettes to 1/2 inch.

A rare mineral in miarolitic cavities and pegmatitic veins in syenite. Associated with catapleiite, kupletskite, eggletonite, orthoclase, analcime, and acmite. Known from Pulaski County.

Ref.: 48, 106, 125, 127.

Figure 84 - Pyrophanite on acmite (aegirine), Pulaski County, SEM. (HLB)

□ **PYROPHYLLITE**

$Al_2Si_4O_{10}(OH)_2$. Monoclinic, triclinic. Hardness: 1-2. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.65-2.90. Color: white to grayish white. Luster: pearly, transparent to translucent. Habit: foliated, radiating lamellar, fibrous, granular. Feels greasy.

A relatively scarce primary silicate of hydrothermal sulfide-bearing quartz veins. Associated with quartz, ankerite, siderite, galena, sphalerite, and dickite. Known from Pulaski County.

Ref.: 8, 41, 48.

PYROXENE GROUP

A group name for monoclinic or orthorhombic chain silicate minerals of general formula ABZ_2O_6 where A = Ca, Fe^{2+}, Li, Mg, Mn^{2+}, Na, Zn; B = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Mg, Mn^{2+}, Sc, Ti, V^{3+}; Z = Al, Si.

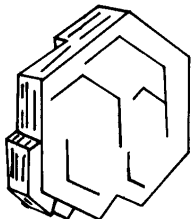
Pyroxenes are among the most abundant silicate minerals in many igneous and metamorphic rocks, and will be found in most of such rocks in Arkansas. They occur in many habits, often prismatic; in color often dark greenish-black. See *acmite*, *augite*, *diopside*, *diopside-hedenbergite, hedenbergite, titanaugite*.

□ **PYRRHOTITE**

$Fe_{1-x}S$ where X = 0-0.17. Monoclinic, hexagonal. Hardness: 3.5-4.5. Cleavage: none. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4.53-4.77. Color: bronze-yellow to bronze-red. Luster: metallic, opaque. Streak: grayish black. Habit: platy or bipyramidal crystals, pseudo-hexagonal; aggregates.

A scarce, weakly magnetic, primary igneous or hydrothermal sulfide present in sulfide-bearing quartz veins; in serpentinitic and peridotitic rock; in volcanic tuffs and sediments; and in contact zones adjacent to igneous intrusions. Associated with pyrite, marcasite, quartz, calcite, and serpentine. Known from Garland, Hot Spring, Howard, Pike, Saline, and Sevier Counties.

Ref.: 8, 11, 18, 29, 31, 92.



Pyrrhotite, Howard County. (JMH)

□ **QUARTZ** (crystalline) ⊕

SiO_2. Trigonal. Hardness: 7. Cleavage: 7 directions, seldom observed. Fracture: conchoidal, brittle. Sp. Gr. 2.65. Color: see specific variety listed below. Luster: vitreous, sometimes waxy or greasy; transparent to translucent. Streak: white, tinted faintly in colored varieties. Habit: see specific variety listed below.

● *Amethyst*: various shades of purple or violet. May have inclusions of goethite. Short prismatic, sometimes doubly terminated; encrusting. In hydrothermal veins associated with igneous rock. Associated with calcite and goethite. Known from Garland, Pike, and Saline Counties.

● *Milky*: milky white to grayish white. As thin to thick hydrothermal veins crosscutting sandstone and shale; may be host vein material for sulfide mineralization; associated with manganese and iron mineralization; the host vein material for most rock-crystal deposits; as overgrowths on rock crystal; a common constituent of sand and gravel deposits as a detrital material. Known from nearly every county in Arkansas; relatively common as vein material in the Ouachita Mountains.

● *Rock crystal*: colorless. Short to long prismatic crystals, frequently distorted, bent, twisted, skeletal, multiply-terminated, doubly terminated, fractured and rehealed; rarely as Japanese twins; common as druses; widespread as detrital sand and silt particles. Crystals may have inclusions of a variety of minerals: adularia, cookeite, kaolin, dickite, brookite, pyrite, chalcopyrite, marcasite, galena, goethite, or chlorite; also, fluid, sand, shale, or carbonaceous material. Known predominantly from deposits in fractured sandstone of the Ouachita Mountains; some rock crystal occurs in shale units in the Ouachitas and in lead-zinc deposits in north Arkansas. Also, as a late-crystallizing mineral in the formation of chert in limestone units

in north Arkansas. Most widely distributed as detrital sand and silt particles in soils, and unconsolidated and consolidated sediments. Best known from Hot Spring, Garland, Montgomery, Pike, Perry, Polk, Pulaski, and Saline Counties.

● *Smoky*: pale smoky brown to almost black, often with distinctive growth phantoms. Short to long prismatic, occasionally doubly terminated; may contain fluid inclusions. Occurs in contact zones adjacent to igneous intrusions; as a rare late hydrothermal phase in miarolitic cavities in syenite; as fluid inclusion crystals in calcite veins in fractured shale and sandstone host rock; rarely as veins in sandstone, like rock crystal. Known from Garland, Hot Spring, Montgomery, Pike, and Pulaski Counties. Much smoky quartz marketed from Arkansas has been irradiated.

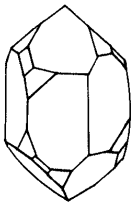
Ref.: 5, 6, 8, 10, 47, 48, 55, 98.

Figure 85 - Quartz, Montgomery County, 2.5 x 6.3 x 7.0 cm. (DRH)

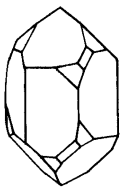
Figure 86 – Quartz, Pulaski County, 2.5 x 2.9 x 5.7 cm. (GN, DRH, DRH)

Figure 87 - Quartz, Pulaski County, 2.5 x 4.5 x 7.0 cm. (MPY, DRH, DRH)

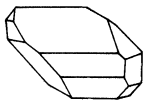
Figure 88 – Stibnite in quartz, Pike County, 4.5 x 6.2 mm. (JMH)



Left hand (DSM – 184.8)



Right hand (DSM – 184.7)



Tabular (DSM- 184.13

Figure 89 – Chlorite in quartz, Garland County, 2.5 x 5.0 cm. (MBW)

□ **QUARTZ** (cryptocrystalline) ⊕

SiO_2. Trigonal. Hardness: 7, frequently slightly less. Cleavage: none. Fracture: conchoidal, well to poorly expressed. Sp. Gr. 2.65, frequently less. Color: see specific variety listed below. Luster: greasy to waxy to dull. Streak: white, tinted for colored varieties. Habit: see specific variety listed below:

- *Agate*: translucent banded chalcedony. Color banding in shades of brown. Detrital cobbles and pebbles in creeks and gravel pits on Crowley's Ridge. Known from Craighead, Cross, Green, Poinsett, and St. Francis Counties.
- *Chalcedony*: translucent white to grayish. Mammillary, botryoidal, and stalactitic forms. Reported from gravels of the Saline River, Saline County.
- *Chert*: translucent to nearly opaque in shades of gray, white, and brown; frequently banded or fossiliferous as bedded replacement deposits and nodules in limestone of north Arkansas; as massive, thinly bedded sedimentary rock in the Ouachita Mountains.
- *Flint*: translucent dark gray to black nodules in limestone in north Arkansas. Also, detrital cobbles and pebbles in stream beds of north Arkansas.
- *Jasper*: translucent red nodules in limestone in north Arkansas. As detrital cobbles and pebbles in Cretaceous gravel deposits of southwest Arkansas.
- *Novaculite**: translucent to nearly opaque white, gray, black, red or green; occasionally porous varieties display liesegang banding. Microcrystalline. As massive to thinly bedded sedimentary rock in the Ouachita Mountains. Detrital deposits of gravels, cobbles, and boulders in Clark, Howard, Pike, and Sevier Counties.
- *Tripoli**: a very finely divided form of microcrystalline silica. White, various colors depending upon impurities. Formed locally within the upper section of the Arkansas Novaculite in the Ouachita Mountains; also, formed from massive-bedded chert developed in limestones of the Boone Formation in north Arkansas.

*Technically a rock name, but described here due to its abundance in Arkansas.

Ref.: 29, 47, 59, 87, 101.

RAMSAYITE Synonym for lorenzenite. See *lorenzenite*.

□ **RANCIEITE** (inadequately described species)

$(Ca,Mn^{2+})Mn^{4+}{}_4O_9 \cdot 3H_2O$. Hexagonal. Hardness: no data. Cleavage: no data. Sp. Gr. 3.2-3.3. Color; black, brownish, silver-gray. Luster: bright metallic, transparent to opaque. Streak: no data. Habit: noted as fine interlayered lamellae in polished section.

A rare secondary oxide in manganese oxide deposits. Associated with bixbyite, cryptomelane, psilomelane, hausmannite, pyrolusite, lithiophorite, and braunite. Reported from Independence County.

Ref.: 7.

RASHLEIGHITE (ferroan turquoise)

See *turquoise*.

□ **RECTORITE** (Allevardite) ⊕

Interstratified pyrophyllite-vermiculite. Monoclinic. Hardness: 0.5-1.0. Cleavage: 1 direction; [001] perfect, flexible, elastic. Sp. Gr. no data. Color: white to tan. Luster: pearly, translucent. Habit: thin to thick leathery mattes when dry (locally termed mountain leather); a paste the consistency of petroleum jelly when wet.

A relatively uncommon, sometimes locally abundant, hydrothermal clay in quartz veins and shear zones. Associated with quartz, cookeite, ankerite, pyrite, limonite, sphalerite, and galena. Known from Garland, Montgomery, Perry, Pulaski, and Saline Counties. Type locality.

Ref.: 4, 10, 45, 58, 65.

□ **RHABDOPHANE-(Ce)**

$(Ce,La)PO_4 \cdot H_2O$. Hexagonal. Hardness: 3.5. Cleavage: no data, fracture uneven. Sp. Gr. 3.97. Color: White. Luster: Greasy to dull, opaque. Habit: microscopic white opaque rosettes in open cavities.

A rare cerium phosphate present in certain nepheline syenites. Associated with acmite. Present from 2 localities in Hot Spring County.

Ref.: 169, 170.

RHABDOPHANE GROUP

Hexagonal or pseudo-hexagonal phosphates, with general formula $XZO_4 \cdot 1\text{-}2\ H_2O$, where X=Ca,Ce,$Fe^{3+}$, La, Pb,Th and Z=P,S. See *rhabdophane-(Ce)*.

□ **RHODOCHROSITE**

$Mn^{2+}CO_3$. Trigonal. Hardness: 3.5-4. Cleavage: 3 directions; [1011] perfect, rhombohedral. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.70. Color: pink. Luster: pearly, translucent. Streak: white. Habit: massive; embedded grains.

A scarce authigenic carbonate in carbonate sediments; in manganese deposits of sedimentary origin. Associated with lepidocrocite, hematite, braunite, lithiophorite, calcite, and pyrolusite. Easily confused with pinkish calcite of the Fernvale Limestone. Known from Independence County.

Ref.: 7, 54.

