

*PROSPECTING*  
*FOR*  
*GOLD*



*BY*  
*DR. L. STOLFA*

**Second Edition**

—

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**by**  
**DR. L. STOLFA**

*A handbook on the secrets of the rocks and the treasures in the sand. To some it opens a field of sport and adventure, with possibilities of rich profits. To others a field of occupation for income building. To others a chance for a profitable tourist trip through the golden West. To all health and possibilities for a profit that has no tears upon it and makes no one poorer, no matter how much you appropriate from Nature's hidden treasures.*

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## INTRODUCTION

By LETSON BALLIET, Mining Engineer and Industrial Economist, Director Chairman of the Governor's Nevada State Emergency Committee on Employment and Relief.

Out of the wreckage of the world's financial cataclysm will emerge new leaders, new fortunes and new incomes that will come from the nation's unmined gold. Each individual must climb out of the wreckage himself; each must rebuild his own fortune and income. Any predatory business that depends upon somebody else having money, any business depending upon patronage or artifice to get old money from others, has very little chances to-day of success, since those who would normally be buyers, customers and speculators have no money. There are three classes of people: 1. Those who sell, 2. Those who buy and 3. Those who mine gold. Only the last of the three classes are free from depression. No one becomes poorer, no matter how rich the producers of gold become.

Everybody can be his own prospector, builder of his own fortune and creator of his own income. The western states and Canada have thousands of undeveloped prospects and thousands that are yet to be discovered. Thousands of deposits of gold ores were passed over by the early pioneers and prospectors as being too low grade to work by hand and by the crude methods then known. They passed on in search of "rich spots" that came through to the surface. But not all rich spots have outcropped. More rich spots

are being found under the surface and out of sight of the casual observer. By following the low-grade outcrops the rich spots are found. Modern methods of mining make even these low-grade deposits possible of many great fortunes and steady incomes and the high-grade "rich spots" make that much greater profits. Many a tourist can make his summer vacation trip a profitable one, some by finding rich spots, others by finding large deposits that capital will purchase. Capital is crying for them.

When Andy said to Amos: "This har depression ain't going to be over for you, till you'se got some money to pay dese har bills," he uttered one of the greatest economic truths in modern times. It applies to all of us. There are but two avenues open: You must either get some old money away from somebody else or find some new money (gold) in the great deposits of nature. The picking is mighty slim when you try to get it away from others, for there is but little old money in their hands. The population is rapidly increasing, and the amount per capita is growing less, but Nature's vast resources are at your disposal if you understand them.

Dr. L. Stolfa's new work "Prospecting for Gold" comes at a timely moment. It teaches the art of prospecting without the technical verbage. It is easily within the understanding of the masses and should be an important factor in finding nature's resources. It covers a wide range of subjects and of territory. At the present time gold is the most necessary, the market for it is unlimited, the price absolutely assured, there being even a premium on it at the present time.

Women prospectors are not as numerous as men, but they are often more successful being closer observers. Notable among the recent sales is the case of Mrs. H. A. Pitt, a young woman who discovered a rich

deposit while camping in the mountains of California. She sold it for \$70,000, receiving \$10,000 cash and \$200 a month until the \$60,000 shall have been paid. A \$200 a month income through this period of business stagnation has ended the depression for Mrs. Pitt.

The stagnation of business and industry has turned the eyes of the world upon the efforts to produce more gold. Capital finds no incentive to open new stores or new business, because those who are in business are finding it unprofitable and are failing in great numbers. There is no incentive for starting new factories, because the ones now in existence are running only at part time, if at all, and are not earning any profits. Twenty per cent of the banks in the United States have failed since October 1929 and the others have stopped paying interest on deposits. Where else can money be invested to earn its interest, except in producing gold? This condition creates a demand for every worth while gold deposit that can be found. And developing these deposits will end unemployment and put new money in circulation to start industry and business.

If you find a gold deposit that is larger than you can handle, your neighbors and friends will often assist in financing and operating, for they too need safe incomes from the Nation's unmined gold, even if they are unable to go prospecting themselves. If you find a "rich spot" that you can mine yourself, that is one thing; if you find one that you can sell, it is another; if you find one that you and your friends can operate, you can make your own mining company and all three will add their output to the world's wealth.

Even those who do not go prospecting or cannot make a trip and look over the opportunities of the West, should read this book carefully. It gives an insight into prospecting and mining that will be of value

to those who desire to assist in financing others, so that they too may enjoy a share in the profits obtainable from mining and thus build incomes that are safe even in times of depression. If you give others who have some money to invest a chance to read this book, they may be willing, even anxious to finance your trip at least partially with your promise to share the profits of your strike.

The book is a hand book. Keep it where you can refer to it when opportunities arise to join others in the production of new gold, either in prospecting or in grubstaking, or in financing the trip or in taking an interest after it has been found.



## CHAPTER I.

### THE OPPORTUNITIES OF THE PRESENT.

To introduce to the sport and adventure loving American public a new, quite unique sport that may freely be enjoyed by any man or woman, young or old, rich or poor, graduate of a college or one educated in the hard school of life, to teach the reader the rules of a fascinating game which he is welcome to play without chances of losing, but with very attractive possibilities of winning unusually liberal stakes, to initiate you into alluring adventures of mountains and deserts, open to all in this great country of ours — these are the ideals to which this work is dedicated.

Prospecting, that is a search for valuable mineral deposits, is the sport that offers you all these inducements, is the adventure that lures irresistibly many red-blooded Americans into the glorious outdoors in close communion with mother Nature. It is prospecting for gold especially that is most suitable for all these purposes, since it is more easily mastered and generally requires fewer tools and less equipment than prospecting for any other metal.

The modern means of transportation, modern inventions and equipment enable one to transform the dangers and hardships of the old-time gold prospecting into exhilarating sport, a grand and often profitable adventure.

Prospecting for gold is not altogether a story of the romantic past. There are numerous instances of rich strikes even at the present time.

It was only last year (August 4, 1931) that very rich gold ore was discovered by R. Duncan Gardner in Tank Canyon, near the small town of American Fork, located some thirty miles south of Salt Lake City, Utah. Assays ran between \$300 and \$1700 per ton in gold. One hand picked specimen yielded \$3200 per ton. Within few days after this discovery several hundred claims have been staked in Tank Canyon and its immediate vicinity.

“The Salt Lake Telegram” of August 12, 1931, prints the following interesting details of the discovery:

“The fissure of gold bearing ore is located several hundred feet up the canyon from a huge fault, the footwall of which is white quartzite, while the hanging wall is composed of a black limestone and slate formation. First indication of gold bearing ore, according to Mr. Gardner, was obtained from the contact of the two fault faces, where small, highly mineralized vein was seen. Further prospecting up the canyon revealed the major vein upon which the development is being done. Mr. Gardner to-day confirmed the story of endless searching that was told Tuesday by his associates. His father, a logger, had discovered a boulder bearing ore that ran as high as \$100,000 per ton in gold.”

And March 31, 1932, “The Chicago Herald and Examiner” brought the following piece of news:

“Find Gold Nuggets in New Mexico. — Hot Springs, N. M., March 30. — Intense excitement prevailed to-day over exhibition of a bottle of placer gold in a local bank. Nuggets worth \$10 and more can be seen in the bottle. Local miners are preparing to rush to the new diggings if its location can be learned.”

The same newspaper announced another rich discovery in its issue of Wednesday, April 20, 1932:

“1,000 Claims Staked in New Gold Field. — Tucson, Arizona, April 19. — More than 1,000 claims to-day have been filed on gold bearing territory in Altar Valley, where the University of Arizona College of Mines announced Sunday gold assaying \$12,000 a ton had been discovered by Thomas Wiggins, 56, a prospector.”

Gold is constantly being found and panned now-a-days in many part of the western country. Lest we should be suspected of having been swept of our feet by excessive, unwarranted enthusiasm, let us hear what others have to say about contemporary prospecting.

In “The Mining Journal” of Arizona, May 15, 1932, there is an article by R. D. Hockensmith entitled “Unemployment Brings Gold Rush of 1932.” He points out in his writing how the state of Colorado has turned to placer gold mining as a solution of the unemployment problem: “A few weeks ago Edward I. Watson, state supervisor of industrial education, and H. A. Tiemann, state director of vocational education, were considering what might be done for the unemployment situation, particularly in Colorado. They were interested only in work which would bring ready cash for unemployed men. After careful thought they decided upon what seemed the practical solution of the problem — gold panning. Not only could the products of such labor be converted readily into money which would buy groceries and pay rent, but there were a number of other points which made this work favorable for the thousands of unemployed. There are 5000 miles of gold bearing streams in Colorado — sufficient space for an almost unlimited number of men. More than one hundred classes have been organized throughout the state and members of the classes are making from \$1 to \$7 a day with their pans. More men are going out as rapidly as the melting snows will permit.”

And in "Western Mineral Survey" of May 6, 1932 there is an article by Harold Bowman, entitled "The Prospector Comes Back." Among other things the writer speaks, as follows: "The spirit of the Pioneer Days is returning to the west. Men have learned their lessons of paper profits, taken their losses and turned again to the basis of all value — Gold..... Colorado and Idaho mine schools are teaching their students to pan gold, a simple process which will shorten the length of the bread lines..... In conclusion it can safely be said that all this scratching on the surface of Mother Earth will bring about some important discoveries."

In one of his addresses Letson Balliet, mining engineer and industrial economist, makes the following statements:

"The eleven western states are already beginning to increase the efforts at gold production. More men are employed in the gold mining regions than have been employed for several years. Old mines are being reopened, new mines are being developed and the hills are alive with prospectors. The West is going to be the first to emerge from the depressed condition, and many individuals in all other states will build themselves safe incomes from the nation's unmined gold. Spending these incomes will improve business. Out of this depression will emerge new fortunes, new incomes and new leaders, who secure a foothold in the golden prospects of the West. It is the tourists' opportunity. The swing of the gold mining is rolling up like a tidal wave, and the gold rush will equal the rush of '49, or the rush to the Klondyke, but without the hardships of the pioneers. Gold incomes are depression proof. Such incomes are unemployment insurance, and a protection against hard times, and old age."

In "Los Angeles Times" of April 17, 1932, Frank

A. Crampton, a mining engineer of long experience, makes the following statement about the present status of gold mining in California:

“There is an actual gold rush on now, well identified by mining engineers. The operations are not as lavish as in the old days, but California’s gold output has steadily grown in the last three years as men, out of work, turned to old tailings dumps and prospecting old placer streams in search of gold. In 1929 the State’s gold production was valued at \$8,526,703. In 1930 it jumped to \$9,451,162. During 1931 it increased to \$10,708,000. This gold is being gleaned in small amounts by great horde of men and logically, as they prospect, new lodes and development will follow.”

A. J. Smith writing in the “Sun”, a newspaper of Vancouver, B. C., Canada, (April 1932), is of the opinion that Canada is on the threshold of the greatest gold interest since the pioneer days. “Hundreds of men are going into the gold districts. Some of the leading mining interests are preparing to develop the mines of such districts as Bridge River, made famous by Pioneer. In one day more than 200 men applied at the British Columbia Chamber of Mines here for prospecting information. It has been prophesied that more than 10,000 from Vancouver alone will visit the gold-fields this year. Besides that, parties are organizing all up and down the Pacific coast. Those men intend to join some 2,000 others estimated by mining men to be out in the gold areas now or preparing to start within the next few weeks. They are expected to be the vanguard of a gold-seeking army. The great gold belts stretching from Hope to Alaska is their objective. The gravel bars of the Fraser River and small streams tributary to the Fraser are receiving the first contingent. They are working their way north, past Barkerville and on to Atlin. This summer is ex-

pected to see thousands in the field, and a spark, such as the discovery of a new Klondike, will set the country ablaze."

"Gold mining is enjoying a real revival in the West and a considerable portion of the production is coming from small properties. The large mining companies of the world get most of the publicity, but in the last year the small gold property has often proved a more attractive field for the mining engineer looking for something to do. Old mines have been reopened, prospects have been more closely examined and many properties that were out of the running with the high commodity and labor costs of two or three years ago, have recently been making money for the operators. An interesting phase of this activity is the operation of the so-called one-man mines. The West is dotted with these small properties, without the resources and reserves to warrant large-scale operations, but which return a living and often something over to one or two men who understand mining and simple methods of treatment."—(One Man Mine. R. C. Fleming in "Mining and Metallurgy", Feb. 1932.)

"There is a new gold rush on — one in which you can participate as well as the seasoned prospector, with the reasonable assurance of panning out a fair day's wages, and with the ever-present possibility of striking a nugget which may vary anywhere from \$50 to \$5000 in value. Hundreds of men thrown out of work by the business depression are to-day panning out gold in the thousands of places where it is known to exist in small quantities. They are making fair wages in a healthful, outdoor occupation and they are assured a job as long as they are willing to shake a gold pan."—(John Edwin Hogg in "Modern Mechanics and Inventions" for July 1931).

"That a number of large and relatively rich gravel deposits exist in the State is undeniably true, and it is

very probable that the still unrecovered placer gold has a value greatly exceeding that already obtained, but lack of water and the cemented condition of much of the sand and gravel create a situation that has proved very discouraging. That these drawbacks will some day be overcome seems certain.”—(G. M. Butler in Preface to “Arizona Gold Placers”, 1927).

Such are the utterance and opinions of men who are well acquainted with the opportunities for gold prospecting in the West. From all that, it is readily apparent that there is still plenty of territory favorable for gold prospecting in the United States, not to speak of Canada, Mexico and Alaska. Some of the richest strikes have been made in places gone over by many prospectors, both professional and amateurs. The surface indications pointing to the hidden underground deposits of gold are constantly appearing. The surface of the earth is continuously being changed by atmospheric agencies, like wind, rain and running water that disintegrate and wash out the rocks, by intense heat that decomposes, and intense cold that cracks the rocks in the presence of water. Even animals may unwittingly aid in uncovering and discovering the rich ores as often happened when gold was found in the dirt excavated by gophers, badgers or other animals. The outcrops or surface indications of ores, that were hidden yesterday may become uncovered to-day.

You cannot fail “to strike it rich” in the sport of gold prospecting. Even should you find no gold, the outdoor activities of gold prospecting will have such profoundly beneficial influence upon the health of your body and mind, that you will feel yourself richly rewarded for all the expenditure of time, money and energy. The muscular activity under the influence of mild mental excitement, created by constant anticipation of a rich discovery, becomes easy and pleasant.

The lazy sauntering of an average tourist "taking in the country" cannot be compared to gold prospector scouting among the hills with definite goal in his mind. In this lies the great superiority of the sport of gold prospecting over the ordinary touring. The elastic spring, the bright eye, the cheerful glow of the gold prospector form a great contrast to the tired and languid expression of an average tourist. And the final results in point of health are quite as different.

In his interesting book "The Secrets of the Rocks" the grizzled old prospector Mr. Frazier makes the following remarks about prospecting:

"If the prospector be a lover of nature as well as a lover of gold, his interest in the revelations of these mysterious hills will be magnified many fold. The yellow-god may have its single charm, but this grand old mountain range for such will even be a treasury of delightful surprises..... If your tastes are those of the true liberty-loving American freeman, should you come back from your first expedition without having discovered a "bonanza", augmented physical and mental vigor acquired through the influences of a clear, crispy sky, pure atmosphere and the glorious scenery of the grand old Rocky Mountains, you will have been more than compensated for loss of time and money by improved health and enlarged experience."

