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OF

THE GEOLOGICAL SOCIETY OF MINNESOTA

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SPRING 1957 SUMMER

NO. 1.

Iron rusts from disuse, stagnant water loses its
purity and in cold weather becomes frozen; even
so does inaction sap the vigors of the mind.

Lenardo da Vinci.

GEOLOGICAL SOCIETY OF MINNESOTA

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MEETINGS: October to May inclusive, 7:30 P.M. every 2nd and 4th Monday
not a holiday, Ford Hall, University of Minnesota, 17th Avenue and Washington
Avenue. Visitors welcome.

FIELD TRIPS: May until October inclusive.

ANNUAL DUES: Residents in a 50 mile radius of the Twin Cities \$ 3.00 plus
\$ 1.00 additional for husband, wife, or dependent family members, for
students and non-residents, \$ 1.00.

AFFILIATE MEMBER

MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES

and

THE AMERICAN FEDERATION OF MINERALOGICAL SOCIETIES

* Deceased

Notes on June 15th to June 29th Field Trip
to Central Colorado and Northern New Mexico.

Plans for the 1957 "Long Field Trip" are nearing completion. Mr. McWethy desires to meet with these "trippers" at room # 55 Ford Hall on Monday evening, June 3rd at 7:30 P.M. to complete final arrangements.

At the present time there is a possibility according to Mr. Havill, our comptroller, that we have room in the bus for one or two more trippers. The estimated cost of the 3450 mile trip which will include Colorado Springs, Pikes Peak, Royal Gorge, Colorado Sand Dunes, Taos, Bandolier, Santa Fe, Albuquerque, Grants (Uranium), Gallup, Shiprock, Mesa Verde, Durango, Million Dollar Highway, Gunnison Canyon, Leadville, Idaho Springs, Red Rock Theatre, Central City, Boulder and Denver, will average in the neighborhood of \$ 160.00.

Each member of the trip has been furnished with a list of subject assignments to report on during the trip. We should check up on these assignments at the June 3rd meeting. At this meeting you will be furnished with a schedule of the overnight stops, mileage etc. Each member should have Conoco map (or its equivalent) of the route we will cover.

Final arrangements have been made with the Jefferson Transportation Co. for an air conditioned bus seating 40 passengers.

Dr. Daniel S. Turner, consulting geologist, of Denver will be one of our lecturers. A writeup of his activities in teaching the fundamental principles of Geology of the Rocky Mountains west of Denver to some 230 teachers and laymen of Denver appeared in the Denver Baillies and in the last issue of the G. E. O. Times, the national news monthly of the American Geological Association. He will be with us at Colorado Springs and will join us again at Leadville and conduct us on our trip from Idaho Springs to Denver.

We are all looking forward, I think, to a trip which will be worthwhile and profitable.

Comments by President McWethy.

Your Board of Directors met on May 6th under the Chairmanship of retiring President Lawrence King. Among the items of business on Mr. King's agenda was the election of officers to serve you for the coming year. Faithful in their discharge of their duties in past years, Mr. C. H. Havill was again elected Vice President, Dr. Bert Carlson, Secretary, and Mr. A. P. Rickmire, Treasurer. I was chosen as your President. This repeat order as your President was not as I would have had it, but since I finally accented the mandate of the Board, I pledged to them and do now pledge to the Society, that I will carry out the duties of the office to the best of my ability. To this end I shall need, and shall expect, to have the full cooperation of each of you. This cooperation has been pledged to me by the individual members of the Board and by Mr. King our retiring President.

The initial duties of your new President and the Board's officers has been considerably lessened through the characteristic thoroughness with which Mr. King has carried out his work. As one instance, your field trips for the remainder of the summer have all been planned. The dates, destination and leader of each trip are listed elsewhere in this Bulletin. Everyone of these trips has a worthwhile objective and is under able leadership. Lets give these leaders our support by being with them on their trips. Our lives will be richer because of these contacts and experiences.

In the above I have intimated that I expected full "cooperation" of the individual members of the Society in it's program. I do not intend this to be

merely a figure of speech. I realize however that for you to participate more fully in the work of our Society a responsibility rests upon me as your President to provide a vehicle through which your individual effort and personality may be made effective. As a starter in this direction I have tentatively set up about a dozen committees under the leadership of our Board members and other trusted lieutenants. To these committees I have arbitrarily assigned the names of those individuals who I thought would be effective in the work of the particular committee. The work assignments to these committees are not mandatory. A letter from you to me prior to August 1st will effect any change you desire. Obviously I do not as yet have enough committees to give each of our members some specific activity. If your name has been omitted or if there is some essential activity we should engage in not covered in the committee list let me know about it and I will make the desired changes.