□ **RICHTERITE**

$Na_2Ca(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$. Monoclinic. Hardness: 5-6. Cleavage: 2 directions; [110] perfect, [001] [100] parting. Fracture: uneven, brittle. Sp. Gr. 2.97-3.132. Color: brown to dark green. Luster: vitreous, translucent. Streak: colorless. Habit: prismatic grains.

A rare amphibole in lamproite and syenite. Associated with chromite, magnetite, diopside, pyrite, serpentine, olivine, and phlogopite. Known from Pike County.

Ref.: 3, 62, 108.

□ **RIEBECKITE**

$Na_2(Fe^{2+},Mg)_3Fe^{3+}{}_2Si_8O_{22}(OH)_2$. Monoclinic. Hardness: 5. Cleavage: 2 directions; [110] perfect. Fracture: uneven, brittle. Sp. Gr. 3.32-3.382. Color: dark blue to black. Luster: vitreous, translucent to nearly opaque. Streak: no data. Habit: crystals long prismatic, striated parallel to elongation.

A rare amphibole that is a replacement after acmite in miarolitic cavities in syenite. Identified by optical methods. Associated with orthoclase, albite, biotite, titanite, pyrite, and analcime. Known from Pulaski County.

Ref.: 33.

□ **RINKITE**

$(Ca,Ce)_4Na(Na,Ca)_2Ti(Si_2O_7)_2F_2(O,F)_2$. Monoclinic. Hardness: 5. Cleavage: 1 direction; [100] distinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 2.93-3.5. Color: yellow. Luster: vitreous on cleavage, greasy on fracture. Streak: no data. Habit: brittle transparent blades to $1/8^{th}$ inch long, most often embedded in host rock.

A scarce, but sometimes locally abundant, silicate in pegmatite zones in syenite; also as a fine-grained constituent of vanadium ores. Associated with orthoclase, acmite, catapleiite, and pyrophanite. Known from Garland and Pulaski Counties.

Ref.: 48, 105, 127.

ROCK CRYSTAL See *quartz* (crystalline).

□ **ROCKBRIDGEITE**

$(Fe^{2+},Mn^{2+})(Fe^{3+})_4(PO_4)_3(OH)_5$. Orthorhombic. Hardness: 4.5. Cleavage: 2 directions at 90^o; [100] perfect, [010] [001] distinct. Fracture: uneven, brittle. Sp. Gr. 3.3-3.49. Color: dark olive-green to black. Luster: vitreous to dull, subtranslucent. Streak: no data. Habit: microscopic elongated slender crystals and radial aggregates; radial fibrous masses.

An early secondary phosphate filling fractures in novaculite. Associated with laubmannite (discredited), beraunite, dufrenite, strengite, cacoxenite, and goethite. Known from Garland, Montgomery, and Polk Counties.

Ref.: 13, 37, 38, 48, 123, 124.

□ **ROSCOELITE**

$K(V^{3+},Al,Mg)_2(AlSi_3)O_{10}(OH)$. Monoclinic. Hardness: 2.5. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.97. Color: clove-brown to dark green. Luster: pearly, translucent. Streak: no data. Habit: scaly encrustations in pyroxenite cavities; fine-grained, light brownish, clay-like gangue or matrix.

A rare silicate in vanadium deposits. Associated with quartz, fluorapatite, sanidine, and anatase. Known from Garland County.

Ref.: 48, 124.

□ **RUTHENIUM (NATIVE)**

Ru. Hexagonal. Hardness: no data. Cleavage: no data. Sp. Gr. 12.20. Color: creamy white (reflected light). Luster: metallic. Streak: no data. Habit: a single anhedral grain noted in a scanning electron micrograph (magnification 2600X).

The second noted occurrence in the world of native ruthenium. In enigmatic siliceous rocks from the Stanley Shale. Associated with an assortment of microscopic minerals including barite, acmitic pyroxene, monazite, xenotime, galena, sphalerite, pyrite, rutile, and quartz. Known from Saline County.

Ref.: 48.

□ **RUTILE** ⊕

TiO_2. Tetragonal. Hardness: 6-6.5. Cleavage: 3 directions at 90°; [110] [100] distinct. Sp. Gr. 4.2-5.6. Color: black (due to Nb), reddish brown. Luster: adamantine, splendent, translucent to opaque. Streak: brown, yellowish, grayish, greenish black. Habit: crystals short prismatic to acicular, striated parallel to c-axis; massive; twinning on [011] common, forming knee-shaped twins, sixlings, and eightlings; pseudomorphs after brookite.

A primary accessory oxide in igneous rock; in alteration zones in and adjacent to igneous rock; in hydrothermal veins; a resistant detrital mineral in soils and sediments. Associated with orthoclase, pyrite, quartz, molybdenite, ilmenite, galena, sphalerite, anatase, brookite, calcite, and ankerite. Known from Garland, Hot Spring, Pulaski, and Saline Counties.

Ref.: 11, 18, 19, 48, 82, 85, 94, 142.

Figure 90 – Rutile eightling twin, Hot Spring County, 4.1 mm diameter. (JMH)

RUTILE GROUP

Tetragonal oxides of general formula $M^{4+}O_2$ where M^{4+} = Ge, Mn, Pb, Si, Sn, Te, Ti. See *pyrolusite*, *rutile*.

SALITE A variety of diopside. See *diopside*.

□ **SANIDINE**

$KAlSi_3O_8$. Monoclinic. Hardness: 6. Cleavage: 2 directions; [001] perfect, [010] imperfect. Fracture: uneven, brittle. Sp. Gr. 2.57-2.58. Color: colorless, white, gray. Luster: vitreous, transparent to translucent. Streak: uncolored. Habit: crystal blocky, often embedded in matrix; massive.

A primary feldspar of igneous rock, particularly syenite dikes; in high temperature veins; in metasomatic alteration zones adjacent to igneous intrusions. Associated with diopside-hedenbergite, pyrite, rutile, brookite, chalcedony, palygorskite, and vanadium minerals. Known from Garland County.

Ref.: 23, 48, 85, 124.

SATIN SPAR A fibrous variety of gypsum. See *gypsum*.

□ **SAUCONITE**

$Na_{0.3}Zn_3(Si,Al)_4O_{10}(OH)_2 \cdot 4H_2O$. Monoclinic. Hardness: 1-2. Cleavage: 1 direction; [001] perfect. Color: Reddish brown, mottled brownish yellow. Luster: dull. Streak: same as color. Habit: Massive, very fine-grained; claylike.

A zinc-bearing clay of the smectite group. Thought to be relatively scarce, but probably not recognized by most collectors. Compare to montmorillonite. Reported from Boone County.

Ref.: 47.

□ **SCHODERITE**

$Al_2(PO_4)(VO_4) \cdot 8H_2O$. Monoclinic. Hardness: about 2. Cleavage: 1 direction; [010] prominent. Sp. Gr. 1.92. Color: orange-yellow or yellow. Luster: no data. Streak: yellow. Habit: microscopic crystal aggregates.

A rare secondary mineral known from vanadium ores in Garland County. Associated with sanidine, roscoelite, fluorapatite, titanite, rutile-anatase, and sometimes quartz.

Ref.: 48, 68, 124.

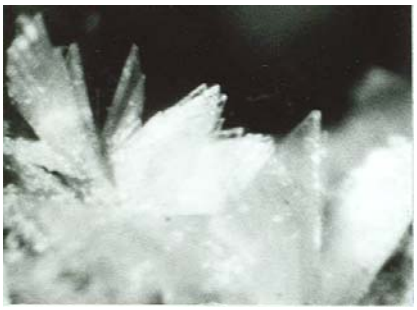


Figure 91 – Schoderite, Garland County, 0.15 x 0.20 mm. (DRO, DRO, JMH)

□ **SCHORLOMITE**

$Ca_3Ti^{4+}{}_2(Fe^{3+}{}_2Si)O_{12}$. Cubic. Hardness: 6.5-7. Cleavage: none. Fracture: conchoidal, brittle. Sp. Gr. 3.7-4.1. Color: black. Luster: dull to vitreous. Streak: white. Habit: crystals dodecahedral modified by trapezohedral faces, to 1 inch diameter; massive.

A garnet often intergrown with white to cream colored fluorapatite. As residual masses and crystals loose in soil; in veins with fluorapatite. Also, associated with vermiculite, rutile, and magnetite in soils. Compare to andradite. Known from Hot Spring County. Type locality.

Ref.: 11, 94, 175.

□ **SCHREIBERSITE** (Rhabdite)

$(Fe,Ni)_3P$. Tetragonal. Hardness: 6.5-7. Cleavage: 1 direction; [001] perfect, very brittle. Sp. Gr. 7.0-7.8. Color: silver-white to tin-white. Luster: metallic, opaque. Streak: no data. Habit: embedded grains.

A rare extraterrestrial mineral of pallasite and iron meteorites. Associated with kamacite, taenite, and troilite. Known from various meteorites found in Arkansas.

Ref.: 67, 113, 114.

□ **SEIDITE-(Ce)**

$Na_4(Ce,Sr)_2Ti[(O,OH,F)_5|Si_8O_{18}(OH) \cdot 5H_2O$. Monoclinic. Hardness: 3-4. Cleavage: [100] perfect, [001] less perfect. Sp. Gr. no data given. Color: typical grains bright yellow, pinkish yellow, creamy white. Luster: vitreous, translucent. Streak: no data. Habit: yellow dense microscopic aggregates that form equant crystals.

A rare hydrated alkali titanosilicate present in small gas cavities in syenitic host rock. Associated with orthoclase, titanite, and zeolites. Reported from Hot Spring County.

Ref.: 164.

SELENITE A coarsely crystalline variety of gypsum. See *gypsum*.

□ **SEMSEYITE**

$Pb_9Sb_8S_{21}$. Monoclinic. Hardness: 2.5. Cleavage: 2 directions; [112] perfect, brittle. Sp. Gr. 6.03-6.12. Color: lead-gray to black. Luster: dull metallic, opaque. Streak: black. Habit: fine-grained aggregates and groups of subparallel crystals.

A rare hydrothermal sulfide of antimony-bearing quartz veins. Associated with quartz, ankerite, stibnite, jamesonite, galena, sphalerite, and pyrite. Known from Sevier County.

Ref.: 31, 48.

□ **SERANDITE**

$Na(Mn^{2+},Ca)_2Si_3O_8(OH)$. Triclinic, pseudo-monoclinic. Hardness: 4.5-5. Cleavage: 2 directions; [001] [100] perfect. Sp. Gr. 3.32. Color: colorless to faintly pink. Luster: vitreous, pearly on cleavage, transparent. Streak: no data. Habit: crystals microscopic to $1/8^{th}$ inch, often perched on acmite or natrolite. Easily mistaken for microscopic analcime or fluorapophyllite.

A scarce silicate of pegmatitic veins and miarolitic cavities in syenite. Associated with orthoclase, acmite, natrolite, and chlorite. Known from Pulaski County.

Ref.: 105, 106, 127.

