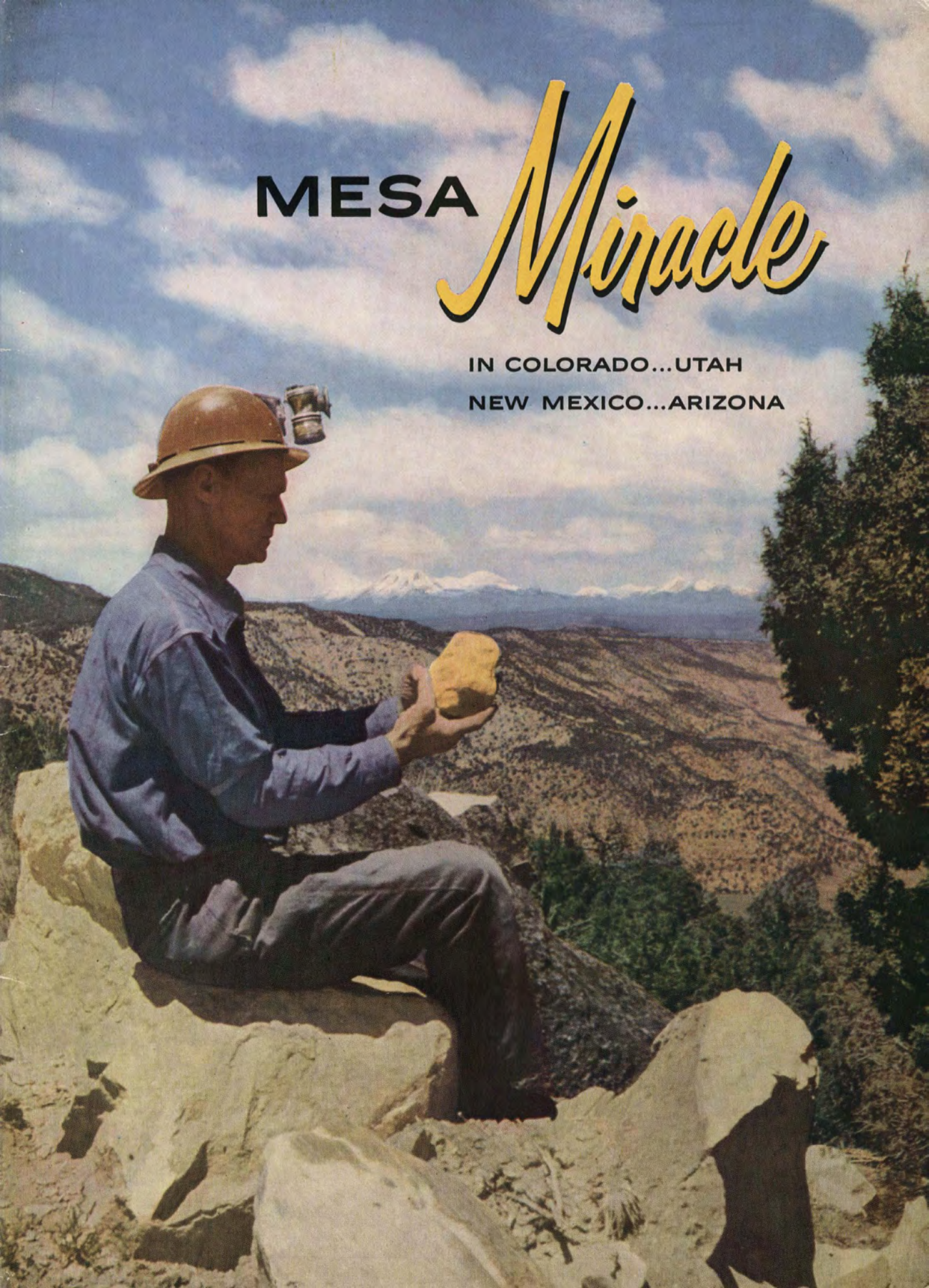
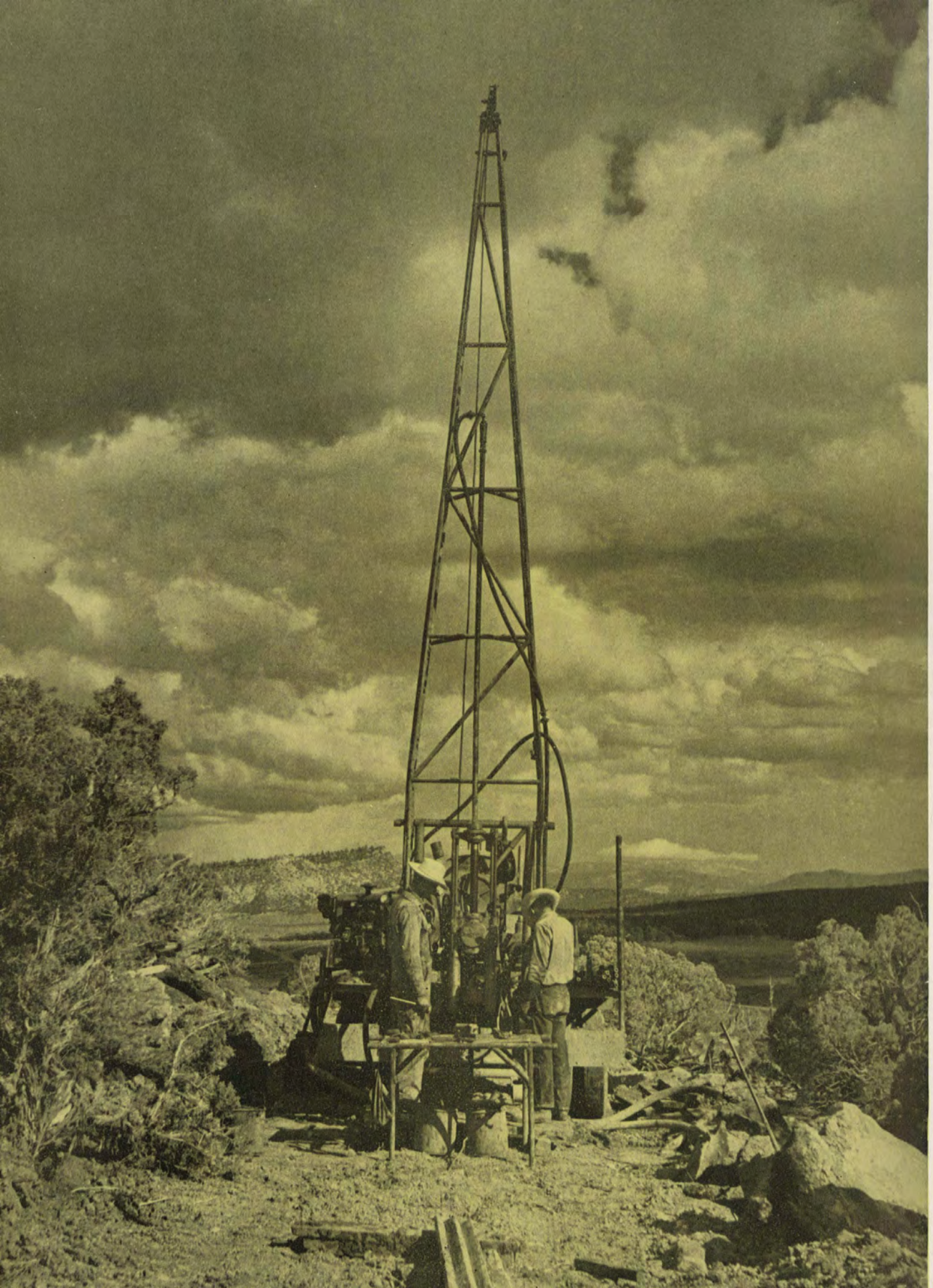

MESA Miracle
IN COLORADO...UTAH
NEW MEXICO...ARIZONA



MESA *Miracle*

In the Uranium Deposits of the Colorado Plateau Lies One of America's Greatest Power Reserves....

If you will take a trip with us back into the hills that make up the colorful mesa country of the Colorado Plateau, we will tell you a tale of men who are building a unique and fascinating industry . . . About the discovery in these rugged hills of a vast treasurehouse of energy, which nature secreted there some 150-million years ago . . . About a perplexing mineral, with seemingly limitless powers, which man is learning to harness in the hopes of giving us a better life.