The unique sport and adventure of gold prospecting is easily made to fit accurately your personal inclinations, your finances and many other peculiar circumstances. You may enter the game on a small or on a grand scale, go on a prospecting trip with a Ford or a Rolls-Royce, in luxurious touring coach or in an aeroplane, you may spend pleasant week's vacation or devote a whole year to scouting among the hills and in the desert, you have a choice of many localities in



almost all the western states, you may combine with the sport of gold prospecting almost any other sport, like hunting, fishing, mountaineering, etc. You may spend just a few dollars on equipment or hundreds, you may continue to do prospecting as a sport or gradually become professional by experience acquired in the field and further studies to which your attention will be directed later on.

“The men become attached to the life and scenes that accompany the existence of a professional prospector,” says the above quoted Frazier. “It is the chance of big finds that makes mining the most fascinating occupation in the world. In all the canyons and gulches and river beds within the gold bearing areas of this (Colorado) and other states old prospectors are scattered. They live a rude life, but it is not a hard one, for it is free from the anxious strife that accompanies the jealousies and competition of “civilization”. Pork and beans and coffee content them in their little cabins. Clothing costs them next to nothing and rent day never comes around. Fuel they have in abundance for the labor of cutting. They manage to gather enough dust to pay their humble way. Very few of them make wages, for they are not industrious and do not care for wages. Not one of them would exchange his lot for that of the best paid city wage earner, for ever ahead is the chance of wealth. It is not by any means an illusion, any chance either. Any day the nugget may appear in the pan or rocker or the rich pocket may be uncovered. Their life is incomparably more independent and manly than that of the ordinary working man. They own themselves, and have the dignity of players at a game which has made millionaires of men once as poor and obscure as they.”

This booklet will attempt to teach the reader the sport of gold prospecting in the simplest possible way,

understandable to anybody who has common school education and some common sense. All complicated technical details, not absolutely necessary for success and enjoyment, have been left out and only such scientific data have been introduced that are necessary to guide the amateur prospector in the right direction.

## CHAPTER II.

### PROSPECTING EQUIPMENT.

To derive full measure of pleasure and profit from the sport of gold prospecting it is essential, as in any other sport, to be equipped with proper tools for playing the game. In selecting this equipment, one should keep in mind that certain articles are absolutely necessary and that, as a rule, the best is the cheapest in the end. With these limitations the amateur prospector is allowed a wide choice in the quality and completeness of his equipment. Besides all the things included in ordinary camping outfit the gold hunter needs few special tools. It is somewhat difficult to draw a definite line between the essentials and non-essentials in gold prospector's equipment, since the decision is influenced by many factors, such as amount of money and length of time available for this purpose, nature of the country in which prospecting will be done, extent of testing and assaying contemplated, etc. With these considerations in mind we have, somewhat arbitrarily, divided the gold prospector's equipment into articles that are: 1. Necessary, 2. Desirable and 3. Optional.

#### NECESSARY ARTICLES.

**GOLD PAN.** What a gun is to the hunter, a rod to the fisherman, the gold pan is to the gold prospector. It is the most important single item in his armamentarium, one that should be constantly with him. Gold pans are made of different materials (iron, agate

ware, aluminum, copper), but one made of sheet iron with a rolled edge, costing about a dollar, is quite satisfactory. It should be rusted and pitted, to better catch and hold back fine gold. The "colors" are easier to see against rusty background. Its edges should be gently sloping, not too steep. The usual pan is 16 to 18 inches in diameter at the top, but it is convenient to have also smaller sizes of 12 and 6 inch, one of which you should always keep handy to pan sand of any stream, flowing or dry, wherever you may stop. In this connection it should be remembered that gold is found not only in the sands of the present river beds, but also in sands where river flowed ages ago.

**PROSPECTING PICK.** This is a small pick with the head about 7 inches across, one end of the head being a pick or preferably a chisel and the other a hammer. It should be made of good steel with a handle about 12 or 14 inches long. A leather sheath with a loop enabling one to carry the pick on the belt is very handy. A pick of this description should be prospector's constant companion.

**SHOVEL.** A small trench shovel or a folding shovel sold by sporting goods or auto supply houses should be carried to enable you to dig for deeper sands which are likely to contain more gold than the surface sands.

**CHAMOIS BAG** or buckskin bag is necessary for collecting gold amalgam (gold taken up by mercury). This may be purchased in almost any leather goods or department store or from a mail order house. Get at least two of them, since they are not expensive.

**MAGNIFIER** of almost any kind, if strong enough, will do. Very handy are pocket microscopes, made in Germany, with three lenses, magnifying 18- to 25-times. They sell for about a dollar and may be carried in the pocket like a fountain pen. A lens or a system of lenses taken out of a telescope or binoculars

may be used for the same purpose when a regular magnifier is not available.

**QUICKSILVER** (mercury). This is necessary to save fine gold dust by the process called amalgamation. Buy a pound of quicksilver at a convenient drug store, pour a little into a smaller wide mouth, thick bottle, preferably with a screw top and carry it with you in a pocket.

The above described articles are absolutely essential and they form the gold prospector's equipment stripped down to the very minimum. For better work with more chances of success we recommend further articles, classed as

#### DESIRABLE ARTICLES.

**MAGNET.** This will be valuable for testing magnetic qualities of minerals and also for separating the "black sand" from the gold in the pan. "Black sand" is made up chiefly of heavy grains of magnetite and also other fine iron particles which, being heavy, lag behind with gold in the pan. Complete separation of gold and black sand is sometimes quite difficult without magnet and without quicksilver.

**HORN SPOON** is used for similar purposes as a gold pan and is very handy for taking samples. Carry one in your pocket. The darker the horn, the better, since the "colors" (the fine specks of gold) show better against dark background. If polished too smooth, roughen it by scratching with coarse sand paper. The horn spoon may also serve for roughly estimating the weight of gold. While at home yet, determine accurately what part of an ounce of water your horn spoon will hold. Multiplying this by 20, you will get approximate weight of gold in a slightly heaping horn spoon. If you have small scales with horn pans, you may use these pans for the same purpose as horn spoon.

**PICK.** A regular miner's pick is preferable, but any other good pick may be purchased in a hardware store. It should be made of good material, since it will be used on hard rocks.

**SHOVEL.** Miner's shovel No. 2, with a round point.

**DRILLS.** An amateur prospector, especially in the beginning, may get along without drills, the lack of them, however, will limit his prospecting to the surface. For good, thorough work one or more drills are essential. Miner's drills for single hand work are made of preferably octagonal steel bars, in size of  $\frac{3}{4}$  inch and to 1 to 4 feet long. One end of each drill is made into a cutting edge about  $\frac{1}{16}$  to  $\frac{1}{4}$  inch wider than the shaft to prevent sticking in the hole. For drilling soft rocks the cutting edge is usually straight edge end flares sometimes almost to twice the diameter of the stock, for harder rocks the cutting edge is more or less curved. The following set of four drills will be found quite handy: 1. Length 1 foot, cutting edge  $\frac{1}{4}$  inch wider than the shaft. 2. Length 2 feet, cutting edge  $\frac{3}{16}$  inch wider. 3. Length 3 feet, cutting edge  $\frac{2}{16}$  inch wider. 4. Length 4 feet, cutting edge  $\frac{1}{16}$  inch wider. The first two will probably be quite sufficient for the beginner. The drills have to be occasionally sharpened, hardened and tempered. Since the drills are somewhat heavy, it is advisable to purchase them at the local stores in the prospecting country.

**SCRAPER,** also called a "spoon", with a long handle is necessary for cleaning the drill holes.

**HAMMER.** If the prospector is not using a drill, then the hammer end of his prospecting pick answers all his requirements, but for driving holes with a drill, a heavy hammer, called "single-jack", weighing about 3 pounds is necessary. This is preferably purchased in a hardware store near your prospecting territory.

**IRON MORTAR** is necessary for crushing ore preparatory to panning and testing. Prospector's mortar is an iron cylinder, open at both ends, one end fitting into a removable base. The crushing end of the pestle used with this mortar should be square to allow crushing close to the sides. Mortar like this weighs about 5 pounds, is easily taken apart for cleaning and the base may be used as an anvil. To save weight, prospectors sometimes use the head of a drill for a pestle. Besides this, larger iron mortars in sizes from one-half pint to 5 gallons and ranging in prices from \$1.50 to \$25.00 may be purchased, if larger amounts of ore is to be crushed, or a crushing mill may be constructed in the field.

**IRON SPOON** for roasting and melting ore, testing for the presence of sulphur in suspected pyrites, for evaporating mercury from gold amalgam and for driving off tellurium from gold tellurides.

**TESTING OUTFIT.** No elaborate testing outfit is necessary when prospecting for gold only. Concentrated inorganic acids, chiefly nitric, hydrochloric and sulphuric are generally used for testing minerals. Being highly corrosive, they are liable to do considerable damage or even serious personal injury, if accidentally spilled during transportation. To obviate this, we have included only those tests that can be done without the use of acids and these tests prove to be quite sufficient and satisfactory for the gold prospector. The acid solubility test for gold is not absolutely necessary for establishing identity of gold, if other tests prove to be positive. Reagents necessary for simple testing outfit are: Sodium bicarbonate (ordinary baking soda) — 1 pound. This chemical may be used for medicinal purposes (heartburn, etc.) and also for baking. For testing, heat the bicarbonate, until all water is expelled and carbonate is thus formed. Strong vinegar —

at least 4 ounces. Powdered charcoal. This may be prepared in the field from wood; flour may be used instead. Apparatus: Several test tubes of different sizes, nested, to save space. Sterno heat, preferably in tubes. For the few tests in which heat and colorless flame are necessary, Sterno heat is preferable to alcohol, avoiding the danger of spilling, and making a lamp unnecessary.

POCKET SCALES with preferably horn pans are very useful and handy in the field.

HARDNESS TESTING OUTFIT. This, in its simplest form, will consist of a piece of heavy plate glass with a sharp edge, a good steel knife, a fragment of quartz and of corundum, each with a sharp edge. Quartz may be picked up while prospecting and a chip of corundum may be purchased from a dealer in minerals. The softest minerals are tested with a finger nail.

#### OPTIONAL ARTICLES.

TESTING OUTFIT. If you wish to test for other elements besides gold, order from Arizona Bureau of Mines, Tucson, Arizona, Bulletin No. 128, "Field Tests for the Common Metals", by George R. Fansett. Price 10 cents. This bulletin describes in simple, non-technical language easy tests for the most common metals and tells you also what reagents and apparatus are necessary for these tests. Compact and easily portable blow pipe sets are also obtainable. The most practical is one designed by Prof. Butler. The various pieces are compactly arranged in a case with compartments and receptacles, especially designed to avoid breakage. Some knowledge of chemistry and blowpipe analysis is necessary for making these tests successfully. The above mentioned bulletin gives the rudiments of blowpipe analysis and determination of metals. If



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deeper and more extensive knowledge is desired, we recommend a course in "Determinative Mineralogy" as given by the University of California and described on pg.

**DIPPING NEEDLE.** In recent years there has been perfected a number of chiefly electrical apparatuses designed for locating and exploring ore deposits that give insufficient surface indications. Most of them are quite complicated, requiring special study and training preparatory to their intelligent use, they are very expensive (some as high as \$12,000), heavy and cumbersome, and therefore utterly unsuitable for the average amateur prospector. Notwithstanding the claims made by certain makers of mineral rods, there is no apparatus nor device that will tell what metal is hidden under the surface at a certain place. In search for ore deposits the geophysical instruments are used chiefly for delineating the ore deposits in a known field and not for the purposes of determining the presence or absence of ore deposits in a field that has not been investigated by other prospecting methods.

A. E. Eve, D. A. Keyes and F. W. Lee make the following statement about the geophysical prospecting:

"However, the exploring physicist must himself be guided by the geologist, the mining engineer, or the prospector into regions that are likely to yield minerals in profitable quantities." (Depth Attainable by Electrical Methods in Applied Geophysics. U. S. Bureau of Mines Technical Paper 463.)

In discussing the question as to whether these geophysical methods may not ultimately displace the prospector by making him unnecessary, an expert makes the following statement:

"I do not believe that there is any mine in this western country that was not discovered by some

prospector scouting around the hills, and I do not believe there will be one. Science is doing a lot in developing methods of electrical prospecting, but it is very unlikely that such methods will ever be used for prospecting any field to which attention was not originally directed by some prospector." (W. B. Gohring in "Mining Congress Journal", Feb. 1929).

The application of geophysical methods in prospecting is therefore very limited, but still there are few simple apparatuses that may be used by the amateur gold prospector to a great advantage. The simplest and the most useful of these is the dipping needle.

In placer deposits gold is often associated with other heavy minerals that have come down from disintegrated veins. Since some of these minerals, like black sands for example, are often magnetic, the places where they are highly concentrated, may be detected by a local variation of a sensitive compass or by a so-called dipping needle which is nothing else than a compass with the needle swinging in the vertical plane. By inference it may be concluded that wherever magnetic minerals are present in high concentration, gold also is likely to be present in a high concentration, provided it was originally contained within a vein (most often of pyrites) in the mountains. A compass may be used for this purpose, but is not sufficiently sensitive. A large dipping needle swinging freely in the vertical plane is preferable. The greatest deflection of the needle will correspond to the greatest concentration of the magnetic material, and directly above the magnetic pole of the deposit the needle may point straight down, if the force of attraction is strong enough. Small bodies of magnetic material near the surface may exert as much attraction as large bodies deeply buried, but their effect extends over a small

area. A slow and steady increase in deflection limited to a small area indicates a small deposit. Poor magnetic deposit at the surface may give the same indication as a rich magnetic deposit at depth. By the use of the dipping needle it may be possible to outline areas of the greatest concentration in old river beds, in old river benches above the present banks, in courses of ancient rivers that produced placers and in some buried placers. You should keep in mind, however, that it is not gold to which the needle reacts and that the magnetic deposit may be entirely devoid of gold.

**BLASTING EQUIPMENT.** In order to expose a vein or a lode and sometimes even in placer mining it may be advantageous or even necessary to use explosives in blasting rocks or loosening hard packed, cemented gravel. This procedure, however, is almost beyond the scope of the amateur prospector and will not be described here. If interested in it and willing to attempt it, study first carefully how explosives should be used. There are two good booklets in this line that will give you authoritative and reliable information on the subject:

“Primer on Explosives for Metal Miners and Quarrymen”. U. S. Bureau of Mines Bulletin No. 80. Order from Superintendent of Public Documents, U. S. Government Printing Office, Washington, D. C., and enclose a money order for 25c or coins (not stamps).

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Complete, first-class equipment, as described, may be somewhat expensive, but the same thing is true of complete, first-class equipment for other sports, it being nothing unusual for a hunter to spend hundreds of dollars for shotguns and rifles, or for a fisherman to purchase rods, lures and other fishing paraphernalia for even considerably more than a prospecting outfit would cost. It is possible, however, to economize by

limiting the equipment to the absolutely necessary items and to cut down the expenditures to such a low figure that nobody has to deny himself the pleasure of participating in these healthful outdoor activities, in a sport that will offer you more enjoyment, more genuine thrills, more alluring adventures than almost any other sport. And to all this is added the vitalizing, bracing cheering effect of constant anticipation of good luck and the knowledge that a single rich strike will amply repay all the expenditures of time, money and energy.

