Minerals
of
Arkansas

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1925

ISSUED BY

BUREAU OF MINES, MANUFACTURES
AND AGRICULTURE
STATE OF ARKANSAS

W. N. WILKES, Commissioner
1925

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MINERALS
of
ARKANSAS

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STATE BUREAU *of* MINES, MANUFACTURES
and AGRICULTURE

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INTRODUCTION

"Minerals of Arkansas" was compiled after an exhaustive study of the mineral resources of the State. The book was written with simplicity as the main idea, in order that every reader may thoroughly understand the characteristics of the minerals, easily draw a mental picture of them as they are found in nature, and understand their uses and the part the finished product plays in the every day life of our citizens. Many pages are devoted to minerals which are, for the present at least, inconsequential and commercially valueless. There are many other pages, however, describing minerals that are a valuable asset to our State.

Some minerals are found in extensive deposits, yet have little value, as commercial uses have not been found for them. Other ores are of a low grade and must either await the exhaustion of richer beds in other states, or until a less expensive method of reduction has been found. There has been some criticism of "Minerals of Arkansas" because of the fact that so much space has been given to the now valueless and practically useless lesser minerals and comparatively little attention paid to the minerals which form so great a proportion of the State's resources. It is not the

intention of the Department of Mines, Manufactures and Agriculture to prepare an exhaustive treatise on every mineral, but to give the characteristics of every one found in this State and thereby create a desire for further information which would result in research on the part of our readers.

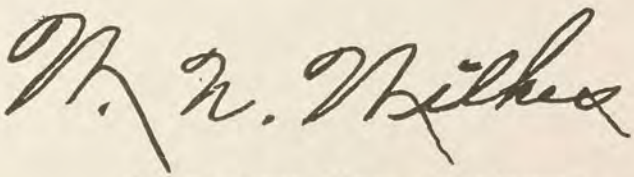
There are many volumes on the major minerals of Arkansas, but it has taken months of research to prepare the following information about the lesser ones. "Minerals of Arkansas" will be supplied to all the public schools, in order that the men and women of tomorrow may have a better knowledge of the State's resources. Production statistics concerning various minerals change so rapidly that in some instances the figures given today will be quite inaccurate a few months later. Production is influenced largely by supply and demand with the exception of crude oil. The disposition seems to be to produce the greatest possible quantity of petroleum in the shortest possible time. New wells are being brought in daily and the supply from old ones is being exhausted. Therefore, the figures shown in "Minerals of Arkansas" on crude oil production can be considered accurate only for the time being.

The Department of Mines, Manufactures and Agriculture acknowledges with gratitude the valuable assistance given it by George F. Branner,

State Geologist, and N. F. Drake, Geologist of the University of Arkansas. They have read "Minerals of Arkansas" many times in its various stages of development and such changes as were suggested by them have been made.

There are treatises on Arkansas Minerals which are more instructive to the technical mind, but the average person is incapable of understanding the scientific terms in which they are written. Our sole purpose is to awaken in the minds of our boys and girls a pride in their native state, and a knowledge of the truly wonderful resources with which it has been endowed by Nature. Having gained this fundamental knowledge, they will not be content until they have pursued the subject more thoroughly.

I am confident this will prove one of the most valuable text-books ever used in our public schools and I feel great pride in being able to offer it for general use for such purpose.



Commissioner Mines, Manufactures and Agriculture.

ACTINOLITE

(Calcium Magnesium-Iron Silicate)

Asbestos occurs in two elemental forms, fibrous and crystalline. The former is pure asbestos and readily yields to the change in form that makes it commercially important. The latter is more beautiful, and while it has considerable heat resisting qualities, is too brittle and difficult to work to be of real value. Crystalline asbestos, known geologically as Actinolite, is one of the peculiar mineral formations of the Magnet Cove section of Hot Spring county. It is a composition of magnesium, calcium and iron silicate, and is common to many of the granite rocks of the Ouachita mountains. Actinolite appears in all the delicate shades of green, often quite transparent, with a silky, pearly lustre. Granite blocks are quarried in irregular shapes, consequently it is impossible to extract the deposits of Actinolite in thin sheets, the necessary form for commercial use as a heat resistant. Scientists have abandoned the idea of powdering granite boulders, rich in Actinolite, and using this substance in a mixture, as it is impossible to remove the gritty substance without prohibitive cost. Until some practical use is found for Arkansas Actinolite, it will remain in its native habitat, just another very peculiar and valueless mineral.

AEGIRITE

(Sodium Ferric Metasilicate)

Evidence of the igneous origin of a certain portion of the rocks of central Arkansas is given in the presence of Aegirite, a black crystal, found only in igneous rocks. This mineral is very common in the vicinity of Vesuvius and Etna volcanoes, though it is not present in all igneous rocks. It is found in the Magnet Cove section of Hot Spring county in granitic rocks associated usually with labradorite and microcline. It is a composition of aluminum, calcium and iron soda silicate, various alkalies often being included in the substance. Aegirite varies in color according to the depth from which the mineral is removed. Near the surface it is often reddish or brown, with occasionally pale yellow or gray streaks, but when taken from a depth of twenty or thirty feet is jet black, and will take a very high polish. Aegirite is formed of long, prismatic crystals, terminating in a blunt point. It is difficult to cut the stone regularly, but with proper machinery it can be manufactured into ornaments of great beauty. Aegirite is of the Pyroxene group, and the name was given it by R. J. Haug, celebrated geologist of the eighteenth century, who made an exhaustive study of European igneous formations.

AGALMATOLITE

(Soft Pencil Stone)

Prehistoric man would have found great delight in the Agalmatolite of Saline and Garland counties. This stone lends itself wonderfully well to the amateur sculptor, or hand carver. The mineral is found in pockets of shale, or as selvage in seams of quartz, and is common to many parts of the state. Its name is of Greek origin and means Statue of Stone, though it is also known as pagodite and prophylite, and commonly, as pencil stone. It was used quite often by the ancient Chinese, and in many large museums of the world there are collections of small, hand-carved figures, probably used as talismans to protect the possessor from the wrath of innumerable gods worshipped by those people. Many of these figures are grotesque in the extreme, similar in design to the totem poles of the Indian and Esquimo tribes of the far Northwest. Agalmatolite is quite soft when removed from its natural resting place and is very easily carved. It hardens when exposed to the weather. It has a glossy appearance and to the touch, feels as though strongly impregnated with an oily or greasy substance. It occurs in many shades, white, gray, yellow, brown, red and black. The red and black Agalmatolites are extremely rare, however.

AGATE

(*Silica*)

Arkansas Agate is as beautiful as any of the foreign Agates. The most finely variegated specimens come from Montgomery county. Agate, a crypto-crystalline silica, is a crystal formation, with particles so minute they are not discernable under the microscope. It is formed in steam fissures of eruptive and sedimentary rocks, and consists of innumerable fine bands of silica, which vary in thickness from 1/5576 to 1/17220th of an inch. The Agate is shaped by the cavity in which it is formed. Silica, carried by water, trickles through the cavity and is deposited on the sides, the outside layers of Agate forming first. The colors depend upon the mineral matter, iron producing the reds, saponite the deep greens, chalcedony the grays, and celadonite the blues. Often the process of formation is arrested and the cavity filled with quartz or amethyst, its colors showing through the striped mass of Agate, giving it a more beautiful appearance. Agate is classed as a gem, but is used in the manufacture of vases, bowls, paper knives, signet rings, for burnishing metals and for rollers in textile industries. Nuggets weighing several hundred pounds have been unearthed in Arkansas by prospectors who were seeking more valuable minerals.

ALBITE

(Sodium Aluminum Trisilicate)

Albite is one of the primary minerals in granitic rocks, hence it is quite abundant in Arkansas. It takes its name from the Latin, albus, meaning white, and as most Arkansas Albite is pure white, it is true to its name. Alpine granite is rich in Albite, hence its crystalline whiteness, making it one of the world's most beautiful building stones. Canada produces Albite with a delicate bluish sheen described in government documents as "like that on the neck of a pigeon." Albite is most common to the Magnet Cove section of Arkansas, also Garland, Saline, Pulaski and Pike counties. Granites vary in value as to their Albite content and the distribution of this mineral through a mass of rock may be irregular. Where Albite is present in quantities, Arkansas granites have as beautiful sheen as those of the foreign countries. When the syenite quarries of Arkansas are fully developed, so that syenite, sufficiently rich in Albite to make it attractive for ornamental purposes, can be separated from that used for building purposes, these quarries will have a very valuable by-product. Albite, a composition of sodium-aluminum silicates, is one of the feldspars. Some very fine specimens of this mineral have been found in Pike county.

ALLOPHANE

(Hydrous Aluminum Silicate)

Allophane is a translucent material resembling very much the stained glass windows of churches and cathedrals. It is quite beautiful, resembling opal, and should be valuable commercially for decorations, as well as ornaments. Allophane is formed by a composition of other minerals, produced usually by weathering. It forms in fissures and cavities, usually in copper and iron mines, though it is often found in the face of marl and limestone cliffs or in excavations made in beds of these minerals. It is usually a glassy substance, with a waxy lustre but sometimes is as colorless as a crystal. It is more commonly sky blue, green, yellow and brown. Chemically it is hydrous aluminum-silicate, and is formed by a decomposition of masses containing these elements. These are carried into the crevices by trickling streams of water which filter through the porous strata. Allophane is also formed through the action of heat, as the elements are easily extracted, and do not require an excessive temperature to set them free. Nature, in its wonderful old workshop, sometimes combines these elements, just as it separates them. Allophane changes appearance when heated, and crumbles to the touch after being subjected to the heat of a blowpipe.

ALMANDITE

(Iron-Aluminum Garnet)

Almandite is nature's best substitute for the ruby, and so well does this stone polish that quite often the services of a gem expert are necessary to distinguish Almandite from the more precious stone. Almandite is commonly known as carbuncle. Almandite is a member of the garnet family, and the one most rich in iron. It is abundant in the Magnet Cove section, both in the free soil, where it has been washed from its natural moorings, and imbedded in granite. Common garnet is a mixture of several types, but Almandite has an individuality all its own. It is hard and brittle and is usually cut and polished in rounded, convex form. The Arkansas Almandite is red, brown, black and violet. Some of the finest carbuncles in America have come from this state. Almandite is a favorite jewel in India, but experts agree that their stone is not superior to the fine specimens of Arkansas. Almandite is also known as Syrian garnet, or Australian ruby. It has been used extensively in those countries in fashioning arm bands, ringlets and fetishes which the superstitious natives believe keep the evil spirits away. The stones are quite numerous, and often of good size, some as large as hen eggs having been found in Arkansas creek beds.

ALUMINITE

(Basic Potassium-Aluminum Sulfate)

This mineral is also known as Alumite or Alumstone. It is a white, fine granular substance resembling limestone in appearance. It is used in the manufacture of alum. It is extracted from its natural state by roasting and lixivating, and is thus obtained in solution. Alum is then secured in the crystalline form by evaporation. Aluminite occurs in seams of volcanic rocks, and is insoluble in water. It is for that reason that some lixivative substance, such as lye, must be used to free it from the other minerals. When first discovered in 1797 the mineral was known as aluminitite, but this was soon contracted to its present name. Aluminite is plentiful in Pulaski, Saline, Hot Spring, Pike, Sevier and Polk counties where some of the hills are of volcanic origin, and has also been found in the mountains of the northwestern part of the state. Springs in the vicinity of Hot Springs and also Heber Springs, are heavy with alum and are supposed to contain healing properties for diseases of the skin and eye. So far as is known no commercial use has been made of Arkansas aluminite, though during the war between the states, alum was produced by local chemists when blockades prevented its being secured elsewhere.

ANKERITE

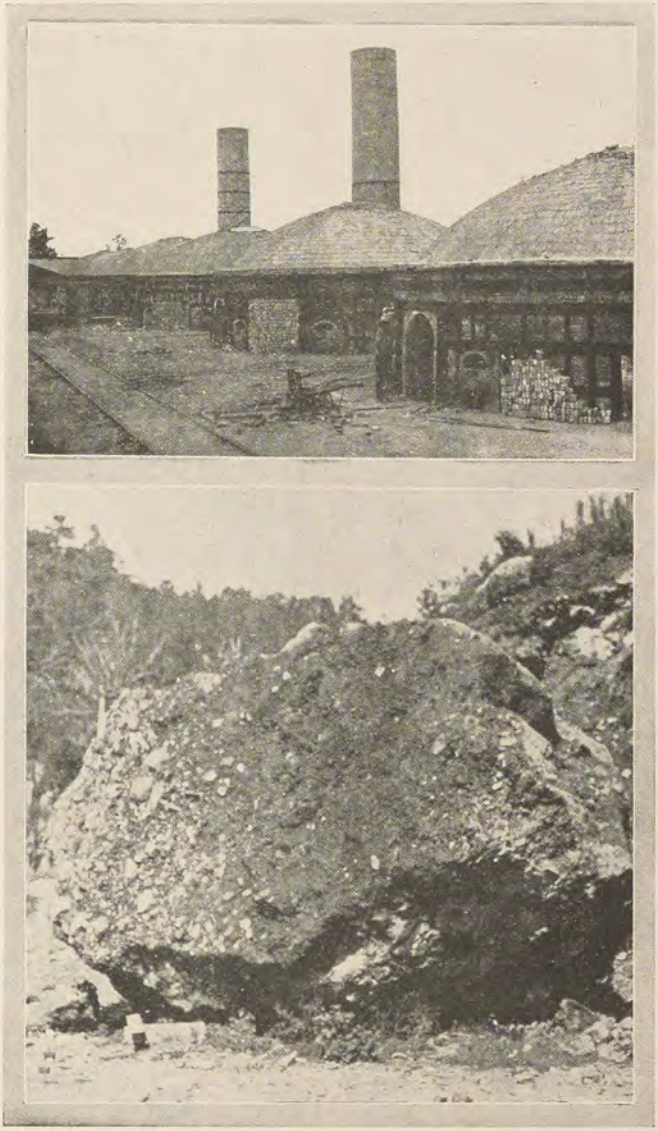
(Calcium, Magnesium and Ferrous Carbonates)

Ankerite is one of the varieties of calcite, or calc-spar. It is found in all common rocks of limestone formation, chalk and marble consisting almost entirely of compact calcite. Its iron content distinguishes it from dolomite, and others of the calcite group. Ankerite itself is valueless and is seldom found except in limestone or marble, of which it is a very important part. Its colors are red, green, brown and black. Its chemical content is calcium, magnesium and iron carbonate. Geologists report Ankerite in the Magnet Cove section, but as limestone is general throughout the state, and marble is found in many sections, it must be common to a great portion of Arkansas. In a powdered form, Ankerite can be used as a plaster, and as it is sufficiently plentiful, has a commercial value in the manufacture of cheap statues, and as a substitute for Plaster of Paris. This is one of the minerals of general distribution and bountifulness for which no one has apparently sought a real commercial use. Science for centuries ignored some of our most important minerals until by chance discovery they became valuable. When this time comes for Ankerite Arkansas will be materially enriched thereby.

ANTIMONY

(*Antimony*)

Antimony, a metal which gives hardening and friction-resisting properties to the alloys, babbit and type-metal, is found in the form of stibnite in various localities of Sevier and Howard counties. Although it has been demonstrated that antimony is present in commercial quantities, it has been mined only intermittently. Discovery was first made in 1873. Babbit is used wherever a metal least affected by friction is required, principally to line the bearings which support rapidly revolving machinery. Antimony is the element in type-metal that toughens and hardens it, permitting the type founder to produce a sharp and clear type face which will not chip or become battered under the heavy pressure of printing presses. Modern printing would be seriously handicapped should Antimony disappear and there be no substitute. Antimony is present in the light yellow soil of certain parts of Sevier and Howard counties, but the percentage of the mineral is much higher in the heavy black shale and rock formation beneath it. Excavations have been made in the Antimony area to a depth of 100 feet without passing through the deposit. A fairly complete report of the Arkansas Antimony area was made in 1907 by the U. S. G. S.



Top: Ovens, near Fort Smith, for baking brick of Arkansas clay.
Bottom: Large Arogonite formation, Hot Springs.

Picturesque cave formations, Diamond Cave, Newton County.