Now as to some further plans for next year. Following Mrs. Sommers Afton Anticline Field Trip and her excellent presentation of the phenomena at the Sommers' home at North Hudson on Sunday May 17th, we continued the discussion by giving consideration to plans for next year. As a result of this informal meeting attended by more than 30 of our members and also as a result of subsequent developments, we have the following announcement to make:

1. We will continue to hold our meetings on Monday evenings.
 2. The meeting nights will be the 2nd and 4th Monday evenings of the month instead of the 1st and 3rd.
 3. The meetings will continue to be held at room # 55, Ford Hall, U. of M.
 4. Our lecturer will be Dr. J. Campbell Craddock, Department of Geology, University of Minnesota. His lecture series of 12 lectures will be on structural geology beginning October 14th. (we think we have an excellent "find" in Dr. Craddock. We will tell you more about him and his lecture series in a subsequent issue of the Bulletin).
 5. Mr. & Mrs. L. W. King have consented to deliver a series of three or more half hour informal talks, 7:00 P.M. to 7:30 P.M. (preceeding Dr. Craddock's lecture) on beginning Geology. These will be particularly desired for those who have limited technical background in Geology. (More about these lectures later too). I have an idea that none of us will want to miss this series.
- There you have the tentative plans for next year. Dont forget to tell your friends about them and their opportunity to learn something of a science which will bring joy and satisfaction to them through the remainder of their lives. And dont forget to come and invite your friends to join us on our field trips. Now may we present the tentative list of committees and their personnell.

WORKING COMMITTEES FOR 1957-58.

1. Lecture Program Committee: Mr. Havill, Vice President chairman. Mr. King, Mrs. Becker, Mr. Grime, Mrs. Hallberg, Miss Gossler.
2. Publicity: Mrs. H. S. Sommers, Chairman. Dr. Carleen, Mrs. Koons, Mrs. Koppen, Mr. Hitchcock.
3. Membership Drive: Mr. Howard, Chairman. Miss Woltman, Mrs. Rickmire, Miss Brewster, Mrs. Miner, Miss Knox, John Nordberg, Mrs. Hitchcock, Miss Witt.
4. Dues Collection Aids: Miss Paschke, Chairman. Mrs. Heilman, Mr. Hargrove, Mrs. Benson, Mr. & Mrs. Papke, Miss Ormond, Miss Cecelia Weaver.
5. Hospitality - Fellowship: Miss Hinchley, Chairman. Mrs. Gosler, Miss Hoy, Miss Sacia, Mrs. Roney, Miss Swenson, Mrs. Sommers, Mr. Marshall.
6. Geology Plaques: Mr. King, Chairman. Dr. Thiel, Dr. Schwartz.
7. Field Trips 1958: Mr. Pattengill, Chairman. Mr. Roney, Mrs. Hallberg, Miss Hinchley, Mrs. Engen, Mrs. King, Mr. Brown, Miss Knox, Miss Facett, Mrs. Heller.
8. Transportation For Field Trips: Mr. & Mrs. Havill, Co-Chairmen.

9. Telephone Committee: Mrs. McWethy, Chairman. Miss E. Hinchley, Mrs. O. Papke, Miss Sacia, Mrs. L. D. Hargrove, Miss Theo. Zickrick, Miss Volkman, Mrs. Ralph Brown, Mrs. Ara Rickaire, Mrs. Merle Harris, Miss Grace Benz.
10. Roster Committee: Mr. & Mrs. Koppen, Co-Chairmen. Mr. & Mrs. Merle Harris, Mr. & Mrs. Chas. Howard, Dr. & Mrs. Bert Carlson, Mr. & Mrs. J. O. Engen.
11. October 1957 Boy Scout Geology Month: Dr. Carlson, Chairman. Miss Hoy, Mr. Heilman, Mrs. Hallberg, Mr. O. Papke, Mr. J. O. Engen, Miss M. Kinkor, Miss Peterson.

We did not have an exhibit at the State Fair last year and at the last meeting of the Board some doubt was expressed as to whether the registrants at the Fair resulted in permanent accruals to our membership. We will hold the formation of this committee in abeyance for the time being and will await suggestions from our membership.