In describing the discovery of radium ore in Canada, Boyden Sparkes in his article "Thar's Radium in Them Hills", published in the April, 1932, issue of "The Elks Magazine" mentions a case of a gold prospector that struck it rich:

"Harry Oakes found some quartz gleaming with gold at Kirkland Lake in Ontario about ten years ago. Instead of selling his claims Oakes worked in the mines of other men as a laborer until at last by selling a minor interest in his property he had enough money to develop it. To-day he is the principal owner of that mine and has so many millions dollars that he is rated one of the richest men in Canada; and the lesson of his career for any prospector is that you only have to find one rich mine to make your dreams come true."

## CHAPTER III.

### GENERAL EQUIPMENT.

#### ORIENTATION.

**MAPS.** Before undertaking any long trip, it is advisable to procure good auto road maps in order to make at least tentative plans as to the routes and the daily mileage. Most service stations along the road distribute such maps free of charge, but it is better to buy an atlas of roads in all or at least in the western states of the Union. In common with every other traveler, the gold prospector should be provided with these maps, but he should also have topographic and geologic maps of the locality in which he expects to do his prospecting, since in most cases the really prospecting part of the trip will be made afoot, on horseback or with burros, and he should therefore become well acquainted with the topographic features of the particular locality. The topographic and geologic maps and their use will be discussed in Chapter V.

**COMPASS.** A compass is an indispensable item for anybody who ventures into a wilderness where there are no blazed trails. While almost any kind of a compass is serviceable, still it is advantageous to get a good, dependable instrument, since in the desert or mountains your very life may depend on correct determination of the direction, and a good compass is also necessary in staking claims, as will be explained later.

A prospector's compass should have a sighting arrangement and its circle should be divided at the

circumference into degrees. In trackless desert and mountains without definite landmarks the compass is quite serviceable in enabling you to retrace your steps back to the point of departure. In using it for such a purpose, you will be guided chiefly by the numbers at the circumference of the compass circle. Proceed, as follows:

Sight the point of the compass in the direction in which you expect to go, and when the needle settles, read the number to which it points. Be sure to be at least ten or more feet away from your car, since the mass of magnetic material contained in the car would strongly affect the needle. Enter this number in your note book, e. g.: Start 27. This number denotes with sufficient accuracy the direction in which you depart from the starting point. As long as you continue going in the same direction, measure the distance travelled in steps taken (about 2000 average steps to one mile), pedometer, by hours travelled or by any other reasonably exact method. Just before changing the direction, note a natural landmark, e. g. big boulder, a tree, a brush, if present, or make a mark (pile of rocks) yourself. Sight the compass again, read the number and enter in your book, e. g. Big boulder 17, which means that at the big boulder you have changed the direction of your travel from the previous one to one designated by the number 17. Thus your itinerary may read, as follows:

Start 27, one mile to:

Big boulder 17, two miles to:

Hidden spring 20, half a mile to:

Pile of rocks 18.5, 3 miles to the mouth of a canyon.

Now, if you want to return by the same route to the point of departure, proceeds, as follows:

Turn the compass until the north end of the needle points to a number which lies across the dial, just op-

posite to the last number of your itinerary, and walk in the direction to which the pointer of the compass shows. Thus, e. g. in finding the return direction from the mouth of the canyon, you allow the needle to point to the number which is opposite to 18.5 and this will be 0.5. (Or the number may be obtained by adding 180 to the original number, e. g. 18.5 plus equals 36.5 and dropping always 36 whenever the number becomes larger than 36. In this way you will get 0.5. Walking in the direction which the pointer indicates when needle points to the given number will bring you to the pile of rocks. Repeat the same process at the other places where the direction was changed. Your return route would be then described thus:

Mouth of the canyon 0.5 (3 miles)

Pile of rocks 2. (Half a mile)

Hidden spring 35. (Two miles)

Big boulder 9. (One mile to the starting point).

The local magnetic declination may be entirely disregarded when using the compass in this manner.

At night the Polar Star is the most reliable guide, pointing to true North. To locate it, find first the constellation of seven bright stars, called Big Bear or Big Dipper. The line drawn through the two stars that lie away from the handle of the dipper, if extended about four times the distance between the two stars, meets a very bright star called Polaris, Polar Star or North Star. The direction towards the North Star is always true North.

Should the compass be lost, a watch keeping correct time may be used to determine South, provided the sun is shining. Hold the watch horizontally, face up, and point the hour hand towards that portion of the horizon above which the sun stands. In this position, the line drawn midway between the hour hand and the numeral XII will point south. If the watch



used keeps good time, the determination arrived at by this method is sufficiently accurate for practical purposes.

And vice versa, the compass may be used to tell the time of the day, if the sun is shining. Allow the compass needle to settle, pointing due north. When sun is east, it is 6 A.M., when south, it is 12 noon and when west it is 6 P.M. Knowing that it takes the sun six hours to change its position from east to south and again six hours from south to the west, it is easy to divide the arc between these positions and to estimate the time accordingly. It is true that the sun appears at the above named positions at exactly the time indicated only twice a year, March 21 and September 22, during the time of equinoxes, but for practical purposes the above described procedure is sufficiently accurate.

TELESCOPE or binoculars are a very desirable article of equipment, allowing the prospector to look over distant mountains and inaccessible peaks and note their surface details, like outcrops, etc. Another advantage lies in the fact that some lenses may be taken out and used as magnifiers or a burning glass, or a system of lenses may be used as a microscope.

## TRANSPORTATION.

AUTOMOBILE will probably be used in most cases for the first part of the prospecting trip. Almost any make of car will do, but be sure to have it in first class condition, with preferably new tires and sufficient extras (tires, tubes, fan belt, chains, radiator hose) and later, when you venture into sparsely settled country, carry extra can of each gasoline, oil and water. Sufficient, rather ample supply of water is of paramount importance in the western deserts. The best way of carrying water will be discussed later. If there are two

cars in your prospecting party, it is of great advantage to have both of the same make and of the same model, so that the parts are interchangeable in case of need. Do not be afraid to leave your car behind when you strike out afoot, even if it be for several days.

The auto camp trailer, while very useful for an ordinary traveller who stays on good roads, is rarely suitable for the prospector who leaves the highways to travel mountain roads with their steep grades and sharp turns. And besides, the prospector must have a tent and sleeping equipment, both light enough to be carried on his back, since the last lap of his journey, in most cases, has to be made afoot or with pack animals.

**AEROPLANE** possesses some very decided advantages over automobile. It offers means of rapid transportation, allows the prospector to survey from the air large territory and to select most favorable places for prospecting. About its only disadvantage is that it needs a long and level stretch of land for landing field. For this reason the Autogiro is especially suitable for the prospector, since it is able to land at comparatively low speed on a short runway. If necessary, it may land without any forward speed at all, although it is usually landed with a slight roll. The size of a field in which it can safely land or take off is, of course, governed by the obstructions around that field and by the character of the field, the load in the ship and the prevailing wind. In dead still air the ship fully loaded (useful load being 590 lbs), will run from one to two hundred feet before take off, and under ordinary conditions with a slight breeze, its run will be considerably shorter. We have seen good landing places for autogiro in the Arizona desert, in mountains of Utah, in Death Valley and Panamint Valley of California. An autogiro and an airplane are, of course, more ex-

pensive in original cost and in running expenses than an average car, they require special skill in piloting, but in spite of all these drawbacks, they offer superior means of transportation, especially suitable to the amateur prospector who is looking for sport and who can afford to own and to fly either an aeroplane or an autogiro. As a matter of safety it is highly desirable to have an intercommunicating radio set in the plane, since you will undoubtedly venture into wilderness, far away from human habitations.

**MOTORCYCLE** may be used in many places not accessible to the automobile and it is probably better than horses or burros, even if it is necessary to dismount occasionally and walk a short distance. It is possible to carry much heavier pack while riding on motorcycle than when walking, and the motorcycle will cover plenty of ground in a short time. There are very few places where a motorcycle will not be able to penetrate. If you do not have a motorcycle and wish to use one, it is probably better to purchase one in the last large city through which you pass on your way to the prospecting country. A light, second hand automobile may be procured almost as cheaply as a motorcycle, and when stripped of all not absolutely necessary parts, it will offer almost the same advantages as a motorcycle, with additional advantages of larger carrying capacity. It may also be used to furnish power for some extensive operations, should you happen to discover a rich placer and decide to work it yourself. Be sure that the car is thoroughly dependable. To be stranded in the desert or wild mountains far away from help may be quite a serious accident.

**BURROS.** Driving a good, light automobile and subsequently walking, the amateur prospector will be able to penetrate almost all good prospecting regions in United States. It is only exceptionally that he will

have to take to pack animals for transportation and then his choice will be burros (small donkeys), since they are able to endure good many hardships and can subsist on very meagre quantities of food and water. When there is even a small amount of green feed, no additional feed and only about a gallon of water is necessary for each animals, as a rule. Even with 150 pounds, which is about the load limit, the burros are more sure-footed on narrow mountain trails than horses. When unloaded in camp, they should be hobbled and freed either to rest or to browse on whatever vegetation grows around. Pack sacks or pack saddles, if proper size is obtainable, are easiest for an amateur to handle. Care should be always taken to see that the loads on both sides are properly balanced and firmly secured. Complete outfit for one burro will consist of one saddle blanket, one pack saddle or one riding saddle, one pair of hobbles, one bell and sufficient length of rope. Burros can be purchased in the West for about \$10 each and even less, and in many localities they may be rented. There should be two burros for one man, one for riding and one for carrying packs, and if water has to be transported, an additional one will be necessary. If the party is larger, the number of burros per man will be proportionally smaller, since many articles may be used by two persons just as well as by one. One burro is able to carry all prospecting, camping equipment and rations to last one person about a month or water enough for one man and one animal to last about a week. One disadvantage with burros is that they travel slow, anywhere between 10 to 20 miles daily at most.

WALKING, which is usually necessary in the last lap of a prospecting trip, presents several specific problems and therefore it may not be out of place to offer some practical suggestions about the same.

If you expect to stay away from your base camp, that is from your car, overnight, it will be necessary to carry 30 to 50 pounds in a ruck sack or pack sack on your back. Select a good ruck sack, one that fits your back comfortably and try it on with a full load. In a region with sufficient and dependable water supply it is possible to carry, besides a light camp and prospecting equipment, rations sufficient to last up to a week. When water has to be transported, however, as is the case in many parts of the West that are especially favorable for prospecting, at most three days' rations including water, can be carried. The minimum daily requirement of drinking water per person is 2 quarts, and this, together with a canvas bag or a canteen weighs more than four pounds. To avoid excessive fatigue and to preserve full vigor for prospecting, strip down your equipment to the bare necessities and go as light as possible. It is advisable to begin, if possible, with carrying about 30 pounds. As your muscles grow stronger, gradually increase the load up to a maximum of about 50 pounds, which is about the limit of weight that may be carried all day without undue fatigue. Remember that the load carrying capacity becomes much less high up in the mountains. At elevations above 9000 feet even walking without a load may severely tax the strength of one accustomed to living at low altitudes.

Pack the heavier articles in the bottom of your knap sack and, if you expect to stay out over night, include in it the following: Rations, single burner Sterno folding stove, large can of fuel for it (do not depend on an open fire), boy scout mess kit, one pair of socks, one suit of underwear, first aid kit, snake bite outfit, can opener and a light air mattress, if possible. A light tent and a light sleeping bag can be carried on top of the knapsack, water, if necessary, in a

felt covered canteen on a shoulder strap, gold pan and a small shovel strapped to the outside of the knapsack so as to be easily accesible. On your belt you will carry a prospecting pick, a strong sheath knife and possibly a larger compas or a gun. Telescope or binoculars are best caried on a shoulder strap. In your pockets you should carry maps, a magnifier, a small bottle of mercury, matches, chamois bag, couple of handkerchiefs, possibly a small gun, small snake bite outfit, first aid and emergency rations in the form of couple bars of chocolate in a tin box.

The distance travelled daily varies widely, depending in the first place upon the total weight carried, the nature of terrain, altitude, weather, temperature, personal fitness and amount of actual prospecting being done. Five to ten miles in the beginning may gradually be increased to probably 20 to 25 miles as a maximum. Walking at this rate, however, does not leave much time or opportunity for prospecting and is advisable only when you are intent upon reaching a certain location as soon as possible and are not much interested in the country through which you are passing. As a rule, you should walk leisurely and carefully observe all changes of contour, especially sharp ones, in the nature of cliffs, buttes, canyons, etc., sudden changes from one kind of rock to another, when they are exposed, all peculiar looking rocks and formations, any different and especially deep colors, isolated patches of vegetation, springs, in fact you should study in minutest detail the surface of the earth, and if anything peculiar or suggestive is encountered, you should investigate it until fully explored and fully explained.

Do not allow your vigor and enthusiasm to tempt you into brisk walking at the start. Slow yourself down deliberately for the first mile or so, giving thus

your muscles a chance to limber up and gradually accommodate your heart to the unaccustomed exertion. This applies especially to walking high up in the mountains and in sandy desert under the fierce rays of the blazing sun. In extreme heat avoid drinking too much cold water. The most suitable drink under these conditions is hot tea, hot coffee or tomato juice. These drinks will refresh and stimulate you better than cold water. In the evening when you stop for camp and after you have cooled off somewhat, you may drink of the cold water as much as you desire and as much as your supply allows you to. Avoid alcoholics.

Travelling afoot is not only more pleasant, but also easier with a companion who shares some of the equipment and by doing so affects considerable saving in the load carried. It is also advisable for reasons of safety, not so much because of the danger of attack by men and beasts, but because it makes help available in case of broken limb or any other injury.

## FOOTWEAR.

Foot health and comfort are highly important for full enjoyment of outdoor activities and the question of proper footwear should receive careful consideration.

**SOCKS.** On any long hike, even in very hot weather, wear two pairs of socks. The extra sock will decrease friction, prevent formation of blisters and abrasions and will make your foot more comfortable. Try this double sock idea on some longer hike near your home before starting on a prospecting trip and you will surely be delighted. Closest to the skin wear the thinnest all wool sock that you can buy. Wool takes up the perspiration and allows it to evaporate much better than any other material, and thus prevents chilling. While the choice of the other pair of socks depends somewhat upon the weather and your person-

al preference, still for many reasons, heavy wool socks are preferable. In a complete equipment, at least 4 pairs of light and 2 pairs of heavy socks should be included.

**SHOES.** Any kind of good comfortable shoes will do, but for the highest degree of comfort and efficiency one should provide himself with three pairs of shoes: Ordinary shoes as worn at home, work shoes and hiking shoes. For panning, digging, blasting and other actual work an old pair of shoes or sturdy work shoes are desirable, since they are subjected to much more than ordinary wear. The moccasin, which is generally recommended for long distance hiking, is not suitable for a prospector who walks over rough and often rocky ground. Moccasin type boot with leather heels and strong leather sole, 12-16 inches high, should be his choice. The high boot offers some, although not absolute protection against snake bite. In a properly fitted shoe the foot with one thin and one thick woolen sock should have enough room to allow the toes to wiggle freely while standing, since on a long walk the foot becomes somewhat swollen due chiefly to increased blood supply attendant upon the increased functional activity. For the same reason the lacing should not be too tight. Have the boots well broken in before the trip. Women prospectors who enjoy their work as much as men and are fully as successful, considering that the men outnumber them, should avoid high heel shoes and also wear high topped hiking boots with heavy soles.