APATITE

(Group of Isomorphous Minerals)

Apatite has a pleasant sound, which is augmented by the more common term applied to it, Asparagus Stone. It is found in central and western Arkansas. Its chief value is as a fertilizer. Some of the larger crystals rank high as gems. Its scientific name comes from the German, meaning "to deceive." This probably was applied to the stone by its discoverer, who was so delighted with the long, beautifully developed crystals, sometimes a foot in length, that he considered them of intrinsic value. These crystals are often colorless, or transparent. In Arkansas they are usually green or brown, though violet, sky blue and yellows have been reported. It is the yellow-green stone of Spain which gave the name Aparagus Stone to Apatite. There are also extensive deposits in Canada, Norway, Sweden, England, Spain and Switzerland. The transparent crystals come from the Alps, where they appear in mountain crevices. Apatite is essentially phosphate of calcium, but the Arkansas deposits contain also fluorine and chlorine. In addition to the crystalline form, Apatite appears in compact, earthly masses. This is Superphosphate of Lime, a natural fertilizer and being soluble in water, is directly assimilated by plants.

APLOME

(Garnet)

Aplome in its fundamental form is a cube, and as such is the most simple of all garnet formations, hence it is sometimes called the "simple" garnet. Its name is even taken from the Greek word meaning simple. It lacks the attractive lustres of the other garnets, and is the only variety that is not considered semi-precious. It is found in three parts of the world, Siberia, Saxony and Magnet Cove. It is the most obscure member of the garnet family, and is likewise the least valuable. The Aplome from the mines of Europe is dark brown in color, but in Magnet Cove specimens have been found which were a yellowish green, and a brownish green. Aplome occurs in the foreign fields encased in a matrix, but in Arkansas the specimens have been picked up in the free state. In all probability the crystals were at one time attached, but have been set free through the ravages of the elements. Aplome is formed in the same manner as other garnets, but some one mineral entered into its composition to characterize it from the others. It has more magnesium than the other varieties. Aplome has been used as an inlay in interior decorations, its dull brown and green colors giving an effect impossible to obtain with the more brilliant stones.

ARAGONITE

(Calcium Carbonate)

Aragonite is a sedimentary stone and in Arkansas is made up from deposits cast on the banks of certain thermal and healing springs. The small particles in the water lodge on the banks and harden, thereby forming this stone. It is present about the famous springs of Carlsbad in Bohemia as well as at Hot Springs, in Arkansas. Pictures produced, with the aid of the microscope, resemble a mass of worms, solidified into stone, or as a bramble with thorns entangled. Another has the appearance of small sea shells. One scientist asserts it resembles boils, indicating that the curative powers of the waters are depicted by nature as a "caster out of devils." The third form is prismatic crystals, white and indicative of purity, the conditions of the patient after bathing in the waters of these springs. Aragonite was first found in Spain, but it is common to a number of places in Arkansas, principally in the Hot Springs section. It is a mineral form of calcium carbonate. It is colorless usually, but specimens of white and yellow have been discovered in Arkansas. It is difficult to distinguish Aragonite from calcite, the chief difference being the hardness of Aragonite, and the fact that it decomposes when heated to a high degree.

ARKANSITE

(*Titanium Oxid*)

While Arkansite has no commercial value, it is a mineral so rare that collectors eagerly seek these thick black crystals which are obtainable only in Arkansas. A new mineral is extremely rare and when Arkansite first appeared it attracted much attention from geologists and scientists, commanding considerable space in professional and technical journals of the world. Such eminent geologists as Charles Uphand Shepard came to Arkansas and after an exhaustive study of the Magnet Cove section of Hot Spring county, wrote a series of articles on Arkansite and two other new minerals that had been discovered in the same vicinity, Ozarkite and Chloromite. As Arkansite is of no commercial value and its crystals are not sufficiently large or attractive for use as ornaments, interest in the new mineral soon lagged and now only those who seek specimens for mineral collections come to Arkansas to obtain them. Arkansite appears in the free form and is not attached to another mineral in its natural state. It is a compound of titanium and oxygen, very much like rutile, except in crystalline structure. Arkansite is found in every important mineral exhibit in the world, placards explaining its origin giving Arkansas some excellent advertising.

ASPHALT

(Volatile Bitumin, Sulphur, Ash and Water)

Pike and Sevier counties have extensive beds of Asphalt. Arkansas Asphalt, in its natural state, is in sheet form and impregnates loose sand in portions of the field and gravel in others. The average thickness of the beds is about ten feet. There are three distinct fields in Pike county and four in Sevier. When Asphalt paving was in its infancy and much experimenting was done, several streets in Little Rock were paved with Pike county Asphalt. Crude as well as improper methods were applied and the Asphalt was not properly purified before being laid, yet this pavement bore the heaviest traffic in Little Rock for a number of years before breaking. Certain sections of it were in perfect condition ten years after the pavement was laid and no repairs had been made upon it. Paving experts declare that these portions were superior to the imported Asphalt with which they were replaced. Mining Asphalt in Arkansas is largely a steam shovel proposition. Geologists declare there are deeper beds which will require underground mining, but their extent or the probable cost of removal has never been determined. It is believed that the Arkansas Asphalt deposits can now be successfully developed provided the proper methods are used.

AUGITE

(Calcium-Magnesium Silicate with Aluminum and Ferric Iron)

Augite is a member of the pyroxene group of rock-forming minerals, found in the basic igneous rocks. Augite is a black or dark green crystal. The crystals are in the shape of prisms. They are found imbedded in basalts, gabros or other dark colored rocks. This rock is similar to the peridotite in which the diamond is imbedded, and like it, disintegrates when exposed to the atmosphere. Many specimens of Augite have been found in the Magnet Cove area, and in Pike county where the crystals have fallen when the rock in which they were encased crumbled under the action of the elements. Augite is a very common mineral of Bohemia, where the crystals are used in the manufacture of ornaments. Only collectors of minerals place any value upon those from Arkansas, although some magnificent specimens have been discovered in this state. The Arkansas Augite differs materially from the others in color, caused by the presence of considerable quantities of aluminum oxide. Augite was at one time supposed to be merely foreign matter encased in igneous rock, but minerologists now agree that it is a mineral formed by composition of the elements in the molten state.

AVENTURINE QUARTZ

(Silicon Dioxid with Mica and Hematite)

In the far east, where there are artisans who appreciate the value of exquisitely marked stone of a texture which permits of their cutting or carving, Aventurine Quartz is almost a precious stone. It is obtainable in Arkansas in greater quantities than in those countries where a constant search is made for it, and little is found. This quartz glistens with enclosed scales of other minerals, principally mica and hematite. These have the appearance of gold, silver and copper, with variegated colors according to the manner in which the specimen encounters the light. The name comes from Aventurine, a kind of glass containing gold colored spangles. Commercial Aventurine Quartz of the past has come principally from the mountains of Europe and Asia. This stone is usually reddish brown or yellow, but very often green specimens have been obtained, containing scales of chrome-mica. This comes from the Bellary district of India and is valued along with the gems by the Chinese. As beautiful specimens as the old world has produced have been found in the Magnet Cove field. Carried back to Europe by collectors of rare stones, they have been cut into fantastic shapes and sold at high prices as native gems by unscrupulous curio dealers.

BARITE

(*Barium Sulfate*)

Barite is sulphate of barium, and is also known as "heavy" spar. This last name was given to it because of its high specific gravity. Barite is usually found in veins, but quite often it is attached to metalliferous ores, such as zinc and lead. It occurs usually as large, well developed crystals which can be readily scratched with a knife. This mineral is either white, or colorless, unless stained by the action of other minerals. Barite is quite valuable, and is used in the manufacture of paint, being often mixed with white lead to give it a gloss. The large crystals have pearl-like edges when broken, and this property remains with the minute particles when the crystal is crushed. Barite is also used to give finish and weight to certain kinds of paper. There are scattering deposits of Barite in Pike, Polk, Pulaski, Saline, Garland and Montgomery counties. Much Barite has also been found in the refuse piles about the lead and zinc mines of northwest Arkansas which has been used for repairing community roads. Some forms of Barite are soluble in water. These are most valuable, being of use in refining sugar. One of the common uses of Barite is as a base for rat poisons. In appearance Barite resembles the common varieties of quartz.

BASANITE

(*Silica*)

Too rare for building purposes, too dull for ornamental, Basanite belongs to a family of semi-precious stones, and yet remains valueless. It has a waxy lustre and in color is a velvety black. In Arkansas it is found in Pulaski county, appearing in beds where the strata were fractured through upheavals in ages past. Basanite is also known as Touchstone and differs from other Chalcedony stones in that its crystals are fibrous, having the appearance of minute veins bundled together in a very compact mass. Included in the Chalcedony group are the agates, flints, bloodstones, onyx, hornstones and jaspers. Basanite has more the appearance of a crystalline quartz than any of these. It is one of the few forms of the Chalcedony group that is evenly marked and is not beautiful. Basanite has a regular cleavage and it is when divided that it shows to its best advantage. It is readily split along plane surfaces parallel to the face of the crystal, which presents a variegated medley of colors, ranging from peacock blue to the deepest black. When so treated by the gem cutter, Basanite has been used for ornamental purposes, but such use is impractical as the mineral is comparatively soft, and in a short time the attractive colors fade away.

BAUXITE

(Iron Hydroxids with Hydrous Aluminum Silicate)

Probably no mineral, not even iron, enters more extensively into the every day life of so many people as does Bauxite, a metamorphosed syenite, that is found in large beds in central Arkansas. At the present time about 90% of the Bauxite mined in the United States comes from Arkansas, there being large Bauxite mines and plants in Saline and Pulaski counties. Aluminum is the principal derivative of Bauxite. Another important derivative is alum, used in the manufacture of paper and baking powders. Artificial abrasives, such as alundum, aloxite, exolon and lionite, are manufactured from Bauxite. All water works systems use aluminum sulphate, manufactured from Bauxite, for the clarification of water in their filtration and storage plants. The annual production of Bauxite ore in Arkansas is approximately 400,000 tons. Bauxite is mined with steam shovels, crushed and dried at plants located near the mines, then shipped to reduction plants in the East to be reduced and fabricated for manufacture into its various products. Foreign countries, with cheaper labor, are now actively competing with Arkansas in the production of Bauxite, but Arkansas has so far been able to retain about 75% of the American Bauxite business.

BIOTITE

(*Acid-Potassium Magnesium-Iron Aluminum Orthosilicate*)

Biotite, in appearance, is petrified chewing tobacco. It is usually dark brown or black, in thin sheets like tobacco leaves closely pressed together, the veins of the leaves clearly showing, as well as shades and blends of the tobacco. Biotite is a member of the mica group, classified as potassium mica, plus magnesium and iron. It has less commercial value than other micas because of its color. Biotite occurs in Arkansas syenite, principally in pockets. Having by nature a brilliant polish, it adds materially to the beauty of the syenite that is marked with it. Quarrymen endeavor to cut their stone, when there is Biotite present, to present cross grain sections on the surface, thus giving it the wavy mottled appearance of quarter sawed oak. There has never been an attempt to make use of Biotite for other than ornamental purposes, as there are more convenient forms from which it can be extracted for commercial exchange. Biotite is found in cleavage flakes in Siberia and was named for J. M. Biot, the French physicist and astronomer who made an exhaustive study of it in the Nineteenth century. The mineral has been found in large sheets, in an almost pure state in certain parts of Arkansas.

BREUNERITE

(Magnesium Carbonate)

Breunerite, better known as Magnesite, is a magnesium carbonate. It has an irregular distribution over the state. Mineralogists and chemists class it in the calcite group of rhombohedral carbonates, rarely found in the crystal form. It is earthly or compact, generally resembling chalk, but has the appearance of unglazed porcelain. Specimens have been discovered which are of exceptionally fine grain, and show a rich mixture of hydrous magnesium silicate, the mineral which is used in the manufacture of the very expensive meerschaum pipe. This form of silicate is very light, resembling cuttle fish bone. It will float on water, and is filled with very fine pores which so quickly absorb moisture that if placed upon the tongue it adheres to the surface, and if left a short time becomes quite painful. No especial interest has been shown by geologists in Arkansas Breunerite, and by most of them it has been passed as chalk. A similar condition existed in Europe until, by accident, pockets of the pure meerschaum were found in vast plains. Natives now locate these pockets, extract the meerschaum, dry it in large balls, and after waxing it, transport it in crude conveyances, many hundreds of miles overland to the markets.

BROOKITE

(*Titanium Dioxide*)

Where precious gems and minerals are found, Brookite is not always present, but where Brookite has been unearthed, some other mineral of extraordinary value has also been discovered. Brookite is found in the Ouachita mountains of Arkansas, and the diamond fields of Pike county are in the Ouachita foothills. Chemically Brookite is titanium dioxide, and chemically is identical with rutile and anatase, but each of these minerals has a distinctive formation of crystals. The Brookite of the European countries and Wales is a rich reddish brown. These translucent crystals have many small and brilliant facets. They are found in the vicinity of the Ural mountains, on the Sanarka river where gold is mined. The Arkansas Brookite has crystals that are six sided bi-pyramids and are black and opaque. They are found only in the Magnet Cove sector. The Arkansas Brookite is a link between the Brookite of Europe and rutile, the needles which compose the Arkansas mineral being identical with those of rutile. There is no commercial value to Brookite, but mineralogists made much of it when first discovered, as to them it was quite remarkable. Many articles were at that time written about the "remarkable discovery."

BRUCITE

(Magnesium Hydroxid)

When A. Bruce, the American mineralogist discovered in 1814 the substance which bears his name, he described it as "native magnesia." As he lived for years afterward it is conceded that the discoverer did not change his mind about the medicinal qualities of the mineral through personal consumption. Brucite is in appearance much like gypsum or talc, usually white, though sometimes gray, blue and green. It is a platy mass and was first discovered in New Jersey, though in different forms has since been found in European countries and Pennsylvania. Deposits of considerable magnitude occur in Saline county of this state. Brucite varies from transparent to translucent. It has a perfect cleavage parallel to the surface and presents a pronounced pearly luster. It is distinguished from gypsum and talc by its optical character, and its specific gravity. Brucite has also been observed in metamorphosed limestone. Mineralogists speak of Brucite as "a mineral consisting of magnesium hydroxide and crystalizing in the rhombohedral system." In most places where Brucite is found it appears in the form of streaks, or veins, in serpentine. Brucite was first called Chrondodite. It is usually associated with magnesite and dolomite.

CELESTITE

(*Strontium Sulfate*)

Getting its name from its color, the pale blue of an autumn sky, Celestite, subjected to a gas flame, presents the lurid red of the infernal regions. It is the red fire of all pyrotechnics. A derivative of Celestite, strontium hydrate, is used in the refining of sugar. Celestite is strontium sulphate. It is generally white, but often has a bluish tinge, and less frequently, one of canary. Celestite is similar to barytes, and the only real test to differentiate between them is to treat each mineral with hydrochloric acid and subject it to the heat of a Bunsen burner. The Celestite gives off a heavy red fire, and the barytes yellowish green. Celestite is slightly soluble in water and is reported in analyses of many springs of Arkansas. It occurs in thin veins in the limestones of Howard, Pike and Sevier counties. No attempt has ever been made to produce Celestite commercially in this state, but there is a legend that the Indians gathered certain stones from southwest Arkansas which were used in their signal fires. The Indians had evidently discovered the secret of the red fire, and were able to burn rock containing Celestite so that the sky was made to glow with a lurid light which was a signal by day, as well as by night.

CEMENT

(Shales and Clays)

Cement is not a basic mineral, but a composition, the ingredients of which are very common to many parts of Arkansas. Cement is a composition of clay and limestone or chalk. The finer the clay and the finer the grade of limestone or other mineral, the better the Cement. Arkansas possesses ideal cement making materials in its chalk, bauxite and pure limestones. It has only recently been discovered that the alumina in bauxite when mixed with clay produces a Cement unaffected by salt and alkaline waters. Arkansas has many acres of low-grade bauxite suitable for the manufacture of Cement of this character. The chalks of southwestern Arkansas have been used in the manufacture of a perfect cement. This industry was promoted in the pioneer days of the material, but with little success. The industry has recently been revived and much capital invested in a plant in Little River county. No other state has finer clays in such close proximity to its limestone, chalk or bauxite fields than Arkansas. Economic conditions form the chief barrier to the formation of a development company, since it would be very hard for a new concern to compete with the large cement corporations of other states.

Top: Bauxite drying mill and plant, Bauxite, Saline County.
Middle: Mining bauxite with steam shovel.
Bottom: Secondary stripping of bauxite after the big shovels have finished.

Top: Ten-foot vein of coal, Sebastian County.
Bottom: Coal strip pit, Johnson County.