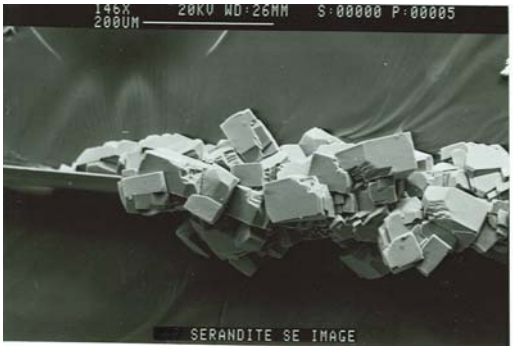


Figure 93 - Serandite, Pulaski County, SEM. (HLB)

SERICITE Fine-grained muscovite. See *muscovite*.

SERPENTINE GROUP* ⊕

General formula $A_3Si_2O_5(OH)_4$ where A = Mg, Fe^{2+}, Ni. Monoclinic, orthorhombic. Color: shades of green. Luster: dull, opaque. Streak: no data. Habit: massive, fine-grained.

A secondary alteration product of ferromagnesian minerals of igneous rock, particularly peridotite and kimberlite. Associated with olivine, phlogopite, calcite, talc, barite, chromite, and magnetite. Known from Hot Spring, Pike, Saline, and Scott Counties.

Ref.: 8, 11, 60.

*The Arkansas literature lists contain no specific mineral names. See *antigorite*, *chrysotile*.

□ **SIDERITE** ⊕

$Fe^{2+}CO_3$. Trigonal. Hardness: 3.75-4.25. Cleavage: 3 directions; [1011] perfect, rhombohedral. Sp. Gr. 3.96. Color: cream, brown, weathering to reddish, sometimes iridescent. Luster: vitreous to earthy, translucent to subtranslucent. Streak: white, reddish when weathered. Habit: crystals commonly rhombohedral, curved; coarse to fine-grained, massive.

A relatively common carbonate in bedded sedimentary deposits; a secondary mineral in bauxite deposits; in sulfide-bearing quartz veins; as veins in carbonatite; in alteration zones adjacent to intrusions. Associated with quartz, calcite, dickite, cinnabar, stibnite, galena, chalcopyrite, gibbsite, bohmite, and ankerite. Known from Clark, Franklin, Garland, Hot Spring, Lafayette, Montgomery, Nevada, Pike, Pulaski, Saline, Scott, Sevier, and Washington Counties.

Ref.: 6, 8, 10, 21, 31, 72, 87, 124, 127.

□ **SIDEROPHYLLITE**

$KFe^{2+}{}_2Al(Al_2Si_2)O_{10}(F,OH)_2$. Monoclinic. Hardness: 2.5-3. Cleavage: 1 direction; [001] perfect; flexible. Sp. Gr. 3.27. Color: Blue-green. Luster: pearly to vitreous, translucent. Streak: blue-green. Habit: biotite-like books.

A rarely identified variety of biotite. Associated with calcite, pyrite, and carbonate-fluorapatite. Reported from Hot Spring County. One of the four members making up the micas commonly termed biotite. Compare to biotite.

Ref.: 29.

□ **SIGLOITE**

$Fe^{3+}Al_2(PO_4)_2(OH)_{12} \cdot 7H_2O$. Triclinic. Hardness: 3. Cleavage: [010] perfect, [001] good. Sp. Gr. 2.35. Color: pale straw yellow to light brown. Luster: no data. Streak: no data. Habit: short prismatic to thick tabular microscopic crystals.

A very rare phosphate from abandoned manganese mine. Associated with kidwellite, beraunite, and dufrenite. Known from Polk County.

Ref.: 151, 165.

□ **SINCOSITE**

$CaV^{4+}{}_2(PO_4)_2(OH)_4 \cdot 3H_2O$. Tetragonal. Hardness: no data, soft. Cleavage: 3 directions; [001] perfect, [100] [110] distinct, brittle. Sp. Gr. about 2.84. Color: green to blue green. Luster: vitreous, translucent. Streak: green. Habit: crystals microscopic to ¼ inch, thin to thick tabular, square in cross-section; often displays growth zoning and may form rosettes.

An extremely rare phosphate occurring as crystals on drusy quartz surfaces (fracture planes) of recrystallized novaculite in alteration zones adjacent to igneous intrusions. Associated with various vanadium minerals. Known from Garland County.

Ref.: 48, 124.

SMECTITE GROUP

Monoclinic silicates of general formula $X_{0.3}Y_{2-3}Z_4O_{10} \cdot nH_2O$ where X (exchangeable ions) = Ca/2, Li, Na; Y = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Li, Mg, Ni, Zn; Z = Al, Si. See *montmorillonite*, *nontronite*, *sauconite*.

□ **SMITHSONITE** ⊕

$ZnCO_3$. Trigonal. Hardness: 4-4.5. Cleavage: 3 directions; [1011] near perfect, rhombohedral. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4.30-4.45. Color: white, gray, reddish, brown, yellow, black, greenish. Luster: vitreous, pearly to dull. Streak: white. Habit: botryoidal, stalactitic, earthy; crystals microscopic rhombohedral to scalenohedral.

A common secondary carbonate in the oxidized zone of sphalerite-bearing deposits. In north Arkansas, often in thin to thick coatings over sphalerite or dolomite and as small clusters coalescing into crusts on quartz. Associated with sphalerite, dolomite, quartz, calcite, chalcopyrite, and hemimorphite. In the Ouachita Mountains, smithsonite occurs sparingly in sphalerite-bearing quartz veins. Associated with quartz, stibnite, stibiconite, bindheimite, anglesite, azurite, and malachite. Known from Baxter, Boone, Lawrence, Marion, Newton, Pulaski, Searcy, Sevier, and Sharp Counties.

Ref.: 31, 41, 47, 126.

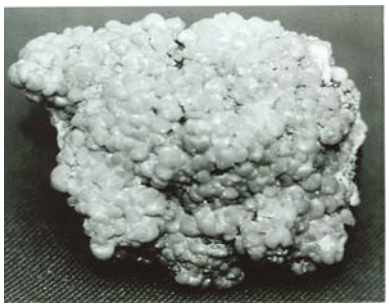


Figure 93 - Smithsonite, Marion County, 12.7 cm. (ALK)

Figure 94 – Smithsonite on sphalerite, Marion County, 0.3 x 0.5 mm. (MPY, JMH, JMH)

SMOKY QUARTZ See *quartz* (crystalline).

□ **SODALITE**

$Na_8Al_6Si_6O_{24}Cl_2$. Cubic. Hardness: 5.5-6. Cleavage: [110] poor. Fracture: uneven to conchoidal, brittle. Sp. Gr. 2.14-2.4. Color: colorless, white, blue. Luster: vitreous to greasy, transparent to translucent. Streak: white. Habit: euhedral to anhedral crystals embedded in syenite; late thin fracture-filling films and coatings on syenite; massive.

A late-forming primary silicate of silica-deficient igneous rocks, such as syenite. Associated with orthoclase, fluorite, pyrite, and nepheline. Known from Garland, Hot Spring, Pulaski, and Saline Counties.

Ref.: 1, 20, 29, 30, 57, 125, 127, 135.

SODALITE GROUP

Cubic silicates of general formula $(Na,Ca)_{4\text{-}8}Al_6Si_6(O,S)_{24}(SO_4,Cl,(OH),S)_{1\text{-}2} \cdot nH2O$. See *nosean*, *sodalite*.

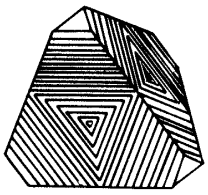
□ **SPHALERITE** ⊕

(Zn,Fe)S. Cubic. Hardness: 3.5-4. Cleavage: 6 directions; [011] perfect. Fracture: conchoidal, brittle. Sp. Gr. 3.9-4.1. Color: brown to honey-yellow, yellow, black, greenish. Luster: resinous to adamantine, transparent to translucent. Streak: colorless to pale brown. Habit: crystals tetrahedral, sometimes overgrown with oriented chalcopyrite; massive, disseminated, granular.

The most widespread zinc mineral in Arkansas; a primary hydrothermal sulfide. In north Arkansas, as crystals and disseminated grains in limestone and silicified dolostone; associated with quartz, dolomite, chalcopyrite, smithsonite, calcite, and galena. In the Ouachita Mountains, in sulfide-bearing quartz veins; associated with quartz, galena, chalcopyrite, stibnite, jamesonite, calcite, ankerite, and siderite. In igneous rocks as rare microscopic crystals in miarolitic cavities and pegmatitic veins associated with orthoclase, acmite, and lavenite. As a scarce mineral in alteration zones in and adjacent to igneous intrusions associated with rutile, orthoclase, smoky quartz, brookite, and tainiolite. Known from most of the counties of the Ozark and Ouachita regions.

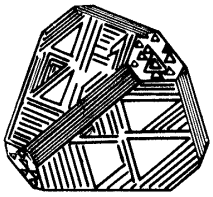
Ref.: 10, 29, 31, 47, 48, 72, 85, 87, 124, 125, 126, 127.

Figure 95 – Sphalerite on acmite (aegirine), Pulaski County, SEM. (HLB)



(DSM – 60.1)

Sphalerite



(DSM – 60.2)

SPHALERITE GROUP

Cubic sulfides, selenides, and tellurides of general formula AX where A = Cd, Fe, Hg, Zn; X = S, Se, Te. See *hawleyite*, *metacinnabar*, *sphalerite*.

SPHENE See *titanite*.

□ **SPINEL**

$MgAl_2O_4$. Cubic. Hardness: 7.5-8. Cleavage: [111] parting, indistinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.58. Color: black. Luster: vitreous, opaque. Streak: white. Habit: crystals octahedrons to ¼ inch; rounded anhedral grains

Chrome spinel is present in mafic xenoliths in syenite where it is associated with pyrrhotite and diopside. Spinel, as rounded grains and rare small octahedrons, is present in lamproite and soils weathered from these ultramafic rocks. Detrital grains are present in the heavy mineral fraction of the Woodbine Formation (Cretaceous). Also present in carbonatite where it is easily mistaken for perovskite.

Ref.: 29, 127.

SPINEL GROUP

Cubic oxides of general formula AB_2O_4 where A = Co, Cu, Fe^{2+}, Ge, Mg, Mn^{2+}, Ni, Ti^{4+}, Zn; B = Al, Cr^{3+}, Fe^{2+}, Fe^{3+}, Mg, Mn^{3+}, Ti, V^{3+}. See *chromite*, *hercynite*, *magnesioferrite*(*?*), *magnetite*, *spinel*.

STEATITE See *talc*.

STERRETTITE See *kolbeckite*.

□ **STEVENSITE**

$(Ca/2)_{0.3}Mg_3Si_4O_{10}(OH)_2$. Monoclinic. Hardness: 2.5. Cleavage: 1 direction; [001] perfect. Sp. Gr. 2.15-2.565. Color: pastel shades: white, gray, pink, buff, amber, brown. Luster: dull to nearly resinous, translucent. Streak: same as color. Habit: rounded grains admixed with manganese oxide.

