



By Ralph Keeler

## FIRST, FIND A MINE!

An old recipe for chicken soup starts out like this: "First catch a chicken—" The same formula applies to the formation and operation of a mining company: "First find a mine!" Now finding a mine is, always has been, and probably always will be, about one part skill, nine parts common sense, and ninety parts sheer luck. The mine may be a series of small veins carrying rich values in gold or silver, a placer deposit buried 75 feet below the bed of a river, an enormous body of ore with small values in copper, or any one of dozens of different types of deposits—but it must be found before it can be of value.

There's a trite saying "Gold is where you find it", which explains how most of our mineral deposits were found. For Mother Nature did not adhere strictly to rule when she distributed her valuable metals. True enough, after a mine has been opened up, the geologist can tell you the age of the formations, and can explain how the gold was deposited—but it isn't often he can look over virgin territory and tell you where to find the vein.

Mining, milling, metallurgy, refining, marketing—all of the complicated processes that make up each phase of the mining industry have made possible the mining of ore from deep in the

earth and the recovery of valuable metals from complex chemical compounds—but so far the scientists have depended upon the lowly prospector to a great extent to lead them to the lode in the first place.

Scientific prospecting has become more and more important in recent years, and has undoubtedly been of invaluable aid in locating salt domes, oil wells, and large deposits of base metals. With but few exceptions, however, the rich gold, silver, diamond, lead, and zinc discoveries of the world have been made by sheer luck or by prospectors whose chief qualifications have been unlimited courage and the faith to keep searching year after year for the ever-elusive pot of gold at the end of the rainbow. Only a few prospectors ever succeeded in finding a rich mine—but those few have blazed the trail for the scientific mining man.

The stories told about the discovery of the mining fields of the world illustrate this point.

\* A little child picked up a shining pebble on a bank of the Orange River in South Africa in 1867—the pebble turn—

\* *Man and Metals*, by T. A. Rickard, Whittlesey House, New York, 1932.

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ed out to be a diamond, and the industrial development of South Africa was started.

In 1834, a Boer named Carel Kruger, while on a hunting trip north of the Vaal in Africa, found gold and took samples with him back to Capetown. The Witwatersrand (White Waters Ridge) thus discovered became the world's richest goldfields (in 1937 The Transvaal produced \$400,000,000 worth of gold, or nearly one-third of the world's output).

A Mormon named William Prouse panned gold in a little creek in Nevada in 1849, but the values were not high enough to interest him. In 1859, in the same area, the famous Comstock Lode yielded millions in gold and silver. Incidentally, Henry Comstock, fur-trader and trapper, bluffed two Irishmen who staked one of the richest properties in the area, into giving him an equal share in it. The lode was named after him, but that was about all he did make out of it, although the mine itself produced some \$18,000,000; he committed suicide in 1870, and died without a penny to his name. The two Irishmen finally wound up in paupers' graves.

Two Colorado prospectors were grubstaked—provided with supplies—by an uneducated storekeeper in Leadville named Tabor, who was to have half of anything that they found. Included in their supplies was a jug of whisky, which the prospectors proceeded to drink on starting out from camp. After they had done away with the jug, they felt too tired to continue farther, and so they decided to stop and dig where they were. The spot on which they halted, on Fryer Hill, was one point on the whole hillside on which the ore lay near the surface. At a depth of 30 feet they cut the orebody of the Little Pittsburgh Mine, from which Tabor took millions in silver.

Many more such tales could be told. The man of science had his part, however, in locating stores of mineral wealth. William S. Stratton, a carpen-

ter who studied mineralogy in his spare time, was instrumental in opening up the Cripple Creek district, from which \$125,000,000 in gold was taken. Even Stratton, familiar as he was with the various minerals, did not recognize gold telluride after he had found it, and an ignorant miner is credited with having made the discovery that the peculiar looking rock, when heated, would yield globules of gold.

There is a story current in Cripple Creek to the effect that John Hays Hammond, one of the famous mining engineers the world ever produced, reported that it was geologically impossible to find gold in the phonolite rock of the district. Practically all of the gold in the area came from that same phonolite, despite the noted authority's scientific opinion.

Gold was found under the moss on the seashore at Nome, in Alaska, — it had been concentrated by the tide from sands washed down from the hills. What man of science would have dared to advise the working of sea-moss for gold?

It is practically impossible to tell what lies hidden beneath the surface of the earth without actually digging down to investigate. Many rich properties have been condemned by geologists because the surface indications were not promising; millions have been spent in the development of worthless properties because from all that could be predicted from geological studies a valuable mine was just waiting to be tapped.

In the Philippines, Benguet and Balatoc—both are today among the richest mines in the world for their size—were turned down several times by mining engineers of long experience, as not being worth the investment of a few thousand dollars. A return of capital was once started for Benguet, as a matter of fact, because of the exhaustion of the ore body. Just before the plant was shut down, fortunately, a diamond drill luckily ran into a pocket of ore averaging P25,000 per ton—and



the mine is now turning out nearly \$500,000 a month!