CHALCOPYRITE

(*Cuprous Sulfoferrite*)

Chalcopyrite is often mistaken for its relative, "fool's gold" or iron pyrites. Instead of containing iron, it has a content of about one-third copper. The pyrites of both copper and iron are attractive through their resemblence to gold, and both are included in the small number of minerals that can be distinguished because of their effect upon the human senses. Strike iron pyrites sharply with an instrument and it emits an odor of garlic. Scratch copper pyrites and a greenish black mark will appear upon its bright surface. Chalcopyrite is the most abundant of the copper minerals. It is found in veins and deposits, is golden yellow, and is not so hard as the iron pyrites. The surface often displays brilliant iridescent colors, which, combined with its metallic luster, gives the mineral a striking appearance, and the name, "peacock ore." The coloring is due to some alteration product on the face of the chalcopyrite. The crystals are small and indistinct. Chalcopyrite is found in Arkansas in the slate areas of Sevier county. It is not mined, as no extensive vein has been uncovered, but the copper content of the specimens produced is so high that copper mines may possibly be developed in the slate beds of western Arkansas.

CHALK

(Pure White Limestone. Calcium Carbonate)

Great cliffs of pure white chalk tower to a height of 150 feet along streams of Little River county. There is a supply here to last the world for many generations and chemically, it compares favorably with that of the celebrated Cliffs of Dover, England. In magnitude the Arkansas chalk fields are only slightly less extensive than the famous Old World deposit. Spasmodic attempts have been made to develop the mountains of chalk at White Cliff, and recently a large foreign corporation was formed for the purpose of erecting an immense cement, lime and commercial fertilizer plant in that section. In the immediate vicinity clays containing the essential properties for mixing with the chalk in the manufacture of cement are to be had in practically inexhaustible quantities. Erosion has leveled other cliffs in Sevier and Little River counties, producing a heavy black soil which covers a considerable portion of Southwest Arkansas, and which is very productive agriculturally. The chalk beds dip to the southwest, thus passing under other rock beds in that direction. This covered portion might be mined but it will take a century or more to remove and convert into the manufactured product the 900-acre precipice that is most accessible.

CHRYSOLITE

(Magnesium-Iron Orthosolicate)

Chrysolite is a member of a royal family. It is a gem much sought for, and it apparently has its origin in much the same manner as the diamond. It is a transparent mass of irregular grains, usually imbedded in certain rocks, and is rarely in large crystals. One of these rocks is peridotite, the matrix in which the diamond is imbedded. Differing from diamond-bearing peridotite, that in which Chrysolite is found, when exposed to the elements, absorbs moisture and hardens, forming another substance. The color of the gem depends upon the amount of magnesium or iron it contains. In this manner Chrysolite may be yellowish, green or olive green. In some instances there is a small amount of nickel present, in which case the gem is a rich leaf-green. Olivine is the name usually applied to the lower grades of Chrysolite. Precious olivine is dignified with the name of "true Chrysolite." This mineral is found in Arkansas as granules and large crystals. Excellent specimens have been taken from the Fourche mountains near Little Rock, and others from Saline, Montgomery and Hot Spring counties. Chrysolite is a comparatively soft stone, but is a popular gem. The Khedive of Egypt maintains a monopoly on European Chrysolite.

CINNAMON STONE

(Calcium Aluminum Garnet)

From two sources Cinnamon Stone gets its name. It is found in the gem gravels of the Cinnamon Islands of Ceylon, and is also of a cinnamon color. It is one of the garnets that ranks as a gem, and there are specimens of great value in royal collections. Cinnamon Stone is really a mixture of all the five garnet substances, which combination produces a stone softer than any of its ingredients. It is essentially a calcium-aluminum-garnet, but has also ferrous and ferric iron, manganese and magnesium. The crystals are often transparent, a warm reddish brown, honey-yellow or hyacinth-red. The Arkansas stones are largely honey colored, and like those of the far East, are found in gravel beds, though some fine specimens have been discovered attached to limestone rock. The Cinnamon Stone is easily cut, and its facets cause it to sparkle like a canary diamond. Some beautiful crystals have been removed from veins of serpentine, associated with green crystals of diopside. Cinnamon Stone is the nearest approach to a gem of any mineral or stone of the Magnet Cove area. Hessonite is the scientific name for Cinnamon Stone. Where found in gravel, the stones are often nearly round, due to much rolling by the water.

CLAYS

(Hydrous Aluminum Silicate with Various Impurities)

Clays for every purpose, both ornamental and useful, are to be found in practically all sections of Arkansas. Even the surface clays are adaptable to tile manufacturing. A manufacturer of clay products has merely to select his site, erect his plant and transport the raw material to the mill by conveyor. There are many deposits of lignite in Arkansas and beneath this in most instances is a clay from which the best of fire brick is manufactured. There are a number of fire, pressed, and vitrified brick plants located on main line railroads in Arkansas. This eliminates not only transportation expense from pit to mill, but switching charges as well. It is claimed by fire brick manufacturers that Arkansas produces a fire brick with greater heat-resisting properties than those manufactured in certain other states. They justify this assertion by fusion tests made in the leading laboratories of the United States. This gives Arkansas fire brick manufacturers the world for a market. Malvern is the center of the fire brick industry. Vitrified or paving brick is manufactured at Fort Smith from the shale of that vicinity. Potter's clay, in all colors, is distinctive of Saline county. At Benton is manufactured the famous Niloak pottery, sold in every part of the world.

COAL

(Carbonacious Minerals of Variable Composition)

Arkansas has two distinctive fields and two varieties of smokeless Coal, semi-anthracite and semi-bituminous, producing annually about 2,000,000 tons. Arkansas has 1,864 square miles of known Coal fields of which 1,554 square miles is semi-anthracite and 310 square miles is semi-bituminous. The semi-bituminous field includes Sebastian, Scott and small parts of Logan and Franklin counties. The semi-anthracite field includes Pope, Johnson and portions of Franklin and Logan counties. Modern mining methods are applied in mining coal in Arkansas. Many mines are electrically equipped. Few mines in Arkansas are of a greater depth than 300 feet. The Coal beds vary from four to twelve feet in thickness. Arkansas Coal is remarkably free from impurities, burning with a clear white ash and seldom producing clinkers. The semi-bituminous Coal is unexcelled for heat producing qualities. Arkansas semi-anthracite Coal commands a price equal to the best anthracite. Trunk line railroads traverse the Coal fields of Arkansas. Strip pits which produce an excellent quality of surface Coal are also profitably mined in both fields of the state. Geologists assert Arkansas has a supply sufficient to last at least 350 years.

COPPER

(Copper)

Traces of native Copper have been found in a number of places in Arkansas, and numerous companies have been formed to fully develop the most promising leads, but the history of every enterprise has been the same—the investors have been the sadder and wiser men in the end. Native Copper is such an extremely tough metal that where it is found mining is a difficult process. On the surface it is extremely dull and tarnished to a full brown color. It is only when there has been a fresh fracture that the characteristic copper-red color is apparent. Most Copper is extracted from ores of Copper, such as Copper Pyrites and other compounds of Copper, of which there are promising deposits in Arkansas. Copper in the natural state has been mined on a small scale in Pulaski county, but a sufficient amount of the ore was not recovered to meet the cost of mining. Charts have been "discovered" on numerous occasions showing the location of copper mines operated by Mexicans or Indians, but each year these charts are given less credence, as people are beginning to realize that native Copper is a very rare thing, and as a source for real Copper, the chalcopyrites are to be more seriously considered.

COPPERAS

(Ferrous Sulphate)

Nature's oldest astringent is copperas, or green vitriol. Its name comes from the Latin, and means "flower of copper." As an astringent, green vitriol was used by armies of Biblical time to staunch the flow of blood, a truce being declared in order that the wounded might have attention. Modern industries have given it new uses, and today it is an important factor in the tanning of hides, the manufacture of writing fluids, and in dyeing fabrics where a deep and solid black is desired. Copperas is obtained through the decomposition of iron pyrites, usually produced artificially. In Arkansas nature has itself attended to this and Copperas is often found in the free state. Exposed to the atmosphere, Copperas becomes a dull brown, absorbing oxygen, and producing a powder. The Copperas of Arkansas usually appears in connection with iron and copper pyrites, of which there are beds in the southwestern part of the state. Copperas is also used in the manufacture of sulphuric acid and oil of vitriol. It turns water black in a short time. Copperas is sweet to the taste, but has the same puckery effect upon the tongue as alum. Scientifically, Copperas is known as ferrous-sulphate. It is a deep bluish-green color.

DIAMONDS

(Pure Carbon)

Over 20,000 Diamonds, one weighing in excess of 40 carats, have been found in Arkansas, the only genuine Diamond field of the American continent. Gem experts declare that brilliancy is one of the real tests of a Diamond. The harder it is, the more brilliant the stone. These experts assert that the Arkansas Diamond is one point harder than those of South Africa and Australia, hence it exceeds them in brilliancy. Near Murfreesboro, in Pike county, is the pipe of an extinct volcano. It is now filled with a grayish green rock, called peridotite, identical in its chemical properties with that of the South African and Australian Diamond fields. The extinct volcano is about fifty-two acres in area. The first Diamonds were discovered in Arkansas in 1906 by John Huddleston, a farmer, who picked up in the road and creek bottoms some exceedingly brilliant pebbles. A foreign corporation owns this pipe of volcanic origin, has erected a large plant and made quite extensive investigation to determine the extent of the field. White, brown, yellow, canary and wine colored Diamonds have been found there. Diamond discoveries have been reported in several other parts of Pike and in Howard, the adjoining county.

DOLOMITE

(Calcium Magnesium Carbonate)

Dolomite is a stone which withstands the ravages of time and elements without a change of color. Chemically it is calcium-magnesium-carbonate and is a member of the calcite group. In Arkansas Dolomite occurs in large beds similar to limestone and sandstone. Other than the color, it has all the qualities of the European stones which are a beautiful white. The name comes from the Dolomite mountains of the Alps, where this mineral abounds in the form of a marble. Arkansas has a cream Dolomite, but there is still a wide gap between it and marble. They are easily polished, but are equally as beautiful for building purposes when used in the rough. There are many buildings in the mountainous northwestern part of the state, constructed of Dolomite, which bring favorable comment from all visitors, because of their clear, buff color and regularity of cleavage. Much of this stone has been quarried and shipped to other states. The stone yields readily to the chisel and hammer of the mason. There are large deposits of Dolomite in England, and the Houses of Parliament are constructed largely of it. There is a great similarity in appearance of the Dolomite of England and that of Arkansas, especially when it is weather worn.

ELAEOLITE

(Sodium Aluminum Orthosilicate)

Elaeolite or Nepheline is one of the constituents of Arkansas Granite which is known as nephelite syenite, and occurs in large, rough crystals, or more often, as irregular masses. It has a greasy lustre and is opaque, with a red, green, brown or gray color. It forms an essential constituent of certain alkaline plutonic rocks which are typically developed in Southern Norway. Elaeolite is generally distributed over Arkansas and is abundant. The name comes from the Greek, and means "oil stone." The color and greasy lustre are due to the presence of numerous microscopic enclosures of other minerals, possibly augite or hornblende. These enclosures sometimes give the specimen a chatoyant effect. When the marking is a rich green or red, with a distinct band of light about it, this portion is often removed and cut as a gem stone. Elaeolite has no general use, though it has the properties of first class oil stone, in which Arkansas abounds. Specimens of Elaeolite have been cut in a convex form and mounted so that they have the flash and fire of a cat's eye reflecting the rays of an automobile headlight at night. They seem to contain a living fire, and the lines apparently move in waves. It is a very interesting and curious stone.

EPSOM SALT

(*Heptohydrated Magnesium Sulphate*)

While it has never been gathered for general use, Arkansas nevertheless is nature's storehouse for a considerable quantity of Epsom Salt. It is formed through chemical action of the elements in caves and tunnels of abandoned mines and is in an impure state. It has long been claimed that Epsom Salt is present in veins and pockets in mountains of Faulkner county. This has not yet been proven, but should it be, Arkansas will boast of another mineral deposit not found elsewhere on the American continent. Epsom Salt, in the pure crystal form, is imported from Europe and, contrary to public opinion, its principal use is not for medical purposes. Epsom Salt is used for weighting cotton and its presence makes fast the dye in cotton fabric. In all probability the Epsom Salt which forms in Arkansas caves and underground passage ways could be used in this manner, but the quantity is entirely too small to be worthy of consideration. With the advent of the cotton mills in Arkansas an increased demand for the mineral may stimulate a search for it in the localities where legend has it as existing. Spring waters in various sections of the state which have alkaline taste quite frequently contain a considerable portion of this healthful salt.

FLUORSPAR

(*Fluoride of Calcium*)

Fluorspar appears in crystal form in association with limestone, lead and other ores. It presents many colors, often more than one color in the same crystal. When pure, Fluorspar is perfectly colorless and transparent. The fact that heat will destroy all colors in Fluorspar indicates the pigment of color is a hydrocarbon of some kind. Certain specimens change color in the sunlight and some show one color by transmitted and another by reflected light. Fluorspar is of one color, if held between the eye and a strong light, and another if the eye is between the light and the specimen. This phenomenon is responsible for the word fluorescence. Fluorspar is also phosphorescent, as when heated almost to red heat, it glows with a soft greenish light like a glow worm. Chemically fluorspar is fluoride of calcium. It is insoluble in water, and resistent to most chemical reagents, but warmed with sulphuric acid it gives off hydrofluoric acid gas, which readily attacks glass and other silicates, giving it great value for etching upon these substances. As it fuses at red heat it is employed as a flux in the smelting of ores. It is also used in the construction of lenses. In Arkansas it is found in Garland county, near Lawrence.

FREIBERGITE

(Copper Sulfantimonite)

Freibergite is Arkansas' most promising of silver-bearing ores. It has been found in small quantities in the Kellogg and McRae mines of Pulaski county, in the Silver City region of Montgomery county, and in Sevier county. There was a rush of prospectors to Silver City in 1892, when the first strike was reported, and for a time it was a characteristic boom town. Little remains today to show the frenzy of the treasure seekers, Silver City being a city in name only. Freibergite is commonly called gray copper ore, and is much similar to Tetrahedrite, a compound of copper, antimony and sulphur, except in Freibergite the copper is almost entirely replaced by silver. In some instances 30 per cent of the ore is pure silver. The mineral takes its name from a German village near which are many silver and copper mines. The rich producing silver mines of Bolivia have heavy veins of Freibergite. In color it is iron black and steel gray. Some rich ores have been taken from mines of Central Arkansas, but the main vein, if there be any, has not been uncovered, and what mining has been done has not been profitable. Prospectors still devote much time working promising leads in the sections which are supposed to contain silver.

FULLERS EARTH

(Clay-like Substance of Variable Composition)

Finding in Saline county a light colored soil closely resembling that mined in France for bleaching purposes, a foreign-born citizen caused an analysis to be made which resulted in the development of Fullers Earth as an enterprise in Arkansas. Fullers Earth is a chalk-like substance with an affinity for oil and grease. It was first used in Europe for the cleansing of wool, all wool being washed in a solution of it to remove the natural oil before it could be spun into cloth. Packers are large consumers of Fullers Earth, they using it in bleaching lard, the snow white evidence of purity thus obtained often being a tribute to an Arkansas mineral. Cottonseed oil lard substitutes are also bleached with Fullers Earth. In recent years Fullers Earth has also found favor with the manufacturers of cosmetics and it is now the base for many popular brands of face and talcum powders. England originally was the principal source of supply, but much now comes from Florida and Texas. Chemical analysis shows the Arkansas product to excel the imported article and the Saline county plants have supplied many American manufacturers with this mineral. Fullers Earth is also used as a cleansing powder, it being free from grit or sharp surfaces.

GARNET

(Calcium-Silicate)

The dull rich red settings of the less expensive rings offered by jewelers to the trade are for the most part Garnet. Arkansas can furnish sufficient Garnet to ornament every finger in the known world. Its abundance, and the fact that it can be so closely imitated by glass manufacturers prevents Garnet from being a real commercial asset to Arkansas. In the vicinity of Magnet Cove, Hot Spring county, Garnet in the form of dark red pebbles, sometimes as large as a hen egg, virtually litters the ground. A sharp-eyed person can in a few hours pick up a quart or more of them if he cares to take the trouble. Cut in the same manner and shape as a diamond, Arkansas Garnet has great brilliancy and the luster of the stone never fades. Were they less plentiful this stone no doubt would be classed as a gem and possess great value. No effort has ever been made to determine the extent of the Garnet-bearing area of Hot Spring county, as people seldom conduct exhaustive research without hope of a reward. The Garnet pebbles of Arkansas have been uncovered by erosion and even should they become popular, excavation would be unnecessary as there is a sufficient number of free stones in the creek beds to supply any reasonable demand.