A scarce smectite-group clay mineral known from hydrothermal quartz veins where it is associated with cookeite and rectorite. Known from Pulaski County.

Ref.: 48.

□ **STIBICONITE**

$Sb^{3+}Sb^{5+}{}_2O_6(OH)$. Cubic. Hardness: 3-7. Cleavage: no data. Sp. Gr. 3.3-5.5. Color: white to yellow, tan. Luster: vitreous, pearly to earthy; translucent to subtranslucent. Streak: white to yellow. Habit: fine grained compact; powdery; encrusting films.

A secondary oxide occurring in the oxidized portions of stibnite-bearing quartz veins. Associated with stibnite, quartz, and valentinite. Known from Clark, Pike, and Sevier Counties.

Ref.: 6, 31, 48, 81, 87.

STIBICONITE GROUP

Cubic oxides of general formula $A_{1-2}B_2O_6(O,OH,F)$ where A = Ag, Bi, Ca, Cu, Fe^{2+}, Fe^{3+}, K, Mn^{2+}, Na, Pb, Sb^{3+}; B = Fe^{3+}, Sb^{5+}, Ti. See *bindheimite*, *stibiconite*.

□ **STIBNITE** ⊕

Sb_2S_3. Orthorhombic. Hardness: 2. Cleavage: 1 direction; [010] perfect, easy; [100] [110] imperfect; flexible, inelastic. Fracture: uneven to subconchoidal. Sp. Gr. 4.63-4.66. Color: pale to dark lead-gray. Luster: metallic brilliant, opaque. Streak: gray to dark lead-gray. Habit: crystals prismatic, vertically striated, often curved; stellate clusters; massive; intergrown with quartz.

A primary hydrothermal sulfide occurring in antimony-bearing quartz veins. Associated with quartz, goethite, sphalerite, galena, calcite, pyrite, and cinnabar. Known from Clark, Pike, and Sevier Counties.

Ref.: 8, 24, 31, 72, 83.

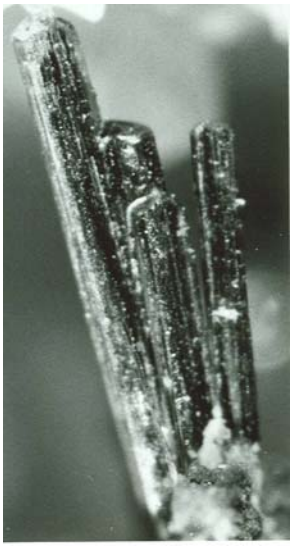


Figure 96 – Stibnite, Sevier county, 0.3 x 3.0 mm. (JMH)

Figure 97 – Stibnite, Sevier County, 0.8 x 3.5 mm. (JMH)

□ **STILBITE**

$NaCa_2Al_5Si_{13}O_{36} \cdot 14H_2O$. Monoclinic. Hardness: 3.5-4. Cleavage: 1 direction; [010] perfect, [100] indistinct. Fracture: uneven, brittle. Sp. Gr. 2.09-2.20. Color: yellowish tan. Luster: vitreous to pearly, translucent. Streak: uncolored. Habit: crystals microscopic blades and clusters of blades; subparallel thin encrusting aggregates.

A scarce late hydrothermal mineral in miarolitic cavities in syenite. Associated with orthoclase, analcime, chabazite, and acmite. Known from Pulaski County.

Ref.: 29, 48, 127.

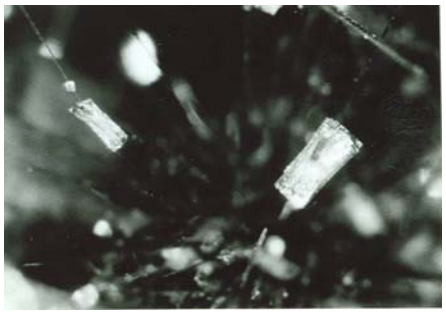


Figure 98 – Stilbite on acmite, Pulaski County, 0.4 x 0.8 mm. (JMH)

□ **STRACZEKITE**

$(Ca,K,Ba)_2(V^{5+},V^{4+})_8O_{20} \cdot 3H_2O$. Monoclinic. Hardness: not determined – soft. Cleavage: 1 direction; [100] perfect. Sp. Gr. 3.09-3.29. Color: dark greenish black to gray. Luster: metallic to greasy, almost opaque; single crystals transparent. Streak: greenish black. Habit: fibrous foliated masses, rarely individual crystals to 0.5mm; fibrous seams and fracture fillings, bladed rosettes and lamellar aggregates.

A rare vanadate in vanadium ore bodies. Associated with clays and vanadium minerals. Known from Garland County. Original type locality.

Ref.: 115, 124.

Figure 99 – Straczelite, Garland County, 0.02 x 0.12 x 0.12 mm. (DRO, DRO, JMH)

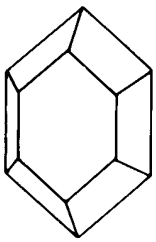
□ **STRENGITE**

$Fe^{3+}PO_4 \cdot 2H_2O$. Orthorhombic. Hardness: 3.5-4.5. Cleavage: 1 direction; [010] good, [001] poor. Fracture: conchoidal, brittle. Sp. Gr. 2.87. Color: pink, purple, white, lavender. Luster: vitreous, transparent to translucent. Streak: white. Habit: rarely, single microscopic bladed crystals; most often, radiating spherical clusters, coalescing into crusts.

A secondary phosphate formed from the alteration of iron phosphate minerals in fractured novaculite. Associated with kidwellite, cacoxenite, beraunite, laubmannite (discredited), and opal. Known from Garland, Montgomery, and Polk Counties.

Ref.: 13, 29, 37, 38, 39, 98, 123, 124.

Figure 100 – Strengite, Polk County, 0.2 x 1.0 mm. (JMH, JMH, JDM)



Strengite (DSM – 822.0)

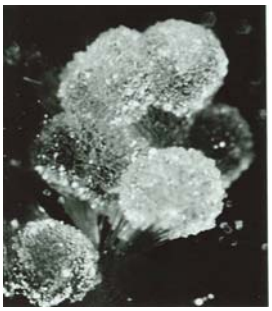


Figure 101 – Strengite, Polk County, 2.4 mm diameter. (AES)

□ **STRONTIANITE**

$SrCO_3$. Calcium- and Barium-rich. Orthorhombic. Hardness: 3.5. Cleavage: [001]nearly perfect; [021]poor; [010]traces, Fracture: conchoidal to uneven, brittle. Sp. Gr. 3.78. Color: white. Luster: vitreous to resinous, transparent to translucent. Streak: white. Habit: elongate crystals.

A carbonate in altered rocks adjacent to igneous bodies. Associated with vug-filling natrolite. Known from Hot Spring County.

Ref.: 157.

□ **STRONTIOPYROCHLORE***

$Sr_2Nb_2(O,OH)_7$. Cubic. Hardness: no data. Cleavage: no data, brittle. Sp. Gr. 2.8. Color: tan. Streak: no data. Luster: subvitreous to dull, opaque. Habit: microscopic rough-surfaced octahedrons.

In vanadium deposits on cavities and fractures in pyroxenite. Associated with diopside-hedenbergite, kolbeckite, mahlmoodite, titanite, and orthoclase. Known from Garland County.

Ref.: 124.

*The original reference in American Mineralogist has an inadequate description for approval by the Commission on New Minerals and Mineral Names of the International Mineralogical Association. The name is correct for the described material, but the description from the Russian locality has insufficient data for formal name approval.

□ **STRÜVERITE (Strueverite)**

$(Ti,Ta,Fe^{3+})_3O_6$. Tetragonal. Hardness: 6-6.5. Cleavage: no data. Sp. Gr. 5.25. Color: black. Streak: no data. Luster: submetallic, opaque. Habit: microscopic black rods and crude discs.

A rare oxide that forms a series with ilmenorutile. Associated with ankerite in veins adjacent to intrusive bodies. Known from Hot Spring County.

Ref.: 138, 166.

□ **SULFUR**

S. Orthorhombic. Hardness: 1.5-2.5. Cleavage: [001] [110] [111] imperfect; [111] parting. Fracture: uneven to conchoidal, brittle. Sp. Gr. 2.07. Color: yellow. Luster: vitreous to greasy, transparent to translucent. Streak: white. Habit: microscopic aggregates.

A scarce secondary native element, derived from the oxidation of pyrite, in veins associated with igneous rock. Associated with chalcedony, pyrite, fluorite, tainiolite, jarosite, and goethite. Known from Garland County.

Ref.: 29, 85.

Figure 102 – Sulfur, Garland County, 0.5 mm diameter. (JMH)

□ **SYNCHYSITE-(Ce)**

$Ca(Ce,La)(CO_3)_2F$. Monoclinic. Hardness: 4.5. Cleavage: 1 direction; [0001]. Fracture: subconchoidal to splintery. Sp. Gr. 3.90-4.15. Color: yellow. Luster: vitreous to pearly, translucent. Streak: pale yellow. Habit: granular to microscopic rosettes.

A rare late carbonate formed in the reaction rims of xenoliths in carbonatite; may also form small secondary veins in carbonatite. Known from Hot Spring County.

Ref.: 29, 105.

□ **SZOMOLNOKITE**

$Fe^{2+}SO4 \cdot H_2O$. Monoclinic. Hardness: 2.5. Cleavage: none. Fracture: conchoidal to uneven, brittle. Sp. Gr. 3.03-3.07. Color: pale pastel green to greenish white. Luster: when green, vitreous; when white, dull; translucent to opaque. Streak: no data. Habit: globular massive.

A decomposition product of iron sulfide minerals in the Tokio Formation (Cretaceous). Present as a precipitate (effluorescent) from acid iron-rich groundwater in the floor of a gravel pit. Known from Howard County.

Ref.: 149.

□ **TAENITE**

γ-(Ni,Fe). Cubic. Hardness: 5. Cleavage: none; malleable, flexible. Sp. Gr. 7.8-8.22. Color: silver-white to grayish white. Luster: metallic, opaque. Streak: no data. Habit: massive; as intergrowths with or as narrow borders around kamacite.

A rare mineral that occurs in all octahedral iron meteorites. Associated with kamacite and schreibersite. Known from several meteorites found in Arkansas.

Ref.: 113, 114.

□ **TAINIOLITE** (formerly Taeniolite)

$KLiMg_2Si_4O_{10}F_2$. Monoclinic. Hardness: 2.5-3. Cleavage: 1 direction; [001] perfect, micaceous; flexible, somewhat elastic. Sp. Gr. 2.82-2.90. Color: colorless, gray, brownish. Luster: vitreous to pearly, transparent. Streak: white. Habit: crystals microscopic pseudohexagonal; flaky scaly aggregates.

A rare hydrothermal mica occurring in veins in metaquartzite in alteration zones adjacent to igneous intrusions and in miarolitic cavities in syenite. Associated with quartz, brookite, pyrite, orthoclase, acmite, pectolite, fluorite, and chalcedony. Known from Garland and Hot Spring Counties.

Ref.: 11, 48, 61, 85, 125.