## WEARING APPAREL.

**CLOTHING.** Any kind of old clothing is serviceable, even overalls may be used, if you wish to economize.



**TROUSERS.** For hiking, whipcord trousers in riding breeches style are probably the most suitable for both men and women and not very expensive. Do not lace them too tight, since this would interfere with proper blood circulation.

**SPORT SHIRT.** Ordinary shirt, coat and vest should be left out of the prospector's wardrobe. The coat interferes with freedom of movement and the vest is nothing else than a collection of pockets hung on the body. All wool or flannel, light weight shirt of khaki color is best. For cold climates provide yourself with one light and one heavy sport shirt.

**UNDERWEAR.** Light wool underwear is advisable even in summer. Have at least three loose fitting union suits. In winter two suits are warmer than one suit of about the same thickness as two. In high mountains the nights are cold in summer and even the southern deserts may cool down almost to freezing in spring and autumn even after a very hot day.

**HAT.** Selection of a hat is not of much importance. For very hot climate either a tropical ventilated helmet (imported from China) or a heavy Mexican felt sombrero is most suitable. The object is not to eliminate heat, but rather to prevent the sun's ray from penetrating to the head. Most "desert rats", as the desert prospectors are called, wear indescribable hats of some past generation, just anything to cover the head and to protect it against the fierce rays of the sun.

**RAINCOAT** is too cumbersome, but a light rain shirt that may be rolled up in a small bundle and carried in a pocket, is very serviceable, wherever sudden rains and squalls may be expected.

## H E A L T H.

Before starting on a prospecting trip you should be in good general health and especially your feet and

your teeth should be in first class condition. An aching tooth or a painful corn are apt to spoil all the enjoyment of what would otherwise be a perfect trip. Typhoid immunization (vaccination) is highly advisable, since you may be exposed to infection by drinking contaminated water or milk. The injections should be completed before departure.

**FIRST AID KIT** should be included in every complete outfit. They vary in prices, but a small Boy Scout First Aid Kit is quite satisfactory for common emergencies. Add to it aspirin tablets or other tablets for headaches and other aches, compound cathartic or some other cathartic pills for constipation and other remedies according to your personal choice. For small cuts, bruises and other wounds tincture of iodine is the best antiseptic and the most convenient way to carry it, is in 2 cc. Saf-T-Top vials filled and marketed by Robert A. Bernhard, Rochester, N. Y.

**SNAKE BITE OUTFIT.** Although even the worst snake infested regions of the West are, on the whole, much safer than automobile infested streets of Chicago and New York, it is better to play safe and to carry a snake bite outfit. Dudley's or any other outfit providing for suction are preferable, since by repeated tests it has been shown conclusively that the mechanical removal of the snake venom by cutting and suction is the only reliable method. The chemical neutralization by antivenin injected hypodermically should not be depended upon to the exclusion of mechanical measures.

**WATER FILTER** is highly desirable. A convenient form for travelling is one made of a small piece of unglazed porcelain with long rubber tube and a mouth piece attached, so that it may be used to drink directly from the tube or to syphon water from one vessel to another.

## S A F E T Y.

The Wild Woolly West is not overrun with hostile Indians and daring bandits as in the days of yore. In the wide open spaces of the western deserts and mountains you are safer with \$1000 worth of gold dust than in some eastern cities with a measly ten-spot. The wild animals as long as you leave them unmolested, are as innocuous as a bootlegger with whose activities you do not interfere.

**FIREARMS.** In spite of all that, however, it is advisable to carry firearms, since they increase the feeling of safety, give you a certain amount of confidence, and are very handy for hunting, when game is plentiful, and in giving distress signals.

The knowledge of distress signals may occasionally be of great value. These signals vary with different localities, but as a rule, two shots fired five seconds apart mean either: "Partner, where are you?" or "Help!" The answer is again two shots, meaning: "What do you want?" If no further signals are heard, or if the two shots, five seconds apart, are repeated, it is a signal for immediate help. If, however, only one shot is fired, then it means that everything is all right and that the first shooter wanted to know where his partner was. Two fires burning about fifty feet apart and giving off plenty of smoke are distress signals that may be visible for great distances.

What firearms you will carry on your trip, depends, of course, chiefly upon what you already have in your arsenal, and upon your personal preference. The smallest automatic in a pocket or in a holster and a Mauser automatic pistol in a wooden holster would be my choice. These Mausers are very good weapons for self defence and may be used for hunting, having wider range and more penetration than many rifles.

**SHEATH KNIFE.** A sturdy hunting knife in a sheath carried on the belt is a handy item of many uses. Finish Kauhavan knives are strong enough to stand all the rough usage to which a prospector will subject it, including testing minerals by scratching and scraping debris between the rocks.

**RADIO.** A two-way communication radio set is probably too heavy to be carried by a lone prospector, but when there are several persons in a party, it becomes feasible. Enabling the communication with the base camp or with some other near by station, a set like that offers many practical advantages.

## SHELTER AND SLEEPING.

**TENT.** If you wish to go extremely light, you might be able to do without a tent, using a sleeping bag with a head protecting flap. A tent, however, is highly desirable even in arid climate, offering protection against small and large animal pests, bugs, insects; snakes and also against dust. There are tents that do not weigh more than five pounds and are large enough for two men. Should even lighter tent be desired, then boy scout shelter or pup tent should be selected. Be sure to provide yourself with stakes and collapsible pole, since travelling in the desert, you cannot depend on cutting the sticks to support the tent. Many prospectors prefer a dugout to a tent and in favorable weather their only canopy is the blue of the sky.

**SLEEPING BAG.** By all means include a sleeping bag and, if possible, an air mattress in your equipment to insure pleasant sleep, perfect rest and renewed vigor in the morning. Some air mattresses are very light and very comfortable. Although you may be able to sleep on the ground comfortably enough, still it is

preferable to use a good, light weight air mattress that may be inflated without the use of a pump.

### COOKING OUTFIT.

**MESS KIT.** For general use, when travelling with a car, especially if there are several persons in a party, a nested outfit of the best enamelware for four persons is convenient. When you leave the car behind and start out afoot, carry special boy scout mess kit of aluminum and a small Sterno folding stove, such as you may purchase for about 10 cents. Even out of the boy scout kit some items may be left out in order to decrease the load or merely one aluminum vessel and one steel frying pan with a folding handle may be carried. Knives, forks, spoons are best carried in a separate roll.

**STOVE.** Do not depend on making an open fire for your cooking, since in many favorable prospecting localities you will find no firewood and besides it takes too much time to gather and chop wood, and to make the mussy open fire. Get a two burner gasoline stove, preferably one with an oven and you will have a stove almost as good as gas stove at home. Besides this carry one burner Sterno folding stove to be used when going extremely light. Provide yourself with several large cans of "canned heat".

**EGG BOX** with a separate card board container for each egg, as used in shipping eggs by parcel post, will enable you to enjoy the luxury of fresh eggs that may be purchased directly from farmers on the road.

**WATER BAGS** are the best means of transporting water in arid regions. Constant oozing through the fabric keeps the water cool and palatable. Get one with 5 gallon capacity for the car and another one with 1—2 gallons capacity. For hiking, a felt covered canteen of about 2 quart capacity is more convenient. Vacuum bottles cannot be depended upon to keep the liquids cold in the intense heat of the desert.

## RATIONS.

As long as you travel in a car and are able to stop for a meal in a restaurant or can purchase almost anything for your own cooking, you do not have to worry about the rations any more than you do at home, and you may allow yourself to be guided entirely by your healthy appetite in the selection of proper variety and proper amount of food. When, however, you break away from civilization and leave the beaten path for the wilderness of the desert or mountains for any length of time, the problem of rations assumes an important aspect. Few general rules giving you the why's and wherefore's will be useful in guiding you in proper selection, leaving plenty of freedom for exercising individual preference and choice.

An adequate, well balanced diet, suitable to sustain vigorous health on a prospecting trip must have not only sufficient quantity, but also a variety, including: 1. Carbohydrates. 2. Proteins. 3. Fats. 4. Vitamins. 5. Stimulants. 6. Condiments. About 3—3½ pounds daily per man are necessary.

**CARBOHYDRATES.** Almost 2 lbs. of the total 3 pounds should be made up of foodstuffs that are chemically carbohydrates, i. e. flour, potatoes, oatmeal, cornmeal, rice, beans, peas, sugar, chocolate. Flour, oatmeal and similar foodstuffs are most conveniently carried in jars with screw caps. Fasten a 3 inch strip of adhesive plaster around the middle of the jar to prevent breakage.

**PROTEINS and FATS.** About one third of the ration, that is about 1 pound daily should be made up of proteins and fats. If you select for this portion lean bacon, pork, ham and not too lean meats and cheese for the chief source of proteins, it is not necessary to worry about additional fats, except in a very cold climate.

VITAMINS are contained in fresh and properly dehydrated fruits and vegetables, in milk, butter, eggs and powdered lemon juice. When leaving for the wilderness get as much of fresh fruits and vegetables as is convenient to carry.

STIMULANTS are tea and coffee. Best and most convenient form of coffee is G. Washington powdered coffee in tins, 6 oz. tin according to makers being sufficient for 75 cups of coffee. Burroughs Welcome & Co. Tabloid Tea in small, flat metal containers of 100 to 200 tablets is the most convenient way to carry very good grade of tea. Yerba Maté tea is preferred by some.

CONDIMENTS. Besides the necessary amount of sugar and salt the selection of condiments depends entirely upon your personal preference. Outdoor activity of prospecting produces such ravenous appetite that, as a rule, you do not need any condiments to tickle your palate and to bribe your appetite.

The above given amounts of rations are figured as low as possible and do not allow for waste due to spoiling. Besides, the trip may take longer than planned beforehand and you may have to share some meals with somebody else, which makes it wise to add a little as an extra margin of safety. In a book "Prospecting in Canada" compiled by the officers of the Geological Survey of Ottawa, Canada, the following ration list is given in pounds per man per day, calculating on the total 3.5 pounds daily:

Flour or hardtack	0.900
Baking powder	0.025
Cereal (oatmeal)	0.15
Beans	0.2
Rice	0.075
Evaporated potatoes	0.161
Split peas	0.025
Evaporated soup vegetables	0.022

Bacon and ham	0.75
Lard or crisco	0.06
Cheese	0.05
Crystallized eggs	0.03
Beef tea capsules (if desired)	
Sugar	0.35
Tea	0.06
Coffee	0.03
Chocolate	1 bar (small)
Onions (dессicated)	0.005
Barley	0.02
Milk (powdered)	0.15 (can)
Salt	0.04
Evaporated fruit	0.22
Pepper	0.002
Spices	0.002
Soap	0.02
Butter	0.15

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Total     3.50 pounds per  
                  man per day.

Few practical hints gathered from experience may not be out of place:

BACON and BEANS are the old standbys of the outdoor man and should never be omitted. Select the leanest bacon, ready cut and wrapped either in cellophane containers or in pitched casings. Beans are probably best carried in cans as "Pork and Beans", since it takes many ingredients and a long time to prepare beans tasting as well as those in a can.

CANNED GOODS, except beans, milk and fruit are not very suitable. Although they are time savers, and do not require any skill in preparation, one will soon get tired of them and will crave fresh food.

SOUPS are chiefly appetizers and do not contain



sufficient food value. In cans they are too bulky for practical purposes.

**EGGS.** Fresh eggs are the best and may be conveniently carried in special mailing cases, although somewhat bulky. Whole egg powder, tablespoonful of which with two tablespoonfuls of water make an equivalent to one egg, decrease the weight carried, but when water is to be transported, they do not have much advantage over fresh eggs.

**MILK.** We prefer evaporated milk in small cans. A six ounce tin of condensed milk is just about proper quantity for 2—3 cups of coffee. Powdered milk may also be used and is preferred by some, but the same objection may be made to it as to powdered eggs.

**CHOCOLATE** is a highly concentrated food, containing all the food elements necessary and may temporarily replace all other foods in emergency. A couple of bars should be carried in a metal container in the pocket as an emergency ration.

**MATCHES.** Paper matches in books, enclosed in at least two water proof tin cans with prying lids, sealed with paraffin, are very practical. For ordinary matches waterproof match boxes are the best. To be prepared for all emergencies, wrap one book of matches separately in tinfoil and then cover well with melted paraffin and allow to cool. Carry this package always in your pocket. Flashlight should be a part of every complete equipment. If you expect to be away in the wilderness for a long time, the magneto flash light, without batteries will be found very dependable, although somewhat expensive. Stonebridge lantern, using candles is storm proof, and since it folds flat, is easily carried. The candles may be used for some blowpipe tests.

**ART OF COOKING.** It is advisable to learn at least the rudiments of camp cooking before leaving

home. As a sort of preparatory training, make excursions into nearby woods or forest preserves with all camping equipment and stay a whole day, preferably also night. This will initiate you into the mysteries of the camp life and camp cooking and will undoubtedly prevent many disappointments on the trip.

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We may be accused of having devoted too much valuable space to the detailed description and minute choice of proper equipment. We may be told that the ordinary "desert rat" never even dreamed of such a formidable array of different items. The inadequately equipped prospector, however, faces many dangers and hardships, his life is a hard struggle and little chance and disposition he has left for enjoying the beauties and mysteries of the wide open spaces. In the proper and complete equipment lies the secret whereby the dangers and hardships of an ordinary prospector are transformed into glorious sport, into alluring adventure, the memory of which will always linger pleasantly in your mind.

The equipment recommended was selected as a result of experience in actual prospecting done, not in the expectation of fabulous riches, but in expectation of rich enjoyment of simple life in silent deserts and mysterious mountains of the great West. Even though we have not found an actual bonanza yet, we feel amply repaid for the time, energy and money spent on these pursuits of happiness, a good share of which was granted us. And if you ever get the full taste of this unclouded joy and happiness, you will certainly return year after year to this exhilarating sport, to this alluring adventure and will undoubtedly infect your very best friends with the microbe of enthusiasm for gold prospecting.

## CHAPTER IV.

### **MINERALS AND ROCKS.**

To derive full measure of pleasure and profit from the sport of gold prospecting it is necessary, like in any other sport, to learn the rules of the game and then to practice. The theoretical preparation and practical training can and should begin at home. Knowledge of mineralogy and geology, some of which is essential for gold prospecting, can be acquired easily, since the gold prospecting both in its theory and practice is much simpler than prospecting for other metals. We shall try to teach you the rudiments of mineralogy and geology clearly and concisely, with as little theoretical and technical terminology as possible.

#### A. MINERALOGY OF GOLD.

Gold is an element, that is a chemically simple substance that cannot be disintegrated into anything simpler. It occurs in nature in three forms:

1. Native gold (free, metallic, elemental).
2. Mechanically mixed with and dissolved in other metals and minerals.
3. Chemically combined.