Top, left: Worker in Manganese mine, Independence County.
Top, right: Mining Tripoli, Hot Spring County.
Bottom: Working gravel pit with steam shovel, Saline County.

Top: Chalk Cliffs, on Little River near Whitecliffs.
Bottom: Searching for Diamonds in the Pike County diamond fields.

GEYSERITE

(Hydrated Silica)

The presence of Geyserite in the Magnet Cove area proves conclusively that there were geysers at one time in Arkansas. Geyserite is built up of tiny organisms, a low form of animal life that exists in natural hot water. Geyserite is a variety of opal. It is porous and while not a precious stone, appears in many fantastic forms. It is found about the edges of hot water springs of Iceland, New Zealand and Yellowstone National Park, as well as in Arkansas. The porcelain variety, known as girasol, similar in every respect to that about the geysers of Yellowstone National Park, occurs in Garland and Hot Spring counties. It varies in character and the assortment about "Spanish Diggings" at Magnet Cove is remarkable. The more common varieties have the appearance of porcelain, white and a delft-blue, with a bright luster. There are some specimens which give off a bright red light when subjected to the rays of intense light and though pure Geyserite, these are known as fire opals. Some specimens are marked as though nature was endeavoring to decorate its porcelain with delicate rings and designs and to compete with the skill of the ancient potter. Geyserite is too frail to have a real commercial value, yet no mineral affords a more interesting study.

GLASS SAND

(Saccharodial Sandstone, Novaculate, etc.)

Glass Sand abounds in Arkansas. North Arkansas has many deposits of great purity which extend from near Batesville in Independence county to the western border of the state in Washington county. Near Guion, in Izard county, there is a bed of Glass Sand of sparkling white. Saline county is also rich in Glass Sand and that great natural dividing line between the river alluvial and prairie sections of Eastern Arkansas, Crowley's Ridge, contains a large deposit of Glass Sand. Crowley's Ridge Glass Sand is impregnated with a slight deposit of iron which will require treatment before it can be manufactured into a clear glass. In its natural state it will produce tinted bottle glass. Jefferson county also has a Glass Sand. Large glass factories are located in Fort Smith and Texarkana. These factories are located in natural gas areas and Texarkana uses Saline county Glass Sand. The other cities are too remote from the beds to use much Arkansas Glass Sand. For them to obtain this material in Arkansas it is necessary to transport it in a roundabout way through another state with an excessive freight rate, consequently these manufacturers are forced to use an outside sand. Extension of the gas fields will remedy this.

"GRANITE"

(Not Real Granite, but Nephalite Syenite)

According to the United States geological reports there is only about 14 square miles of exposed "Granite" in Arkansas. These outcroppings are usually in conical form, with the area spreading beneath the surface, and quality improving with depth. There are four distinct areas, in Pulaski, Saline, Hot Spring and Garland counties. Buildings in each of these counties display the distinctive properties of the "Granite" peculiar to that vicinity. In Pulaski there has been more development of "Granite" than in the other counties and many of its more pretentious dwellings and business blocks are faced with this wonderful stone. It is principally in gray, blue and green, but occasionally a dark red "Granite" of fine texture is uncovered. The "Granite" takes a very high polish and is often used for monuments or where ornamental stone is required. Surface "Granite" is somewhat discolored by the elements, but this does not affect its road building properties, and enormous quantities are used for this purpose. Pulaski county "Granite" chisels as perfectly as the imported stone. Arkansas "Granite," according to mineralogists, is not real granite, but nephalite syenite, which, however, is the same for all practical purposes.

GRAPHITE

(Modification of Carbon)

Graphite has three principal uses, for the manufacture of pencils, as a lubricant and in paint mixtures. Geologists report Graphite shale in Hot Spring, Garland, Pulaski and Montgomery counties. None of the state reports indicate more than a superficial investigation, consequently the extent, value or quality of the mineral is at the present unknown. The surface outcroppings show a quality and promise a sufficiently extensive field to attract further investigation. The Graphite on the surface is mixed with clay, yet it is suitable for use in the cheaper grades of paint. Geologists are of the opinion that if the pockets and veins are followed some distance into the earth, a much purer Graphite may be discovered. Like so many other minerals of Arkansas, Graphite usually is found in the most remote sections. The extent of the Graphite deposit will be given much consideration by the State Geological Department in a survey which has recently been authorized by the General Assembly. The Graphite sections are mountainous, and as roads can there be cheaply built and easily maintained, it will not be difficult to transport the raw material by trucks to the railroad centers, should the deposits prove of sufficient commercial value.

GRAVEL

(Small, Hard, Water-worn Stones)

Geologists class the Gravels of Arkansas under three heads, according to the age in which they were deposited. Commercially there are but two varieties, one a clean Gravel of the creek beds, and the other, a mixture with clay. The Gravel from the creek and river beds is used in making concrete and for ballasting railroad tracks. The principal use for the Gravel mixed with clay is road construction and its value is determined by the proportion of clay. All Arkansas was at some time the bed of great bodies of water and these Gravel beds were then formed. They vary in thickness from ten to one hundred feet and in some instances whole mountains are of an exceptional grade of Gravel. The two principal Gravel areas are the Crowley's Ridge section and the entire southwestern portion of the state. There is a small field in Independence county. Large pits are operated in Saline, Hot Spring and Pike counties. Here Gravel is excavated and loaded on railroad cars by steam shovel. The beds of Pike county show a Gravel of uniform size and in many instances the stone is almost round. These pebbles range from one-half to ten inches in diameter and should be valuable for use in tube mills.

GREENOCKITE

(Cadmium Sulphide)

Greenockite is a rare and interesting mineral, found in the United States only in the Ozark mountains. It is cadmium sulphide and occurs in very minute, though distinct, honey yellow crystals, which give it the common name of "turkey fat." It is also found in conjunction with blende and calamine, displacing a small amount of zinc. Greenockite is found in the true crystal form only in Scotland, where it occurs in cavities in basaltic igneous rocks. The largest crystal, one half-inch in diameter, was discovered in 1810, and Lord Greenock later made such an extensive and valuable collection that the mineral was named for him. It is the only known brown mineral that contains cadmium as an essential constituent. Its canary yellow color, to the geologist, is the most attractive feature of the lead and zinc ores of northwest Arkansas. Greenockite, in the powdered form, is found in Bohemia and Greece. As the mineral is found only upon the face of the ores to which it has attached itself, it was deposited there either by a gas, which penetrated the fissures and pockets of the minerals, or was detained by a natural filtration process, water carrying the tiny crystals of Greenockite upward from far down in the earth.

GROSSULARITE

(Calcium-Aluminum Garnet)

One of the most beautiful of all the garnets is Grossularite. It is an unusual shade of greenish-yellow, hence the Latin name meaning "gooseberry-stone." It is chemically a calcium-aluminum garnet, and when pure is colorless, but specimens of this kind are more rare gems than diamonds. The common name is exceptionally well applied, as it resembles a gooseberry almost in the most minute detail, having the vein and husk markings of the berry pie-filler. The Arkansas Grossularite is the only American mineral of this kind that is true to its name, though there is a species in Mexico. This crystal is rose pink, and is imbedded in a white marble along with pale green splashes of epidote, giving it the appearance of the bright hued Spanish shawl or mantilla of the Mexican senorita. This is cut into slabs and polished and is held in high favor by the color-adoring Mexicans. The Arkansas specimens have all come from the Magnet Cove area, in Hot Spring county. Grossularite is not a large crystal, nor is it of sufficient hardness to make it exceptionally brilliant or to prevent it scratching readily, yet it is so beautiful that few can resist the temptation of exposing its surface to the ravages of friction, as a setting for some personal ornament.

GYPSUM

(*Hydrous Calcium Sulfate*)

The principal commercial use of Gypsum is Plaster of Paris. The less pure Gypsums have a high rank as fertilizers. Southwest Arkansas has many Gypsum producing areas which the geological report of 1888 states are "too impure for the arts but suitable for agricultural fertilizer or land plaster." There is a precipice a short distance south of Murfreesboro, in Pike county, which is known as Plaster Bluff. It contains a stratum of pure saccharoidal alabaster from six inches to six feet in thickness, with seams of satin spar. This Gypsum is sufficiently pure for the manufacture of Plaster of Paris. Geological reports also indicate the presence of other Gypsum beds along the western border of the state in Sevier, Howard and Little River counties. The geologist, who 35 years ago made this investigation, declared "these deposits will no doubt be a source of much wealth to the country some day." There have been practically no developments of the Gypsum areas, though citizens in that section have for many years made use of this mineral for plaster casts. It is possible that a mineral sufficiently pure for art work will be discovered when the bed has been penetrated to a sufficient depth to escape the surface impurities.

HORNBLENDE

(Metasilicate of Calcium, Magnesium, Ferrous Iron, Aluminum and Ferric Iron)

Hornblende is a member of the mineral family of Amphibole, with a chemical combination of aluminous magnesia-lime. It is found in Arkansas principally in the "granites" of Pulaski county, and the syenites of the Magnet Cove vicinity. It is truly characteristic of igneous rocks and usually forms in bladed masses embedded in the rock; but the most perfect crystals are those found in limestones which have been baked by close contact with a molten mass of igneous rock. Hornblende, one of the most diffused of minerals, has many forms, compositions and colors, though it is usually dark green, black or brown. When appearing in granite it usually presents a crystal that cannot be readily cleaved except perpendicular to the plane of symmetry. The lava rocks in the vicinity of Mt. Vesuvius are rich in Hornblende. The name comes from the German term, meaning "a crystal which resists all efforts to extract its mineral." It is insoluble in acids. Its composition is very complex, traces of fluorin and hydroxol being present, as well as the above-named constituents. Hornblende has many local names, given under the impression that it is found only in that vicinity. It is a comparatively common stone.

HYPERSTHENE

(Ferrous-Magnesium Metasilicate)

Hypersthene is a member of the Pyroxene group of minerals, so called because they were believed by the ancients to be impervious to the ravages of fire. Specimens are found imbedded in hornblende. Arkansas Hypersthene has a perfect cleavage so that it can be separated with a smooth surface, if mirrors of that kind become popular. Scientists assert that the same elements cooled by different degrees will produce different minerals, which accounts for the many varieties of minerals found in igneous rocks. Hypersthene contains much iron and is dark brown in color. Because of its very pronounced metallic reflection, Hypersthene is often polished as an ornamental stone. It rarely appears in crystal form, usually in rock masses. Its chemical composition is Magnesium-iron-silicate, and in Arkansas it is largely confined to the Magnet Cove area. Hypersthene has considerable more iron that the other pyroxenes, and less magnesium. It is this peculiar formation which gives it the metallic luster, so that it has been polished and used for mirrors by the natives of Labrador, where it is given the local name of Labrador lavas. They were probably formed by molten masses which cooled more quickly than others.

IOLITE

(Basic Magnesium-Iron Aluminum Diorthosilicate)

Like many other minerals and stones, Iolite is named because of its color. Its name comes from the Greek word meaning "violet stone." Iolite is ordinarily a violet color, and is often cut as a gem. It is transparent in many cases, and has close resemblance to the sapphire. In fact, the pale varieties are often called Water Sapphires, and the darker ones, Lynx-Sapphires. Iolite shows many shades of blue, according to the direction from which it is viewed. Although there is no apparent division in the stone, by turning it slowly the investigator will be rewarded with a perfect array of shades and blends of blue. It is also possible to cut the stone so that the color is noticeably changed. Iolite is not so dense as sapphire. Occasionally a gray specimen is discovered but these are extremely rare. Chemically, Iolite is a hydrous-magnesium and aluminum-silicate. Its Arkansas habitat is the Magnet Cove area, where it appears in metamorphic rocks, and rarely in unaltered condition. Iolite is found among the gravels of small streams in Ceylon, and forms a considerable part of the jewelry worn by the natives. Its discovery in Arkansas was made through laboratory examination of rocks. None has yet been found in the free gravel form.

IRON

(*Iron*)

Over a large part of Arkansas either scattering deposits of iron ore or ferroginous rocks may be seen. Geologists have surveyed the state quite thoroughly to determine the value of its iron ores. All report that it is either of a low grade or the deposit is too small in area for profitable development. In Randolph and Lawrence counties there is a very good grade of iron ore, but it is inferior in quality to that now mined in other states. Should a process be discovered by which low grade iron ores can be marketed profitably this will become a great industry in Arkansas. Wherever chemical analysis has been made of Arkansas mountain spring waters the iron content usually is large, which indicates a wide distribution of iron-bearing formations. For example, the presence of iron is discernable in Crowley's Ridge in eastern Arkansas through heavy stains in the glass sand strata of this extended elevation. It seems probable that iron in commercial quantities exists in Arkansas. Large manufacturers of steel products evidently share this opinion, as their geologists spent the summer of 1924 in Carroll and Boone counties, purchasing much land in this section, which probably at some time will be thoroughly developed.

IRON PYRITES

(Iron Disulfid)

"Fool's gold," or Iron Pyrites, has been the foundation of more than one "gold" discovery in Arkansas with all its accompanying excitement. It is present in considerable quantities in practically the entire coal field of Arkansas. It forms nodular layers between the veins of coal and occurs as nodules in the shale immediately over and beneath the veins. It has been considered a menace to the coal mining industry as its presence in slack coal prevented that commodity being molded into a more valuable commercial form. There is a considerable deposit of Iron Pyrites in Garland, Polk and Logan counties. It is also present in the zinc and lead fields of north and west Arkansas. Iron Pyrites is valuable for the manufacture of sulphuric acid, new uses for which are being continually discovered. The extent of the Iron Pyrites area of Arkansas was being determined in the closing days of the World war with the intention of developing it in connection with the huge sulphuric acid plants which were being erected in the state. With the further development of a commercial use for Iron Pyrites, many of the coal properties which are now considered worthless may then be profitably operated if the by-product should make up the deficit.

JASPER

(Quartz streaked with impurities)

Jasper is an impure, opaque, colored quartz found in metamorphic rocks and often occurs in very large masses. It takes an elegant polish and is used quite often in the manufacture of vases and ornaments. It is less hard than the more common varieties of quartz, hence it is worked more evenly and readily, and its charming array of colors makes it very attractive. The Jasper of Biblical times was evidently a distinct green, for it is spoken of as a clear stone and compared with the emerald. Jewels worn by high priests had Jasper in the breastplate. Jasper consists of an aggregate of several varieties of compact quartz intermixed with a clayey material and red or yellow oxides and hydro-oxides of iron. These impurities color it red, yellow, brown, green and blue. They may be present singly or together in the same stone. The colors are often in parallel bands or circles, a most pleasing effect to the eye. One variety is Porcelain Jasper, a clay baked by molten rock. The color in such Jasper is even, devoid of circles or rings. Jasper occurs in Arkansas in all colors in Montgomery and Polk counties, it being a residue left by ancient hot springs which were exceedingly numerous in that section centuries ago.