□ **TALC**

$Mg_3Si_4O_{10}(OH)_2$. Monoclinic, triclinic. Hardness: 1. Cleavage: 1 direction; [001] perfect; flexible, inelastic. Sp. Gr. 2.58-2.83. Color: pale green, white, silvery white. Luster: pearly, translucent. Streak: white. Habit: fine-grained, loosely compact; aggregates of coarse stellate groups filling fractures.

An uncommon secondary mineral formed by the hydrothermal alteration of ultrabasic igneous rock. Associated with quartz, calcite, pyrite, limonite, antigorite, and serpentine. Known from Pulaski and Saline Counties.

Ref.: 48, 92.

TENNANTITE The arsenic end member of the tennantite – tetrahedrite series $(Cu,Fe)_{12}As_4S_{13}$. See *tetrahedrite*.

□ **TERLINGUAITE**

Hg_2ClO. Monoclinic. Hardness: 2.5. Cleavage: [101] perfect, brittle. Sp. Gr. 8.7. Color: yellow, turning gray-green on exposure. Luster: adamantine, transparent to translucent. Streak: no data. Habit: crystalline coating of yellowish aggregates.

A rare secondary oxide noted on mercury mine dumps. Associated with cinnabar, quartz, siderite, dickite, and artsmithite. Known from Pike County.

Ref.: 135, 167.

□ **TETRAHEDRITE**

$(Cu,Fe,Ag,Zn)_{12}Sb_4S_{13}$. Cubic. Hardness: 3-4.5. Cleavage: none. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 4.6-5.1. Color: steel-gray to iron-black. Luster: metallic, opaque. Streak: black to brown to dark red. Habit: fine-grained.

A scarce fracture-filling primary hydrothermal mineral in sulfide-bearing quartz veins of the Ouachita Mountains. Associated with quartz, galena, sphalerite, chalcopyrite, stibnite, jamesonite, calcite, ankerite, and pyrophyllite. Known from Montgomery, Pulaski, and Sevier Counties.

Ref.: 41, 72, 87.

TETRAHEDRITE GROUP

Cubic sulfides, selenides, and tellurides of general formula $A_{12}B_4X_{13}$ where A = Ag, Cu, Fe, Hg, Zn; B = As, Sb, Te; X = S, Se, Te. See *freibergite*, *tennantite*, *tetrahedrite*.

□ **TETRANATROLITE** (also see gonnardite)

$Na_2Al_2Si_3O_{10} \cdot 2H_2O$. Tetragonal. Hardness: no data. Cleavage: not observed. Sp. Gr. 2.22-2.28. Color: white to gray. Luster: dull, translucent to opaque. Streak: white(?). Habit: spherical radiating fine silky aggregates.

Occurs in syenite pegmatite and is associated with stilbite, acmite, chabazite, calcite, and orthoclase. Second known occurrence in the world. Very similar in general appearance to pectolite. Known from Pulaski County.

Ref.: 105.

□ **THAUMASITE**

$Ca_6Si_2(CO_3)_2(SO_4)_2(OH)_{12} \cdot 24H_2O$. Hexagonal. Hardness: 3.5. Cleavage: [1010] traces, brittle. Sp. Gr. 1.91. Color: white. Luster: silky, translucent. Streak: white. Habit: microscopic tufted aggregates to felted masses of fibers.

A rare constituent of pegmatitic veins in syenite. Associated with orthoclase, acmite, analcime, and natrolite. Known from Pulaski County.

Ref.: 105, 106, 127.

□ **THOMSONITE**

$NaCa_2Al_5Si_5O_{20} \cdot 6H_2O$. Orthorhombic. Hardness: 5-5.5. Cleavage: 2 directions; [010] perfect, [100] distinct. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 2.25-2.40. Color: white to pinkish. Luster: pearly, translucent. Streak: colorless. Habit: radiating masses of acicular fibrous crystals.

A late primary hydrothermal zeolite in miarolitic cavities in syenite and as joint fillings in syenite. Associated with orthoclase, albite, biotite, titanite, pyrite, acmite, fluorapophyllite, analcime, natrolite, sodalite, and fluorite. Known from Hot Spring and Pulaski Counties.

Ref.: 33, 57.

□ **THORITE**

$(Th,U)SiO_4$. Tetragonal. Hardness: about 4.5. Cleavage: 1 direction; [100] distinct. Fracture: conchoidal to subconchoidal. splintery, brittle. Sp. Gr. 4.1-6.7. Color: black. Luster: dull. Streak: no data. Habit: microscopic crystals.

A very rare silicate occurring in pegmatitic veins in syenite. Associated with green andradite, magnetite, fluorite, and orthoclase. Known from Pulaski County.

Ref.: 105.

THURINGITE An iron variety of chamosite. See *chamosite*.

TITANAUGITE A titanium-rich variety of augite. See *augite*.

□ **TITANITE** (Sphene) ⊕

$CaTiSiO_5$. Monoclinic. Hardness: 5-5.5. Cleavage: 2 directions; [110] distinct, [221] parting; brittle. Sp. Gr. 3.45-3.55. Color: tan, brown, gray (Nb-bearing). Luster: adamantine to resinous, transparent to nearly opaque. Streak: white. Habit: crystals wedge-shaped disphenoids, rarely prismatic; embedded grains in syenite.

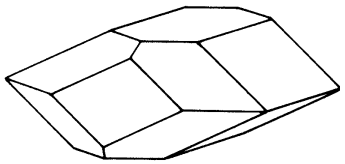
A common primary accessory silicate of igneous rock; in miarolitic cavities of various igneous rock types; in pegmatitic veins; in alteration zones in and adjacent to igneous intrusions; as detrital grains in bauxite and sediments. Associated with orthoclase, sanidine, acmite, biotite, chlorite, analcime, fluorapophyllite, natrolite, nepheline, calcite, magnetite, and perovskite. Known from Garland, Hot Spring, Pulaski, and Saline Counties.

Ref.: 1, 11, 19, 30, 33, 48, 124, 125, 127.

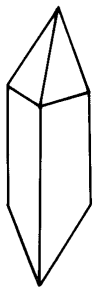
Figure 103 – Titanite, Pulaski County, SEM. (HLB)

Figure 104 – Titanite with acmite, Pulaski County, 0.4 x 6.0 mm. (JMH)

Titanite



(JFW – 217.11)



(JFW – 251.18)

□ **TOBERMORITE**

$Ca_5Si_6(O,OH)_{18} \cdot 5H_2O$. Orthorhombic. Hardness: 2.5. Cleavage: 2 directions at 90°; [001] [100] distinct. Sp. Gr. 2.432-2.44. Color: gray. Luster: silky, translucent. Streak: white to gray. Habit: granular chert-like masses.

A rare secondary silicate associated with a lime-silicate alteration zone in ijolite. Associated with magnetite, andradite, and vesuvianite. Known from Hot Spring County.

Ref.: 11.

□ **TOPAZ**

$Al_2SiO_4(F,OH)_2$. Orthorhombic. Hardness: 8. Cleavage: 1 direction; [001] perfect. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 3.49-3.57. Color: colorless to white, pale brown. Luster: vitreous, transparent to translucent. Streak: colorless. Habit: small prismatic crystals, rounded detrital grains.

A scarce primary igneous component of crustal xenoliths in peridotite-lamproite. A minor resistant detrital mineral in sediments. Associated with almandine, serpentine, and quartz (sand). Known from Pike County.

Ref.: 29.

□ **TOURMALINE***

A group name with the general formula $WX_3Y_6(BO_3)_3Si_6O_{18}(O,OH,F)_4$ where W = Ca, K, Na; X = Al, Fe^{2+}, Fe^{3+}, Li, Mg, Mn^{2+}; Y = Al, Cr^{3+}, Fe^{3+}, V^{3+}. Trigonal. Hardness: 7. Cleavage: [1120] [1011] very indistinct, brittle. Sp. Gr. 3.03-3.10. Color: variable. Luster: vitreous, transparent to translucent. Habit: rounded grains; embedded grains.

A scarce accessory detrital mineral in sediments; a rare constituent of hydrothermal veins associated with igneous rock. Associated with quartz (sand), chalcedony, pyrite, fluorite, zircon, tainiolite, and rutile. Known from Garland (hydrothermal), Clark, Dallas, Grant, Hot Spring, Howard, and Saline Counties.

Ref.: 85, 95, 153.

*Although a group name, only Hanson (1991) has indicated what species is present in Arkansas – schorl.

□ **TREMOLITE**

$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$, where $Mg/(Mg + Fe^{2+}) = 1.0\text{-}0.9$. Monoclinic. Hardness: 5-6. Cleavage: 2 directions; [110] good, [100] parting. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 2.9-3.2. Color: white to gray. Luster: vitreous, translucent. Streak: no data. Habit: embedded grains in igneous rock, reported in thin sections.

A rare secondary alteration product in igneous rock. Associated with palygorskite, calcite, epidote, vesuvianite, magnetite, and muscovite. Known from Hot Spring and Pike Counties.

Ref.: 11, 60, 124.

□ **TRIDYMITE**

SiO_2. Monoclinic, pseudo-hexagonal, triclinic. Hardness: 7. Cleavage: none. Sp. Gr. 2.26. Color: white. Luster: vitreous, translucent. Streak: no data. Habit: microscopic granular.

A scarce SiO2 polymorph occurring as a matrix mineral in certain vanadium ores. Rarely as a matrix for pyroxene and fluorapatite. Known from Garland County.

Ref.: 48, 124.

TRIPOLI A microcrystalline variety of quartz. See *quartz*.

□ **TROILITE**

FeS. Hexagonal. Hardness: 3.5-4.5. Cleavage: none. Sp. Gr. 4.67-4.82. Color: light grayish-brown, bronze-brown. Luster: metallic, opaque. Streak: black. Habit: nodular.

An extremely rare extraterrestrial sulfide identified in nickel-iron meteorites. Associated with olivine, daubreelite, taenite, and schreibersite. Known from various meteorites discovered in Arkansas.

Ref.: 67, 113, 114.

□ **TUPERSSUATSIAITE**

$Na(Fe^{3+},Mn)_3(Si_8O_{20})(OH)_2 \cdot nH_2O$. Hardness: no data. Cleavage: none, fracture conchoidal, uneven. Sp. G. 2.465. Color: reddish brown. Luster: vitreous, translucent. Streak: brownish yellow. Habit: microscopic acicular tufts to acicular spheres.

A very rare phyllosilicate mica mineral, the iron-rich end member of the Tuperssuatsiaite-Loughlinite series. In miarolitic cavities associated with syenitic contact rocks at Magnet Cove. Known from Hot Spring County.

Ref.: 185.

□ **TURQUOISE*** ⊕

$Cu^{2+}Al_6(PO_4)_4(OH)_8 \cdot 4H_2O$. Triclinic. Hardness: 5-6. Cleavage: 2 directions; [001] perfect, [010] good. Fracture: conchoidal to smooth. Sp. Gr. 2.6-2.8. Color: pale to sky blue, greenish blue, green. Luster: vitreous to dull, translucent to opaque. Streak: bluish, greenish. Habit: crystals rare, microscopic; usually massive cryptocrystalline to fine-granular in veins and nodules.