You will find that this is a typically American story . . . of people working together in a land where great resources abound, and where everyone is free to reap these resources and to enjoy the benefits that they bring. This is the story of what these people are doing with uranium . . . the magic metal that is bringing new wonders to our world.

Hundreds of miles of mesa country are being combed in the Colorado Plateau in the search for uranium ore. Shown here is a diamond-drilling operation.

"MESA MIRACLE" has been prepared by United States Vanadium Company, a Division of Union Carbide and Carbon Corporation, to indicate the tremendous importance of the Colorado Plateau to the nation's great atomic energy program. The Plateau is today the chief domestic source of uranium ores.

Since the uranium operations are so thinly scattered over such a large area, few people realize the extent to which this new industry has grown. It is difficult to appreciate its value not only to our national defense, but also to the prosperity of the Plateau area itself.

In telling this story, we have attempted to give an overall picture of the mining and processing of uranium ores. Naturally, we have drawn largely from our own experiences. It is believed, however, that the operations described are typical of the work being done by others involved in the program.

Anyone who wishes to reprint any of the material contained in this booklet may do so, if credit is given to the source.

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This is typical of the country where uranium is mined. It is mostly a high tableland dotted with mesas—rugged flat-topped hills with steeply sloping sides.

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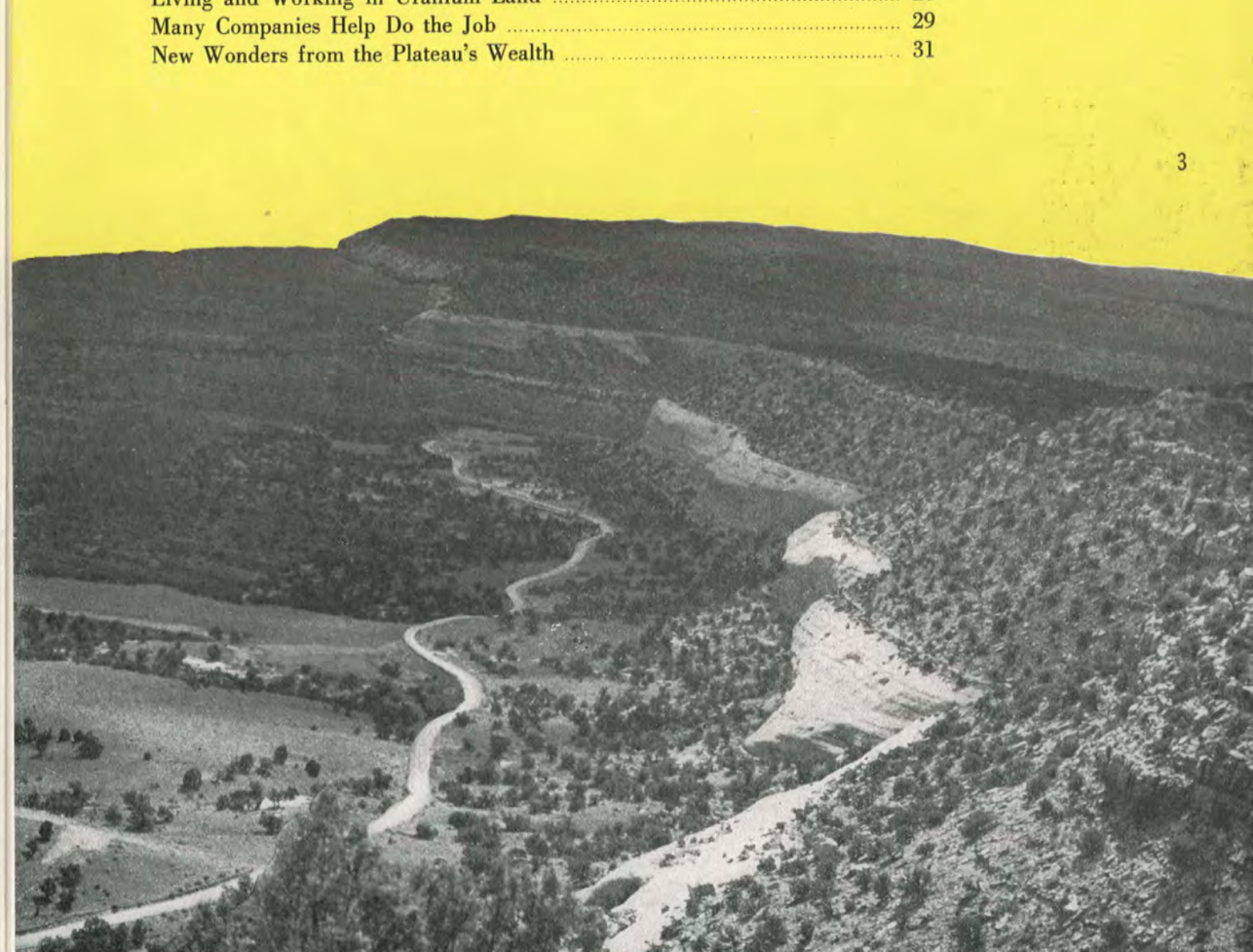


The Colorado Plateau covers an area of about 65,000 square miles and reaches into four states. Some of the principal uranium-vanadium ore deposits, as well as the processing mills in the area, are indicated on this map.

TO THE PLATEAU HAS COME A NEW INDUSTRY

One of the last frontiers in America—that vast arid tableland known as the Colorado Plateau—is bustling with activity these days. Its tumbled mesas and deep-walled canyons have attracted some thousands of people, who are engaged in a fast-growing industry that has transformed hundreds of miles of wastelands into a booming community.

The Plateau covers an area of about 65,000 square miles. It reaches into four states: Colorado, Utah, New Mexico, and Arizona. Today, men are combing the most remote corners of this vast mesa country in their search for uranium.

It is almost impossible to draw a picture complete enough to do justice to the new uranium industry that has come to the Plateau. To begin with, it is part of an overall program that has grown to be the largest single business in the country. For the atomic energy program represents an investment of several billion dollars in plants and equipment.

The name most people associate with this tremendous enterprise is, of course, the Atomic Energy Commission, the agency that was set up by the Government to control every phase of activity having to do with development of the atom. One of its most important jobs, these past few years, has been to obtain uranium—the basic source of atomic power.

If you spend any time in the Plateau area, you cannot help but be impressed by the speed and efficiency with which the people are carrying out the uranium program there. You will find a spirit of remarkable teamwork displayed throughout every phase of uranium production: by the individual workers and many independent miners in the field; by the small companies in the area that furnish the materials, supplies, and services that are needed; by the larger companies brought into the program because of some special skill or "know-how"; and, of course, by those working for the Atomic Energy Commission, itself, and an associate agency of the Government, the United States Geological Survey.

When the AEC came to the Plateau to start its uranium production program, it enlisted the aid of the industries and people in the area. This proved to be a wise move, because our domestic production of uranium has risen to a high level in just a few years' time. In fact, today, the Plateau is the second largest source of uranium in the world.

BRINGING PROSPERITY TO THE PLATEAU

Almost 5,000 people are taking part in the uranium program—including 500 Government employees, over 1,000 miners, 250 drillers, 150 truckers, and over 1,000 mill employees.

These past few years, there has been tremendous industrial and individual progress in the Colorado Plateau. The prosperity of the area has naturally been greatly stimulated by expenditures for uranium mining and refining activities. Even the most conservative estimates place total expenditures for the program at more than $30 million a year. This

The nerve center of uranium operations is Grand Junction, Colorado, largest city on the Western Slope. The Colorado Raw Materials Section of the AEC and many mining companies have their headquarters here.

includes money spent for payrolls, as well as for supplies; and it covers exploration work, mining, ore-refining, and trucking.

The hub of uranium operations in the Plateau is the city of Grand Junction, Colorado. This friendly and modern community has been the principal trade center of the Western Slope of the Rockies for the past 50 or so years. Grand Junction lies in the midst of a long and fertile lowland known as Grand Valley, about halfway between Denver and Salt Lake City. It is home to some 17,000 people, whose chief interests have been mostly fruit-growing, railroading, and livestock. The area is one of the biggest peach-growing centers in the country.