LABRADORITE

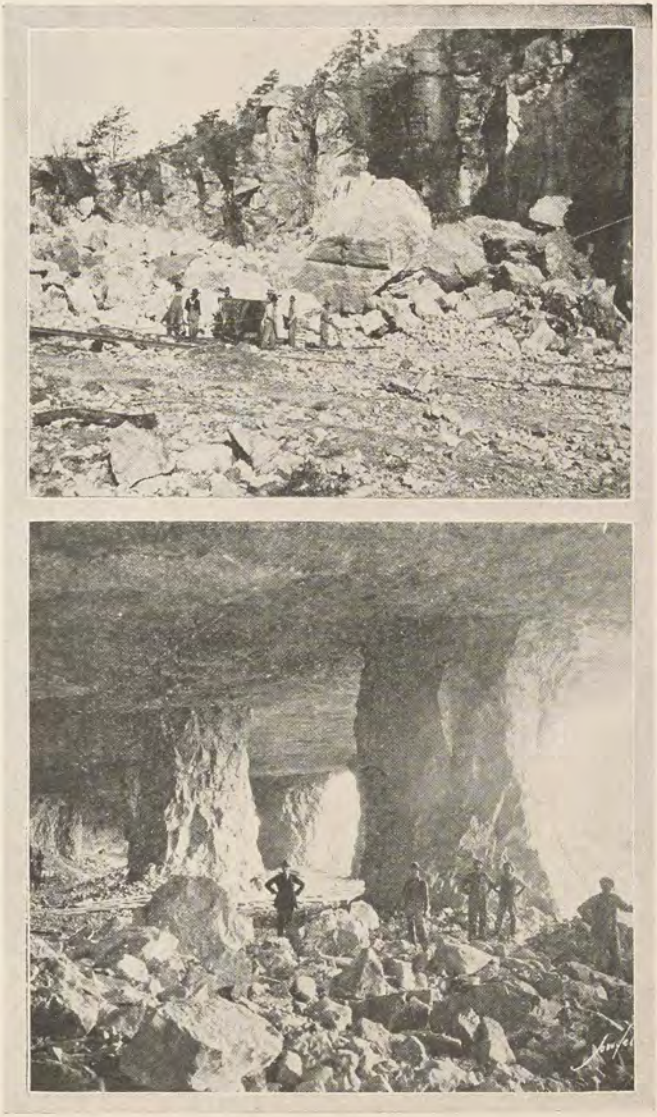
(*Calcium-Sodium Aluminum Silicate*)

Labradorite, a lime and soda feldspar, was first called Labrador Hornblende, and as its name suggests, originally came from Labrador. It has since been found in many other countries. It is an important constituent of the more basic igneous rocks. Labradorite is a most peculiar stone because of its interference colors. The mineral, which is often cut and highly polished for use as inlays, is a dull grayish-black and opaque, but when wet and turned slowly in the hand, suddenly flashes with a rainbow of brilliant colors. There are intense reds, yellows, greens and blues, of the gorgeous blending of the peacock's feathers or of the wing of a tropical butterfly. Turned even the most slightly, the colors disappear. The brilliance is much increased when the stone is cut with a flat surface and polished, but even then it must be turned to the right position before the medley of colors appears. This effect is caused by a combination of minute mineral plates, which nature has so arranged that they reflect light at various angles, as though the stone contained thousands of microscopic mirrors. In Arkansas Labradorite is found as a constituent part of other rocks in the Ouachita mountains; in Labrador it often occurs in masses.

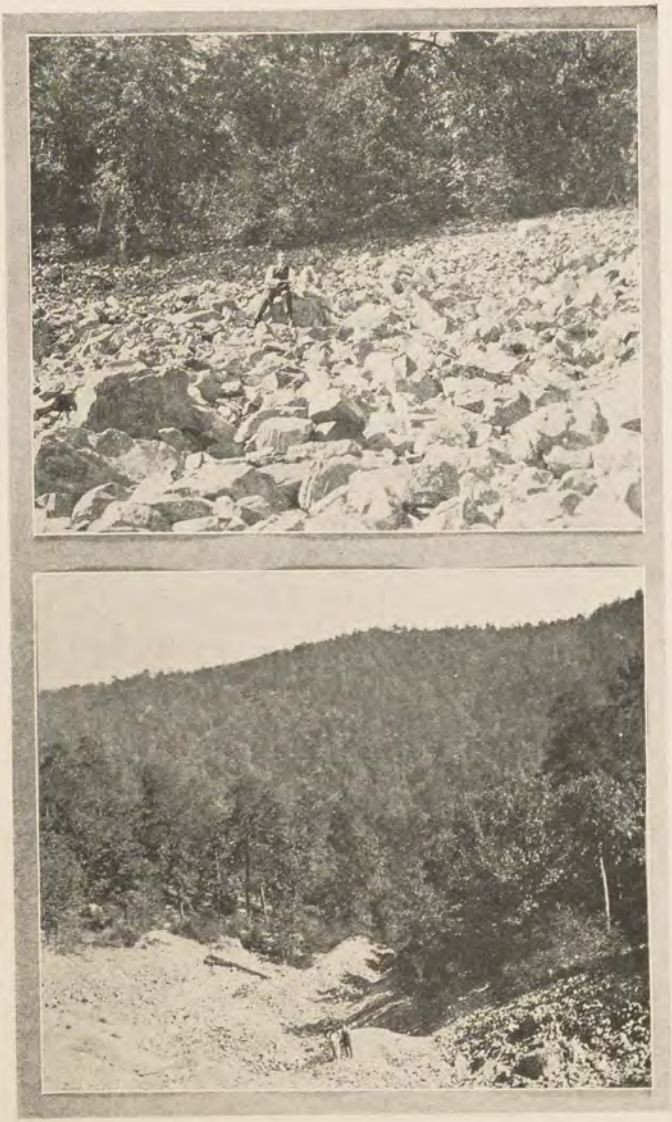
LEAD

(*Lead*)

Schoolcraft, an explorer and ethnologist, published in New York in 1819 a treatise on Lead possibilities in Arkansas. Featherstonhaugh, a geologist of the United States government, made a survey of northern Arkansas in 1834 and referred to Lead mines on Strawberry river. Smelters were operated upon a small scale, being crude, home-made affairs. Lead was mined then to supply bullets for the pioneer rifles. In 1851 the first commercial smelter opened. The product was hauled overland to Springfield, Mo. During the war between the states smelters and mines were operated in the vicinity of Lead Hill, Boone county. The largest smelter was on Cave Creek, Newton county, and the Lead was hauled to Russellville, from where it was shipped to Pittsburg. Lead is found as nuggets of lead sulphide. The largest mass of ore ever mined in Arkansas came from Marion county. It was displayed at the Columbian Exposition, where it took a prize for size and purity. It weighed 2,400 pounds. Geological reports show that 852 tons of Arkansas Lead was marketed in 1917, and 687 in 1919. Early smelters operated upon surface ore. Two shafts were sunk at Lead Hill in 1874 and 104,600 pounds of Lead ore was taken from them.



Top: Limestone quarry near Batesville.
Bottom: Mining Limestone under ground, Washington County.



Hell's Half Acre, Magnet Cove; home of more interesting mineral formations than any like area in the world.

LIGNITE

(Carbon, Sulphur, Water)

With coal, oil and gas so bountiful in Arkansas, little attention has yet been given to the State's Lignite deposits. There are large beds of Lignite in Ouachita, Pike, Clark, Poinsett, Clay and St. Francis counties. These range in thickness from three to six feet and the area from a few acres to many square miles. The Lignites of Arkansas, as shown by chemical tests, are capable of yielding a gas of high candle power. The Arkansas Lignite resembles a brown clay and can be removed in any shape with greatest ease. It is soft and can be cut with knife, spade of any sharp instrument. Exposed to the air the color darkens and the percentage of volatile matter increases as the moisture decreases. Arkansas Lignite burns with an ash, in most cases, of less than ten per cent. The Lignite of Crowley Ridge section is of even a higher grade than that of the southern portion of the state. Chemical tests made in one of the leading laboratories of the United States showed an average of 22.3 candle power gas from Ouachita county Lignite when heated to 1,900 degrees Fahrenheit. This Lignite absorbs moisture, when exposed to it, as readily as it loses it when subjected to a drying process. Lignite is a resultant of decaying vegetable matter.

LIMESTONE

(*Calcium Carbonate re-crystalized to form Calcite or Aragonite*)

The formations of north and northwest Arkansas contain enormous amounts of Limestone, a considerable portion showing a chemical analysis of over 99 per cent pure. A high grade white Lime has been burned in these sections for many years, and until recently was used almost exclusively for building purposes. Modern kilns are now maintained adjacent to quarries. The rock is blasted and conveyed to the kiln in tram-cars by gravity or hoists. Wood, the natural fuel for burning Lime, is obtainable in almost inexhaustible quantities near the kilns. Lime is now manufactured for chemical, construction and agricultural purposes and shipped in bulk, barrel and paper bags. Hydrated Lime, a powdered form that will not deteriorate when exposed to air, is now manufactured. Lime is used chemically in the preparation of varnish, in dyes, in cleansing compounds and for bleaching cotton fiber. Lime is the ingredient of varnish that toughens and clarifies it. It is exceedingly valuable for agricultural purposes and when its use becomes general the manufacture of agricultural Lime will be a great industry. Arkansas Lime is accessible to all markets west of the Mississippi river.

LITHOGRAPHIC STONE

(Smooth, fine-grained Limestone)

A smooth, fine-grain, compact and evenly bedded limestone which will quarry in regular sizes and shapes is essential for use as Lithographers' stone. There must be absolutely no grit nor fissures. Samples of buff, gray and black stone have been taken from a shallow quarry in Izard county. These contained an occasional crystal, often much smaller than a grain of sand, which chipped under the engraver's tool and left a ragged edge, rendering them unfit for lithographic purposes. Other specimens contained fine, hair-like veins which streaked the polished stone. These specimens were obtained from the top layers of a bed of about 170 feet of stone. This stone is overlaid by about twenty feet of gravel and other rock beds, which must be removed before it can be quarried in quantities. With the top layers so near perfection, it is probable that a perfect Lithographers' Stone may be found in depth. Lithographic Stone, due to the development of high speed printing presses, is in greater demand than ever. Designs to be reproduced are engraved upon the polished surface of this stone then transferred to sheets of zinc by a photographic process. These plates are then used directly upon the printing presses.

MAGNETITE

(*Ferrous Metaferrite*)

Magnetite is responsible for the name of that haven of unusual metallic substances in their native elements, Magnet Cove. It is a magnetic iron ore, sometimes in a crystal form, but more often occurring in compact or granular masses. It is so evident in Magnet Cove that it is impossible to survey parts of it, the needle of the engineer's compass being at times neutralized, and at others it reels and whirls as though the direction of the poles was constantly changing. There is no static interference with radio waves in the Magnet Cove area, the only place yet to record such freedom of the air. Suspend a specimen of Magnetite and it will settle itself in a true North and South position. Placed in proximity with a magnetic needle it displays its polarity by repelling one pole and attracting the other. Magnetite is extensively mined in Sweden, in the Ural mountains and in New York. It is not mined in Arkansas, nor has it been developed, though many specimens have been taken from this field by scientists or persons who considered the rock a curiosity. These specimens often retain their polarity, sometimes for years. Iron ores in the form of Magnetite are valuable. In Sweden the nuggets are imbedded in sand.

MALACHITE

(*Basic Copper Carbonate*)

Malachite is a carbonate of copper, of a dark emerald-green color, and is used for ornamental purposes. Pulverized it becomes a basis of paint in several shades of green; polished, it is inlaid in boxes and extensively used for knife handles, also for table tops. Malachite occurs in the proximity of copper deposits, and its rich color is directly traceable to the action of weathering agents upon that mineral. Most specimens show rings and light streaks, and being conical in shape, the rings diverge as the diameter increases, giving a most pleasing effect. The Malachite is cut across the face to produce the beautifully colored table tops. Vases, with lines of light green or yellow, are manufactured from Malachite. It is a very popular mineral in Russia, where it is used for many household ornaments. It has also been used for cameos, and some beautiful antique specimens are on exhibition. In the vicinity of Hot Springs there are extensive deposits of Malachite, appearing in ledges of rock, several feet in thickness. This has never been mined, no doubt because its value has not been appreciated, or because the facilities necessary for working it into saleable articles have been lacking.

MANGANESE

(*Manganese*)

There are two known fields of Manganese in Arkansas, one in Independence and Izard counties and the other extending from Pulaski to Polk county. Practically all the mining has been done in Independence county. This area is about twenty miles in length and from eight to ten miles in width. Manganese is used chiefly in the manufacture of iron and steel. It gives a toughening property to these metals. High grade Manganese usually runs from 45 to 50 per cent of the ore in which it is found. Arkansas Manganese quite often runs as high as 60 per cent. During the World war there was a heavy demand for Manganese and over 200 mines and pits were operated in the north Arkansas field. Little development has been done in the southwestern area. There are now four mines in operation in the state, but their annual production is small. Mining methods are almost primitive, due to the readiness with which the mineral is severed from the soil. The mine resembles a well, the hoisting machinery being an ordinary windlass. Arkansas Manganese often runs as high as 10 per cent in iron ore and all contains some phosphorus. Batesville is the center of the Manganese industry in this state.

MARBLES

(Limestone or Dolomite that can be polished)

Almost the entire area of North Arkansas between the Black river and the Boston mountains is underlaid with Marble of exceptional quality. There is an almost unlimited supply of light colored marble, besides red, pink, gray, yellow, brown and black. While Arkansas Marbles take as high and lasting a polish as any, they have been used to a much greater extent for building purposes than in the arts. Mantels have been manufactured of Arkansas Marble for use in many public buildings of the United States. The Arkansas State Capitol, the Pulaski county courthouse and numerous other buildings were constructed partially of Batesville Marble. Prominent engineers and architects insist that the Arkansas Marble is elastic, a quality which prevents it from crumbling under the continued expension and contraction which occurs where climatic conditions are subject to sudden change. The first Marble shipped from Arkansas, a block weighing 9,000 pounds, was hauled by ox teams from Marble City, Newton county, 60 miles to the railroad. It is the Arkansas stone in the Washington monument. One slab of Marble weighing 220 tons was removed from a quarry near Batesville. Arkansas Marble is exceptionally free from fissures.

MICA

(Acid Orthosolicates of Aluminum with Magnesium, Ferrous Iron and the Alkalies)

The Mica group is one of the largest of the rock-forming minerals and its usefulness is as great as its abundance. Many of the most common rocks of Arkansas are rich with Mica, as sandstone, and many of the finer grained rocks and clays. It occurs in many forms and in many colors. Mica is known to everyone as the transparent material used for windows of stoves, the peep holes of furnaces, and other places where transparent and heat-resisting substance is required. It is sometimes used for lamp chimneys. Ground Mica is of greater use to mankind even than the sheet form. It is used in the manufacture of wallpaper, giving it a glaze. It is the material which gives the frosted effect to toys and to Christmas tree ornaments. Stage scenery would have no snow scenes were it not for powdered Mica. In this form it is also used as a lubricant and in making paints and varnishes. Mica, being an absorbent, is essential in the manufacture of nitro-glycerine and disinfectants. Being a poor conductor of electricty, insulators are manufactured of it. Mica has not been mined in Arkansas, but in the vicinity of Potash Sulphur Springs, in Garland county, and in the Magnet Cove sector, there are many deposits of it.

MICROCLINE

(*Potassium Aluminum Trisilicate*)

Microcline is a crystal potash feldspar which appears in cavities of granite. Many visitors to Pike's Peak have purchased various small ornamental objects manufactured of Microcline, as souvenirs of this haven for tourists. Its clear, bright greenish color gives it more charm than the average semi-precious stone. It polishes highly and cuts with a cleavage that produces bright lights which sparkle, even in the dark. Microcline is found in the Magnet Cove section, and slabs of syenite taken from that vicinity are often beautifully marked with its crystals. The name comes from Greek words meaning "small incline," apparently given because of the slight deviation from right angles of the crystal faces. Microcline has a peculiar optical effect in that when examined under certain lights it appears to have a cross-section structure, or checkerboard appearance. It is frequently called Amazon stone. Microcline is usually associated with rocks which abound in soda, and in Europe it is found only in rock formation produced through the eruption of volcanoes. Geological reports of the United States show Microcline in commercial quantities in only two other states besides Arkansas. They are Pennsylvania and Colorado.

NATURAL GAS

(Methene, Carbon Dioxid, Oxygen and Ethane)

Natural Gas fields have been developed in Crawford, Sebastian, Scott, Ouachita and Union counties. The first well was drilled in 1901 on Massard Prairie, south of Fort Smith. The Western Arkansas field centers about Alma, with an area of about 150 square miles, producing over 200,000,000 cubic feet a day. One well has a daily record of 24,000,000 cubic feet, rating it as one of the largest in the Southwest. The product is dry, clean and odorless. Government tests show it to have a heating record of 1057 British thermal units, which is considerably higher than the test made by most Natural Gases. The Union and Ouachita county fields have over fifty gas wells in operation. Natural Gas is of secondary importance to crude oil, so this field has not been as yet thoroughly exploited. The total daily production in the South Arkansas area is 1,560,000,000 cubic feet. Gas was produced at the Constantin well in 1919, which later began to flow oil. Arkansas has conservation laws which prohibit the use of Natural Gas for the manufacture of carbon black. The Union county Natural Gas has a heavy gasoline content. Natural Gas is piped to many Arkansas cities for use as a fuel.