No one would have anything to do with the Antamok Goldfields mine for years. One mining engineer was offered a third interest in it for \$2,500, but refused to throw his money away! Yet the property produced \$2,500,000 in 1937, and will do as well in 1938.

In many cases modern mining operations are being conducted on areas where the ancients once scratched for infrequent pieces of shining metal. This is unusually true in the Philippines, where every producing gold mine was worked hundreds of years ago. Not a single producer has been found in virgin territory—although during

in 1936 boom there were a number of companies formed on the basis of such discoveries. The early Malay tribes, the Chinese, the Japanese, the Spanish, the English, and the Americans all found more or less gold all over the Archipelago—but at that time they didn't know what to do about it.

The search for the base metals, for coal, for petroleum and gas, and for various other minerals, was often a different story. While gold and silver occur in small quantities, and thus are hard to detect scientifically, the location of deposit of iron ore, for example, carrying millions of tons of iron, is impossible to hide from modern instruments.

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## LOOKING INTO THE EARTH

While it is impossible to tell with certainty what lies beneath the surface, or to explain exactly what happened during the formation of the various features of the earth, a study of the different structures and occurrences has made known much information which is of help to the prospector.

Early man naturally was curious as to what caused storms, floods, earthquakes and volcanoes, hills and valleys, fertile plains and deserts. At first all such things were credited to, or blamed on, the gods, but as the intelligence of man grew he began to acquire an understanding of what likely had happened.

\* *Geology* is the science which treats of the history of the earth and its life, especially as recorded in the rocks. The three principal branches of geology are: *Structural geology*, which deals with the form, arrangement, and internal structure of the rocks; *Dynamic geology*, dealing with the causes and processes of geological change; *histor-*

*ical geology*, which, aided by other branches, aims to give a chronological account of the events in the earth's history.

*Economic geology* deals with the application of the science in industrial relations and operations. *Legal geology* is the application in litigation of the facts and principles of geology, particularly its subdivisions *mineralogy* (the study of the minerals), *economic geology*, and *mining geology*. *Mining geology* is a subdivision of economic geology concerned with the application of geological facts and principles to mining.

The *geologist* is one of the most important allies of the prospector and of the miner. He studies various rock formations and structures, and maps his findings. The prospector is often

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\* Glossary of Mining and Mineral Industry, by Albert H. Fay, Bulletin 95, Bureau of Mines, Washington, 1920.



# MINING FOR THE INVESTOR

guided in his search for new deposits by the work of the geologist, while the miner in his work underground depends upon geology considerably in the intelligent and economic mining of the deposits.

\* The ancient Greek and Roman philosophers had very sound ideas about the earth although they also had some very highly imaginary theories. The study of the earth progressed slowly for many centuries, and it was not until about the beginning of the 12th century that recognized prospecting was started. At that time the bounding or staking of ore was established in Cornwall, and slaves discovering ore were given their freedom and civic independence.

The first department of mines was started at about this time by the King of England, who put the tin mines of Cornwall under the supervision of a warden which he appointed.

Until the start of the 19th century, however, there was but little connection between geology and mining. Mining was carried on by the most primitive methods; geology was still more or less in the realm of fantasy. With the dawn of the 19th century, the world made rapid progress in thought and in action. Machinery and steam power suddenly revolutionized industry. At once a great demand for metals was made upon the miner. Mineralogy had but recently been established on a systematic basis, and geology had begun to develop into a real science.

An English surveyor, William Smith, in 1800, is credited with being one of the first to apply geology to the problems of mining and to the search for valuable minerals. His chief contribution to the science was the dis-

covery that a definite succession existed in sedimentary rocks, and that certain fossils were found in definite horizons in this succession. Great progress was being made about this time in the study of fossils which finally had been recognized as the petrified remains of animals that once had lived, died, and had been buried in mud and sand which was latter formed into rock.

About 1850 the theory that deposits of minerals came from the interior of the earth was replaced by one that advanced the idea that ore deposits were formed by the accumulation of circulating waters of minute amounts of minerals present in the ordinary rocks which, under favorable conditions, were concentrated and redeposited to form ore-bodies. Later this theory was in turn displaced by one which proposed that ore deposits were formed from fluid molten rock during the process of cooling.

The study of geology, or of any branch of it, is complicated, and takes years of concentrated effort for the training of a skilled geologist. The investor in mining is not particularly interested in whether a formation is Palaeozoic, Mesozoic, or Tertiary (the three great divisions of time after the appearance of life on the earth). He wants to know about the ore in the mining property in which his money is invested—whether it will bring him a profit or not.

Advertisements and prospectuses offering stock in new mining companies for sale usually stress a geological report on the property. To the layman, and, indeed, often to an experienced mining man, such reports often mean little or nothing. Any similarity between the new property and a producing area is usually emphasized, although actually such comparisons are more than likely useless.