Today, however, the picture is changing. Uranium is at least three times as important as peaches from the standpoint of the revenue that it brings to the city, and many millions of dollars in new money has been coming in each year with the expansion of the uranium program.

On the outskirts of Grand Junction are the headquarters of the great uranium industry—the offices of the Colorado Raw Materials Section of the AEC. Here are the people who help guide the development of all the uranium deposits in the Colorado Plateau.

Altogether, there are from 4,000 to 5,000 people taking part in the uranium program on the Plateau. The U. S. Government has about 500 people, including the geologists and mining engineers of the AEC Exploration Branch, as well as those of the U. S. Geological Survey.

Over 1,000 people are in the mining end of the business. Drilling operations account for about 250 more. And about 150 people are engaged in trucking the ore and supplies to and from the mines and mills. The balance is made up mostly of those employed in the plants where the ore is processed, and construction workers.

The whole area is benefiting not only from the money paid out for supplies and payrolls for the uranium program, but also from that spent for all the commodities that the workers themselves need. Everywhere in the Plateau, today, you can see evidence of great prosperity.

IT STARTED 150 MILLION YEARS AGO

As you look out this portal of an abandoned mine, you can see the horizontal formations of sandstone laid down ages ago by vast inland seas. Uranium deposits are usually found about 200 feet above the slick rock, the smooth, white formation in the center of this picture.

Geologists admit that there is still a lot to be learned about the source 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. Fossiled 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. They are of a larger size and have higher grade ore than those of adjoining areas.

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.

This old-time photograph shows the original mill at Uravan that treated carnotite ores for the extraction of radium early in the century. It was known as the "Joe Junior Camp."

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.

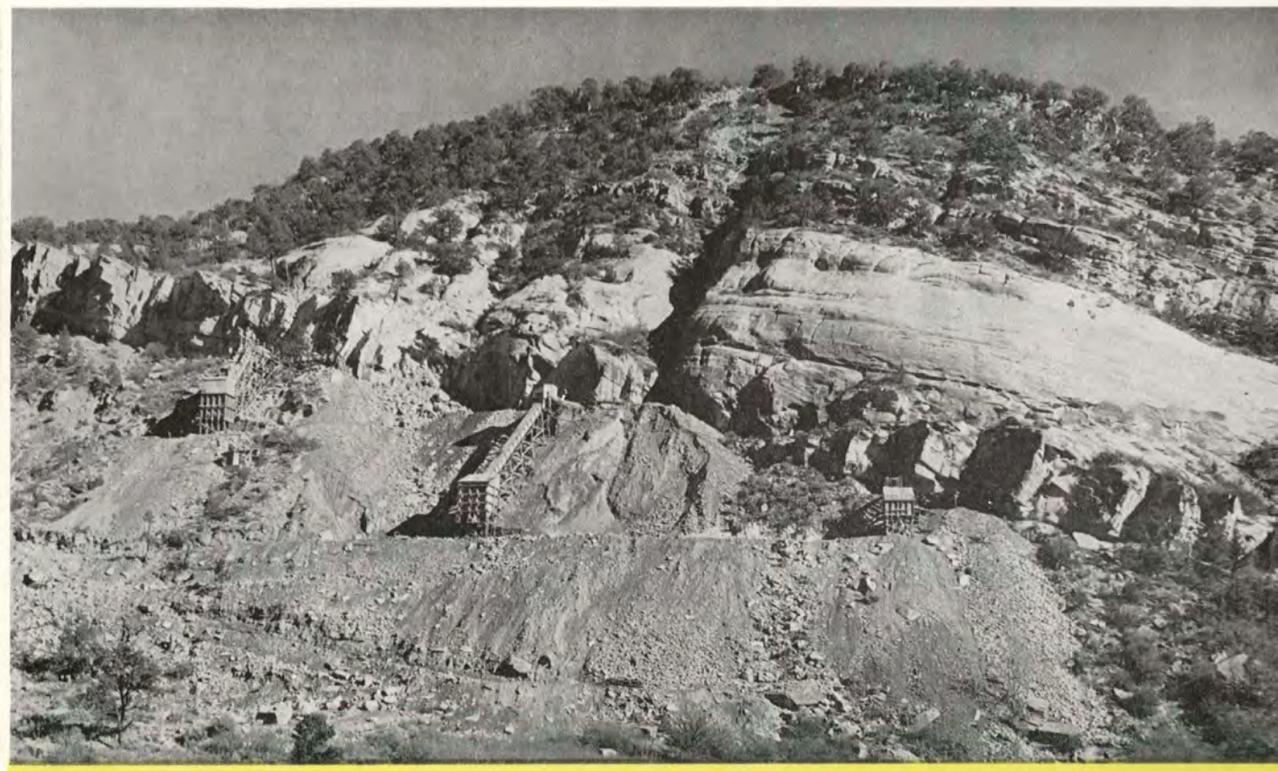
Many years later, these same carnotite ores were mined to extract the radium that they contained. The ore was shipped from the Plateau to Paris to be used in the experiments being conducted by the famous French scientists, Marie and Pierre Curie. In fact, the Colorado Plateau was the world's chief source 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 mine, 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.

Early in World War II, the mining companies in the area began working closely with the Manhattan Project of the U. S. Army Engineers. Plants were redesigned to permit the extraction of uranium. Mining, milling, and expansion of all facilities continued at a feverish rate throughout the war. Then there was a lull in activity, between 1946 and 1948. About this time, the AEC started its domestic uranium program, and a big effort was made to stimulate exploration work.

AREA HAS A COLORFUL HISTORY

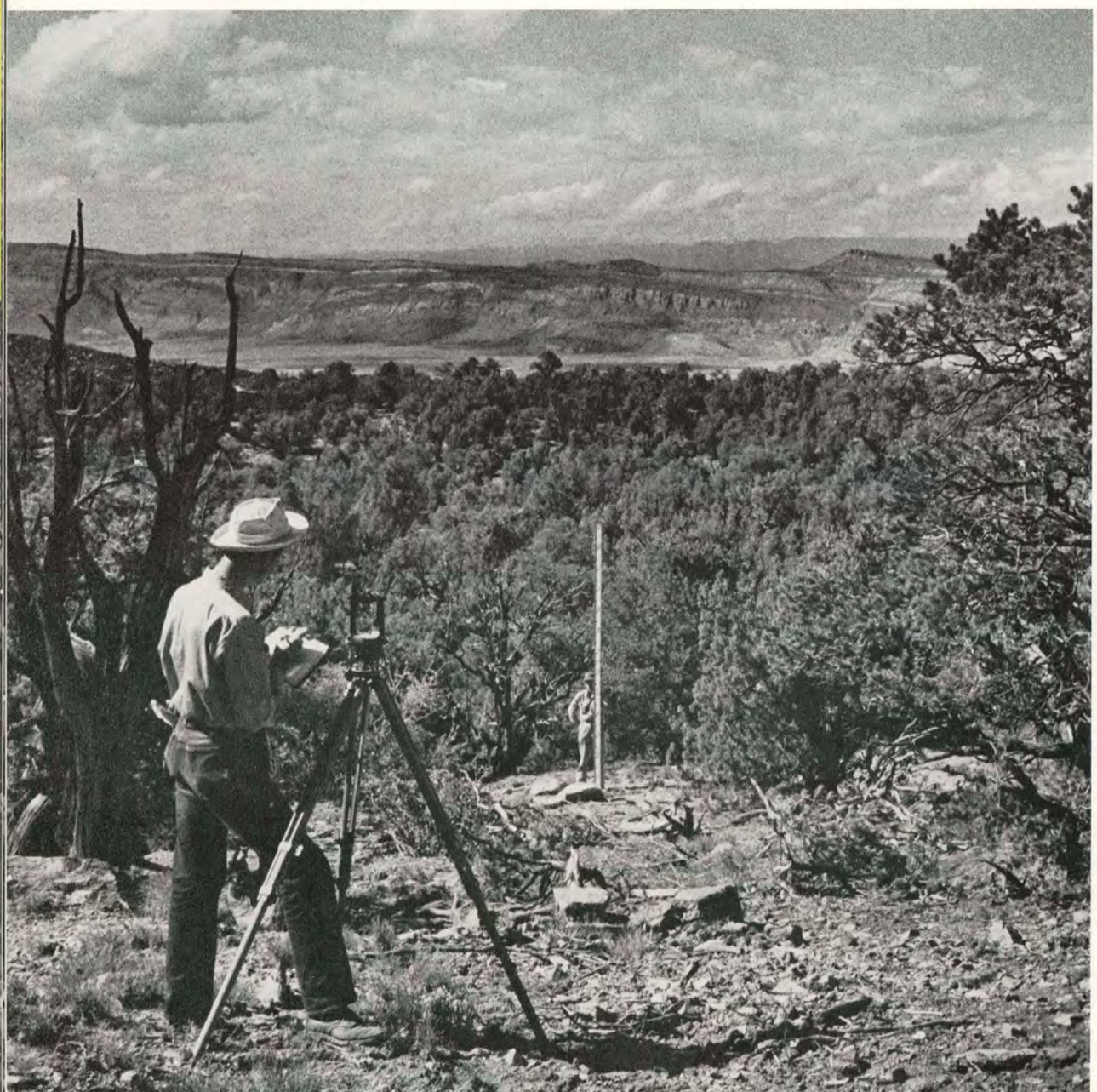


(Above)—Here you can see some of the waste rock from old mines in the Rifle area. Notice how they all are located about the same height with respect to the rim rock.