Bulletin Board

TENTATIVE SCHEDULE of 1957 FIELD TRIPS.

| DATE | PLACE | LEADER |
|--------------|-----------------------------|-----------------------------------|
| June 2 | St. Cloud Minn. | Dr. Bert Carlson |
| June 16 | Colo. - New Mex. Field Trip | Hal E. McWethy |
| July 7 | Washington County | Linda Bennett - Elsie Hinchley |
| August 4 | Cuyuna Iron Range | Elmer H. Brown |
| August 18 | Baraboo Wisconsin | Dr. Robt. Sloan |
| September 1 | Jay Cook State Park | Hal E. McWethy |
| September 15 | N. Shore Lake Superior | Margaret Paschke |
| September 29 | Redwood Falls Minn. | Chas. B. Howard |
| October 13 | Faribault Minn. | Arthur D. Honey |

PLAN TO ATTEND

The Second Field Trip Convention of the Midwest Federation of
Mineralogical and Geological Societies

June 27, 28, 29, 30, 1957.

HOST SOCIETIES

Madison Geological Society and Madison Lapidary and Mineral Society

TO BE HELD AT

Platteville, Wisconsin, Headquarters, Municipal Building, Free Parking.

HIGHLIGHTS

Area is a Mecca for Geology, History and Sightseeing.

There will be lectures by authorities in their fields on Geology of the area, on Wisconsin diamonds and on Wisconsin mining. Field trips to mine dumps. Bus trip to historical points, agate and fossil hunting and mineral collecting. On the route is Wyalusing, Prairie du Chien, Wausau (dinner here and Famous Pheasant Place Museum, Kickapoo Cave, Muscoda Quarry (all kinds of minerals and rocks found here). Cornish Miners Banquet. Auction and Trading (bring your specimens). Old timers meeting. Boat trip on Mississippi River (all geological and historical points of interest will be pointed out via microphone).

HOUSING: Make your own reservations. List of hotels and motels as well as rooms at private homes can be obtained by writing Miss Margaret Smith, Housing Chairman, 134 W. Gilman St., Madison 3, Wisconsin.

Material available for preliminary study of areas to be visited:

1. Wisconsin Highway Map - Wisconsin Highway Commission, 434 State Office Building, Madison Wisconsin.
2. Zinc, Lead, Copper Resources and General Geology of the Upper Mississippi Valley District - Bulletin 1015 G, with map, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. (75¢).
3. Stratigraphy of Middle Ordovician Rocks in the Zinc, Lead District of Wisconsin, Illinois and Iowa. Paper 274 K. Obtained same as No. 2. (60¢).
4. Mineral Investigations Field Studies Map MF 40, United States Geological Survey, Washington D. C. (50¢).

List for post convention trips will be available at registration desk.

REGISTRATION: Fee \$ 1.00. Send fee and name or names to Mrs. H. S. Baird, Registration Chairman, 1044 Jenifer St., Madison 3, Wisconsin. Advance registration is requested to obtain approximate attendance for trips and dinners, however, registration will be continued each day of convention.

WHAT TO LOOK FOR AT THE MIDWEST CONCLAVE.

Galena, the principal ore of lead, is mined in the Platteville region to be visited by the Midwest Federation in June, which is a part of the famous Tri-State district of northwest Illinois (Galena), southwest Wisconsin (Platteville), and northeast Iowa (Dubuque). It will be one of the chief minerals to be collected while there.

Galena is perhaps one of the easiest to identify of all minerals. It nearly always occurs as cube-shaped crystals and it has a strong tendency to break into cubic fragments when it is shattered. The mineral has a typical lead-grey color and a gray-black streak, and it has a bright metallic luster. One of the early state geologists described the fresh cleavage faces as "shining almost like a mirror." Galena is heavier than most minerals and so soft that it will make a mark on paper.

Lead has been extracted from galena since at least 1500 B.C. The ore has been mined in the United States for more than 300 years, being first discovered in Virginia, where lead pellets, called shot, were manufactured even in pre-revolutionary days. Shotgun pellets begin their career at the top of a shot tower, where molten lead is poured into a dropping pan with a finely perforated bottom. In Washington's time the Natural Bridge of Virginia was used as the vantage point from which molten lead was poured, and the resulting pellets were picked up by hand from the stream below.