#### NATIVE GOLD.

Native gold, which is almost always mixed with small quantities of silver, is very widely disseminated in nature and is found most commonly as rounded grains from pin point to pin head size, although it may occur as very fine sand, called "flour gold" or larger

pieces, so-called nuggets. These are usually bean shaped, except the largest ones. The heaviest nugget on record was found in Australia in 1852. Its weight was 223 pounds and it was worth almost \$50,000. The largest nugget found in California weighed 195 pounds and was discovered at Carson Hill in Calaveras County in 1854. In Monumental Mine in Sierra County, California there was found in 1860 a nugget weighing almost 1600 ounces, worth more than \$21,000. These, of course, are old finds, but there is a possibility that some of them may be duplicated. Some of the larger nuggets that were found recently are, as follows: In 1924 in Greaterville placers, Arizona, nugget worth \$228, in 1926 in Gila City placers in Arizona nugget worth \$88. In 1932 many nuggets worth \$10 and more were found in mountains south of Hot Springs, New Mexico. Native gold also occurs in the shape of scales, flakes, leaves, wires and very rarely of crystals. These forms of gold are usually found in quartz vein, while nuggets and flour gold are found in placer deposits. Native gold is the most important form for the amateur prospector.

If you find something what looks like gold, it may be gold, but it may also be some other quite worthless mineral. Several simple tests for bringing out the distinguishing properties of gold must be learned by the prospector:

1. **COLOR.** The characteristic color of native gold is pure deep yellow, which shades into paler yellow with increasing quantities of silver mixed with it. This color is the same, no matter from what direction the light strikes the specimen. Sometimes it may be necessary to rub the surface of the nugget in order to remove its tarnish which is produced by deposition upon its surface of some other, chiefly iron minerals, before the characteristic color is brought out. When melted

or scratched with a knife the color of gold remains always the same. Any yellow or yellowish mineral that is heavy should be subjected to further tests in order to determine whether it is gold or not.

2. **HEAVINESS**, technically called specific gravity. With the exception of platinum, gold is the heaviest metal and therefore any unusually heavy rock should be suspected of containing gold. A particle of gold will sink in quicksilver, while any other yellow mineral will float upon its surface.

3. **SOFTNESS**. In spite of its heaviness gold is soft and may easily be cut with a knife almost like lead, can be scratched with a copper coin and the line of the scratch, technically called "streak", is always yellow. Many other yellow minerals resembling gold are harder, cannot be scratched by a copper coin, and their streak is different from the color of the mineral, often being black.

4. **MALLEABILITY**. Gold is very easily hammered into very thin sheets without being crushed. Even a very small speck will flatten out and spread into a thin sheet, easily visible. Moisten the speck of gold with saliva and place it between two pieces of stiff paper. Place the paper on iron anvil and hammer hard. Instead of an anvil you may use a smooth stone and another stone for a hammer.

5. **INSOLUBILITY IN ACIDS**. All other minerals resembling gold are either soluble or are altered or decomposed in one or the other, or in all mineral acids, i. e. hydrochloric (muriatic), nitric and sulphuric acids. Gold is insoluble in any one of these acids, dissolving only in a mixture of one part of nitric and three parts of hydrochloric acid, which mixture is called "aqua regia". If the previous four tests are positive for gold, this acid-solubility test is not absolutely necessary for positive proof.

## MIXED GOLD.

Gold is frequently alloyed (uniformly mixed) with silver, up to almost half and half, in which case the characteristic yellow color of pure gold fades into more or less pale yellow. Less often it is found alloyed with small quantities of iron, copper, mercury and also with other rare metals. These mixtures, however, are not of much importance for the amateur prospector.

Gold is often found associated with pyrites, sometimes even in pyrite crystals. "Pyrite" is a group name applied to native sulphides of iron and copper, usually whitish or yellowish in color, with bright metallic luster. The gold contained in pyrites is usually mixed with them so intimately as to be entirely invisible, and has to be demonstrated by a method that will be described later on.

## CHEMICALLY COMBINED GOLD.

About the only element in nature with which gold becomes spontaneously combined is tellurium. These chemical combinations of gold, called tellurides, are an important source of gold, when found in large quantities, but they are not as common as native gold and mechanically mixed gold. There are several tellurides of gold, containing up to almost 50 per cent of gold. Their color varies from bronze or brass yellow to steel gray or black, exceptionally silver white. Their streak, that is the color of the scratch line, or line produced on unglazed porcelain varies from silver white, through yellowish to iron black. All of them are soft, the hardest being readily scratched with a copper coin. The most important tellurides are calaverite and sylvanite. Sylvanite is also called "graphic tellurium" and is usually found in quartz vein stuff appearing as clusters of silvery white crystals having a fancied resemblance to written Hebrew characters, hence the name

“graphic tellurium”. Another telluride, which besides tellurium and gold contains sulphur and antimony, is nagyagite or “foliated tellurium”, since it has a foliated structure. It is so soft that it may be scratched with a finger nail. Other important tellurides are petzite and hessite.

Whenever a grayish, yellowish or blackish mineral with a metallic luster is found, especially when the mineral is heavy and soft, a telluride should be suspected and the following test made:

Grind about pea-sized fragment of the material into fine powder, mix with sodium carbonate and charcoal dust and fuse in a small test tube. After cooling, add little water, and if telluride is present, the solution will assume purple (reddish violet) color. Put few drops of the solution on the outside bottom of a porcelain cup or any other non-metallic vessel and blow on it. The color will disappear and a gray precipitate of tellurium will settle down.

You may test tellurides also directly for gold by a method described on pg. 122.

## B. GENERAL MINERALOGY.

Some knowledge of mineralogy is indispensable to the amateur gold prospector, especially valuable being to him the ability to know those minerals and rocks that are often associated with gold. The best way to obtain this knowledge is to purchase a set of labeled minerals and rocks and to examine them repeatedly with great care, noting their luster, color and structure, to handle them, noting their feel and weight (hefting), to scratch them with copper coin, knife, glass, quartz and corundum, to determine their hardness; to strike small chips with hammer noting malleability or brittleness, to study their behavior on heating, with acids, etc. This will enable you to become

familiar with rocks and minerals, so that you can recognize them readily in the field and thus draw conclusions as to possibility of finding gold. These collections are not intended to be carried on a prospecting trip, being merely for home study, but small chips of the most important minerals and rocks may be carried in the car for the purpose of comparing them with other minerals in the field. About the most suitable for the beginner is the so-called "Washington School Collection of Rocks and Minerals" which contains 20 minerals and 20 rocks and may be purchased for \$5.00 to \$7.50. A collection of 50 specimens of ores of gold, silver, platinum and iridium is sold for \$75.00. This collection, of course, is only for those advanced in the game or those who want to do gold prospecting as their profession.

After you have become somewhat familiar with different rocks and minerals, you should start making your own collection of the specimens collected by yourself in the field, since in this way you will not only get a clear conception of the occurrence of the different minerals in nature, but their characteristic properties will be much better impressed on your memory, having been associated with other field observations. Be careful, however, to have your specimens correctly labeled. If not sure yourself, consult somebody who knows, professor of geology in a college or some mining engineer, or compare them with some other collection in a school, college or a museum. Otherwise you may be led into a serious error which, if not corrected, may affect your prospecting very unfavorably.

If a better knowledge of chemical composition of minerals and their determination is desired, take a correspondence course in Determinative Mineralogy as described on pg. 135.



A **MINERAL** is an inorganic, homogeneous substance, of definite chemical composition, found in nature. It is usually solid, rarely liquid, it may be either an uncombined element in a native state (e. g. native gold) or a chemical compound of two or more elements (e. g. telluride of gold).

## **PYRITES.**

Among the most important minerals from the standpoint of the gold prospector are the pyrites, that is minerals containing sulphur in chemical combination with different metals. Gold is very often quite closely associated with pyrites and their yellow or yellowish color may lead the inexperienced to mistaking them for gold on a superficial examination. The following are the more common pyrites:

**IRON PYRITE.** Brass yellow, often crystallizes in cubes of various sizes (crystallized gold being exceedingly rare), sometimes found massive. It is so hard that it cannot be scratched with a knife, but may be scratched with a sharp piece of quartz and the streak thus produced is dark greenish, almost black.

**CHALCOPYRITE.** This is a copper pyrite, found usually massive, rarely crystalline, can easily be scratched with a knife and has dark greenish, almost black streak.

**PYRRHOTITE.** (Magnetic iron pyrite). Found in crystals or massive, can be scratched with a knife, has a dark grayish, almost black streak and is magnetic.

The following are the tests used to differentiate between gold and pyrites:

1. **APPEARANCE.** Pyrites are not often found in sands and gravels, but when present, they occur in sharp, angular pieces, while gold nuggets almost always have worn, rounded edges. This is due to the fact that pyrites are much harder than gold.

2. **COLOR.** The color difference between the gold and pyrites may occasionally be so slight as to be of little value for positive differentiation. As mentioned above, the color of gold is the same, no matter from what angle it is looked upon, while the color shades of pyrites vary with the direction of light falling upon the mineral. The color of iron pyrites is often so deceiving that many times it has been mistaken for gold and for this reason is sometimes called "fool's gold".

3. **HARDNESS.** While gold can be scratched with a copper coin, pyrites are much harder, none of them can be scratched by copper coin, and some of them not even with a knife. When cut with a knife they will crumble, while gold cuts almost as easy as lead.

4. **STREAK.** The streak of pyrites gives varying shades between greenish and grayish black, while that of gold is always yellow.

5. **MALLEABILITY.** Pyrites will crumble under hammer stroke, while gold will very easily flatten out into thin sheets.

6. **WEIGHT.** Pyrites, in common with all other minerals, will float on the surface of mercury, while gold and platinum alone will sink. Larger piece of pyrite, when hefted, feels about as heavy as iron, while gold is heavier than lead.

8. **ROASTING.** When heated sufficiently, pyrites will smell of sulphur, while gold is entirely odorless.

9. **MAGNETISM.** Pyrrhotite and some other iron ores are magnetic or become magnetic after heating, while gold is never magnetic, which means, that it is never attracted by a magnet.

Wherever pyrites are found, you should always search for gold, especially small pyrite crystals in a quartz vein being a very good indication of the presence of gold. The method of testing for gold in the presence of pyrites will be detailed later.

## COPPER MINERALS.

Another group of minerals with which the gold prospector should become familiar are those containing copper. It is of great advantage to be able to recognize at least the more important copper ores, since gold is often found in close association with them. All copper minerals are colored: Chalcopyrite brass yellow, bornite reddish brown (color of horseflesh, therefore called "horseflesh ore"), often iridescent, a play of red, purple and blue (therefore also called "peacock ore"), chalcocite grayish black, sometimes green or blue on exposed surfaces and may also be iridescent, tetrahedrite iron black or steel gray, sometimes cherry red or brown, chrysocolla blueish-green or dull blue, azurite various shades of blue, malachite usually bright green, occasionally bluish green, melaconite black, cuprite various shades of red. All copper minerals are rather soft and somewhat heavy. There are two comparatively simple tests for positive determination of the presence of copper in an ore:

1. In the colorless flame of the Sterno heat or of alcohol flame finely powdered copper minerals produce emerald green color. To perform the test dip a moistened piece of an iron wire into powdered ore and introduce this into the flame or sprinkle a little of the powder directly on the flame. The test is preferably made in the dark and the color is observed best against a dark background.

2. A very simple test, applicable to many ores, may be performed, as follows: Soak a small fragment of the ore thoroughly in strong vinegar and then rub it on a clean knife or any other clean piece of steel or iron. Metallic copper of familiar red color will be deposited and may easily be recognized, if present in the ore.

**TABLE FOR DIFFERENTIATION BETWEEN GOLD AND OTHER MINERALS.**

	<b>Color</b>	<b>Streak</b>	<b>Hardness</b>	<b>Heaviness</b>	<b>Tenacity</b>	<b>Charasteristic property</b>
<b>Gold</b>	Golden yellow Brass yellow Pale yellow. may be tarnished	Golden yellow	Copper coin	Heavier than lead	Very malleable	No fumes on heating Soluble only in aqua regia
<b>Platinum</b>	Silver white Steel gray	Steel gray	Knife	Heavier than lead	Very malleable	Soluble only in aqua regia
<b>Tellurides</b>	Silver white Steel or lead gray Brass or bronze yellow Almost black	Gray to black	Finger nail or copper coin	About as heavy as iron	Brittle	Red color with sulphuric acid White fumes, no odor, on roasting Graphic tellurium: Hebrew characters Gold may be isolated from them
<b>Iron Pyrite</b>	Brass yellow Golden yellow Often tarnished	Greenish black Brownish black	Quartz	As heavy as iron	Brittle	Sulphur fumes on roasting Magnetic after heating
<b>Chalcopyrite</b>	Brass yellow to golden yellow	Greenish black	Knife	Lighter than iron	Brittle	Sulphur fumes on roasting Vinegar steel test
<b>Pyrrhotite</b>	Bronze yellow Bronze brown	Dark, grayish black	Knife	Heavier than quartz, lighter than iron.	Brittle	Sulphur fumes on heating Magnetic even before heating

**Explanations to the table:** Streak may be produced by making a line with the mineral upon a piece of unglazed porcelain, by scratching the surface of the mineral or smearing the finely powdered mineral over white paper. For testing hardness use: 1. Finger nail, 2. A copper coin (cent), 3. A piece of heavy plate glass with sharp edge, 4. A good steel knife, 5. A piece of quartz with a sharp edge and possibly 6. A piece of corundum with a sharp edge. In the table under hardness is given the softest thing that will still scratch the particular mineral.

Other minerals with which the prospector should become familiar are, as follows:

**QUARTZ.** This is a very common rock, probably familiar to everybody, its milky white variety being the most frequent. Being an oxide of silicon, it is sometimes called silica. It occurs as a colorless, transparent, resembling glass, or white and of many other colors and shades. In prospecting, look especially for rose colored quartz, since this variety is most frequently associated with gold. Quartz is so hard that it cannot be scratched with a knife, but may be scratched with a chip of corundum. It enters into composition of many gold bearing rocks, like granite, grano-diorite, schist and quartzite. Veins, ledges, seams and pockets of white quartz often occur in metamorphic and volcanic formations and frequently contain gold. Quartz containing gold is almost always found in close proximity of granite and slate. When decomposed, quartz sometimes looks like crushed loaf sugar. Gray, greasy looking quartz is often a very good indication of high gold value.

**CALCITE.** Commonly called limestone, occurs in various forms, massive, granular, columnar and chalky. It is commonly white, although it may be colorless, yellow, brown, blue, red, pink, green, black, etc. Being

a carbonate, it very easily effervesces (gives off bubbles of gas like soda water) in cold dilute acids and even in strong vinegar small bubbles may form, especially if the vinegar is heated. In a vein it is often found in crystalline form. Wherever there are limestone rocks, look for signs of iron and zinc, since they may lead you to gold deposits. Limestone enclosed by slate should always be examined for gold. Wherever limestone is in contact with igneous rocks, it almost always carries metals.

**ALUNITE.** It is usually of pinkish color, but may be white or greyish. It has a glassy, sometimes pearly luster, is brittle and may be easily scratched with a knife: streak white. Sometimes it is fibrous. When heated, it flies to pieces. When alunite is present in an outcrop, it is highly suggestive of the presence of gold.