(Right)—Madam Curie and her husband Pierre, famous French scientists, were among the first to benefit from the radium found in the Colorado Plateau.

EXPLORATION OF CARNOTITE FIELDS NOW AT PEAK

A notice is posted on a tree to indicate the ownership and boundaries of a claim. "Brazil" is the name that will be used to identify this claim.



Standing beside his transit (foreground), a mining engineer makes a preliminary survey in preparation for staking a uranium claim. Individual prospectors and mining companies are staking hundreds of new claims each year.

Although the Colorado Plateau has had its ups and downs as a mining district, exploration has never ceased there from the time when prospectors 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, hundreds 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 200 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. Much of the territory in the Plateau is still public land. The Government withdraws from the public domain the land on which it is conducting exploration. Any found promising for uranium production is then leased to private enterprise.

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 1500 feet. A notice of the claim must be located some place along the center line to identify the owner of the claim.

(Above)—Cores recovered by an exploratory diamond-drilling operation are being examined by a geologist to see if there are any traces of uranium ore.

(Right)—This Geiger counter is used to check drill cores that the geologists think look promising.

"PIN-POINTING" THE ORE DEPOSITS

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 $3 million a year on drilling alone, and they do at least 2 million feet of drilling.

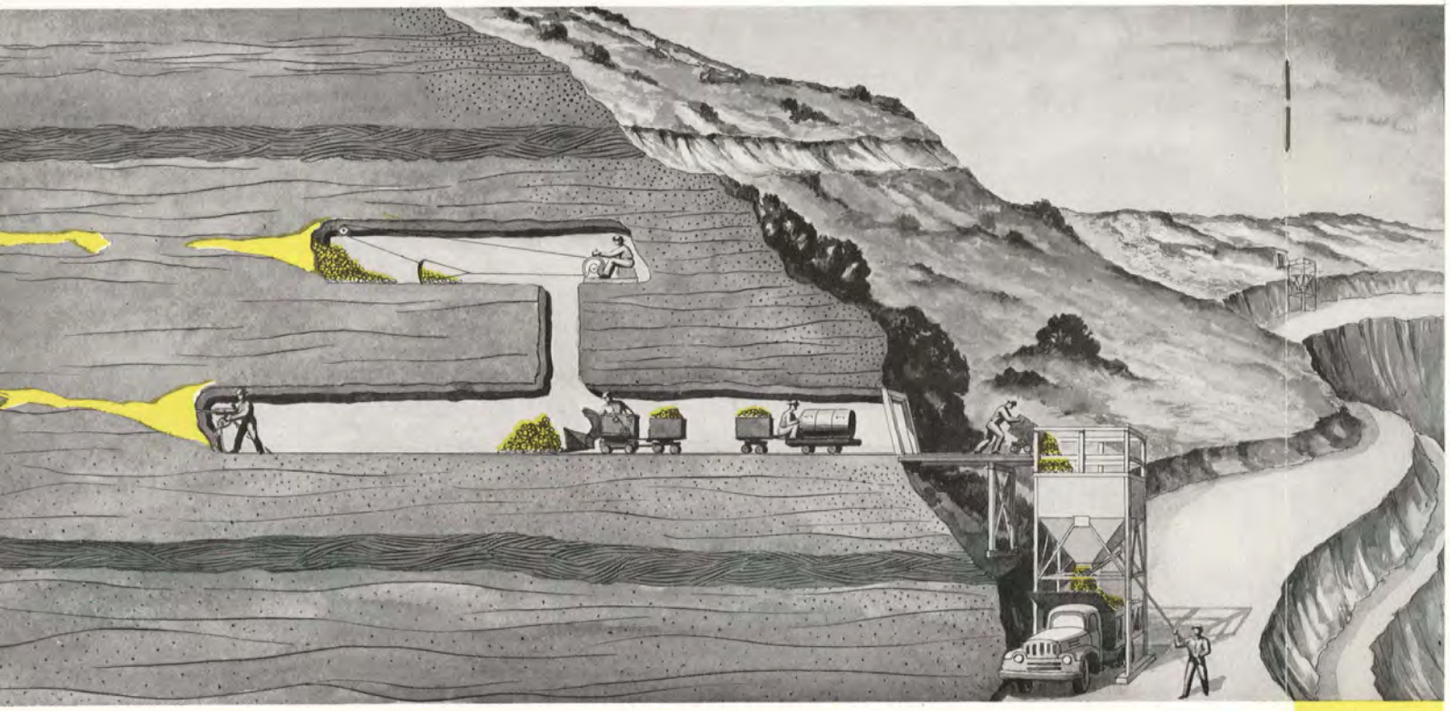
Today, there are about 250 people engaged in drilling uranium claims in the Plateau. This includes employees of the AEC and the United States Geological Survey. The AEC is mostly interested in locating deposits for immediate use; whereas the Geological Survey group takes the long-range approach.

The Government, itself, is now engaged in a tremendous drilling program through various private contractors. There are two stages to their exploratory work. The first is what is known as "reconnaissance" —in other words, a general search is made for areas worthy of more intensive investigation. This stage of the work has eliminated vast sections where a further search by prospectors would have been fruitless.

The second stage of Government drilling has to do with exploration aimed at "pin-pointing" the location of ore deposits, and then evaluating them. After such exploration has been completed, the rest of the development work is usually done by private contractors, although some mining companies also prefer to do the preliminary drilling themselves.

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.

HUNDREDS OF MINES IN THE PLATEAU AREA



Here is a cross-section of a typical uranium mine. There are over 200 such mines in the Plateau area. Operations are small because ore bodies are small and spotty.

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 rugged 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 miners are friendly people, though some may think they lead a rather lonely life. Yet they seem to have the world at their feet. From mines atop the mesas, they have stretched before them a magnificent panoramic view that tourists would travel hundreds of miles to see. They can look far off into the distant hills and see snowy peaks. Beneath them are colorful valleys, which in some sections have been riddled by dried-up water channels; whereas, in other places, they are fertile enough to attract grazing sheep and cattle. Where the valleys narrow down, there are red-walled canyons that glisten in the sun.

Many miners live in cabins close to the mine. Others come to their work from towns many miles away, some perhaps sharing a ride with a miner working nearby. They will move on to other properties, when the deposit they are working on is exhausted.