Everyone attending the Midwest Conclave should make it a point to visit the "OLD SHOT TOWER" at Dubuque, near the bank of the Mississippi, which is celebrating the one-hundredth anniversary of its building this year. A visit to the historic "Shot Tower" on the river bluff, three miles south of Spring Green, located on state route 23 northeast of Platteville, is a diversion very much worth while.

Sphalerite, the important ore of zinc, is built like a diamond and can smell like a rotten egg. One of the most common of minerals, sphalerite, or zinc ore, has been mined in the Platteville area for more than a century. This mineral is also called zinc blende, blende, blackjack, and mook lead. When pure it is nearly colorless, but most specimens are colored brown, yellow, black or red because of impurities. The streak is white to dark brown - always much lighter than the color of the specimen.

Sphalerite crystals commonly have the shape of triangular pyramids with three sides and a base. This substance with atomic structure similar to that of diamonds has good cleavage in six directions and will break into twelve-sided blocks. It has a brilliant, diamondlike, or almost metallic luster, and is harder than a penny but can be scratched by a knife.

In warm hydrochloric (muriatic) acid sphalerite breaks down and forms hydrogen sulfide, which has the well-known odor of rotten eggs, but sphalerite can be more pleasantly identified by its cleavage and resinous luster.

Calcite is a mineral so common that many beginning collectors may feel that it is scarcely worth looking for. Do not be deceived, however, by its abundance, for in many respects it may be considered as one of our most interesting and important minerals, both because of its beauty, and because of its usefulness from a scientific standpoint. Someone has said that the history of calcite is the history of mineralogy.

Its crystals occur in such profusion, variety and beauty as to have easily attracted the attention of early mineralogists and to have furnished them with abundant material for study. In few places are finer specimens to be found than those associated with the minerals galena and sphalerite around the mines of the Platteville area. Older mine dumps are always to be looked upon as likely spots for good collecting.

This area has long been known for the excellent examples of rhombohedron and scalenohedron crystal forms found here.

Several other varieties of the carbonate group of minerals have likewise been found in the region, and one should hang on to any specimen which appears to be a bit unusual while collecting, as it might turn out to be something uncommon, if not very rare. Greater care should be exercised in packing such crystals as are found than usual, due to their fragility and lesser hardness. A good supply of old newspapers on hand makes for excellent packing material.

IOWA'S FAMOUS EFFIGY MOUNDS. Everyone who has time should visit Iowa's Effigy Mounds National Monument, which may be reached by a drive of a few minutes north from the west end of the bridge spanning the Mississippi River from Prairie du Chien, on U.S. route 12.

THE PICTURED ROCKS OF MCGREGOR. In a wooded ravine among the hills overlooking the Mississippi River, one mile south of McGregor, IA., a stratum of St. Peter sandstone is exposed which is almost pure silica. But small amounts of iron oxide have been deposited between the grains of sand by the water percolating down from the overlying Trenton limestone, and this infiltration has produced more than forty delicate shades of color in bands and patches, which give the face of the rock a beautiful variegated appearance. To the thousands of visitors the place has long been known as the "Pictured Rocks."

It was from this sandstone, wherein may be found most of the chromatic color range from pale shell pink through deep dark red, as well as green, blue, terra cotta, brown, and the achromatic colors from white to black through the intermediate grays, that Andrew Clemens, the world famous sand artist of McGregor, obtained the material for the exquisite miniatures he designed and executed in glass bottles. So great became his fame that he had received world wide acclaim as an artist before his death in 1894, and until this day the excellence of his work has never yet been approached. Only a few of these marvelous picture bottles are yet in existence, and they are considered as priceless works of art. Several may still be seen in McGregor.

All who attend our Field Trip Convention in June, and are interested in colored sands, should bring along a set of clean screw cap bottles or jars in which to make their collection. Nowhere in America is there an opportunity to obtain such a variety of colors in a single exposure of sandstone. On the way out to the "Pictured Rocks", one may see the birthplace of the famous showmen, Ringling Brothers, and a few miles beyond lies Iowa's Pike's Peak State Park, visited early by Lieut. Pike, and the first so named. At its top, nearly 500 feet above the waters of the Mississippi, one stands on the spot of land first viewed by the white man west of the upper Mississippi River, and here he may look down on the south of the Wisconsin River, whence Joliet and Marquette and their party first viewed it in 1763. Effigy mounds are also present in the park.

LETTER FROM EDITOR, EARTH SCIENCE, Rockhounds' NATIONAL MAGAZINE.