**HORNBLLENDE.** This is a variety of amphibole, chemically calcium and magnesium silicate. Its most frequent color is very dark green to black, but it may also be brown and other colors and shades. When sufficiently heated, it fuses quietly, usually with some swelling into a dark, shiny globule. It resembles somewhat mica, but is harder and does not split as perfectly as mica. It can be scratched with a knife. The greenish tint of the mineral becomes especially distinct when the mineral is struck with a hammer.

**GYPSUM.** This is a very soft mineral (can be scratched with a finger nail) of glassy, sometimes almost pearly luster. It is colorless, white, light brown or reddish. When heated, it crumbles to a white powder.

**BARITE.** It is called also "heavy spar", because of its high specific gravity (weight). It is white, yellow or brown with a glassy luster. Insoluble in acids

and when heated, flies to pieces. Barite is always a very favorable indication of ores.

FELDSPAR is a name given to a group of aluminum silicates with potassium, sodium and calcium. The feldspars have in common several properties, all of them are hard (being only slightly softer than quartz), therefore quartz will scratch them, but knife only with difficulty or not at all. They all have perfect cleavage, and are about as heavy as quartz. They vary in colors from reddish flesh color to grayish and white. Usually they are opaque and often found in crystals in different rocks. They are very abundant and important rock-forming minerals. Potash feldspar, also called orthoclase, is usually responsible for the color of granite, red granite having orthoclase, which is colored by red stain. Feldspars are very good indications of paying ore.

SERPENTINE. It is a very common mineral, found usually massive, compact, also fibrous, is of dark green color, sometimes almost olive green, at other times brown or black with greasy luster. Feels smooth, sometimes greasy. It is a common product of metamorphosis of igneous rocks rich in magnesium silicate. Serpentine is a good ore indicator.

## C. GEOLOGY.

Geology is a science describing the composition and arrangement of the rocks forming the earth crust and the formative forces that have produced this arrangement.

The crust of the earth is composed of rocks, each rock being composed of one or more minerals.

Rocks may be classified according to their

### I. Composition:

1. Simple — composed of one mineral, e. g. quartz, limestone, amphibole, hornblende, magnetite, etc.

2. Compound — composed of several minerals, e. g. granite, syenite, diorite, diabase, malaphyre, porphyr, quartzite, trachyte, phonolite, basalt, lava, gneiss, etc.

## II. Structure.

1. Granular — composed of visible, fine or coarse grains or crystals without cementing substance between them, e. g. granite, syenite, diorite, diabase, etc.

2. Amorphous — in which the granular composition cannot be distinguished, e. g. obsidian.

3. Clastic — composed of larger or smaller pieces of some older rock crushed and cemented together, e. g. conglomerate, breccia.

## III. Origin.

1. IGNEOUS ROCKS (unstratified). These rocks originated from the molten mass of the earth's interior and have solidified on cooling. Gold deposits are almost always associated with, close to or formed by the action of igneous rocks and it is therefore quite important to keep the common characteristics of igneous rocks constantly in mind in order to be able to recognize them with ease. Igneous rocks almost always contain large or small, opaque, white, gray or red specks (feldspar), all of them are hard, never have any fossils (plant or animal impressions) and often intrude as veins, dikes, etc., into other rocks.

Igneous rocks are further subdivided into:

A. PLUTONIC (deep seated, massive) rocks that have solidified without having been exposed to the air and therefore they are never porous nor glassy. They are always crystalline and usually coarse grained. Wherever they are found on the surface, they have been exposed by erosion. The most important plutonic rocks are granite, syenite, diorite and gabbro.

B. VOLCANIC rocks, whose volcanic origin may clearly be demonstrated. They are finely grained, may



be amorphous and glassy and most of them are grayish. The commonest volcanic rocks are phonolite, diabase, trachyte, andesite and basalt.

2. **SEDIMENTARY** (stratified) rocks were deposited by the processes of sedimentation from water solutions and thus they formed large sheets or masses — strata. They are classified into:

A. **SAND ROCKS** (arenaceous): sand, gravel sandstone, conglomerate, breccia.

B. **CLAY ROCKS** (argillaceous): clays, muds, shales and slates.

C. **LIME ROCKS** (calcareous): limestone, marble, chalks.

3. **METAMORPHIC ROCKS**. These were originally either sedimentary or igneous rocks, but having been subjected later to extreme heat, their texture has undergone considerable alteration. The most important of these are gneiss, quartzite, schist, serpentine and marble.

Below are brief descriptions of the most important rocks:

**ANDESITE**. A light gray or reddish volcanic rock with large or small crystals, in texture resembling trachyte, or dark gray, almost black, resembling basalt.

**BASALT**. Massive, hard, heavy, dark-grayish, almost black rock with either large or small crystals. When exposed to atmosphere for a long time, its color changes to rusty brown. It often forms rough columns and sometimes intrudes other rocks.

**BRECCIA**. Fragmental rock composed of sharp, angular, not water-worn fragments of different rocks cemented together.

**CONGLOMERATE**. Popularly called also “pudding stone”, because the large pebbles it contains, give it appearance of plums in plum-pudding, is a rock composed of rounded, water-worn pebbles, cemented together.

**DIABASE.** A basic, igneous rock, occurring in dikes or intrusive sheets, granular, often porphyritic, usually dark greenish, but somewhat lighter in color than diorite.

**DIORITE.** A rock resembling granite, granular, sometimes apparently massive, dark green with white and black specks composed of small crystals of plagioclase.

**GABBRO.** Usually coarsely, rarely finely granular, igneous rock, resembling amphibolic diorite.

**GNEISS.** Called also bedded granite, is a widely disseminated metamorphic rock, usually gray, yellowish or greenish, composed of the same minerals as granite, but the crystals are not mixed together without definite plan like in granite, they are arranged in parallel bands or layers producing a layered appearance with a tendency to cleave in slabs but not as well as in a schist.

**GRANITE.** Coarsely or finely granular igneous rock of all shades of color from light gray to reddish, speckled or mottled, being composed almost entirely of crystals (never rounded grains) of various shapes and colors without any visible cementing substance between the crystals. The minerals composing granite are quartz (glassy, transparent or bluish), feldspar (opaque, white, gray or red), hornblende (black) and mica (glistening scales of various colors, white, black, brown). There is a great variety of granites and when some minerals predominate or are replaced by some other minerals, the varieties are designated according to this particular mineral. All granites are more crystalline than any other igneous rocks, are never porous nor vesicular. Commercially almost all compact igneous rocks are called granites as distinguished from slate, sandstone and marble. The lines of contact between granite and other rocks often contain rich

veins and gold is frequently very closely associated with granite. Granite with large crystals (coarse grained) and irregular in texture and composition is called giant granite or pegmatite. Some pegmatites carry minerals containing, besides gold, rare metals, e. tin, tungsten, tantalum, uranium, etc.

**PHONOLITE.** Light gray, greenish or yellowish, massive, cracks easily into large sheets that emit clear ring when struck by a hammer, hence it is called sometimes clinkstone. It is often associated with rich deposits.

**QUARTZITE.** Rusty, white, masonry-like in structure, massive, granular or schistose metamorphosed sandstone, so changed by secondary deposition of quartz around the grains of sand. It is less brittle and more firmly cemented than common sandstone and tends to break across the grain.

**SCHIST.** Sometimes also called laminated gneiss or laminated granite, is a group name applied to any crystalline rock that can readily be split into thin sheets. It is of the same composition as granite, but the crystals of the constituent minerals are all arranged in one direction producing parallel or foliated structure with resulting easy cleavage. There is hornblende schists, mica schist, talc schist, so-called according to which mineral preponderates in its composition.

**SLATE** is a fine grained rock composed of several minerals which are so finely ground that they cannot be distinguished by the unaided eye. It is characterized by easy cleavage into large sheets. Usually it is dark, even black, but may also be colored red or green. It often contains gold on its surface.

**SYENITE.** In composition it is the same as granite, but it contains no quartz, therefore it is sometimes called quartzless granite. It is dark gray or almost black or reddish with fine grains of potash

feldspar or orthoclase (gray or reddish) and amphibole or hornblende (greenish or black). There are intervening forms between granite and syenite, sometimes being quite difficult of definite differentiation.

TRACHYTE is a glassy, very common igneous rock, often porous, has a peculiar rough feel, usually light colored, gray, yellowish or reddish. There is no free quartz in it.

PORPHYRY is the designation applied to any igneous rock in which distinct, large crystals are visible in finely granular or glassy substance producing a spotted appearance. Porphyries are named either according to the composition of their groundmass (granite porphyry) or according to the large crystals contained (quartz porphyry). Sometimes the word "porphyry" is used in designating any igneous rock occurring in sheets or dikes, especially when the rock is spotted, soft or light colored.

## CHAPTER V.

### WHERE TO PROSPECT.

Every sport must have a field, a playground, for its successful consummation. If you wish to follow the sport of gold prospecting, it will be necessary to select proper playground in order to enjoy it to the best advantage and to increase as much as possible the chances of a rich discovery.

Gold is very widely disseminated throughout nature and may be found in any geological formation from the oldest rocks to the deposits that are still being formed, but in common with many other metals it is more likely to be found in the oldest rocks and in those regions where the earth crust has undergone the most extensive changes, like elevations, folding, tiltings, faults (slips), fissuring and also volcanic action in general, with resulting changes in the composition and the texture of the rocks

Speaking of the origin of gold in California, Arthur S. Eakle makes the following statements in "Minerals of California":

"The great supply of gold was brought into California with the intrusion through the Mesozoic sediments of the mass of igneous granitic rock which forms the core of the lofty Sierras. The intrusion of the great plutonic mass lifted on high the overlying sediments, tilted, folded, faulted and metamorphosed the Cretaceous sediments on the flanks of the uplift into slates, schists, quartzites and crystalline limestone; and in the joints and fissures of the granitic and

metamorphic rocks, gold bearing quartz was deposited, forming veins and seams of the precious metal."

And thus it happens that the prospector turn to the mountainous regions of the western states in the hunt for the yellow metal.

Even if you go haphazard, without any definite plan, about prospecting, you run some chance of striking gold in the western states. It is therefore advisable to practice the panning habit on the western travels. Pan the streams you cross, the dry beds of rivers and also the sands of the desert wherever you happen to pitch your tent. You may discover "colors" in your pan. While hiking or hunting in the mountains of the great West, be on the lookout for any peculiarities of the earth surface and of the rock formations, try to recognize and name the various minerals and rocks that you encounter, keep your eyes open for any outcrops, peculiarly looking minerals, especially if heavy, or any surface indications, since by doing so you will not only increase your enjoyment of the nature, but you may also make a surprising find.

"It is notable that many rich mines have been stumbled on by accident," says Frazier in his "Secrets of the Rocks", and continues: "This is the sequence of chance and not the rule. If the prospector depends altogether upon chance for his find, the probability of his locating a paying mine is remote. Cruse of Montana followed a lead for twenty years before he uncovered the bonanza which made him a millionaire in a day. It was not chance that led Gregory from the mouth of Clear Creek almost to its source to locate the lode which has for four decades been pouring out a stream of golden wealth for the benefit of mankind — and will continue to do so, perhaps, long after the first discoverer has been forgotten. This prospector followed up the trail of the golden sands as unerringly

as the hound trails the hare until he located the parent lode in the famous gulch which now bears his name.”

It is therefore the systematically planned work that offers the best chance of striking it rich. Thorough preparation by dilligent study, complete, proper equipment and careful planning by the use of maps are the most important preliminaries of a prospecting trip.

As soon as you select a state that appears most attractive to you as a prospecting ground, send for a geologic, and if available, also for topographic maps of the state. Below are given addresses of the state bureaus, names of the desirable maps and of the literature having an important bearing on prospecting in the particular states:

**ARIZONA.** (14,370,000 acres of public lands).

Geologic maps of Arizona. (50c.)

Topographic map of Arizona. (50c.)

Bulletin No. 41. Mineralogy of Arizona. (10c.)

Bulletin No. 59. Yavapai, The Land of Opportunity by Grace M. Sparkes. (10c.)

Bulletin No. 118. Arizona Gold Placers. (New edition in preparation)

Bulletin No. 119. A Resumé of the Geology of Arizona, by N. H. Denton. 298 pg. Illustrated. (\$1.00)

Address: Arizona Bureau of Mines, Tucson, Ariz.

**CALIFORNIA.** (16,000,000 acres of public lands).

Geologic map of California. (75c.)

Geologic map of Inyo County. (60c.)

Bulletin No. 91. Minerals of California. 167 pgs. Cloth binding. (\$1.00)

Address: Division of Mines, Ferry Building, San Francisco, Cal.

**COLORADO.** (7,600,000 acres of public lands).

The geologic map of Colorado is out of print, but the U. S. Geological Survey hopes to have it ready for distribution about January 1933, when it may be secured from the Director of Geological Survey, Washington, D. C.

Topographic map of Colorado. (\$1.00)

Southeastern Colorado: A general geologic blue print map covering the area east of the foothills and south of the Arkansas River, issued in three sections. (Complete set \$1.25)

Bulletin No. 3, 1910: Geology and Ore Deposits, Alma District, Park County. (25c)

Bulletin No. 4, 1912: Geology and Ore Deposits of Monarch and Tomichi Districts, Chaffee and Gunnison Counties.

Bulletin No. 5, 1912: Geology of the Rabbits Ear Region, Routt, Grand and Jackson Counties. (Bul. No. 4 and No. 5 sold together for 50c.)

Bulletin No. 9, 1915: Geology and Ore Deposits of Bonanza District, Saguache County. (25c)

Bulletin No. 10, 1916: Geology and Ore Deposits of Gold Brick District, Gunnison County. (25c)

Bulletin No. 13, 1917: Geology and Ore Deposits of the Platoro-Summitville District, Rio Grande and Conejos Counties. (25c)

Bulletin No. 17, 1921: Twin Lakes District, Lake and Pitkin Counties. (25c.)

Bulletin No. 21, 1921: The Geology of the Ward Region, Boulder County. (25c.)

Bulletin No. 31, 1925: The Geology of the Tarryall Mining District, Park County. (25c.)

All these bulletins contain geologic maps of the district described.

Address: Dr. R. D. George, University of Colorado, Boulder, Col.



Geology and Natural Resources of Colorado, by R. D. George. (\$2.00). Address: Campus Bookstore, University of Colorado, Boulder, Col.

## IDAHO.

No geologic map of the state has even been published, but the various bulletins and professional papers of the U. S. Geological Survey contain such maps.

Bulletin No. 3. A Reconnaissance in South Central Idaho. 1920. (15c.)

Bulletin No. 7. Geology and Gold Resources of North Central Idaho. 1924. (50c.)

Bulletin No. 9. Geology and Gold Resources of the Boise Basin, Boise County, Idaho. 1924. (50c.)

Bulletin No. 10. Geology and Ore Deposits of Boundary County, Idaho. 1924. (50c.)

Bulletin No. 11. Geology and Metalliferous Resources of the Region about Silver City, Ida. 1926. (50c.)

Bulletin No. 12. Geology and Ore Deposits of the Clark Fork District, Idaho. 1930. (50c.)