NEWTONITE

(*Silicate of Aluminum*)

Newtonite is a very distinctive Arkansas mineral. It is found only in the vicinity of Sneed's Creek in Newton county. Newtonite is one of the divisions of Halloysite, an earthy clay greatly resembling Kaolin. It is white and occurs in soft masses. It is a silicate of aluminum, like kaolin, but contains more water. Newtonite was first found in a well south of Harrison in 1889. At a depth of eight feet it was found imbedded in a dark clay, scattered in lumps, varying from a few ounces to forty pounds in weight. R. N. Brackett and J. F. Williams gave Newtonite its name in a treatise published by them in the American Journal of Science in 1891, after its discovery had been reported, the fourth member of the kaolin family. It is treated rather fully in Branner's report of 1892. Newtonite is infusible before the blow pipe, resists the action of concentrated hydro-chloric acid, but is decomposed completely by sulphuric acid. It is decomposed also by caustic potash, and the residue is an easy victim of hydro-chloric acid. Magnified 500 times, it is found to be composed of perfect squares, with lines running from the corners to the center. There is usually a narrow white rim about the edge.

NITRE

(*Saltpetre*)

"Nitre earth" occurs in the dry caverns of the limestone regions of North Arkansas. This is a natural salt-petre, and Arkansas geological reports as early as 1858 show chemical analyses of specimens taken from Bean's Cave by Dr. D. D. Owen. There are several chemical methods of producing nitre artificially, and nature can be forced to create the transformation by the placing of alkaline earths in the proximity of nitrogeneous matter. Oxidation completes the formation of nitre, or salt-petre. This mineral is used extensively in the preservation of meats and in the manufacture of gun-powder. In the latter days of the war between the states when the residents of the Southwest were forced to extremities, this natural salt-petre was used in their efforts to preserve meats, but with little success, due to its impure form. In the liquid form Nitre is valuable for its cooling effect in fevers. Salt-petre is also used in the manufacture of matches, fireworks and dyes. The white powder which covers the floor of certain Arkansas caves is rich in salt-petre. It is valuable in the manufacture of nitric acid. Salt-petre is produced in Europe by spreading the ingredients on the ground and letting the atmosphere make the chemical change.

NOVACULITE

(Gritty, finely granular Siliceous Stone)

The only true Novaculite in America, capable of being quarried in large quantities, is found in the Ouachita mountains of Arkansas. It has for years been admitted that the finest whetstones of the United States are those manufactured from Arkansas Novaculite. Hot Spring, Garland, Montgomery and Polk counties contain much pure Novaculite. Near Magnet Cove, in Hot Spring county, there are large pits which historians assert were excavated by early inhabitants of America to obtain Novaculite for implements of war—arrow and spear heads, and tomahawks. Hammers, axes, plow points and crude grain-grinding stones have also been discovered in these excavations. There is such an abundance of this stone that it is often used for road construction. It is usually accompanied by shale, which affords an excellent binding material for road building. The manufacture of composition stones into excellent grinding tools has lessened the demand for Arkansas Novaculite, yet a considerable quantity is still shipped to New England factories where it is manufactured into whetstones for skilled mechanics. Six books have been published on Arkansas oilstone, or whetstone, one of them by the Geological Society of London.

OCHRE

(Earthy Limonite or Hematite)

So common are the Ochres of Arkansas that they are considered by the average person merely as colored clays. Geologists have dealt at length in writings and text-books with the Ochres of Arkansas and their superior properties. According to these scientists, Arkansas Ochres contain mineral pigments which are lasting. This renders them excellent material for the manufacture of paints. The surface Ochres are largely mixed with sand and clay. There are pockets of absolutely pure Ochre which lead some geologists to predict that excavations will eventually unearth deposits of excellent paint-making material which will require only the addition of oils. Red and yellow Ochres are the most common in Arkansas and in the Crowley's Ridge section there are barns which were painted with Ochres taken from the soil of that vicinity. This paint was uniform in color and has stood the wear of many years, surpassing in many respects some nationally advertised mixtures. Red Ochre is to be found in the Fourche mountains near Little Rock and in various parts of Crowley's Ridge. Yellow Ochre is known to exist near Monticello, in Drew county, and Piggott in Clay. Brown ochre, or limonite, occurs in many parts of the state.

OCTAHEDRITE

(*Titanium Oxid*)

Octahedrite is a mineral that has had several names, and is so similar to another that it loses its identity under the action of heat. It is sometimes called Anatase, and in Europe it is known as Wiserine. Octahedrite is a titanium-oxid, in the form of small, sharply defined crystals. Its name comes from the shape of its crystals, which are octahedrons and are brown, dark blue and black in color. The specific gravity of Octahedrite is high, and it is much harder than other minerals of its class. Octahedrite occurs in sandstone, slates and often in clays and powdered rocks, from which it may be extracted by washing away the lighter constituents. The European crystals are, for the most part, of a honey-yellow color. Octahedrite crystals can be formed by the action of steam upon titanium chloride and it is possible that geysers formed it in the same way. This is another of the peculiar minerals of the Magnet Cove area, although it is found in several other parts of the United States. When heated, Octahedrite is identical with rutile, both as to form and chemical composition. No practical use has been found for Octahedrite, but chemists and mineralogists have found it a most interesting mineral for purposes of scientific research.

OIL SHALES

(*Oil-Bearing Stndstones*)

Northwest Arkansas is especially rich in Oil Shales. In his geological report of 1888, Dr. John C. Branner, state geologist, stated that petroleum occurred in small quantities in the Fayetteville shale of Washington county. Dr. Branner expressed the opinion that the sandstone in which the oil occurs is cut off along the north base of the Boston mountains and as other rock in that section is below this level, the petroleum bearing rock is of a limited area. Professor A. H. Purdue, contributing to a bulletin of the U. S. Geological Survey in 1918, says that oil may perhaps be distilled from the Chattanooga shale of northwest Arkansas, which is sufficiently bituminous to give off the odor of petroleum when struck with a hammer, but adds that distillation will be profitable only after the prices of petroleum and its products have materially advanced. Springs in this section of the state often are coated with an oily substance which gives the taste of petroleum to the water. Bits of stone often have the odor of petroleum and when a flame is applied to them, sputter as though they were filled with animal fat. No effort has been made to distill these shales commercially as the operation is too expensive to compete with crude oil.

Top: Novaculite (Whetstone) quarry.
Bottom: Mining Novaculite, Garland County.

The Murphy Crater, oil fields near El Dorado.

OLIGOCLASE

(*Sodium-Calcium Aluminum Silicate*)

Due to the enclosure in the stone of numerous small scales of hematite, the surface of Oligoclase gives off a pretty spangled metallic reflection, and when cut with facets, its beauty is increased. As Oligoclase is a very durable stone, it is often cut for ornaments, and is sometimes known as Sunstone. It is one of the feldspar group. In chemical composition it is intermediate between albite and anchorite, a crystalized soda-lime feldspar. The color is usually white, with shades of gray, green or red. The red specimens are the most beautiful, the color appearing in the form of a cloud arrested as it floats through the misty colored mineral. The color flames out at the point of greatest concentration, and shades to a delicate pink as the clouds apparently dissolve toward the edges. This mineral has been reported from two places in the United States, near Bakersville, N. C., and Magnet Cove, Hot Spring county, Arkansas. Most attractive specimens have been discovered in southern Norway, but the formation in the Magnet Cove area is so similar to that of the European fields that valuable Oligoclase will no doubt be discovered in Arkansas if search is made for it. Oligoclase has the appearance of an opal, but is of a different origin.

ONYX MARBLE

(*Banded Calcite or Aragonite*)

Geologists who have made surveys of Arkansas minerals grow quite enthusiastic over specimens of Onyx Marble of the northwestern part of the state. Dr. John C. Branner, former state geologist, in one of his reports says: "We have seen beautiful pieces of this rock that would have brought high prices in the market, wantonly destroyed, partly because the owners were not aware of its value, and partly because this is a zinc mine—not a stone quarry." T. C. Hopkins, in his report, says: "None of the Onyx Marbles of Arkansas are quite as translucent or as brightly banded as the finest quality of Mexican stone, yet much of it is very handsome, works easily, takes a brilliant polish and will no doubt command a good price. Further research may show even finer quality." The caves of Northwest Arkansas contain great quantities of it. At Eureka Springs it is manufactured into souvenirs, which for beauty and luster equal the highest priced imported Onyx Marble. Slabs several feet across the face have been removed from Arkansas caves, but boulders weighing a ton or more are often removed from zinc mines. Arkansas Onyx Marble is largely white, cream, dull red and yellowish brown, and usually occurs with these colors in alternating stripes.

OPAL

(*Hydrated Silica*)

Opal is a gem stone, transparent and colorless when perfect, but those containing foreign matter, with their beautiful display of color, are the most valuable. Opals are found encased in igneous rocks, indicating that they have formed in cavities made by steam when the rocks were in a molten state. Opal is an amorphous mineral of hydrated silica. In Arkansas it is found near the thermal springs in Garland county, and in the sand carbon mines of Saline county. Opal is unlike all other gem stones which show a divergence of colors, in that they are not produced by the action of other minerals, but by the peculiar construction of the stone. Fissures or pores cause the light to be reflected in various directions, producing the brilliant flashes of color which make the stone valuable. Opal is a comparatively soft stone, and when subjected to heat, even to a slight degree, the water within is evaporated. This process destroys the color, and the stone becomes clear, and the gem valueless. Opals are found all over the world, the Hungarian stones being the most valuable. Arkansas has all the common varieties, also the milk, fire and resin Opals. The Opal is avoided by the superstitious, who consider it an unlucky setting.

ORTHOCLASE

(*Potassium Aluminum Trisilicate*)

Orthoclase is a potash-feldspar, the most abundant of all feldspars, and for that reason often referred to as "common feldspar." It is usually found in large, well-formed crystals, an important part of all granites, of lavas and other igneous rocks, more specially those which contain quartz. Specimens of cream colored quartz containing dull red Orthoclase resemble very closely a loaf of raisin bread. Sometimes a single crystal, fully the size of a foot ball, is found in a cavity in granite. Orthoclase is often of a glassy appearance, earning for it the name of ice-spar. Another species, because of the moon-like reflection or opalescence, seen on its surface, is known as moonstone. This stone is cut with a rounded surface and is used as a setting for jewelry. All varieties of Orthoclase are beautiful, and it can be cut in almost any form. It is often cut into slabs and polished, being used for ornamental purposes. The most valuable property of Orthoclase is its form of fusion. It yields to a glaze superior to that of other ordinary minerals, and is commonly used for this purpose. As it is common to Granite and igneous rocks Orthoclase is found in the principal mineral deposits of Pulaski, Saline, Garland, Perry, and Hot Spring counties.

OZARKITE

(*Hydrous Aluminum-Silicate*)

This peculiar stone is found in America only in the Magnet Cove vicinity. Because of its large content of water, loosely held, it was called the "boiling stone" by the ancient Greeks. When heated the whole mass boils, due to the rapid expulsion of the water. Ozarkite contains from ten to twenty per cent of water. Ozarkite occurs commonly in the steam cavities of certain volcanic rocks. The rock crystallized and cooled rapidly, accounting for the large amount of water in its composition. The transparent crystal makes a severe contrast with the dark, igneous rock which encloses it. Ozarkite is a hydrous aluminum-silicate. Thomsonite is a very similar mineral, but the crystals are smaller. Some Ozarkites are opaque, with a tinge of red, green and brown and still others are clouded with a white substance, all caused by the presence of mineral gases mingling with the steam when the rock was formed. Ozarkite is found in small beds, as well as in intrusions in the rocks. It is commonly believed that the name was given because of its being found on this continent only in the Ozark mountains of Arkansas, but as Ozarkite is referred to by early geologists, it is more probable that the mountains were named for the mineral.

PEARLS

(Growth in Mollusca)

Pearl fishing is a year-round industry on White and Black rivers and some of their tributaries. Fresh water pearls are formed in mussels. It is supposed they are formed about a grain of sand or some other foreign substance which gets between the flesh of the mussel and the shell. To prevent irritation the mussel secretes a liquid which solidifies and takes on great luster. This process is continued until the Pearl is of considerable size. A high percentage of the Pearls taken in Arkansas are perfect in shape, round or oval. The highest price paid for an Arkansas Pearl was $7,500. Hundreds averaging from $300 to $1,000 each are sold annually. Most of the Pearls are discovered by fishermen by means of an unique frame from which a number of hooks are suspended. This is allowed to drag along the bed of the river. The mussels attach themselves to the hooks and are taken in great quantities. Mussels are also taken on a large scale by dredging. So extensive is the Pearl industry of Arkansas that boats on the White and Black rivers are used exclusively in handling the shells. Button factories are located in Newport, Clarendon, De-Valls Bluff and other cities where button blanks of superior quality are cut from the shells.

PEROVSKITE

(*Titanic and Calcium Oxids*)

As the name of this mineral would indicate, it is a native of Russia, though by some peculiarity of nature, it occurs as a member of the Magnet Cove collection. Perovskite was discovered first in the Ural mountains by George Rose, an Englishman, in 1837, and was named for a Russian nobleman. It is truly an aristocrat among minerals, even though lacking intrinsic value. Perovskite occurs attached to quartz, or some other mineral, in the form of cubic crystals. Often the crystals are in twin formation, and though perfect cubes externally, have a complex internal structure. It is a chlorite schist and can be easily separated along definite planes. Perovskite is a lustrous dark brown or black, and sparkles like a black diamond, but lacks the density of the precious stone. The cubes of Perovskite are remarkably uniform in size, and as they can be readily removed from their natural resting place, without a flaw appearing upon the attached surface, they make ideal little stones for inlays. They have also been used for ornamental purposes. So far as known, Magnet Cove is the only place they are to be found, except in parts of Russia and Switzerland, and not all who search for them here are rewarded.

PETROLEUM

(*Crude Oil*)

Arkansas ranks fourth in the production of crude oil in the United States. The average daily production is now about 355,500 barrels. The first Arkansas oil well was "brought in" on January 10, 1921, a few miles south of El Dorado in Union county. It was a gusher, blowing oil over quite an area before it could be subdued. In 1921, there were 672 wells in Union county, 598 of which produced 10,800,000 barrels of oil, valued at $23,344,960. Previous to the El Dorado development a small quantity of oil was discovered in a well near Stephens in Ouachita county. This field is still producing. The Smackover field, about 20 miles north in Ouachita county, saw its initial production April 14, 1922. At the end of July, 1923, there were approximately 1,100 producing wells in this field with a total average daily production of about 100,000 barrels. On August 1, 1923, the Smackover field had produced 25,000,000 barrels of oil. In the summer of 1923 oil production began in the southern part of Nevada county. The oil of the Smackover and Louann fields is for the most part heavier than that of the El Dorado territory. There are a number of independent refineries in Arkansas but most of this crude oil is piped outside the state.

PHOSPHATES

(Native Calcium Phosphate not distinctly crystalized)

Farmers of Arkansas should not want for fertilizers when the state has such a wide area of Phosphate-bearing rocks. The entire territory between St. Joe, in Searcy county, and Batesville, in Independence county, a distance of about 80 miles, has Phosphate-bearing beds that are practically horizontal. In the larger part of this area the rock is too poor in phosphates to be of commercial value, but many of the phosphate beds, even though high in iron silica and alumnia, are adaptable as fertilizer when applied direct to the soil. Government analyses show over 25 per cent of phosphoric acid in some of the surface rocks of the area. This is increased to 33 per cent in samples taken from the depth of a few feet. A considerable acreage in the vicinity of Batesville is owned by an Arkansas fertilizer company. Phosphate-bearing rock outcrops on most of the mountain sides. Aside from the large deposits in the northwestern part of Independence county, Phosphate beds lie south of White river, in Boone, Stone, Newton and Marion counties, extending in a line half way across the state. With practical farming becoming generally prevalent, it is not likely that this valuable source of natural fertilizer will be long overlooked.

POTASH

(*Leucite Rock*)

The ending of the World war, thereby reopening the Potash beds of Europe, prevented the development of Arkansas Potash. Government instructions had been given for an exhaustive research in this state, but this order was cancelled with the cessation of hostilities. The United States government sent geologists into Arkansas during the war to make exhaustive examinations of leucite rock in the Magnet Cove district of Hot Spring county. Such favorable reports were made that special plans for the extraction of Potash from this rock were under consideration when the war closed. There is no question about the presence of an abundance of Potash-bearing rocks in this section and certain geologists believe that if excavations were made to any depth in the leucite rocks the percentage of Potash might be sufficiently high to warrant the development of the field. The process of obtaining Potash from these rocks is very expensive and it is possible to deliver Potash from foreign countries to America at much less than the cost of production in Arkansas. Certain springs in the vicinity of Hot Springs are high in the Potash content, one very prominent spring, the Potash Sulphur Spring, being named for it.