In the Baguio district of the Philippines, for example, the gold veins now

\* *Elementary Geology Applied To Prospecting, A Course of Lectures* by John F. Walker, Provincial Mineralogist, Victoria, B. C., 1935.



being worked have been found in the *andesite* (a volcanic rock of large crystalline texture) or *diorite* (a granite-like rock) formations. The Benguet Consolidated, Baguio Gold, and Demonstration vein systems are in the andesites, while the Antamok Goldfields, Balatoc, and Itogon pay shoots are in the diorites. This fact was very useful to the flock of promoters and pseudo-engineers who floated, or attempted to float, hundreds of new companies during the boom days of 1933 and of 1936.

One prospectus had the following information under the heading "Geology":

"The country rock is good, consisting mostly of andesites and basalts." Now the "country rock" is the general mass of adjacent rock as distinguished from that of a dike, vein, or lode; whether it is 'good' or 'bad' has nothing whatsoever to do with its possibilities as a bearer of gold. There are hundreds of square miles of andesites and basalts in the area—but what of it?

Another preliminary report stated: "The country rock is coarse-grained diorite. Andesite is observed on the southwestern part of this property. The country rock on the property side is very well mineralized. Great disturbances have occurred causing displacements and fractures." The author of this evidently wanted to be sure he had both formations, so he put them in. An even greater disturbance occurred when the disillusioned stockholders found out that the mineralization was more imaginary than factual.

"The predominant rock structure is formed by alternate intrusions of fine grained and coarse grained andesites and diorites. The mountains show a very rapid erosion. Gullies cut deep

into the formation. The overburden is very thin and the country rock is on many places exposed." (From a prospectus issued late in 1937). Here again we have the good old andesites and diorites. If the mountains didn't show a very rapid erosion, with gullies cut deep into the formation, they would hardly be mountains. The fact that the overburden is very thin and the country rock is exposed may be interesting, but, in this case at least, didn't mean that nuggets of gold were strewn like so many huckleberries waiting to be plucked.

Here's another geological report that was written with more enthusiasm than common sense:

"A cursory study of the geological condition of the entire area so far explored reveals its Paleolithic and Neanderthal or Neocolithic Layers crumbling off through weathering processes of erosion and through some tectonic faulting. Huge chunks of granite, of nugget-bearing marble slabs, of andesites, of quartzites, of coal, of chromium and copper ores are carried along by the occasional overflowing streams and left scattered along their courses. Some are already rounded off, others are flattened and others still revealing their sharp edges due to the occasional faultings and crumbings. Hence, in some parts of these Placer Claims embankments, there are outcrops of gold-bearing veins as well as silver and ore copper-bearing granite chunks; and over these placer claims, as a result of the ravages of these tributaries, are scattered enormous heaps or mounds of auriferous gravel and black sands gold-bearing debris, huddles along thruout the centuries by these tributaries and by the \_\_\_\_\_ River which serves as an outlet of Lake \_\_\_\_\_ to such an extent that these Placer Claims are



greatly enriched with gold deposits at some of those strategically located "gold pockets." (spelling taken directly from the prospectus). Now black sand, being of high specific gravity, is sometimes concentrated with placer gold; but the existence of black sand doesn't necessarily mean that gold will be found—usually quite the contrary is the case. With all of the possibilities offered by the "nugget-bearing" marble slabs, the andesites, et cetera, one would expect great things of the property. Unfortunately the gold, the coal, the chromium, and the copper have so far proved most elusive.

A prospectus for a company seeking to promote a gypsum property stated "On the strength of my investigation and the indications found on the gypsum deposit of the \_\_\_\_\_ Company I estimate the amount of gypsum of commercial value to be approximately 210,000 tons. With an average price of ₱12 per ton the deposit would represent a value of ₱2,520,000. As the deposit is only half a kilometer from the sea, and labor also cheap, I estimate the expenses of mining to round ₱4.00 per ton delivered to the boat. This would mean a total profit of ₱1,680,000." This company was suc-

cessfully floated on the strength of such statements. Work was carried on at the property for about 18 months, during which only a few hundred tons of the 210,000 tons found by the optimistic estimator were extracted—and even that much has not been sold. Needless to say the chances of the company making a total profit of ₱1,680,000 are about 1,680,000 to 1.

The report of a competent geologist is essential to those who are about to investigate the possibilities of a mine. Such a report, however, can only be interpreted by a competent and trained mining engineer or geologist. For a layman to attempt to form an opinion as to the worth of a property because of a report studded with highly-technical and impressive, but meaningless to him, words, is sheer folly. For an investor to put his money into a company because the report sounds good, is sheer stupidity.

The mining investor, unless he can understand technical geological reports, should investigate the training and experience of the man making them, and the reputation of the company and the men back of them. In no other way can he be sure that he is getting his money's worth.

*(To be continued)*

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