Bulletin No. 14. Geology and Mineral Resources of Eastern Cassia County, Idaho. 1931. (50c.)

Pamphlet No. 27. Geology and Ore Deposits of the Birch Creek District, Idaho. 1928.

Pamphlet No. 32. Geology and Ore Deposits of the Lava Creek District, Idaho. 1929.

Pamphlet No. 34. The Geology and Mineral Resources of the Region about Orofino, Idaho. 1930.

Buletin No. 814. Geology and Ore Deposits of the Wood River Region, Idaho, by J. B. Umpleby, L. G. Westgate and C. P. Ross, with description of Minnie Moore and near-by mines by D. F. Hewett. 1930. 250 pages, 33 pls. (90c.) Obtainable from the Director of U. S. Geological Survey, Washington, D. C.

For the other bulletins and pamphlets address: Steward Campbell, Boise, Idaho.

**MONTANA.** (6,600,000 acres of public lands).

The Bureau of Mines in cooperation with the U. S. Geological Survey is at the present time preparing a geologic map of the state of Montana, which will be ready for distribution sometimes the end of this year (1932).

Bulletin No. 6. Geology and Ore Deposits of Banack and Argenta, Montana. (50c.)

Memoir No. 4. The Geologic Structures of Western Montana. (In preparation).

Address: State Bureau of Mines and Geology, Butte, Montana.

**NEVADA.** (51,400,000 acres of public lands).

There are no geologic maps of this state, except small maps accompanying reports in a great many of the mining districts issued by the U. S. Geological Survey, Washington, D. C.

Bulletin No. 1. Mackay School of Mines: The Identification of Nevada's Common Minerals, with chart. (50c.)

Bulletin No. 3. Mackay School of Mines: Note on the Ore Deposits of Cave Valley Mining District, White Pine County, Nevada. (Free)

Bulletin No. 4. Mackay School of Mines: A Preliminary Survey of Scossa Mining District, Pershing County, Nevada. (Free)

Mining Districts and Mineral Resources of Nevada by Francis Church Lincoln. 1932. (\$1.50)

Ore Deposits of Gold Circle Mining District, Elko County, Nevada. (In preparation).

Address: Mackay School of Mines, University of Nevada, Reno, Nev.

**NEW MEXICO.** (14,380,000 acres of public lands).

Geologic map of New Mexico. (\$1.50)

Bulletin No. 5. Geologic Literature of New Mexico. T. P. Wootton. 1930. (25c.)

Circular No. 1. An Outline of the Mineral Resources of New Mexico. (Free).

Circular No. 2. Geology and Ore Deposits of the Ground Hog Mine, Central District, Grant County, N. M. 1930. (Free)

Address: State Bureau of Mines and Mineral Resources, New Mexico school of Mines, Socorro, N. M.

OREGON. (12,980,000 acres of public lands).

For geologic literature and maps see "A List of Publications of the United States Geological Survey", Washington, D. C.

SOUTH DAKOTA.

Bulletin No. 14. The Geology, Mineralogy and Scenic Features of Custer State Park, South Dakota. (40c. plus postage).

Bulletin No. 15. The Tertiary Mineralization of the Northern Black Hills. 130 pages. 1927. (Free for postage, weight 1 lb.)

Bulletin No. 16. The Mineral Wealth of the Black Hills. 418 pages. 1929. (80 cents plus postage 21c.)

TEXAS.

Map of Pre-Cambrian Texas and Map of Upper Cambrian and Lower Ordovician Seas in Texas. (\$1.00)

Preliminary Map of Underground Position of Pre-Cambrian in Texas. (25c.)

Geologic Map of the Solitario in Texas, in Brewster and Presidio Counties. (50c.)

Bulletin No. 2738. Geology and Mineral Resources of the Fort Stockton Quadrangle. 166 pgs. 1 map. 6 plates. (75c.)

Bulletin No. 2744. Igneous Rocks of the Balcones Fault Region in Texas. 178 pgs. 9 plates, 1 map (\$1.00)

Bulletin No. 2745. Exploratory Geology of a Part of Southwestern Trans-Pecos, Tex. 70 pgs. 1 map. 50c.

Bulletin No. 3125. The Geology of Grayson County, Texas. (50c.)

Address: The University of Texas, Division of Conservation and Development of Natural Resources, Austin, Texas.

UTAH. (25,150,000 acres of public lands).

The State of Utah has never maintained a geological survey and has issued no geological reports except a few bulletins of the University of Utah.

For literature and maps see "A List of Publications of the United States Geological Survey," Washington, D. C.

WASHINGTON. (930,000 acres of public lands).

Bulletin No. 1. Geology and Ore Deposits of Republic Mining District. (35c.)

Bulletin No. 5. Geology and Ore Deposits of the Myers Creek and Oroville, Nighthawk Districts. (50c.)

Bulletin No. 6. Geology and Ore Deposits of the Blewett Mining District. (50c.)

Bulletin No. 7. Geology and Ore Deposits of the Index Mining District. (50c.)

Bulletin No. 20. The Mineral Resources of Stevens County. (\$1.00)

Bulletin No. 23. The Metal Mines of Washington. (\$1.00). Where reports are sent outside the state, postage will be charged in addition to prices given above.

Address: State Librarian, Olympia, Washington.

WYOMING. (15,250,000 acres of public lands).

Bulletin No. 20. Atlantic City South Pass Gold Mining District. 1926.

Address: John G. Marzel, State Geologist, Capitol Bldg., Cheyenne, Wyo.

Besides the maps and bulletins enumerated above, the U. S. Geological Survey has published a great number of maps, reports and other literature pertaining to all these states, a literature too extensive to be enumerated in this little volume. All of these are listed in "A List of Publications of the United States Geological Survey" which may be obtained free by writing to "Director, U. S. Geological Survey, Washington, D. C." In the finding list of this catalogue look under the name of the state you are interested in and note carefully, whether the particular item is still available, or out of print.

The geologic maps are of extreme importance to the prospector, since they show him where different rocks are exposed, give locations of plutonic, volcanic, metamorphic and other rocks and their contact zones, often they show faults, and thus narrow down the prospector's search to places that are most promising. As mentioned above, gold may be found in any geological formation, but in common with other metals, the lode-gold is more likely to be found in plutonic and volcanic rocks and in their vicinity. It would be useless for a prospector to look for a gold bearing lode in a ground covered with drift. In his search for gold he will explore especially the contacts of intrusive rocks with older formations, with metamorphics and especially with limestone beds. The association of gold with certain rocks will be discussed later on in detail. Most geologic maps contain also data on elevations, contours, and some give also locations of different mines.

**TOPOGRAPHIC MAPS.** When by a preliminary study of geologic maps you have decided on a certain locality for prospecting, write to the Director of U. S. Geologic Survey, Washington, D. C., or to a proper state bureau and ask for an "Index Topographic Map"

of the state you are interested in. This will be mailed free of charge. From the Index Map select special maps that cover your locality, its vicinity and localities, through which you have to pass. These maps sell 10 cents a piece, when sold singly, and \$3.00 for 50 maps ordered at one time. The most important features of these maps are contours, grades of elevations, hills, mountains, canyons, springs, etc. They can be well depended upon for these features, but not, as a rule, for automobile roads, since most of them were made years ago.

On the Index Maps are also marked localities for which the U. S. Geological Survey has issued geologic folios. Many of these folios are out of print, but if available, order them too, since they will prove very valuable help in prospecting. List of geologic and other reports accompanies each index map and should be looked over quite carefully for reports of special interest to the prospector, especially "Water Supply Papers" covering many deserts.

Carry the local topographic maps with you while prospecting. They are very useful for orientation. Whenever you find some interesting mineral or rock, you want to test more carefully later on, number the sample and note the place on the topographic map with the same number to assure yourself of finding the place again. A small pile of rocks is useful in marking the exact location of the find. Many valuable discoveries have been lost because their exact location was not noted.

Since local topographic maps are comparatively very cheap, several copies of the same map may occasionally be purchased, to be used by other members of the party, or the map may be cut to pieces and a small portion of it carried only, or one copy may be preserved clean and the other used for marking the

locations of discoveries and other interesting features. The maps that are to be used frequently, should be mounted in such a way that they may be easily folded and carried. The following directions will insure satisfactory mounting:

The best material for mounting maps is white, brown or gray muslin. Stretch a piece somewhat larger than the map upon a board, table or floor with thumb tacks. Tack one side first, then the opposite side and finally the two remaining sides. Tacks should be one to two inches apart. Be sure to have the surface of the stretched muslin perfectly smooth. If it is not, take out the tacks and stretch anew. Cut the map into pieces of the size to which you want to have it folded, using either a safety razor blade guided by a ruler or large scissors, cutting on a previously marked line. Now spread good mucilage on the backs of the cut pieces, using plenty of it, and put the pieces aside for a little while to allow the mucilage to soak in well and the paper to spread, to prevent wrinkling. When ready, grasp a piece at the lower edge, put it lightly in its proper position on the muslin, cover with a large piece of paper, press and smoothen out with a clean, dry rag. A space of about 1/16th of an inch should be left between the pieces to permit easy folding. Allow the mounted map to dry thoroughly before removing the tacks.

## PROMISING LOCALITIES.

While the lack of available space prevents us from enumerating all the promising fields in the great West, still we wish to recommend several regions as especially favorable for the gold prospector.

**PANAMINT RANGE.** Although gold was found in all the mountain ranges surrounding the Death Valley in California, still the Panamint Range with its

plutonic core overlaid in places by Cambrian metamorphics is most promising for gold prospecting. There have been many discoveries of gold in the past three quarters of a century, some gold mines were deserted, but the men who know, believe that there are still many rich deposits in this range that have not been discovered yet. Before establishing a camp in this region, assure yourself of satisfactory water supply. Springs and wells are marked on geologic maps and also on the topographic maps, and most of them, especially those near the main roads, are marked by signs erected by the U. S. Geological Survey, State Geological Survey and by Auto Club of Southern California. Carry an ample supply of water anyway, since some of these springs may be dry and some not very clean for drinking. Your very life may depend upon sufficient water supply in this region. Spring and early summer are the most favorable seasons for prospecting in these mountains. While the summer temperature in the Death Valley reaches up to 135 degrees in shade, it is less oppressive than the humid heat of the Eastern cities, and in surrounding mountains the days and especially the nights are much cooler. Carry a geologic map of Inyo County published by the State of California, also topographic maps of Ballarat, Furnace Creek, Ivanpah and Lida quadrangles. Be sure to have plenty of gasoline, oil and water for the car before you venture into the torrid heat of the Death Valley. Most main auto roads are well marked and although passable in summer, may be in a very poor condition. Be sure to have a dependable car, if alone, better is a party with two cars. There is an airplane field at Furnace Creek Inn in Death Valley and plenty of good landing places on the dry lake in Panamint Valley and on the so-called "Racetrack" in the northern part of the Panamints. Autogiro may be able to land even in some places in the mountains, although the mountains



are mostly very steep, wild and not inhabited, but with proper precautions are not dangerous. We believe there is plenty of undiscovered gold in the Panamint Range.

**ARGUS** and **SLATE RANGES**, lying west of the southern spur of the Panamints, are also highly promising, although they have been prospected much more thoroughly than the Panamint Range. The heavy rains and snows of the last winter make it probable that some rich deposits have been uncovered.

**WHITE MOUNTAINS** in the northern part of the Inyo County, east of Bishop, are also rich in gold, but they are accessible with some difficulty.

**MONO COUNTY** lying north of Inyo County, California, offers very good field for the amateur prospector, but the work has to be done in summer only, because winters are sometimes quite severe, due to elevation above 5000 feet.

**ALPINE COUNTY**, California. "This county lies just south of Lake Tahoe, in the high Sierra Nevada. Transportation is by auto, wagon, or mule back, and facilities in general are lacking to promote development work. The mineral resources of this section are varied and the country has not yet been thoroughly prospected. Occurrences of barium, copper, gold, gypsum, lead, limestone, pyrite, rose quartz, silver, tourmaline and zinc have been noted here." (Henry H. Symons in "California Mineral Production" for 1929).

**KLAMATH RIVER** flowing through northern California offers a very good example how other sports may be enjoyed with gold prospecting. There is excellent fishing (salmon, trout) in the river and in the surrounding mountains large and small game hunting is at its best. Sequoia groves, rugged coast line, beautiful marine scenery, placid lagoons, all of these combine to paint a beautiful picture of sportsman's par-

adise that has not been sufficiently appreciated by the tourists visiting California.

Klamath River originates in Oregon, but from the standpoint of gold prospecting only that portion of it that runs through Siskiyou, Humboldt and Del Norte Counties of California is of importance.

“Klamath River and its tributaries have been the most important agents in the distribution of placer gold through Siskiyou County..... From Weitchpec down the lower Klamath is practically virgin ground so far as the placer miner is concerned. One reason for this is that a large portion of the river is still in the Hoopa Indian Reservation, and has not yet been opened for prospecting..... It is only in the old channels of the Klamath that good values appear to be found.” These are some of the remarks made on Klamath River prospecting by Charles Scott Haley in his “Gold Placers of California”, published by California State Mining Bureau.

Near the mouth of Klamath is a small town Requa. Here the river is wide, smooth stream flowing between high forested banks, but in its upper course the grade is much steeper and the flow much more rapid and turbulent. Lower portions of the river are accessible by a boat or trail only, the upper portions by good auto road. The lower portion of the river is most picturesque and most important for the gold prospector. Gold is found both in recent bars and also in old bars high above the present level of the river where the water flowed ages ago. In the near by mountains “The slates carry thin seams of quartz which is often rich in gold,” states the above quoted Haley.

COLORADO RIVER, both up and down from Topock, Arizona, and the region adjoining the river on both sides, offers very good field for amateur prospecting. In summer the weather is unusually hot,

since all the region around is desert. The sands of the river contain flour gold, that is very fine gold in small quantities, especially in the high benches and bars after floods. In the spring the river is subject to heavy floods, coming sometimes very suddenly. We would suggest to stop first in Topock, Arizona, or Needles, California. Either one of these towns may be reached by a good auto road or by Santa Fe trains. From there you can make excursion to Chemehuevis mountains with their picturesque "needles" where considerable gold was found in the desert sands. Black Mountains in Arizona, just east of the river are also promising. Turtle Mountains, southwest of Needles, will be mentioned separately later on. If you have a folding boat and an outboard motor, you may undertake enjoyable trips up and down the river and prospect on both sides. This will give you access to territory so extensive that it would take several months to cover it thoroughly. Being close to the river all times, it is not necessary to worry about the water, but if you cut loose from the river, be sure of ample water supply, since otherwise the prospecting would be an unusually dangerous undertaking in that wild region.

**TURTLE MOUNTAINS** in San Bernardino County, California, about twenty miles south and somewhat west of Needles. Pre-Cambrian metamorphics are the chief formation of this, about 30 miles long range, and therefore favorable for gold deposits, since volcanic formations are not far away. The mountains are best reached from Needles by Parker road for about 15 miles and then branching southwest in the direction to Carson's Wells in the Turtle Range. There are at most two springs in this range that can be depended upon, so that the question of water supply is of paramount importance in prospecting. At least twice a very rich strike was made in these mountains, but both

times the discoverers' lives were seriously endangered by the lack of water. There is a story that in one of the narrow gulches in this range is a natural bridge beneath which a prospector looking for water found very rich auriferous gravel with many gold nuggets of considerable size. This natural bridge was discovered again several years afterwards once more, but since then its location has been lost and the very rich placer ground is still waiting for some lucky gold hunter. There was also another rich strike made in the same mountains and subsequently lost, not to be discovered up to this time.