PYROPHYLLITE

(*Hydrous Aluminum Silicate*)

Pyrophyllite is a mineral species of the clay family, composed of hydrous aluminum-silicate, occurring in two distinct forms, as crystalline folia, or leaves, and as a compact mass. Distinct crystals are unknown. The folia has a pronounced pearly luster. When heated it swells to several times its normal size, hence the name from the Greek word meaning "fire-leaf." The most common form in which Pyrophyllite is used commercially is in slate pencils, though flat chalk used by tailors is usually of the same material. Its colors are white, pale green, gray and green. Pyrophyllite is quite soft and is greasy to the touch. It is very similar to talc. Many of the smaller Chinese carvings are of Pyrophyllite, in the form of images and ornaments. It is imported into China from the Ural mountains. In America there are large beds of it in southern states, the Carolinas, Georgia and Arkansas. It is commonly called pencil stone in this country, and there are large deposits in the "soapstone" area of Saline county. Pyrophyllite has also medicinal properties, similar to other clays which are used to reduce swellings. The Arkansas beds have been little exploited. Pyrophyllite is always flexible, but never elastic.

QUARTZ

(*Silicon Dioxid*)

Most advertised of any Arkansas mineral is its Quartz crystal, known the world over as the "Hot Springs diamond." The abundance of these crystals and the familiarity of the people in general with them has made many skeptical concerning the real Arkansas diamond. The Hot Springs crystal comes principally from Crystal Mountain, in Garland county. This mountain has furnished some of the largest and most beautiful Quartz crystals in the world. They are easily cut into any shape and being nearly flawless, sparkle with the luster almost of a perfect gem. The Quartz crystal is non-mineral bearing, and while often mistaken for a diamond, it has no real commercial value. Arkansas Quartz is used chiefly in the manufactures of trinkets and jewelry which are sold to the visitors at Hot Springs. The composition or "paste" settings which are supposed to imitate Diamonds are more readily distinguished from the Arkansas Quartz than the Quartz crystal is from the real diamond. Perfect Quartz is found in Madison, Montgomery, Clark, Hot Spring and Garland counties. Manufacturers have produced beads and ring settings from Arkansas Quartz crystals which could not be detected as such without a thorough test for hardness.

RECTORITE

(*Acid Aluminum Silicate*)

Rectorite is a peculiar form of kaolin which is found in Saline county. Kaolin in its pure form is white, but the Saline county material, though having all the other properties of kaolin, is in many colors, ranging from white to a reddish brown. As the Rector family has for generations been prominent in that section of Arkansas, this variety of kaolin was probably named for it. It is tough and leathery, with the smooth, soapy feel so characteristic of the kaolins. Rectorite occurs in association with the carboniferous sandstones. The deposits are about a foot in thickness, and cover a large area. It can be taken from the ground in large sheets, which are flexible, but not elastic. Rectorite is infusible before the blow-pipe, but when heated in the flame of a Bunsen burner loses its water and becomes very brittle. Many colors of Rectorite can be taken from the same pit, and these are mixed in the Benton pottery, where the Arkansas Niloak is produced, giving the beautiful streaks of irregular shapes and sizes. No coloring matter is used in the production of Niloak, except the deep blues, the other kaolin being of the natural colors. Vases, lamps and ornamental vessels of many kinds are manufactured of Rectorite.

RUTILE

(*Titanium Oxid*)

Rutile is a rather abundant stone, found in loose crystals and imbedded in other rocks, some specimens of which are worthy of classification as gems. As such they are cut and mounted, and held in high esteem by their possessors. Rutile is from the Latin word, rutilus, meaning red, though its most valuable crystals are of a yellowish tinge. Commercially it is used to color porcelain and glass, imparting to them delicate shades of cerise, and those of straw. Rutile is the famed "Venus hair stone" of legend. Its crystals are so minute, and are joined in such irregular forms, they resemble human hair. They are often found imbedded in a transparent and clear quartz. It does not take an active imagination to picture a maiden imprisoned in a pillar of crystal, as a punishment for faithfulness to a valiant suitor, her hair appearing in Rutile. Rutile occurs for the most part in clays and slates, but it was first discovered in cavities of granite and igneous rocks. Delicate crystals of Rutile are often seen in mica, where they resemble tiny stars, glowing with a fiery luster when exposed to a strong light. Rutile is very similar to anatase, brookite and octahedrite and is found as a secondary mineral in the Magnet Cove section of Hot Spring county.

SALT

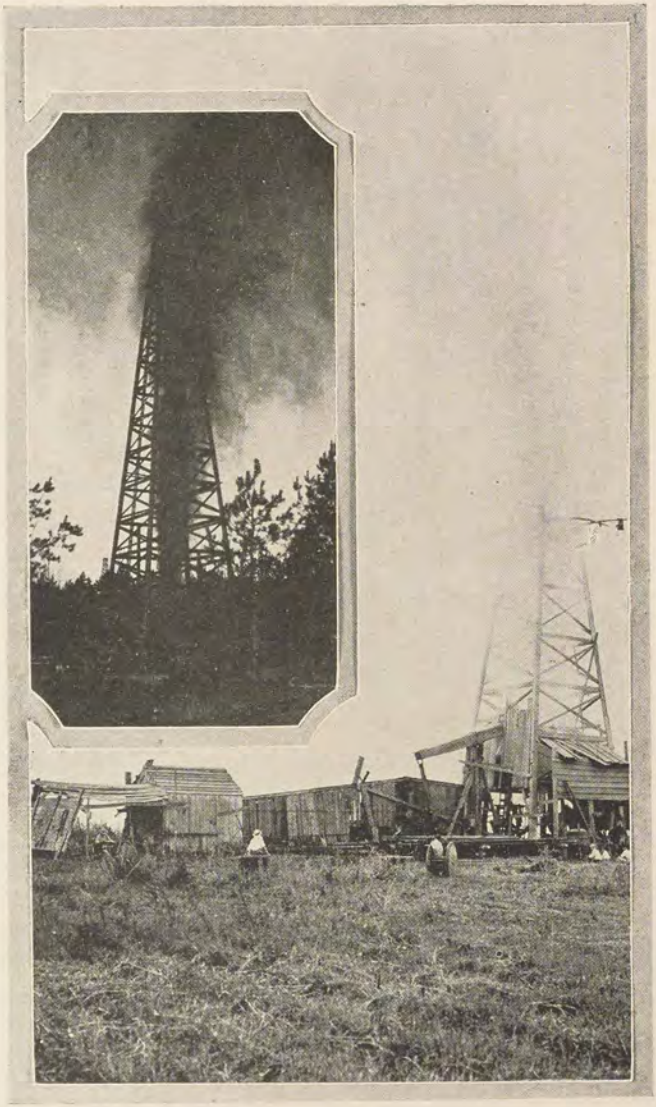
(*Sodium Chloride*)

Arkansas has never produced salt for commercial purposes, though it has been encountered in many oil and gas wells drilled in the state. In several parts of northwest Arkansas there are areas where the soil is strong with salt. In pioneer days these were frequented by big game hunters, as deer, attracted by the salt, was usually to be found there in large numbers. These were called salt "licks." No attempt has been made to salvage salt from the waters pumped from gas or oil wells, as drillers are seeking oil, and salt water is shut off with casing as quickly as possible. Logs of oil wells show salt at depths varying from 1,200 to 2,500 feet. By some drillers the brine is supposed to come from a subterranean sea, but geologists claim that it is no doubt in beds, the same as in many other states, and is brought to the surface by water. It has been proposed by stockholders in wells which were abandoned because of their excessive amount of salt water, to create a lake by pumping the water to the surface, and make of it a resort, with salt water bathing. At present, Kansas and Michigan and several other states produce millions of tons of salt by pumping it to the surface from a great depth. There are also salt cliffs in Nevada.

SANDSTONE

(Consolidated Sands with Quartz)

Sandstone is one of the commonest of Arkansas rocks. It is built up of sand grains held together by a cementing substance. The size of the component particles varies, as does the cementing material. There are few localities in northwest Arkansas which produce no Sandstone. Sandstones vary in their degrees of hardness. Some are thin layers of almost pure sand, with a hardened crust on top and bottom, due to the presence of iron. These stones can almost be crumbled with the hands, and their fine grain makes them highly acceptable for cleansing compounds. This character of rock is unfit for building purposes, yet practically all the building stone of Arkansas is sandstone of the harder varieties. Sandstones occur in all colors, according to the manner in which they are stained by other minerals. They readily take a polish, but are not considered of sufficient hardness for ornamental purposes. There are hundreds of quarries of Sandstone operated in Arkansas, this product being largely crushed for use in foundations for improved highways, or in concrete mixture. As whole mountains are formed of this stone, the entire United States could be supplied with Sandstone for ages without apparently lessening the supply.



Insert: Big gusher spouting, Smackover field.
Right: Natural Gas well near Fort Smith.

Top: Arkansas Zinc mine.
Bottom: Walled up hot springs, Hot Springs National Park, Garland County.

SERPENTINE

(*Acid Magnesium Silicate*)

Serpentine is similar, in most respects, to marble, and as its uses are much the same, it is often taken for this exceedingly common Arkansas stone. Serpentine is marked more distinctly, and when polished has great beauty. It is found in Saline county where it is quite massive, and can be readily mined. Serpentine is, except in rare instances, a mottled green, with stripes of greenish-yellow running through it, giving it the marking of a snake. It was considered by the ancients as being a cure for snakebite, if applied immediately, the theory being that it would absorb the poison, and its name may have originated from this fallacy, rather than from its color. There is a Serpentine which appears in limestone rocks, resembling jade, and because of its brilliant marking is called "noble Serpentine." The Arkansas Serpentine is very similar to that of Italy, and can be as readily carved into small ornaments, though it can be secured in quantity and of sizes sufficient for use in interior decorations. Specimens of red and brown Serpentine have also been found in several localities. Serpentine is too soft for exterior use, and is easily discolored by the action of the elements. Chemically, Serpentine is acid magnesium silicate.

SILVER

(Silver)

While Silver often occurs in its native state, it is more often reclaimed from a combination of other minerals. For this reason the various other ores which contain a small percentage of Silver are of far greater importance in the production of the precious mineral. Lead, and most of the zinc ores, contain Silver, which is quite readily extracted. Native Silver is in twisted, wire-like forms, and occasionally in cubical crystals. When Silver is found in the free form it has been reduced to its pure state through action of the weather, to which it has been exposed. Occasionally a small mass of native Silver is found in Arkansas, but intense research in the locality has failed to find specimens of sufficient value to reward the prospectors for their labors. Silver mines were at one time profitably operated in Arkansas, according to roving bands of Mexicans who occasionally drift into the state, bearing charts and maps which they claim were the property of their ancestors, who amassed riches in mining Silver in Arkansas. Silver mining operations have been actually carried on in Pulaski, Garland, Montgomery and Saline counties, but they were the exploits of young and adventurous amateurs rather than the efforts of practical miners.

SLATE

(Quartz, Chlorite, Muscovite, Pyrite and Andalusite)

When geological reports show that there is about 11,400 feet of Slate-bearing beds in a strip from ten to thirty miles in width, extending from Pulaski to the center of Polk county, every one must admit that there is considerable Slate in Arkansas. Of this the upper 8,825 feet is Slate largely suitable for commercial purposes. At Slatington, in Montgomery county, extensive quarries have been operated. Both red and green slate is obtained from this vicinity. Much of this slate lies perfectly flat, but a considerable portion is in oblique layers. The layers are thin and the Slate is easily quarried and manufactured into shingles. There are fine deposits of black and red Slate in the vicinity of Mena. This Slate is of exceedingly fine texture, a remarkably smooth cleavage surface and a slight luster. The red Slate from this vicinity is of practically the same texture as that of New York. The Missouri mountains also produce a red Slate somewhat finer and softer. A greenish gray Slate is obtainable in Polk county, very closely resembling the sea-green of Vermont. The Missouri mountains also boast a light greenish Slate, the texture of which is too delicate for commercial use. There are also dark blue, light and dark gray Slates.

SMOKY QUARTZ

(Silicon Dioxid with Titanium)

The presence of titanium in quartz gives it a dark-brown color, and it is distinguished from other quartz by the name of Smoky Quartz. It is quite common in the Magnet Cove sector, all of the shades being found, even the bright yellows which are often called "false topaz." Smoky Quartz occurs in crystals lining the veins of very fine granite which run through the main mass of a coarser granite. Smoky Quartz is a favorite ornamental stone of Switzerland and Scotland. It is the most common stone used by the Scots in the brooches of their Highland costume, worn by both men and women. It is also extensively used for the lids of snuff boxes, and for handles of dirks and knives. Smoky Quartz is known in Scotland as Cairngorm, being found in the vicinity of that town. No record has ever been made of an effort to produce Smoky Quartz in Arkansas for commercial use, but should a demand arise for it, there is an ample quantity in Hot Spring, Garland and Saline counties to supply extensive manufacturing establishments. This Smoky Quartz is quite brilliant, and with the proper tools, can be cut with the facets of the diamond. Specimens of considerable size can easily be secured if a demand be created for them.

SOAPSTONE

(*Acid Magnesium Metasilicate*)

Arkansas is credited with the largest bed of Soapstone or talc west of the Mississippi river. It is located in Saline county, near the Pulaski and Jefferson county lines. While its extent and purity have been established, the field has been little exploited. Soapstone is a very common mineral, and likewise is highly important due to its many uses. It is the softest of all stones, being easily scratched with the finger-nail. It is soapy and greasy to the touch. Its colors are gray, white and apple-green, with a silvery appearance. Chemically it is the same as Serpentine and Meerschaum, but the combination is upon a different ratio. Arkansas Soapstone has been used locally with much success as a lining for furnaces, but the Saline county deposit is capable of supplying the artistic industries. Soapstone is often used as the base for face and talcum powders, in the preservation of rubber, in the manufacture of paper, and for adulterating soaps. It is also used by tailors for marking cloth, for jets in gas burners, and in China, small figures are carved from it. The Saline county deposit is easily mined and the mineral can be delivered in large boulders, suitable for any purpose and according to any specification, on very short notice.

STANNITE

(Copper Sulfoferrite-Sulfostannite)

Stannite may be more properly referred to as Tin Pyrites, and is a very rare metal. It has been reported only in Polk county, where it was found in limited quantities in a shaft sunk there a number of years ago. The only commercial importance of Stannite is its content of tin and copper. When pure it contains about 57 per cent of these metals, about equally divided. It is usually found about tin mines, so that no effort is made to distinguish it, and only a mineralogist would recognize, or even credit it with having distinctive features from tin ore. The name comes from the Latin, Stannum, meaning tin. It sometimes occurs in the vicinity of silver mines, and there is silver present, though in small quantities, where Stannite has been found in Arkansas. The color of Stannite depends upon the other elements in the composition. If copper predominates, it is a bronze yellow, and if it is iron the color is black. Stannite is found in greatest quantity in Bolivia, where there are large silver mines. Few states can show even traces of Stannite. Stannite has often been mistaken for silver by amateur geologists and the discovery of this ore in Arkansas is credited to a more inquisitive one of these amateur scientists.

SULPHUR

(*Sulphur*)

Sulphur is found in two forms, a compact, brittle solid and a fine powder. It occurs principally in the vicinity of volcanoes, but in Arkansas it has been discovered in that part of the state which has the least volcanic marking. There are traces of it in the gypsum beds in the western part of the state, but almost pure Sulphur is found in mines which have been operated along Buffalo river. Arkansas Sulphur appears in beautiful primrose-yellow crystals, and when rubbed, emits a peculiar odor. Sulphur is extracted from the earthy matter by a process of distillation, the vapors being liquified by a condenser. Commercial Sulphur is produced by pouring this liquid Sulphur into moulds. Sulphur is a non-metallic substance, and has often been called brimstone. It is used in medicine, in the manufacture of sulphuric acid and of matches, gunpowder and in vulcanizing rubber. It is also combined with oxygen to form a solution used in bleaching and in fixing photographs. Sulphur is produced in great quantities in Sicily, but America has large deposits in Louisiana, Texas, California and Mexico. It is also found in iron and copper pyrites in Arkansas. Its presence can be detected in some Newton county rocks by subjecting them to heat.