Altogether, the Plateau has some 200 uranium mines in operation. There are over 1,000 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 jackleg 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

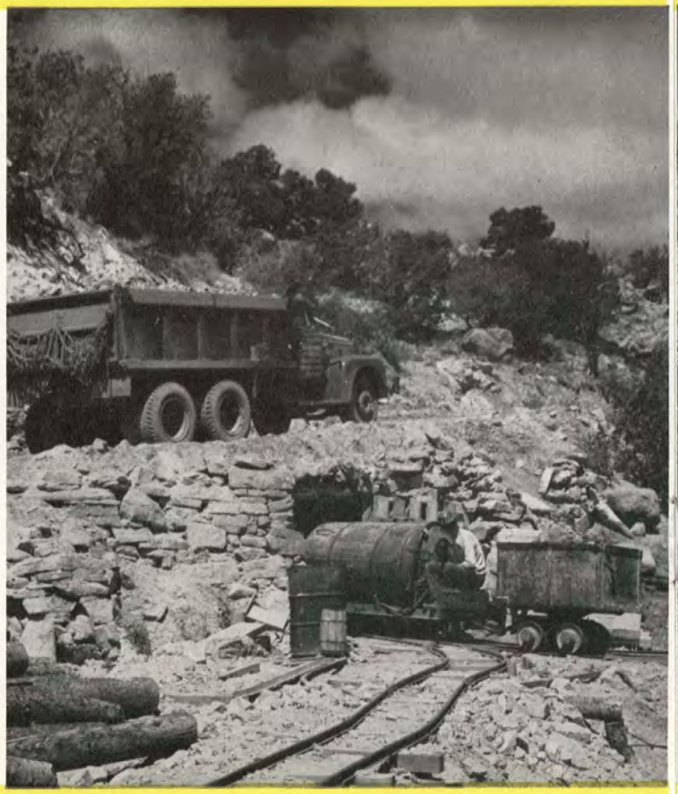
many caverns with bays up above or even below the haulage level. At other mines, shafts may be set in at inclines varying from 12 degrees to the vertical.

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.

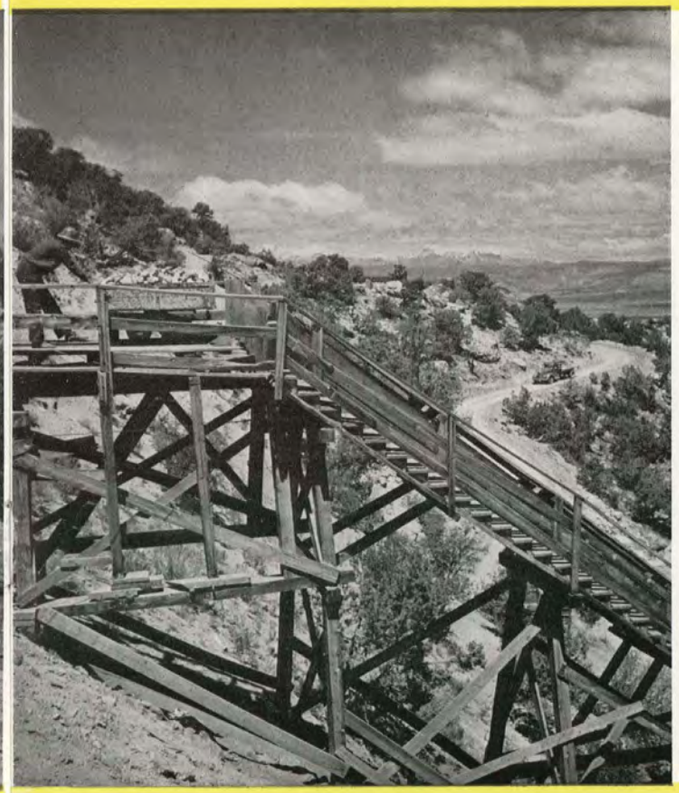
The ore is trammed from the mine to an unloading platform, either in a small mine car or simply by wheelbarrows, if the operation is small. Many of the mines have covered wooden chutes, which run down the side of the cliff to an ore bin below. The ore is later dumped from this bin into trucks which then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

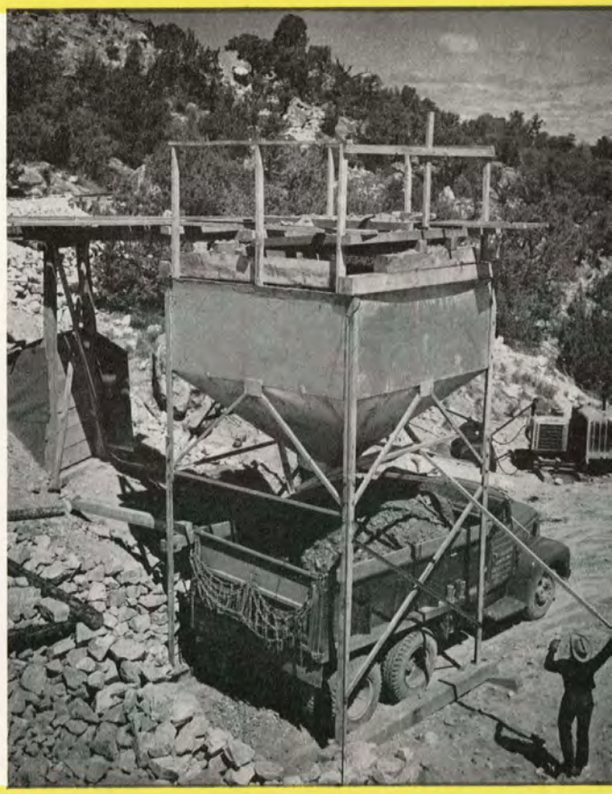
This is the interior of one of the larger uranium mines, which opens up into a number of caverns and bays, known as drifts and stopes.



A small compressed-air locomotive pushes an ore car out of the portal of a mine tucked away in one of the hills. Above is an ore truck.



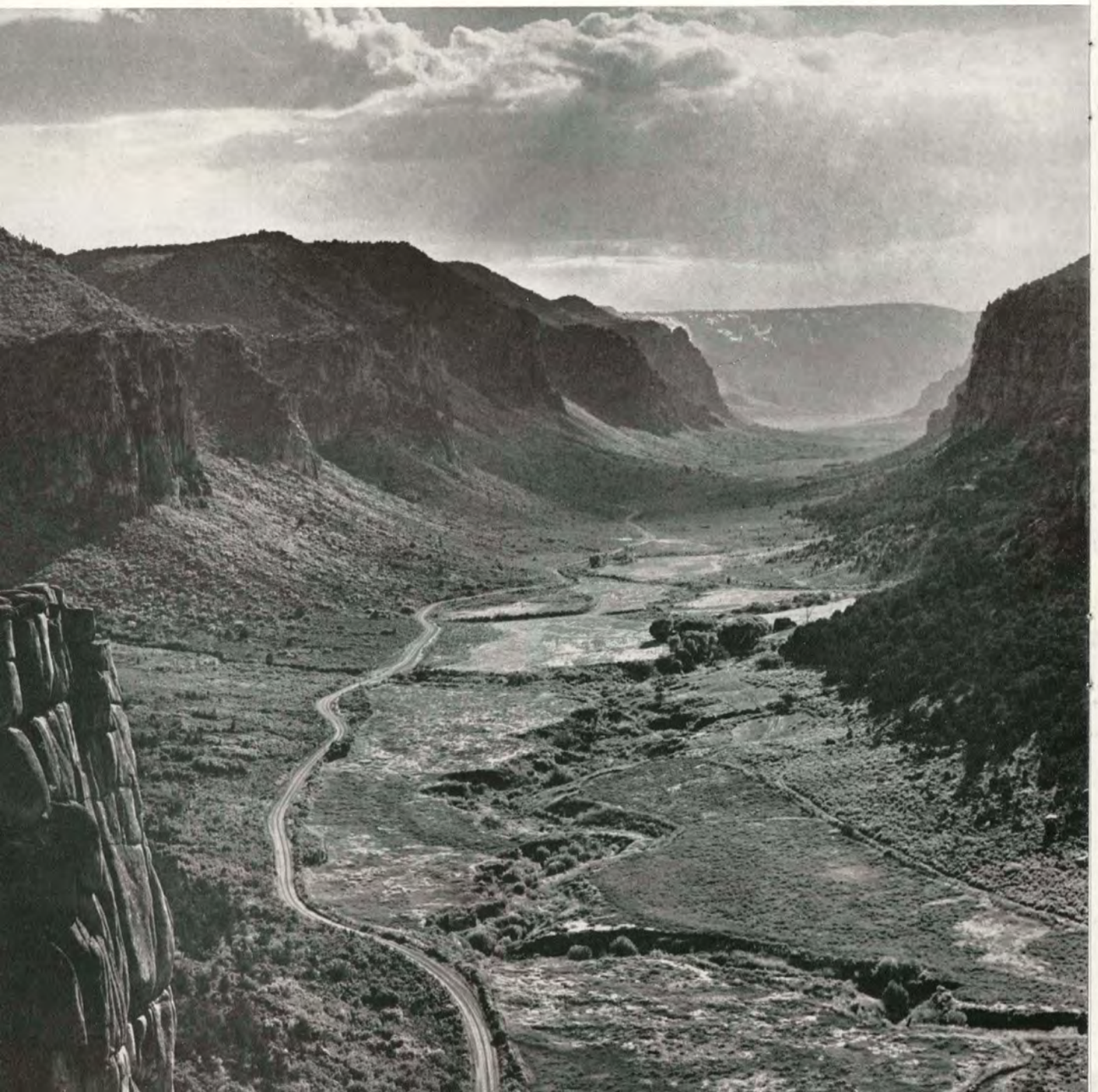
Because of the ruggedness of the country, many of the mines have inclined chutes which run down the sides of the mesas to ore bins below.