A scarce secondary phosphate in the oxidation zone of copper-bearing deposits; fracture fillings in the Stanley Shale and Arkansas Novaculite. Associated with the iron phosphates, quartz, copper, cuprite, and wavellite. Known from Garland, Montgomery, Pike, Polk, and Pulaski Counties.

Ref.: 13, 38, 86.

*Forms a series with chalcosiderite. Most "turquoise" from Arkansas is planerite in composition, although an iron-bearing variety termed rashleighite was reported as microscopic crystals and crystal aggregates.

TURQUOISE GROUP

Triclinic phosphates of general formula $AB_6(PO_4)_XPO_3(OH)_{2-X}(OH)_8 \cdot 4H_2O$ where A = Ca, Cu^{2+}, Fe^{2+}, Zn; B = Al, Fe^{3+}, Cr^{2+}. See *chalcosiderite*, *planerite*, *turquoise*.

□ **VALENTINITE**

Sb_2O_3. Orthorhombic. Hardness: 2.5-3. Cleavage: 2 directions; [110] perfect, [010] imperfect; brittle. Sp. Gr. 5.76. Color: yellow to gray. Luster: adamantine, transparent. Streak: white. Habit: crystals microscopic tabular plates or prismatic rounded aggregates.

A rare secondary oxide formed by the alteration of stibnite. Associated with stibnite, stibiconite, and quartz. Known from Sevier County.

Ref.: 31, 48.

□ **VARISCITE** ⊕

$AlPO_4 \cdot 2H_2O$. Orthorhombic. Hardness: 3.5-4.5. Cleavage: 1 direction; [010] good, [001] poor. Sp. Gr. 2.57. Color: pale to emerald green. Luster: vitreous, transparent to translucent. Streak: white. Habit: crystals microscopic, twinned pseudo-hexagonal prisms; coalescing into crusts; usually thin crusts.

A primary hydrothermal or secondary phosphate filling fractures in the Bigfork Chert and rarely in the Arkansas Novaculite Formations. Associated with wavellite and quartz. Known from Garland and Montgomery Counties.

Ref.: 8, 27, 28, 38, 39, 48, 123, 124.

VARISCITE GROUP

Orthorhombic phosphates and arsenates of general formula $AXO_4 \cdot 2H_2O$ where A = Al, Fe^{3+}, Cr^{3+}, In^{3+}; X = As, P. See *strengite*, *variscite*.

VASHEGYITE A discredited name. See *kingite*.

□ **VERMICULITE** ⊕

$(Mg,Fe^{2+},Al)_3(Al,Si)_4O_{10}(OH)_2 \cdot 4H_2O$. Monoclinic. Hardness: 1.5. Cleavage: 1 direction; [001] perfect; flexible, inelastic. Sp. Gr. 2.3. Color: shades of yellow to brown. Luster: pearly, opaque. Streak: no data. Habit: crystals pseudo-hexagonal prisms; loose anhedral to subhedral flakes and cleavage fragments.

A secondary silicate weathering or alteration product of biotite, seen as a residual in soils developed from igneous rock, particularly lamprophyres; as veins. Also, as a retrograde alteration of biotite in miarolitic cavities in syenite. Associated with andradite, magnetite, biotite, chlorite, and limonite. Known from Hot Spring, Pulaski, and Saline Counties.

Ref.: 29, 87, 105, 127.

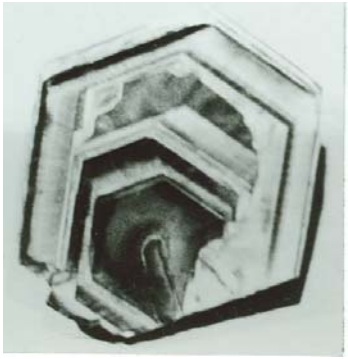


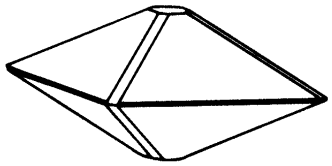
Figure 105 – Vermiculite, Hot Spring County, 7 x 25 x 25 mm. (JMH)

□ **VESUVIANITE** (Idocrase)

$Ca_{10}Mg_2Al_4(SiO_4)_5(Si_2O_7)_2(OH)_4$. Tetragonal. Hardness: 6-7. Cleavage: [110] indistinct, [100] [001] very indistinct. Fracture: uneven to conchoidal, brittle. Sp. Gr. 3.33-3.45. Color: shades of green. Luster: vitreous to dull, transparent to translucent. Streak: white. Habit: crystals rare, pyramidal; fine-grained massive.

A scarce metamorphic silicate formed in the contact zone between carbonatite and other igneous rock types. Associated with biotite, andradite, and calcite. Known from Hot Spring County.

Ref.: 8, 11, 18, 94.



Vesuvianite (JFW-336.38)

□ **VIOLARITE**

$Fe^{2+}Ni^{3+}{}_2S_4$. Cubic. Hardness: 4.5-5.5. Cleavage: [001] imperfect. Fracture: uneven to subconchoidal. Sp. Gr. 4.5-4.8. Color: greenish gray, light gray to steel-gray. Luster: metallic, opaque. Streak: no data. Habit: thin coatings on millerite; anhedral grains.

A scarce sulfide in calcite veins, formed as a alteration or coating of millerite. Associated with calcite and millerite. Known from Benton County.

Ref.: 48, 84.

□ **VIVIANITE**

$Fe^{2+}{}_3(PO_4)_2 \cdot 8H_2O$. Monoclinic. Hardness: 1.5-2. Cleavage: 1 direction; [010] perfect, [106] [100] trace. Fracture: fibrous, flexible. Sp. Gr. 2.68. Color: dark blue or green. Luster: vitreous, transparent to translucent. Streak: colorless to bluish white. Habit: crystals short prismatic, not terminated, often in radiating or stellate clusters; spherical crystalline aggregates form small nodules in some Tertiary sediments on Crowley's Ridge.

A rare secondary phosphate in vanadium ores; authigenic nodules in sediments. Associated with vanadium minerals and limonite in altered pyroxenite. Known from Cross and Garland County.

Ref.: 29, 48, 124.

VIVIANITE GROUP

Monoclinic phosphates and arsenates of general formula: $A^{2+}{}_3(XO_4)_2 \cdot 8H_2O$ where A^{2+} = Co, Fe, Mg, Mn, Ni, Zn; X = As, P. See *vivianite*.

WAD

A general term for hydrated soft oxides of manganese. Compare psilomelane. Ref.: 54, 56, 87.

□ **WAVELLITE** ⊕

$Al_3(PO_4)_2(OH,F)_3 \cdot 5H_2O$. Orthorhombic. Hardness: 3.25-4. Cleavage: 4 directions; [110] perfect, [101] good, [010] distinct. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 2.36. Color: (green color due to presence and valence state of trace vanadium) grass-green, lime-green, blue-green, yellow, white, colorless; rarely fluorescent apple-green to yellow. Luster: vitreous to pearly, transparent to translucent. Streak: white. Habit: acicular radiating crystalline aggregates, often spherical; crystals rare, minute stout to acicular prismatic.

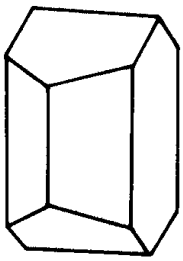
A primary hydrothermal or secondary phosphate in fractures in the Bigfork Chert and Arkansas Novaculite formations; in hydrothermal quartz veins; rarely as fracture fillings in sandstone; rarely on rutile. Associated with variscite, quartz, and planerite. Known from Garland, Hot Spring, Independence, Montgomery, Polk, Pulaski, and Saline Counties.

Ref.: 8, 17, 27, 28, 38, 39, 78, 123, 124.

Figure 106 – Wavellite, Polk County, 0.2 x 0.8 mm. (HSdeL, HSdeL, JMH)

Figure 107 – Wavellite, Garland County, 2.5 x 3.8 x 6.3 cm. (DRH)

Figure 108 – Wavellite, Garland County, 2.5 mm diameter. (MPY, JMH, JMH)



Wavellite (DSM – 842.1)

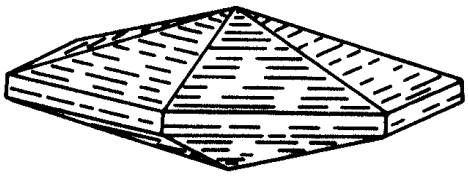
WILLIAMSITE See *antigorite*.

□ **WITHERITE**

$BaCO_3$. Orthorhombic. Hardness: 3-3.5. Cleavage: 1 direction; [010] distinct, [110] imperfect. Fracture: uneven. Sp. Gr. 4.291. Color: colorless to white, gray. Luster: vitreous to resinous, transparent to translucent. Streak: white. Habit: crystals twinned, pseudo-hexagonal dipyramidal.

A rare late hydrothermal carbonate mineral in barite deposits and in hydrothermal veins associated with igneous rock. Associated with barytocalcite, barite, quartz, chalcedony, fluorite, tainiolite, and pyrite. Known from Garland and Montgomery Counties.

Ref.: 80, 85.



Witherite (SM ll – 194.0)

Figure 109 – Witherite, Montgomery County, 4.6 mm diameter. (JMH)

□ **WOLLASTONITE** ⊕

$CaSiO_3$. Triclinic. Hardness: 4.5-5. Cleavage: 4 directions; [100] perfect, [001] [102] good. Fracture: splintery. Sp. Gr. 2.87-3.09. Color: white to grayish. Luster: vitreous to silky, translucent. Streak: white. Habit: massive interlocking fibrous crystals.

A metamorphic silicate formed by the introduction of calcium-rich fluids into novaculite, a silica-rich rock; adjacent to igneous rock or late pegmatitic phases in syenite. Associated with diopside, acmite, miserite, orthoclase, fluorapatite, nepheline, fluorapophyllite, eudialyte, and andradite. Known from Garland and Hot Spring Counties.

Ref.: 1, 11, 30, 75, 94, 124.

□ **WULFENITE**

$PbMoO_4$. Tetragonal. Hardness: 2.75-3. Cleavage: 2 directions; [011] distinct, [001] [013] indistinct. Fracture: uneven to subconchoidal, brittle. Sp. Gr. 6.5-7.0. Color: yellow. Luster: resinous to adamantine, transparent. Streak: white. Habit: individual tabular crystals to 1/4 inch.

A rare secondary oxidation product formed from galena. Associated with galena, cerussite, and quartz. Known from Baxter County.

Ref.: 46, 47.

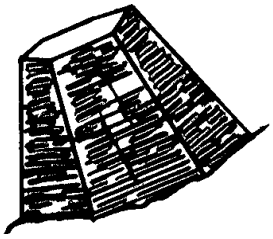
□ **WURTZITE**

(Zn,Fe)S. Hexagonal. Hardness: 3.5-4. Cleavage: 3 directions; [1120] distinct, [0001] indistinct, brittle. Sp. Gr. 3.98-4.08. Color: shades of brown. Luster: resinous, translucent. Streak: brown. Habit: crystals microscopic, short, tapering hexagonal prisms; fractured embedded grains.