Dear Fellow Rockhounds:

Wherever you may live, or regardless of your Federation affiliation - or even if you belong to no club at all, let me urge you, if possible, to attend our 1957 Midwest Field Conclave, at Plattville Wisconsin, on June 27-30 - on any or all of these dates.

I have been very familiar with this area for many years, and let me assure you that there is absolutely no more interesting or worthwhile place to visit in the entire middle west. This region has long been known as the "Switzerland of America" and it is certainly deserving of the name. It holds more of scenic, historic, mineralogic, geologic and archeological interest wrapped up in one small package than any other place that I know of.

Ben Hur Wilson.

IT STARTED 150 MILLION YEARS AGO.

Geologists admit that there is still a lot to be learned about the sources of uranium ores in the Colorado Plateau.

It is believed that the Plateau's flat-topped mesas were once the bed of vast inland seas. Probably when these seas receded, some time at least 150 million years ago, they left behind them marshes and shallow lakes that were overrun by giant reptiles. Fossilized bones of these dinosaurs have been found buried in the strange rock formations that cover the area.

As millions of years went by, and the water channels shifted, sands were laid down. Along with them they carried traces of uranium-bearing minerals, which had most likely bubbled up from the earth perhaps thousands of miles away.

Over 100 uranium-bearing minerals are now known to exist; but in the Plateau area, the uranium occurs chiefly in the mineral carnotite. It is a sedimentary type of deposit, usually found as a powdery mass in the sandstones. Some deposits are bright yellow in color; others may be pale green or gray; and still others have a brownish tinge because they are partially concealed by iron staining. In fact, the ore varies greatly in appearance from one deposit to another.

Because the deposits in the sandstones are so scattered, uranium mining covers a wide area in the Plateau. One of the oldest and most active mining sections is a long, narrow portion of land known as the Uravan Mineral Belt. Its northern boundary is about 50 miles southwest of Grand Junction. The deposits throughout this section are nearly all in what geologists call the Morrison formation and consist of large-size, high-grade ores.

When you drive back in the hills around Uravan, you can see the waste rock from old uranium mines above the slick rock - that is, the layer that has an outer surface worn smooth. It is about at this height the ore bodies generally occur, in this wilderness of mesas and canyons.

The Navajos and Utes who roamed the great Colorado Plateau several hundred years ago were the first to recognize the value of uranium, but in a rather strange way. They decorated their bodies with brilliant red and yellow war paints, made from ores that they had found along the canyon walls. What they were using was powdery carnotite, the same mineral from which uranium is obtained today.

Many years later, these same carnotite ores were mined to extract the radium that they contained. The ore was shipped from the Plateau to Paris to be used in the experiments being conducted by the famous French scientists, Marie and Pierre Curie. In fact, the Colorado Plateau was the world's chief source of radium for 10 years during and after the first World War. Then richer radium-bearing ores were discovered in the Belgian Congo, and mining in the Plateau ceased.

Meanwhile, some of the people who had mined in the area had found that the carnotite ores there also contained vanadium. At first, they had considered vanadium just a nuisance. Later, when the value of the metal was established, they began to look for it in earnest.

The largest deposit of vanadium ore ever found in America is about 12 miles northeast of the town of Rifle, Colorado, and close to this also, a recovery plant was built about 1925. However, when the supply of vanadium ore at Rifle appeared to be exhausted, about 1932, a new processing plant was built at Uravan, about 95 miles south of Grand Junction on the site of the old radium processing mill. At a later date, other mills became active near Uravan and the surrounding country.

Although the Colorado Plateau has had its ups and downs as a mining district, exploration has never ceased there from the time when prospectors and burros first came to the area in search of gold. But now those gray-bearded prospectors, who forged through the hills on burros 100 years ago, are almost forgotten. The burro has been supplanted by the jeep, rugged little pick-up trucks, bulldozers, and airplanes.

No hill is too distant or inaccessible in the Plateau for today's prospectors. Fortunately, uranium has the very useful habit of emitting gamma rays, which can be detected by special scientific instruments. Today, thousands of prospectors, equipped with highly sensitive Geiger counters and scintillometers, are combing every bit of the known uranium-bearing areas in the Plateau. Some are venturing far beyond the limits of present production in search of new sources in remote hills and canyons. Even low-flying aircraft are used to survey wide areas of land in a few minutes' time.