Ore is stored in bins like this until a trucker hauls it to one of the processing mills, which may be as much as a hundred miles away.

TRUCKERS FORGE THROUGH RUGGED TERRAIN

Two ore carriers often meet on the side of a steep cliff such as this. There are over 100 trucks hauling ore in the Plateau area.



Truckers travel this narrow winding road through Unaweep Canyon between Grand Junction and the uranium mining country. It is now being widened under the AEC access road program.

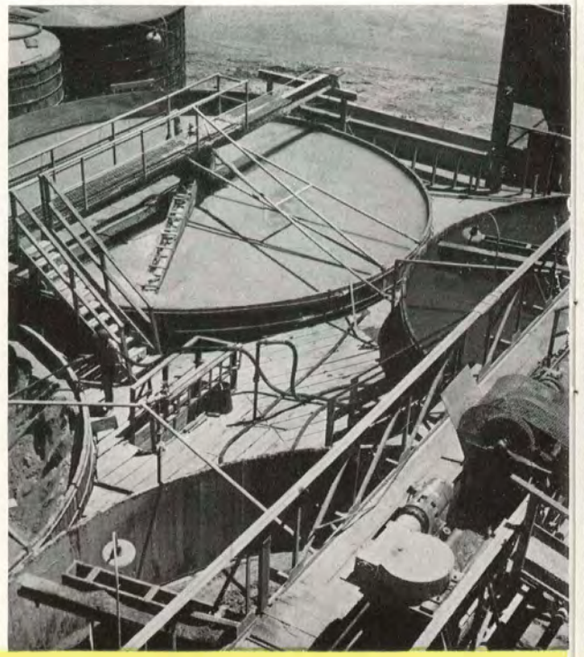
If you have even driven through adobe mud in a downpour, and had the feeling that the bottom of the road was about to drop out, you will have a good idea of what the roads are like back in the hills where the uranium mines are located. Truckers forge up the sides of steep cliffs on roads no wider than the old wagon trails.

Yet, even on the most desolate roads in this busy mesa country, several trucks may pass one another in less than five minutes' time. Some may be just small trucks, driven by geologists or mining engineers out to look over claims. The larger ones are usually hauling ore from the mines to processing mills, or trucking in the supplies that the miners require. About 100 of the larger trucks used in the area are ore carriers. Supply trucking accounts for another 50.

Here is country where road maps show no roads. In fact, the very road the truckers are travelling on may have been a small forest of trees that was mowed down by a bulldozer just a few days before. Further along the way, the trucks may have to stop while a road-maintenance crew replaces a part of the road that a recent storm washed out. Some of the truckers make two trips a day over several hundred miles of this rugged terrain.

Almost all of the trucking is done by contractors. Some of the contractors have just one truck; while others may own a fleet of trucks that they keep in operation throughout the Plateau. In the Uravan area, the truckers may drive from Dove Creek, Slickrock, or some other small town up the river many miles away. Their job is to keep the ore and supplies moving, no matter what the obstacles may be.

The AEC has sponsored a $4 million access road program, of which over $2 million is in Colorado. Actual work is under the supervision of the Bureau of Public Roads, operating through state and county agencies. The job is being done by private contractors on a competitive basis.



(Left)—New roasting furnaces, several stories high, are shown being built at the Uravan mill to expand capacity. This is the largest of the ore processing mills. (Right)—From the roasters, the ore goes to leaching tanks, where the uranium and vanadium are extracted.

— truck and all. The trucker then drives up to a long shed, housing a half-dozen ore bins, and dumps his load.

In a control room below, a button is pushed to start the load in the bin on its way through the crushing and sampling equipment. Ore is withdrawn from the conveyor belt in four steps to make sure that a uniform sample is obtained. From a 10-ton load, for instance, a small, representative sample of the ore will end up in a bag to be sent off to the laboratory. The chemists will check this sample to determine the quantity of uranium and other elements present.

The Government has set a minimum guarantee price for all purchases of uranium ore. The price varies with the richness of the ore, and ranges from $1.50 to $3.50 for each pound of uranium oxide in a ton of ore. In addition, mine operators are given development and haulage allowances, special premiums for high-grade ore, and a bonus for initial production, under certain conditions.

The uranium-bearing ore, after it has been sampled, then starts through various processing operations. In preparation for treatment, it is crushed and screened to small-size particles.

The Uravan mill extracts two products from the ore: uranium and vanadium. This is not an easy job, since most of the ore is just waste rock. There may be as little as one tenth of one percent of uranium in it—or about an average of two or three parts per thousand. The first step is to add chemical reagents, such as salt. Then the ore is fed into huge roasters, several stories high. After the roasting operation, it is treated in large wooden leaching tanks, which look like round swimming pools. During this leaching, the uranium and the vanadium are dissolved by different solutions; each mineral is then precipitated by still further processing operations.

Finally, the uranium concentrate is filtered and dried—ending up a bright canary yellow in color. That's why the mill people call the uranium "yellow cake." The vanadium concentrate, on the other hand, turns out to be red; so it's known as "red cake." Before shipment, however, it is fused in a furnace, and during this final processing the vanadium concentrate becomes black.

(Left)—A mill employee, standing inside one of the washing tanks, is shovelling vanadium "red cake" into a bucket. (Right)—"Yellow cake", which is what they call the uranium extracted from the ore, is here being scraped off the filter presses. It will next be dried, and then packed in steel drums for delivery to the AEC.

This peaceful scene is right in the midst of busy uranium land. The houses at the right are two of the newer ones in Uravan.

LIVING AND WORKING IN URANIUM LAND...

The San Miguel Trading Center stands about halfway up "Main Street," just opposite the big uranium ore-refining mill at Uravan. It's a well-run commissary, and carries, as well, all the other commodities that families need—such as blue jeans, polo shirts, fishing rods, and the latest in children's toys.