A rare hydrothermal mineral in sulfide-bearing quartz veins and in miarolitic cavities in syenite. Associated with quartz, sphalerite, and stibnite. Known from Pulaski and Sevier Counties.

Ref.: 31, 48, 127.

Figure 110 – Wurtzite, Pulaski County, SEM. (AES, HLB, HLB)



Wurtzite, Pulaski County. (JMH)

□ **XENOTIME - (Y)**

YPO_4. Tetragonal. Hardness: 4-5. Cleavage: 1 direction; [100] perfect. Fracture: splintery to uneven, brittle. Sp. Gr. 4.4-5.1. Color: no data. Luster: vitreous to resinous, translucent to opaque. Streak: pale brown, yellowish or reddish. Habit: a grain embedded in a thin section.

A rare constituent in enigmatic siliceous rocks from the Stanley Shale. Associated with an assortment of microscopic minerals including barite, acmitic pyroxene, monazite, galena, sphalerite, pyrite, rutile, and quartz. Known from Saline County.

Ref.: 48.

ZEOLITE GROUP

Hydrous aluminosilicates characterized by the ratio (Al + Si):O = 1:2 and by reversible loss of H_2O at low temperatures. Major cations are Na, Ca; minor cations are Ba, Li(?), K, Mg, Sr. The Zeolite group has been the subject of a major review by a subcommittee of the Commission on New Minerals and Mineral Names of the International Mineralogical Association. The subcommittee's report was published in 1997 (Canadian Mineralogist, v. 35, p. 1571-1606) and a summary of the new nomenclature presented in 1999 by Mandarino (Mineralogical Record, v. 30, p. 5-6). Zeolite minerals are defined as silicates having framework structures which contain open cavities in the forms of channels and cages. Water and extra-framework cations commonly occupy these positions and are readily exchangeable. In many zeolites, aside from the variable extra-framework cations, the ratio of Al to Si may vary. The number of water molecules is also variable. As the number of extra-framework cations increase, the number of water molecules decreases. Formula of any of the Zeolite group minerals should therefore be regarded as simplified representative formulae. The committee established several series within the Zeolite group. See *analcime*, *chabazite*, *clinoptilolite*, *gonnardite*, *heulandite*, *mesolite*, *mordenite*, *natrolite*, *stilbite*, *tetranatrolite*, *thomsonite*.

□ **ZINKENITE**

$Pb_9Sb_{22}S_{42}$. Hexagonal. Hardness: 3-3.5. Cleavage: [1120] indistinct. Fracture: uneven. Sp. Gr. 5.36. Color: steel-gray. Luster: metallic, opaque. Streak: steel-gray. Habit: massive, fibrous.

A rare hydrothermal sulfosalt of sulfide-bearing quartz veins. Associated with quartz, stibnite, sphalerite, wurtzite, galena, jamesonite, and chalcopyrite. Known from Sevier County.

Ref.: 8, 72, 87.

□ **ZINNWALDITE**

$KLiFe^{2+}Al(AlSi_3)O_{10}(F,OH)_2$. Monoclinic. Hardness: 2.5-4. Cleavage: [001] perfect, micaceous, thin sheets flexible, elastic. Sp. Gr. 2.9-3.3. Color: white. Luster: vitreous, pearly on cleavage, transparent. Streak: no data. Habit: loose fine-grained aggregates of micaceous flakes.

A potassium lithium mica present in gas cavities of syenitic rock. Associated with anatase and brookite. Known from Pulaski County.

Ref.:173.

□ **ZIRCON**

$ZrSiO_4$. Tetragonal. Hardness: 7.5. Cleavage: [110] imperfect, [111] poor. Fracture: uneven to conchoidal, brittle. Sp. Gr. 4.6-4.8. Color: shades of brown to tan, pale yellow to colorless. Luster: vitreous, transparent to translucent. Streak: white. Habit: crystals short to long bipyramidal; euhedral to anhedral detrital grains.

A scarce primary accessory silicate in igneous rock, particularly syenite; a resistant detrital mineral in clastic sediments derived form the weathering of igneous rock; in hydrothermal veins associated with igneous rocks. Associated with quartz (sand, silt), orthoclase, titanite, andradite, acmite, nepheline, biotite, olivine, bohmite, gibbsite, tourmaline, pyrite, chalcedony, fluorite, tainiolite, and kaolinite. Known from igneous rock in Garland, Hot Spring, and Pulaski Counties; as a detrital mineral from Clark, Dallas, Grant, Hot Spring, Howard, Pulaski, and Saline Counties.

Ref.: 1, 21, 26, 29, 70, 85, 95, 125, 127, 183.

Figure 111 – Zircon with magnetite, Pulaski County, 0.15 x 1.8 mm. (JMH)

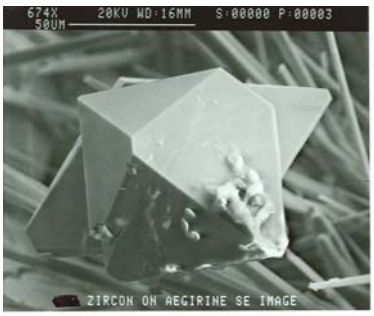
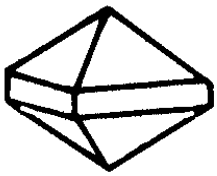


Figure 112 – Zircon on acmite (aegirine), Pulaski County, SEM. (HLB)



Zircon (DSM – 483.1)

Quartz cluster, Montgomery Co. (10 cm long)

Smoky quartz, Garland Co. (7 cm long)

Shale inclusions in quartz, Montgomery Co. (7.5 cm long)

Quartz, Japan Law twin, Montgomery Co. (6.5 cm across)

Quartz with chlorite phantom, Garland Co. (9 cm long)

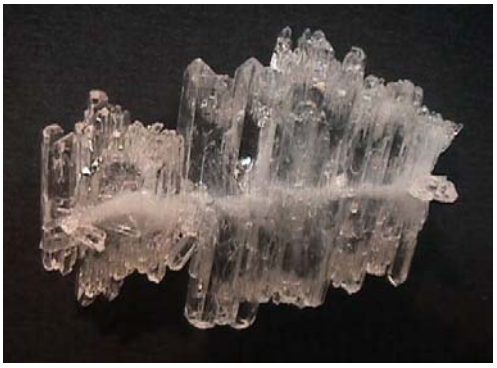
Chlorite in milky quartz, Garland Co. (9.5 cm long)

All color plate images, other than diamonds, taken by J M. Howard, 2007- J.M. Howard collection.

Quartz, double terminated, Garland Co.
(right crystal 4 cm long)

Iron oxide on quartz with calcite,
Garland Co. (17.8 cm across)

Quartz faden cluster with parallel growth
Saline Co. (15.3 cm across)



Parallel growth quartz with faden,
Pulaski Co. (4 cm across)

Quartz with Marcasite/Pyrite
inclusions, Garland Co. (4 cm long)

Quartz regrowth on splinter, Garland Co.
(17.8 cm long)

Adularia on Quartz, Garland Co.
(12.6 cm across)

Smoky Quartz, Hot Spring Co.
(1.4 cm crystals)

Ankerite on quartz, Pulaski Co.
(discoids 2 cm diameter)

Iron oxide stained cookeite on quartz,
Pulaski Co. (rosettes 2.5 mm diameter)

Cinnabar in quartz vein, Pike Co.
(slab 10 cm across)

Milky quartz phantom, Saline Co.
(crystal 2 cm across)

Amethyst, Saline Co.
(crystals 4 mm diameter)

Kidwellite and goethite, Polk Co.
(specimen 8.8 cm across)

Planerite, Polk Co. (largest 3.7 cm long)
Marketed as commercial turquoise.

Wavellite, Saline Co. (10 cm across)

Cacoxenite on beraunite, Polk Co.
(7.5 cm across)

Wavellite, Montgomery Co.
(pocket 3.8 X 7.5 cm)

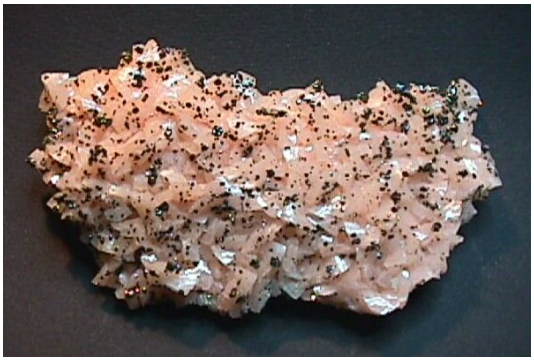
Wavellite, Garland Co.
(radial aggregate 4.4 cm diameter)

Variscite, Garland Co.
(3.8 cm high)

Aragonite, Marion Co.
(specimen 8.8 cm across)

Cu-stained aragonite, Marion Co.
(crystals 4 mm long)

Calcite on dolomite, Lawrence Co.
(crystals 2.5 cm long)



Dolomite with pyrite/marcasite,
Lawrence Co. (7.5 cm across)

Iron-oxide stained dolomite, Marion Co.
(10 cm across)

Smithsonite, Marion Co.
(7.5 cm across)

Malachite after chalcopyrite on dolomite
Marion Co. (7.5 cm across)

Smithsonite, Marion Co.
(11.4 cm tall)

Sphalerite, Marion Co. (15 cm across)

Smithsonite coating dolomite,
Marion Co. (11.4 cm across)

Aegirine needles, Pulaski Co.
(1.2 cm long)

Aegirine, Hot Spring Co.
(15 cm long)

Albite rosettes, Hot Spring Co.
(1.5 cm diameter)

Analcime, Pulaski Co. (4 mm diameter)


Astrophyllite, Saline Co. (1.2 cm long)


Zoned biotite, Hot Spring Co. (2.5 cm)


Brookite, Hot Spring Co. (1.2 cm)


Carbonate-fluorapatite, Hot Spring Co. (needles 1.8 cm long)

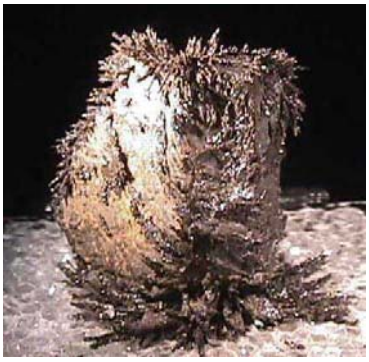

Eudialyte, Hot Spring Co. (1.2 cm)


Fluorite, Hot Spring Co. (1.5 cm diam.)