In addition to the many amateur prospectors, there are at least 1,500 trained geologists and mining engineers doing exploratory work in the Plateau. In fact, this organized prospecting by the mining companies and Government agencies is said to surpass in scope of operations any similar search in the history of the world. Today the emphasis in exploratory work conducted by Government agencies is on acquiring geologic knowledge. With this change there has been a sharp cut in actual footage drilled by these agencies and an increasing rate of drilling by private industry.

Uranium claims are staked in exactly the same way as for gold, copper, or any other valuable metal. First the area is surveyed, then a discovery cut is made and corner posts are set up to locate the claim boundaries. Each claim covers an area of 600 by 1,500 feet. A notice of the claim, located along the center line, identifies the owner.

Many uranium claims may be staked in certain areas that appear to be lucrative, yet not all of them will contain sufficient ore bodies to warrant any mining activity. However, if a claim looks promising after a preliminary survey, the owner will usually contract to have the land drilled, to determine if there are any ore bodies.

One of the standard techniques used is diamond drilling. First a hole is drilled, and the cuttings or core examined. If it shows any evidence of strong mineralization, additional holes will be made in the surrounding area. In this way, the ore body can be partially blocked out and the tonnage estimated. Private companies spend \$15 million a year on drilling alone, and they do at least 5 million feet of drilling.

Today, there are about 1,000 people engaged in drilling uranium claims in the Plateau. This includes employees of the AEC and the United States Geological Survey, as well as employees of private industry. According to recent estimates, private industry is conducting almost ten times as much drilling as the Government Agencies.

The increase in private drilling activity has permitted the reduction in Government drilling, thereby freeing certain personnel for more widespread studies of the complex geological conditions found in the many types of ore deposits and more emphasis on the study and recognition of minute geologic features associated with uranium ores. These intensified geologic studies have resulted in a more thorough appraisal of the Nation's uranium production potential.

In drilling there are two stages. The first is known as "reconnaissance" -- a general search for areas worthy of more extensive investigation. The second stage is aimed at "pin-pointing" the location of ore deposits and evaluating them by preliminary drilling.

The AEC, in keeping with its policy of encouraging private enterprise to develop the country's uranium resources, follows the practice of obtaining uranium ores or concentrates only after they have been mined or processed. And, although the Government, of course, wants all the uranium ore that can be found, and will give technical assistance wherever it is needed, it wants the actual work done by the people under a free-enterprise system.

You really have to see a uranium mine to appreciate how different it is from most people's conception of the mining business. Perhaps a brief description of some typical mining country will give you an idea of what you might expect to see.

You can drive for miles and miles on the rutted roads leading back among the mesas, and you will pass by mine after mine tucked away almost unnoticed in the many hills. These are not large-scale operations, such as you would see where coal is mined, but simply small tunnels dug into the hills. You will usually find only a few miners working—often just two or three.

The Plateau now has approximately 900 uranium mines in operation. There are over 4,000 people engaged in mining these properties. Many of the mines are owned by some of the larger mining companies in the area, and are mined through contractors. These mines may have a half-dozen workers, including a couple of shift bosses. At a smaller mine, operators may work in pairs.

The tools used by a small mine operator are generally an air compressor, a jack hammer and jackler drill, either a wheelbarrow or a one-ton ore car, and of course picks and shovels. On his hard hat, which he wears to protect his head from falling rock, the miner will usually carry a carbide lamp to light his way through the winding mine tunnels. In the larger mines, there are mucking machines, slushers, and frequently diesel-powered shovel loaders and locomotives.

A uranium mine generally covers an area of not more than 20 to 40 acres. In most cases, the procedure is simply to follow the ore body in its many wanderings through tons of waste rock. There may be a short level tunnel into the hill to start with, and this may open up into many caverns with bays up above or even below the haulage level. At other mines, shafts may be set in at inclines varying from 12 degrees to the vertical.

Since drilling is done through solid rock, little timber is required for supports in uranium mines. Water, however, is needed in large quantities for mining operations. Usually it has to be hauled from streams miles away, or obtained from deep wells.

The ore is trammed from the mine to an unloading platform, either in a small mine car or simply by wheelbarrows, if the operation is small. Many of the mines have covered wooden chutes, which run down the side of the cliff to an ore bin below. The ore is later dumped from this bin into trucks which then transport it to one of the processing mills.

The miner's job is not an easy one. He must drill and blast through many tons of rock as he follows the ore body. Naturally, he will find it most profitable to mine ore with the highest uranium content, since he is paid on that basis.

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