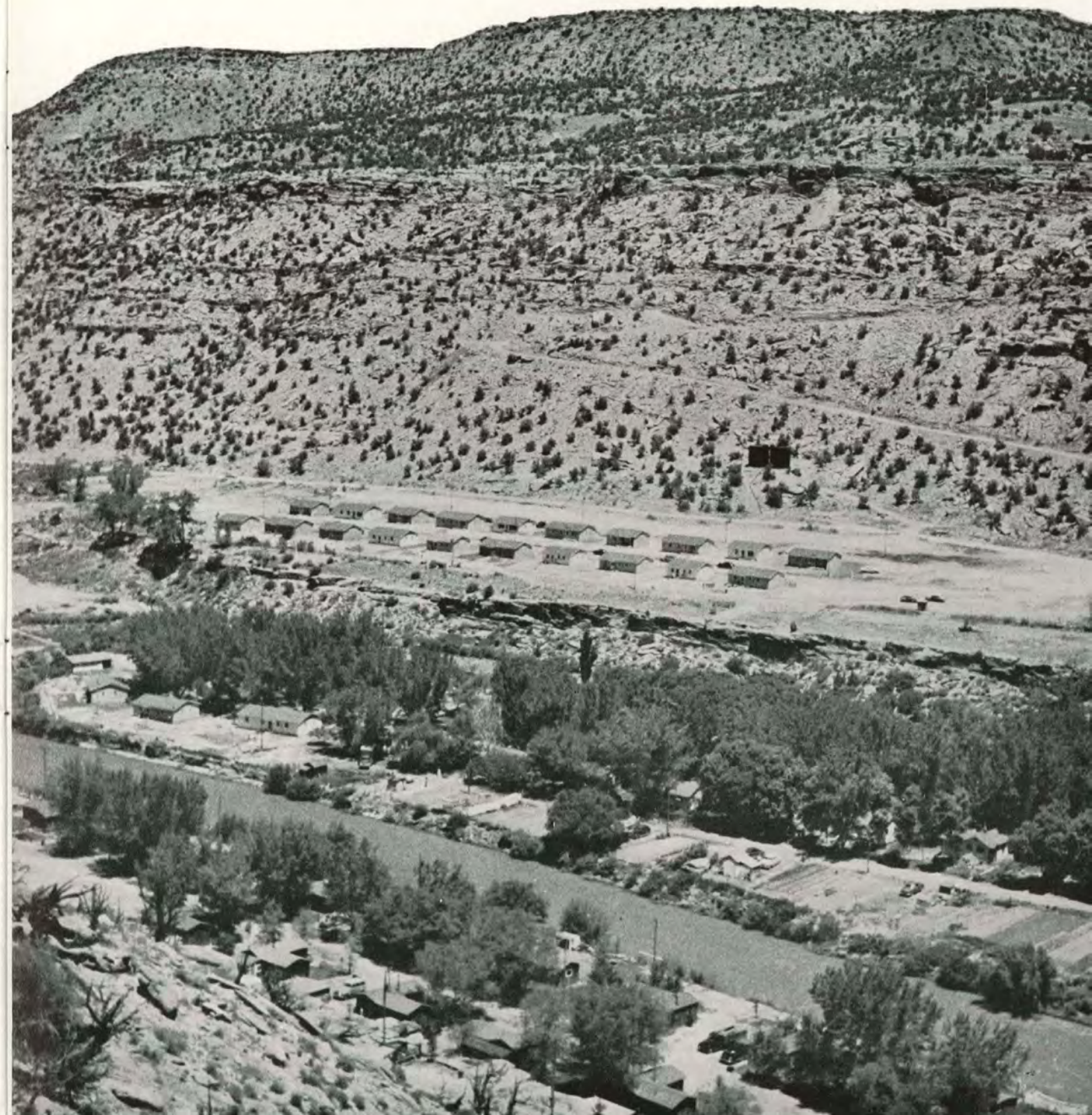
If you drive farther along Uravan's main street, you will see a theater, school, drug store, barber shop, and post office. And on a hot summer's day, you will hear the happy voices of children, as they splash around in the community swimming pool.

Uravan is a peaceful town of about 800 people. It lies in the beautiful San Miguel Valley, right in the middle of the rich carnotite ore bodies of the Colorado Plateau. About 600 of the townsfolk are United States Vanadium Company employees and their families. The Company owns all the community buildings, except the school.

It doesn't take you long to discover that Uravan is not in the least like the usual mining town. It's a prosperous and "up-to-the minute" American community. Most of the people live in the Company housing developments, nestled close to the river in the pleasant valley. They have planted flowers and vegetable gardens, and are proud of their trim lawns.

Increased milling activity under the AEC program has given the people in the area the opportunity for steady employment, under conditions that take into consideration both their welfare and safety.

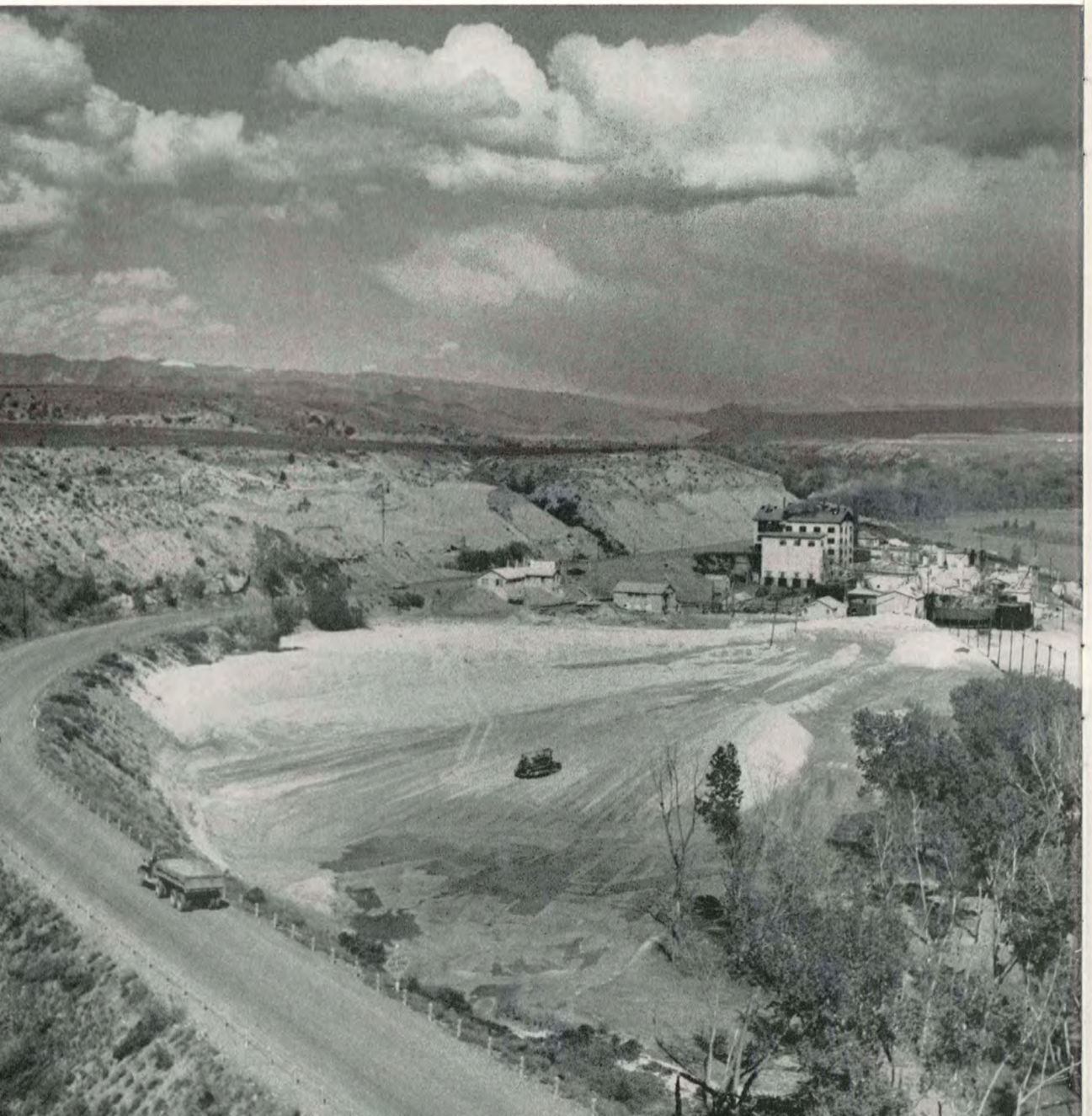
Consider, for instance, a typical mill employee at Uravan. He can participate in a low-cost health and accident insurance plan, which includes both occupational and non-occupational benefits. He also has the opportunity of taking part in a savings plan, to which the Company makes substantial contributions. He receives from one to four weeks' vacation with pay, depending upon how long he has been employed at the mill. And a pension plan, to which he makes no contributions, makes it possible for him to receive regular benefits on retirement.



Most of the people in Uravan live in Company housing developments. One of the new settlements can be seen in the center; other houses are half hidden by the trees in the foreground.

MANY COMPANIES HELP DO THE JOB

Acid is one of a dozen or so raw materials that the ore-processing mills need in tonnage quantities. USV's plants use several hundred tons of acid a month.



The Rifle, Colorado, mill of United States Vanadium Company is the oldest operating mill in the Colorado Plateau.

The outstanding success of the uranium program in the Plateau has not been due to the efforts of any single organization. Many companies are helping to do the job . . . some large and some small. It might be of interest to tell you something about the operations of United States Vanadium Company, which is a typical company doing business with the AEC and also one of the earliest operators in the Plateau.

USV, as the Company is known throughout the area, owns mines in a great many counties in Colorado and Utah, and has about 50 active agreements with mining contractors for the working of these properties. The Company also buys ore from approximately 90 other independent miners working other claims. These latter people represent the small individual enterprises that have become such an important part in the Plateau's industrial activity. In addition, USV owns and operates the two large ore-refining plants at Rifle and Uravan, Colorado, and has a sampling plant at Thompson, Utah. Also, the Company is carrying on an extensive exploration program throughout the entire Plateau.