Hydroxlapatite, Pike Co. (7.5 cm across)


Kazakhstanite, Garland Co. (9 mm spheres)

Kingite, Garland Co. (2.5 mm spheres)



Magnetite (lodestone),
Hot Spring Co. (2.5 cm tall)

Magnetite crystals, Hot Spring Co.
(1.8 cm crystals)

Miserite and wollastonite, Garland Co.
(field of view 7.5 X 5 cm)

Natrolite, Pulaski Co. (1.8 cm long)

Pseudoleucite, Hot Spring Co. (2.5 cm across)

Pyrite, Hot Spring Co. (1.8 cm cubes)

Rutile eightling, Hot Spring Co.
(1.2 cm diameter)

Rutile paramorph after brookite,
Hot Spring Co. (3.8 cm across)

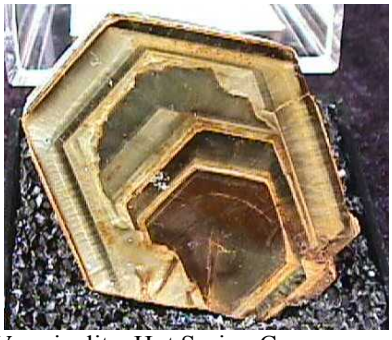
Reticulated rutile,
Hot Spring Co. (3.7 cm tall)

Schorlomite, Hot Spring Co.
(2.5 cm diameter)

Sodalite, Hot Spring Co.
(7.5 X 5 cm field of view)

Stilbite, Pulaski Co. (6 mm sheaves)

Titanite, Pulaski County (1.2 cm long)



Vermiculite, Hot Spring Co.
(2.5 cm diameter)

Vesuvianite, Hot Spring Co.
(1.5 cm across)

Diamonds, Pike County, Arkansas


yellow, 50 points


brown, 25 points


yellow, 15 points


yellow, 25 points


pale yellow, 25 points


brown, 16 points


brown, 15 points


white, 6 points


yellow, 30 points


brown, 7 points


yellow, 10 points


pale brown, 16 points

All diamond images taken by Glenn Worthington, 2007
Original collection of J. M. Howard

GLOSSARY

Mineralogical definitions for the terms in the glossary were extracted from the Glossary of Geology by the American Geological Institute, Washington, DC (second printing, 1973); Mineralogy--Concepts, Descriptions, Determinations by L. G. Berry and Brian Mason (1959); Webster's Seventh New Collegiate Dictionary by G. and C. Merriam Company (1963), and accepted common usage.

Acicular needle-like.

Adamantine brilliant nonmetallic luster, typical of diamond.

Agglomerate clustered, but not coherent.

Amorphous formed originally in the noncrystalline state by rapid cooling of molten liquid or by slow hardening of gelatinous material.

Anhedral a shape characterized by the absence of crystal faces.

Arkose a sandstone containing less than 75% quartz and more than 25% feldspar and plutonic rock fragments.

Authigenic formed or generated in place; refers to a mineral formed after deposition of a sediment.

Bladed a shape term used to describe a mineral that forms an elongate flattened crystal.

Botryoidal a shape term used to describe rounded or nodular masses, imitative of a bunch of grapes.

Capillary a shape term describing a mineral that forms hairlike or threadlike crystals.

Clastic pertaining to or being a sediment or rock composed principally of broken fragments that are derived from preexisting rocks or minerals and that have been transported individually for some distance from their place of origin.

Cleavage the breaking of a mineral along its crystallographic planes, thus reflecting internal crystal structure.

Colloform a textural term said of the rounded, globular nature of a gel-formed mineral deposit. See *botryoidal*; *reniform*.

Columnar a crystal habit that is a subparallel arrangement of slender elongate individual crystals.

Compact said of a close-grained rock in which no component particles or crystals can be recognized by the unaided eye.

Concretionary characterized by or consisting of a hard, compact, rounded, normally semi-spherical mass or aggregate of mineral matter generally formed by localized precipitation from aqueous solution; represents a concentration of some minor constituent of the host rock or of cementing material. Applied loosely to various primary and secondary mineral segregations.

Connate pertaining to waters and gases entrapped in sediments at the time of deposition.

Coralloidal a shape term describing curved and twisted forms.

Cryptocrystalline said of the texture of a rock consisting of or having crystals that are too small to be recognized and be separately distinguished even under the ordinary microscope.

Cubic a crystal system in which the three crystallographic axes (a, b, c) are equal and are at right angles (90^o) to each other; isometric.

Dendritic said of a mineral that has crystallized in a branching form or pattern.

Disseminated said of a mineral deposit in which the minerals occur as scattered particles in the rock.

Earthy said of a dull luster; also composed of or resembling loose, soft, fragmental material in habit.

Efflorescence a mealy, fluffy or crystalline powder produced as a surface encrustation on a rock or soil; produced by the evaporation of salt-laden water.

Euhedral a shape characterized by the presence of crystal faces.

Ferromagnesian containing iron and magnesium; applied to mafic minerals.

Fibrous a habit of a mineral which crystallizes in elongated, thin, needle-like grains.

Foliated a habit of a mineral consisting of thin, leaflike layers or laminae.

Friable said of a rock or mineral that crumbles naturally or is easily broken, pulverized, or reduced to a powder.

Gangue the valueless rock or mineral aggregates in an ore.

Globular spherulitic.

Gossan an iron-bearing, weathered product overlying a sulfide deposit.

Granular said of the structure or texture of a mineral aggregate or rock consisting of or appearing to consist of grains, especially grains of an equal size.

Greasy a type of mineral luster that seems oily to the touch or by sight.

Groundmass matrix.

Habit the characteristic crystal form or combination of forms, including characteristic irregularities of a mineral.

Hardness the resistance of a mineral to scratching; in this text, based on Mohs' scale.

Hexagonal a crystal system which has 4 crystallographic axes (a1, a2, a3, c) in which a1 = a2 = a3 = c in length and a1 is at 120o to a2, a2 is at 120o to a3, a3 is at 120o to a1 (all in the same plane) and c is at 90^o to the a1-a2-a3 plane.

Hydrothermal of or pertaining to heated water; in particular, minerals formed from a hot water solution.

Interstices openings or spaces in a rock or soil not occupied by solid matter.

Interstitial said of a mineral deposit in which the minerals fill the pores of the host rock.

Lamellar composed of or arranged in layers like leaves of a book.

Lateritic refers to a soil, rock, or mineral deposit developed in a tropical environment; said of the end product of tropical weathering.

Liesegang (banding) secondary nested rings or bands caused by rhythmic precipitation (often of iron oxides) within a fluid-saturated rock. Principally known in sandstone.

Luster the reflection of light from the surface of a mineral; described by its quality and intensity.

Mammillary said of an aggregate of crystals taking the form of rounded masses.

Mealy pertaining to a texture of a rock or mineral aggregate that is soft and friable.

Metallic a type of mineral luster that is characteristic of metals.

Metaquartzite a quartzite formed by metamorphic recrystallization of chert, novaculite, or sandstone.

Metasomatic pertains to a process of practically simultaneous capillary solution and deposition by which a new mineral of partly or wholly different chemical composition may grow in the body of an existing mineral or mineral aggregate.

Miarolitic a term applied to small irregular cavities or voids in igneous rock.

Monoclinic a crystal system in which the three crystallographic axes (a, b, c) are of unequal length and a:b = b:c = 90^o; a:c = 90^o.

Oolitic the texture of a rock or mineral consisting largely of small, round accretionary grains, having diameters of approximately 1/32th to 3/16th inch.

Opaque said of a mineral that is impervious to visible light.

Orthorhombic a crystal system in which the three crystallographic axes (a, b, c) are unequal in length (a=b=c) and a, b, and c are at 90^{o} to each other.

Parting the breaking of a mineral along planes of weakness caused by deformation or twinning; a false cleavage; the actual plane of breakage on a mineral surface.

Pegmatitic said of the texture of an exceptionally coarse-grained rock.

Phenocryst a term for a relatively large conspicuous crystal in a porphyritic igneous rock.

Pisolitic pertaining to the texture of a rock or mineral consisting of small, rounded accretionary grains in the size range of approximately 3/16th to 3/8th inch.

Platy the term for a habit resembling flat sheets.

Pneumatolytic formed by gas emanations.

Polymorph a crystal habit of a substance that displays more than one form, i.e. tetragonal (rutile), orthorhombic (brookite), and tetragonal (anatase).

Porphyritic said of the texture of an igneous rock when the same mineral exists in two distinct grain sizes; indicates two different cooling and/or crystallization periods.

Prismatic referring to a mineral or crystal whose length is 1.5 to 3 times its width.

Pseudomorph a mineral whose outward crystal form is that of another species.

Pulverulent said of a mineral that may be easily powdered.

Pyramidal having the symmetry of a pyramid.

Reniform said of a crystal structure in which radiating crystals terminate in rounded masses; kidney-shaped.

Resinous referring to the luster on the fractured surface of a mineral that resembles the appearance of resin.

Silky a type of mineral luster like that of silk cloth; characteristic of fibrous minerals.

Specific gravity a number indicating the number of times heavier a body of any volume is than an equal volume of water; usually measured at ordinary room temperature and pressure.

Splendent said of mineral luster of the highest degree of intensity.

Stalactitic in form resembling stalactites.

Stellate said of an aggregate of crystals in a star-like arrangement.

Streak refers to the color of a powdered mineral, usually on a white unglazed tile.
Striated refers to parallel lines on the surface of a crystal or cleavage plane.

Subhedral said of the form or shape of a mineral grain that is incompletely bounded by its own growth planes--intermediate between euhedral and anhedral.

Tabular said of a crystal form having two prominent parallel faces that give it a broad flat appearance.

Tetragonal a crystal system in which the three crystallographic axes (a,b,c) are at 90^{o} to each other and a = b = c in length.

Translucent said of a mineral that is capable of transmitting light, but is not transparent.

Triclinic a crystal system in which the three crystallographic axes (a,b,c) are of unequal length and not at right angles to each other.

Trigonal a subclass of the hexagonal crystal system characterized by three fold symmetry.

Trimorphic said of a mineral that has three crystal forms.

Ultrabasic said of an igneous rock having a low silica content.

Vitreous the luster of glass on a broken surface.

Waxy having the luster of wax.

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SELECTED ELEMENTS AND CHEMICAL SYMBOLS

Name	Symbol	Name	Symbol
Aluminum	Al	Neodymium	Nd
Antimony	Sb	Nickel	Ni
Arsenic	As	Niobium	Nb
Barium	Ba	Osmium	Os
Beryllium	Be	Oxygen	O
Bismuth	Bi	Phosphorus	P
Boron	B	Platinum	Pt
Cadmium	Cd	Potassium	K
Calcium	Ca	Ruthenium	Ru
Cerium	Ce	Scandium	Sc
Cesium	Cs	Silicon	Si
Chlorine	Cl	Silver	Ag
Chromium	Cr	Sodium	Na
Cobalt	Co	Strontium	Sr
Copper	Cu	Sulfur	S
Fluorine	F	Tantalum	Ta
Gallium	Ga	Tellurium	Te
Gold	Au	Thallium	Tl
Indium	In	Thorium	Th
Iron	Fe	Tin	Sn
Lanthanum	La	Titanium	Ti
Lead	Pb	Tungsten	W
Lithium	Li	Uranium	U
Magnesium	Mg	Vanadium	V
Manganese	Mn	Yttrium	Y
Mercury	Hg	Zinc	Zn
Molybdenum	Mo	Zirconium	Zr