SUNSTONE

(Feldspar with Red Hematite)

Most valuable of the stones which are not classed as gems, is the Sunstone, and Magnet Cove, in Hot Spring county, is rich in this semi-precious stone or mineral. Sunstone is a feldspar which exhibits a peculiar, spangled appearance, due to the enclosure of minute scales of red hematite. It is similar in most respects to aventurine quartz. It is pink or gray in color and takes an excellent polish. When displayed in a strong light, as in the sun, it shines brightly, and the particles of hematite within sparkle as though a blaze of fire. It is from this action in the sun that the stone gets its name. Siberia supplies the world with large quantities of Sunstone, but New York, Pennsylvania, North Carolina and Virginia have also deposits of magnitude. No effort has been made to produce Sunstone in commercial quantities in Arkansas, but should there be a sufficient demand it could easily be done. The production from the fields already worked amply supplies the trade, and the Arkansas area must await development until they have, in a measure, become exhausted. With so many different semi-precious settings for ornaments and jewelry, Sunstone has too much competition for popular favor to make of it a commercial asset.

TRIPOLI

(Weathered Calcareous Siliceous Rock)

Tripoli is another mineral wealth for which the waters of Arkansas are responsible. Tripoli is a soft white substance resulting from the action of water on calcareous siliceous rocks, especially the novaculites. The action of the water has bleached out the calcite in the rock, leaving a pure siliceous residue of fine grain. It is soft and porous, and is easily crushed to be used as an abrasive for polishing in the metal working trades. Its absorbent properties, which enables it to hold liquids, are such as to make it an important factor in the manufacture of dynamite and other explosives. It is also used as a water and wood filter and in making cement. Tripoli occurs in Garland, Hot Spring, Pike and Benton counties, and deposits have also been reported in Montgomery, Ouachita, Washington and Independence counties. Being soft and porous, it is easily crushed into powder or can be cut into any shape desired. Arkansas Tripoli has not been mined extensively but its development is a mere question of time, as the beds are so very extensive and accessible. A few mines are operated but these are all small, and the methods employed most primitive. Larger production no doubt will come with improved facilities for handling.

VESUVIANITE

(*Basic Calcium Aluminum Orthosilicate*)

Found in quantities upon the sides of Mount Vesuvius, embedded in its volcanic stones, Vesuvianite gets its name. It is a silicate of calcium and aluminum and appears in well developed crystals. Vesuvianite is usually brown or green, but where there is a trace of copper the crystals are sky-blue and the mineral is called cyprine. Specimens of Vesuvianite found in Arkansas have all come from Montgomery county and are emerald or bluish-green in color. Vesuvianite is not mined in Arkansas. It has been found either in surface rocks, or embedded in rock taken from wells or prospect holes where the miner was searching for other minerals. Vesuvianite is easily cut, and is often used as a gem or ornament. In the Piedmont section of the Carolinas, and in California, there are some companies which mine Vesuvianite and cut it into settings for jewelry, but they are small and employ but few miners to sever them from the soil. Their market is almost entirely local. If Vesuvianite were plentiful, like quartz, it could easily be made a profitable industry, as the Montgomery county fields are close to Hot Springs, where the number of tourist visitors, all souvenir buyers, totals several hundred thousands annually.

HOT WATERS

(*Hot Water, very nearly pure*)

The Hot Springs National Park is America's most noted health resort. There are 46 thermal springs, flowing in excess of 1,000,000 gallons of water daily, with an average temperature of 135 degrees Fahrenheit. It is claimed that the radio-active properties of the water of the Hot Springs open the pores and induce secretions which cleanse the blood of its impurities, thereby performing cures in cases of rheumatism, kidney, bladder and stomach troubles. Patrons of the bath houses are urged to drink freely of the hot water, thereby hastening the cure. Chemical analyses show less than thirteen grains of solids to the gallon in the hot waters, over one-half of which is carbonate of lime, the balance being carbonate of magnesia, silica, salt and the sulphates of soda and potash. Hot Springs has many palatial bath houses. Twenty-one is a course of baths. A permit must be secured from the superintendent of the government reservation before baths can be taken. Athletes find the baths beneficial in their training. Legend has it that Ferdinand de Soto visited Hot Springs, and that it is the mythical fountain of youth described by the Indians. The climate here is delightful, both winter and summer, making Hot Springs a year-round resort.

MINERAL WATERS

(Mineral Water, in various conditions)

Arkansas is exceptionally rich in health-restoring and health-preserving waters. In all sections of the mountainous western half of the state are located resorts of proven merit. There are many cold water springs in the Hot Springs National Park, and from two of them, Mountain Valley and De Soto springs, a great amount of water is shipped all over the United States. Other famous springs in this vicinity are Radio Magnesia, Arsenic, Lithia and Potash Sulphur. Among the principal mineral springs of the state are: Eureka Springs, Siloam Springs, Heber Springs, Ravenden Springs, Sulphur Springs, Manitou Springs, Armstrong Springs, Boggs Springs, Mammoth Spring and Monte Ne. The water from most of these, particularly Eureka Springs, is beneficial to stomach, kidney and bladder troubles, especially if taken in the early stages of the disease. At Heber Springs there are springs which have produced wonderful cures of skin maladies. The water from thousands of Arkansas springs is so pure that it can be used in prescriptions and in batteries instead of distilled water. There are many springs of great volume in Arkansas. Mammoth Spring flows 864,000,000 gallons daily, and the temperature never varies.

WAVELLITE

(Hydrous Basic Aluminum Phosphate)

Another peculiar mineral is Wavellite. Chemically it is hydrated phosphate of aluminum. Wavellite is usually found attached to slaty rocks in a hemispherical or globular form. When these nodules are broken across they show a beautiful radiated or starlike structure, due to the grouping of the crystals, which join at one end and radiate, fanlike, in a complete circle, giving the appearance of a wheel of many spokes. The mineral is green or greenish-yellow. Wavellite is found in few places, but is quite abundant in those localities. It was named for W. Wavel, its discoverer, and not from the form of the crystals. Wavellite is quite common in the vicinity of Devonshire, Ireland, and in the Magnet Cove area of Arkansas. The most perfect and beautiful specimens, those illustrated in many text books on geology, come from Magnet Cove. Wavellite is quite brilliant, but the nature of the mineral renders it useless for ornamental purposes. Its crystals resemble a daisy in full bloom. It is possible that slabs of stone could be polished showing the Wavellite, but this would depend largely upon the character of the matrix stone in which it is imbedded, some of which is too soft to hold a polish if exposed to the weather.

ZINC

(*Zinc*)

The Zinc ores of North Arkansas are Sphalerite, Smithsonite and Calamine. The Sphalerite is generally mixed with rock and must be ground and separated from it before marketing. Smithsonite and Calamine are imbedded in clay, in the form of nuggets, and are sufficiently pure for immediate shipment. Extensive Zinc mining in Arkansas began in 1899. Hundreds of mines have been worked profitably in Marion, Baxter, Boone, Newton, Searcy, Sharp and Lawrence counties. Geologists assert that richer fields than have yet been worked will eventually be opened. Arkansas Zinc generally commands a premium of about $6 per ton, being about 3 per cent above the standard basis for Zinc content. Arkansas has produced the world's largest Zinc nugget, it weighing 70 tons, from which 12,400 pounds was taken for exhibition at the Chicago World's Fair. It is now in the Field Museum. Zinc, one of the components of brass, is used in galvanizing metal roofing and piping, in the manufacture of paints, and in the production of electricity. Large smelters for the reduction of Zinc ores are operated at Fort Smith and Van Buren, where natural gas is used as a fuel. Two railroads traverse the Zinc fields of Arkansas.

QUESTIONS.

1. Why cannot Actinolite be used commercially as asbestos?
2. Where is it found in Arkansas?
3. What is peculiar about the occurrence of Aegirite in Arkansas?
4. What is the most likely use for this stone?
5. What are the outstanding characteristics of Agalmatolite?
6. What is the meaning of its name?
7. What change is made to Agalmatolite by exposure to the air?
8. How is Agate found?
9. In what colors is it found?
10. What are some of the uses of Agate?
11. In what stone is Albite usually found?
12. What is the meaning of its name?
13. Where is Allophane usually found?
14. How is it formed?
15. What distinguishes Almandite from other garnets?
16. Can it be used as a gem?
17. Of what commercial use is Aluminite?
18. Has this industry ever been developed in Arkansas?
19. What distinguishes Ankerite from Dolomite?
20. What practical use is made of Antimony?

21. Are the Arkansas Antimony deposits promising?
22. What is the chief value of Apatite?
23. When in crystal form, in what colors is it found?
24. To what classification of minerals does Aplome belong?
25. Is Aplome common in America?
26. How is Aragonite formed?
27. What is peculiar about its appearance?
28. How did Arkansite get its name?
29. Where is Asphalt found in Arkansas?
30. Have experiments with it been successful?
31. Has Augite any intrinsic value?
32. What causes the peculiar appearance of Aventurine Quartz?
33. For what is it used in Europe?
34. In what industries is Barite used?
35. What additional use is made of it when found in zinc and lead mines?
36. In what mineral group does Basanite belong?
37. Can it be used for ornamental purposes?
38. What important use is made of Bauxite?
39. What percentage of the Bauxite mined in the United States comes from Arkansas?
40. What is the approximate annual production of Bauxite in Arkansas?

41. How does Biotite usually occur?
42. To what mineral group does it belong?
43. What commercial use can be made of Breunerite?
44. What is its appearance in its natural state?
45. Where is Brookite found in Arkansas?
46. What is the appearance of Brucite?
47. What effect does heat have upon Celestite?
48. What color is it in its natural state?
49 What are the constituents of Cement?
50. Why has this industry not been developed in Arkansas?
51. Of what mineral is Chalcopyrite an important ore?
52. How can it be told from iron pyrites?
53. Is Chalk present to any great extent in Arkansas?
54. Could it be mined easily in this state?
55. In what form does Chrysolite appear?
56. Where does the Cinnamon Stone get its name?
57. To what mineral classification does it belong?
58. Has it a value as a gem stone?
58. Is there in Arkansas a clay suitable for fire brick?

60. What peculiar kind is found in Saline county?
61. What varieties of Coal are found in Arkansas?
62. Where is this Coal area?
63. Is Arkansas' Coal deposit of sufficient size to last very long?
64. Is Arkansas Coal of good quality?
65. Is native Copper of value as an ore?
66. Has it ever been found in paying quantities in Arkansas?
67. Of what use in medicine is Copperas?
68. What other uses have been found for it?
69. Where are diamonds found in Arkansas?
70. Are they found elsewhere in America?
71. How do Arkansas diamonds compare with those of South Africa?
72. Is Dolomite practicable for building purposes?
73. Has it ever been quarried in Arkansas?
74. What are the physical properties of Elaeolite?
75. What important use has Epsom Salt besides as a medicine?
76. What effect has heat upon Fluorspar?
77. For what is it used?

78. Of what valuable mineral is Freiburgite an ore?
79. Has the presence of this mineral ever caused a boom in Arkansas?
80. What are the uses of Fullers Earth?
81. Where is it mined in Arkansas?
82. Is Garnet present in abundance in Arkansas?
83. What value has it as a gem stone?
84. How is Geyserite formed?
85. To what mineral classification does it belong?
86. Is Glass Sand abundant in Arkansas?
87. Where are glass plants located in Arkansas?
88. Which of these use the Arkansas sand?
89. Scientists say the Arkansas Granite is not real Granite. What is it?
90. Is it extensively used as a building stone?
91. In what counties is it found?
92. What are the uses of Graphite?
93. What steps are being taken to investigate the Arkansas deposits?
94. Where is Gravel mined in Arkansas?
95. For what is it used?
96. What is the color of Greenockite?
97. What distinguishes Grossularite from other garnets?

98. What is the principal use of Gypsum?
99. What is the meaning of the name, Hornblende?
100. Where is it usually found?
101. How does Hypersthene differ from other pyroxenes?
102. How did Iolite get its name?
103. Iron is present all over Arkansas, yet is not mined. Why is this?
104. Where is Iron Pyrites found?
105. For what is it used?
106. What are the properties of Jasper?
107. For what is it used?
108. Where is it found in Arkansas?
109. What changes take place when Labradorite is held in the light?
110. What causes this phenomenon?
111. Is Lead ore present in quantity in Arkansas?
112. How was it mined during the Civil war?
113. What was the largest mass of Lead ore ever mined in Arkansas?
114. Has much Lead been mined recently in Arkansas?
115. For what is Lignite used?
116. Why have not the Arkansas deposits been developed?

117. Is the manufacture of Lime from Limestone common in Arkansas?
118. What are some of the uses of Lime?
119. Is the Arkansas Limestone of a high grade?
120. What characteristics are essential in Lithographers' Stone?
121. How does Magnetite live up to its name?
122. Of what is it formed?
123. What effect does it have on the needle of a compass?
124. What use is made of the green coloring matter in Malachite?
125. How is it used in art work?
126. How many Manganese mines are now being operated in Arkansas, and where are they located?
127. For what is it used?
128. How is it mined?
129. Name some public buildings constructed of Arkansas Marble.
130. What properties has Arkansas Marble which make it suitable for a building stone?
131. In what colors is it found?
132. What are some of the uses of Mica?
133. Where is it found in Arkansas?
134. What qualities does Microcline possess that makes it valuable for souvenir ornaments?

135. Where are the Natural Gas fields of Arkansas located?
136. Why has not the South Arkansas field been developed more intensively?
137. How does Arkansas Natural Gas compare with that of other states?
138. What are the general characteristics of Newtonite?
139. For what is Nitre used?
140. What is the principal use of Novaculite?
141. What qualities especially fit it for this?
142. Where is it mined in Arkansas?
143. In what industry is Ochre used?
144. In what colors does it occur?
145. By what other names is Octahedrite known?
146. Petroleum is derived from Oil Shales in Scotland. Why has no attempt been made to do this in this country?
147. Describe the color phenomenon of Oligoclase.
148. For what can Onyx Marble be used?
149. What causes the divergence of color in the Opal?
150. What is the effect of heat upon the Opal? Why does this happen?
151. Why is Orthoclase sometimes called icespar?

152. Is Ozarkite a common mineral?
153. Why does Ozarkite seem to boil when heated?
154. Is the Pearl a mineral or an animal growth?
155. What is the probable explanation of its for mation?
156. How are they sought in Arkansas?
157. Is the Pearl industry a paying one?
158. What use is made of the shells?
159. What are the physical properties of Perovskite?
160. How does Arkansas rank in the production of Crude Oil?
161. When and where was the first Arkansas oil well "brought in?"
162. What towns are the oil centers in Arkansas?
163. What was the average daily production of the Smackover field in 1923?
164. What important use has been found for Phosphates?
165. Why was the government research of the Arkansas Potash beds abandoned?
166. How is Pyrophyllite commonly used?
167. What is the "Hot Springs Diamond?"
168. How are these crystals used?
169. What distinguishes Arkansas Rectorite?
170. What is made from it?

171. In what colors is Rutile found?
172. What evidence have we that Arkansas possesses great subterranean layers of Salt?
173. Why is not all Sandstone fit for building purposes?
174. For what other purpose is it quarried in Arkansas?
175. What peculiar coloring has Serpentine that suggests its name?
176. What defect has it that prevents its use as a building stone?
177. Have attempts ever been made to mine Silver in Arkansas?
178. How does it occur in the native state?
179. Where are the most extensive Slate deposits in Arkansas?
180. Can these be mined profitably?
181. What distinguishes Smoky Quartz from ordinary Quartz?
182. How is it used in Scotland?
183. What are the characteristics of Soapstone?
184. Where is the large Arkansas Deposit?
185. What is Stannite?
186. Is it a common mineral?
187. What are some of the uses of Sulphur?
188. Has it ever been mined in Arkansas?

189. What gives Sunstone its peculiar appearance?
190. How is Tripoli formed?
191. How does Vesuvianite get its name?
192. To what extent do Hot Springs exist in Arkansas?
193. Is this water comparatively pure?
194. What factors make Hot Springs, Arkansas, a famous health resort?
195. Are there many mineral springs in Arkansas?
196. Where are they located?
197. Describe the appearance of Wavellite.
198. Is Zinc mined profitably in Arkansas?
199. Is the Arkansas ore of comparatively high grade?
200. Arkansas has produced the world's largest Zinc nugget. How much did it weigh, and at what famous exposition was part of it exhibited?
201. For what is Zinc used?
202. Where are smelters located in this state for the reduction of Zinc ores.

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