During the last year, approximately $6 million was spent by United States Vanadium Company in the Plateau for payrolls and the purchase of services, supplies, and materials—exclusive of ore. Purchases made from companies in Colorado and neighboring states cover a great variety of commodities. For instance, some typical raw materials required in operation of the Company's uranium processing mills are: salt, soda ash, sulphuric acid, anhydrous ammonia, oil, and coal. The Company also purchases dozens of other essential commodities from concerns in and around Grand Junction, where its headquarters are located. These include: lumber, steel, cement, hardware, paints, gears and other machinery parts, tools, and automotive equipment.

Thus, like other companies working directly with the AEC, United States Vanadium Company could not get along without the help of the many small businesses in the Plateau area.

NEW WONDERS FROM THE PLATEAU'S WEALTH

Here, radioisotopes are being used to trace cancerous growths.

What happens to those black steel drums of uranium concentrates that are delivered to the AEC? They go to various plants where the uranium is converted into "feed materials" used in the final steps of atomic-energy production. The uranium may eventually end up in an atomic bomb, or it may be destined to bring some new wonder to our daily life.

Expansion of peacetime uses of atomic energy can mean prosperity to the Plateau for many years to come. And, at the same time, no one can over-emphasize the importance of the area in the entire atomic energy picture. Some of the country's top scientists have said that one of the greatest power reserves of the United States is its uranium deposits, and the future of the Plateau looks promising in this respect.

You may have already read about the first atomic-powered submarine. Extensive research work is also being done on the use of atomic energy as an airplane propellant and as a producer of electricity.

The most promising uses for atomic energy at the present time are those resulting from the development of radioisotopes. These are the materials formed when some of nature's elements—such as cobalt or

(Left)—Slugs of uranium are being loaded into the huge atomic reactor at the Oak Ridge National Laboratory to make radioisotopes, one of the greatest peacetime uses of atomic energy.

Since jet engines operate at such exceedingly high temperatures, metallurgists have had to develop new and stronger alloys, many of which contain vanadium.

phosphorous—are bombarded by radioactive uranium. Over 150 of these radioisotopes have already been made available for use.

Amazing results are being obtained with radioisotopes in the medical field, for instance. They have been used successfully in the treatment of many serious diseases, such as leukemia; and, also, in tracing and arresting certain cancerous growths. Metallurgists, too, are finding isotopes useful in studying metals and alloys; and oil companies are also using them in their exploratory work.

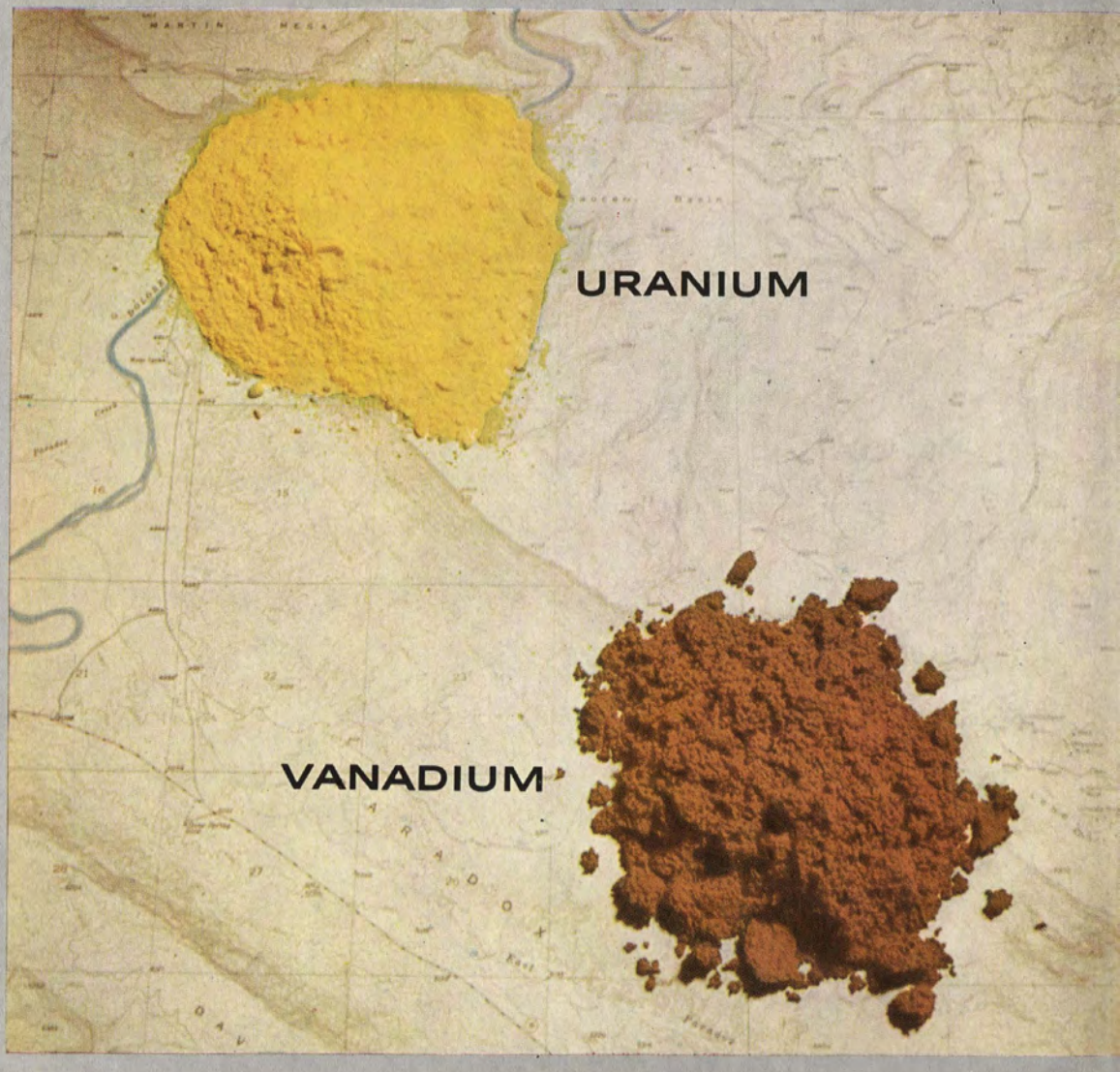
The twin product in this great Plateau program . . . the mineral vanadium . . . has many important uses, too, even though they may not seem as spectacular as those found for uranium.

About 90 per cent of the vanadium ends up in steel, or in some special alloy for high-temperature use, such as those required in making jet engines. Perhaps the metal's best virtue is that it will toughen steel without impairing either its hardness or its ductility. For this reason, substantial quantities of vanadium are used in the production of tool steels, and also steel used for parts that must endure high dynamic stress. These include springs, axles, and other parts of diesel locomotives.

There is no doubt that the future looks bright for both these minerals mined in the Plateau. Vast regions still remain to be explored in the search for uranium ores. In addition, recent advances in prospecting and drilling techniques should be a great help in expanding the mining activity, geographically, way beyond what it is today. Geologically, there's apparently room for expansion, too. Just a few years ago, it was thought that uranium occurred only in two or three geological formations in the Plateau; but lately a wide range of strata has been recognized as a potential source of uranium ore.

With these new frontiers ahead, the people in the area will certainly apply their best ingenuity and resourcefulness. Living in a free country such as ours, they have the opportunity to prosper from the Plateau's potential wealth.

At the gaseous-diffusion plant at Oak Ridge, Tennessee (below), the two types of uranium (U235 and U238) are separated from one another. This huge plant, which covers several hundred acres, is operated by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. Through its various Divisions, which include United States Vanadium Company, Union Carbide has been co-operating closely with the Government since the early stages of the atomic-energy program. It operates the Oak Ridge National Laboratory, where radioisotopes are made; and has made many other important contributions to the program, including the development of special alloys, plastics, and carbons for the highly specialized equipment that atomic-energy production has required.



Here you see **the two valuable minerals that have been captured from the vast resources of the Colorado Plateau— "yellow cake" (uranium concentrate) and "red cake" (vanadium concentrate). Their future possibilities promise unlimited opportunities for the people of this "Mesa Wonderland".**

Additional copies of this booklet can be obtained by writing to:

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