ARCHULETA COUNTY in Colorado, according to state reports lies in what is known as gold belt, but has not been properly developed. "Archuleta County, a large portion of which was for many years closed to prospectors, has been given study and exploration during the past two years, especially with reference to the large porphyry dikes carrying values in gold. No extensive development has been done to determine the extent of ore depositions, but conditions in this section appear favorable for mining operations on a good sized scale." (J. F. Clougher in Annual Report of the Bureau of Mines for the year 1930.)

CASCADE RANGE in Oregon. The Department of the Interior of the State of Oregon makes the following comment on the gold deposits in the Cascade Range:

"The mapping so far accomplished brings to notice a rather striking alinement on the west slope of the Cascade Range of the districts that contain base metal and gold ores. Beginning at the Barron mine, east of Ashland, such deposits are known at intervals as far north as Cheeney Creek, east of Oregon City. Those examined in 1930 are, in order from south to north, the deposits of the Buzzard mine and the Bo-

hemia, Blue River and North Santiam Districts. In these three districts the deposits are known to be genetically connected with intrusive granitic rocks. At some intervening places the occurrence of metalliferous lodes is reported. All the deposits and intrusive bodies are distributed along a nearly straight line that is parallel to the axis of the range and about 25 miles west of the divide. This alinement suggest a great break or zone of weakness in the basement rocks of the west side of the Cascade Range along which igneous magma and the accompanying mineralizing solutions were able to rise. It is an interesting speculation, therefore, that in the gaps between the known districts undiscovered mineral deposits may be present."

**WESTERN OREGON.** Many gold bearing districts in Jackson and Josephine Counties are worthy of thorough prospecting. Among those which might be considered first are the Ashland, Jacksonville, Gold Hill and Greenback Districts.

**EASTERN OREGON,** which includes both Baker and Grant Counties, is probably the most important gold region in Oregon, and possibly promising of as many new finds and new discoveries as any region of the West. The mountains are high and rugged. Countless clear streams of melted snow run all year round. It is sparsely populated, many parts uninhabited and there is plenty of game and fish. The famous Virtue, Bonanza, Baisley-Elkhorn, North Pole, E and E, Columbia and other mines have produced millions. The placer field of Auburn, Oregon, near Baker City, have produced since the late 60's of the last century. The opal mines and opal discoveries along the streams in the Eastern Oregon region have made them famous. Back in the hills, away from the highways, the region has seldom been seen and in many places barely scratched. Baker and Grant Counties of Oregon prob-

ably have more opportunities for tourist prospector, sportsman prospector, professional prospector and for associating yourself with prospectors who have already found gold deposits and need help to develop, than any two counties in United States.

**TONOPAH DISTRICT** in Nevada. There are several very rich silver mines in the district, but there is undoubtedly plenty of gold to be discovered in the outlying or surrounding country, according to the opinion of Mr. Letson Balliet, prominent mining engineer who in his "Pioneers of the Wasteland" says:

"This region for a fifty mile radius, in which the Clifford Mine is included, is one of the most isolated sections of the Great American Desert, one of the regions known to be rich in gold and silver and (except in one or two places) mankind has made very little inroads upon the fortunes that are buried there. It is the virgin ground that offers opportunity to man. Fortune hunters do not rush to old mining camps that are already owned and are producing tremendous wealth, because that wealth is already owned. It all belongs to somebody. The newcomer has no opportunity to get any of that wealth, but to the new districts, where nature's treasures have not been found, have not been owned, is the place where opportunity is open to man..... It (Nevada) is the state that has barely been scratched, and if the United States had but a small part of the gold and silver that lies hidden in the mountain ranges of the Great American Desert there would be no war debt." And in another place the same author-engineer says of Tonopah region: "It's sparse population, its long distances from habitation to habitation has not permitted its hills and valleys to be half explored and yet it has produced in gold, silver, copper, lead, quicksilver and other metals over two billion dollars."

The last winter has been unusually severe in western states. Snow slides and downpours of large quantities of water have undoubtedly uncovered many rich veins, brought down gold-bearing debris into the valleys and have made prospecting this year much more promising. "The Denver Mining Record" in its issue of April 9, 1932 prints the following article:

"Expect Gold Camp in Nevada Will Be Opened This Year. — Fallon, Nevada, April 9. — It would not be surprising if another Goldfield were discovered as the result of heavy storms over the state, is the opinion of Cye Cox, one of the most active prospectors in Western Nevada. Cox explained that bonanzas in the time past have been discovered following slides resulting from heavy storms. With the overburden torn away, float is brought down and ledges are opened up. Not for many years has Nevada enjoyed such heavy snow, it was explained. This already has caused a number of slides and others will follow spring melting period, opening up new riches to be revealed to the prospector."

**BITTER ROOT MOUNTAINS** on the boundary line between Montana and Idaho are very promising territory and at the time of this writing prospecting and placer mining is on the great increase there. Especially favorable seem to be the tributaries of Clearwater and Salmon Rivers.

**BRITISH COLUMBIA.** Although the present work is intended as a guide to prospecting in United States, still we think it will not be out of place to mention briefly the great possibilities for gold prospecting in British Columbia, the Pacific coast province of Canada. In "Lode-Gold Deposits of British Columbia", published by British Columbia Department of Mines, H. G. Nichols, resident mining engineer of the Central

Mineral Survey District (No. 3) with headquarters in Kamloops, B. C., gives the following likely prospecting areas in his district:

1. The area lying west of the Fraser river in the Yale and Ashcroft Division and reaching north to Cayoosh Creek. Gold-quartz veins in granitic rocks and sulphide replacements in limestone and sediments near intrusive contacts should be looked for. The area is difficult of access, but may be reached by way of the valleys of Nahatlatch river or from Cayoosh creek.

2. The heart of the Coast range lying west of the Lillooet river and around the headwaters of Bridge river and south of Chilko lake. A trail has been built for considerable distance up the main fork of Bridge river. Gold-quartz veins in granitic rocks and massive bodies of copper ore and impregnations in volcanic rocks should be prospected for gold values.

3. The area lying to the west of Okanagan lake and along the divide between the Vernon Division and those of Nicola and Kamloops. There are several uncharted dykes and stocks of intrusive; quartz veins should be looked for. This is a likely gold area. Pack-horse transportation is fairly easy, one section may be reached by trail up Deep creek, flowing into the North arm of Okanagan lake.

4. The Adams River and Canoe River watersheds on the eastern border of the Kamloops Division. Pyritized quartz veins in schist should be prospected for gold, especially in the northern half. This area has hardly been prospected at all. Intrusive contacts may be looked for and followed in the southern portion.

5. The area on the west of the North Thompson river, south of Mahood lake, where there are several exposures of intrusive rocks and where occurrences of gold associated with arsenopyrite are to be looked for.



The last winter has been unusually severe in western states. Snow slides and downpours of large quantities of water have undoubtedly uncovered many rich veins, brought down gold-bearing debris into the valleys and have made prospecting this year much more promising. "The Denver Mining Record" in its issue of April 9, 1932 prints the following article:

"Expect Gold Camp in Nevada Will Be Opened This Year. — Fallon, Nevada, April 9. — It would not be surprising if another Goldfield were discovered as the result of heavy storms over the state, is the opinion of Cye Cox, one of the most active prospectors in Western Nevada. Cox explained that bonanzas in the time past have been discovered following slides resulting from heavy storms. With the overburden torn away, float is brought down and ledges are opened up. Not for many years has Nevada enjoyed such heavy snow, it was explained. This already has caused a number of slides and others will follow spring melting period, opening up new riches to be revealed to the prospector."

**BITTER ROOT MOUNTAINS** on the boundary line between Montana and Idaho are very promising territory and at the time of this writing prospecting and placer mining is on the great increase there. Especially favorable seem to be the tributaries of Clearwater and Salmon Rivers.

**BRITISH COLUMBIA.** Although the present work is intended as a guide to prospecting in United States, still we think it will not be out of place to mention briefly the great possibilities for gold prospecting in British Columbia, the Pacific coast province of Canada. In "Lode-Gold Deposits of British Columbia", published by British Columbia Department of Mines, H. G. Nichols, resident mining engineer of the Central

Broadly speaking, the prospect of lode-gold mining in the Central district may be classified, as follows:

First: In relation to the existence of high-temperature ore-bodies of contact, or replacement, type in the remoter areas of the Coast range lying to the west where prospecting has been retarded by conditions of relative inaccessibility.

Second: In relation to fissure-veins and shear-zones developed in the exposed flanks of the Coast range.

Third: In relation to similar occurrences in and around the isolated exposure of batholithic rocks in the interior and in fissure-veins developed in rocks and favorable texture such as are represented by highly altered diabase in certain areas.

Fourth: In relation to more extensive prospecting and deeper development in the eastern belt of crystalline rocks.

In conclusion, it may be said that the district presents varied attractions for intensive search for lode-gold resources that is forecast for the coming season.

If interested in prospecting in this region, write to British Columbia Department of Mines, Victoria, B. C., Canada, asking for Bulletin No. 1, 1932, "Lode-Gold Deposits of British Columbia", where you will find plenty of reliable information on promising districts.

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## LOST MINES.

If you crave for some real adventure and can spare the time for this purpose, a search for lost gold mines and rich deposits should be highly attractive. The world "mine" in the parlance of gold prospectors does not always mean a hole in the ground for the purpose of extracting gold, but rather, in a broader sense, also any deposit of mineral or of ore suitable for extraction, no matter whether there has been any

digging done or not. That a rich discovery, once made, may be lost again, seems unbelievable to many who are not acquainted with the wide open spaces of the western deserts and mountains, where many hills look almost alike and very few of them possess definite distinguishing landmarks whereby they may be recognized again when seen for the second time. This should impress you with the importance of our advice for noting on the topographic maps every spot where a sample has been taken and for noting very carefully and accurately your location on the topographic maps after staking the same. Besides, the location of many rich mines was intentionally kept secret by their discoverers, some of them died without ever revealing their secrets. Some of the old Spanish mines in the Southwest have been abandoned for different reasons, such as attacks by hostile Indians, occurrence of water in the shafts, lack of sufficient technical knowledge, and the workings have been subsequently covered by shifting sands, landslides, earthquakes and various natural agencies.

On the other hand it must be admitted that every gold mining region has its stories and fairy tales of fabulously rich mines. These stories seldom contain all the truth and nothing but the truth, usually, however, they are based on somewhat distorted facts, and always they point to gold bearing districts, where other deposits may often be found while searching for the lost mine.

Thus in January 1932 the newspapers brought the following story:

“**Hunters Locate Lost Gold Mine.** — Tucson, Arizona, Jan. 23. — Because a dog chased a rabbit into a large hole in the mountain side, the famous El Rey Gold Mine, lost more than two centuries ago, was found recently. Tools and manuscripts discovered bore the

date 1672. Early Spanish explorers and Indians are said to have taken \$1,000,000 in gold from the shaft more than 1,000 feet deep. The dog's owner, C. B. Trott, and other members of the hunting party have staked claims."

It is the opinion of many persons acquainted with the circumstances of the original discovery and with the surrounding country that the famous, fabulously rich Breyfogle Mine has never been definitely located. Several other high grade deposits have been discovered, however, in the long continued search for this bonanza. Some think that the lost Breyfogle Mine was discovered in the "Johnnie Mine" in the southern part of the Nye County, Nevada, that contained very rich gold ore in its very outcrop. Others think that the lost Breyfogle Mine was discovered by the sons of James Clifford Sr. who has located on a ranch near a wild horse spring east of Tonopah. On a small hill within the ranch his sons accidentally discovered very rich gold ore. They were subsequently digging out the ore, putting it in sacks and hauling on wagons across the desert to a railroad from where it was being shipped to smelters in Utah or Colorado. The ore was so rich that Clifford sometimes got several thousand dollars for a single load. Without machinery and equipment and with crude workings this mine produced \$600,000 worth of gold.

The existence of some of the lost rich mines was proved beyond any doubt by native gold, either fine or in large nuggets, and by samples very rich in gold, that have been seen and assayed by reliable and trustworthy men. And we believe that at least some of these lost mines will be discovered in the near future by the well informed and properly equipped prospector conducting the search as a grand and glorious adventure. We have personally investigated some of the lost

mine stories and have attempted to gather as much reliable information as possible.

**THE LOST DUTCHMAN.** This supposedly very rich gold mine, located in Superstition Mountains, about 40 miles east of Phoenix, Arizona, was originally discovered many years ago by Jacob Walz who related just before his death in Phoenix in 1891 that he had killed six men to guard its secret. He made repeated trips into this wild range and always returned with a sack of gold. After his death many attempts have been made to locate this bonanza, but all of them have failed. In July last year Adolph Ruth, 66 years old, retired government clerk from Washington, ventured into the mountains in quest of discovery, but perished there supposedly overcome by heat and exhaustion. His skeleton was found there about six months afterwards.

According to a well informed local authority some gold was found in these mountains and possibly important deposits exist there. Some bold adventurer will probably in a near future be rewarded for his daring feat either by discovery of the Lost Dutchman or by making another rich strike.

Superstition Mountains is a wild a weird range of volcanic crags rising abruptly to an elevation of more than 5000 feet from the surrounding desert level which has an elevation of about 2000 feet. They are devoid of vegetation and probably also of water and there are neither roads nor trails within. They may be seen from the main highway, U. S. Route 80, but the road leading to their base is represented by mere ruts in the desert sand, scarcely visible in places. The search for this lost mine should not be attempted by anybody alone, but by a well equipped party of at least four persons. They should be provided with topographic maps (Florence, Arizona, quadrangle), sufficient supplies of food and water, ropes for mountain climbing,

light intercommunicating radio enabling them to be in communication with a camp at the base of the mountains. It might be possible to establish a base camp at the foot of the mountains from where water and food daily or every other day could be transported to the mountain camp. Local Indians refuse to enter the mountains, being afraid of evil spirits that supposedly inhabit this range, and possibly it is safer to venture there without guides, unless they be absolutely reliable and vouched for. The beauty of the scenery cannot be adequately described. Surrounded by the mountains there is a column rising like an obelisk about 500 feet high. Best time for exploration is probably early spring when the heat is not so oppressive and possibly some water may be found having remained from winter.

“PE-LEG” SMITH MINE. Years ago “Peg-Leg” Smith, so named because of his wooden leg, was guiding a party of travellers from Yuma, Arizona, to Los Angeles, California. When west of the Colorado River, he saw three hills clustered together. Some stories talk of two buttes connected together by a saddle. To take his bearings, he climbed to the top of the highest one where he found some black, heavy ore, which later assayed 80 per cent gold. An expedition was made into the region subsequently, but was not successful and disappointed Smith never attempted it again. He died in California in 1868. Almost quarter of a century later another prospector found this fabulously rich deposit and brought back samples, but he died without being able to complete the location and without divulging his secret. Thus by a subsequent discovery the “Peg-Leg” Smith strike was fully confirmed, but unfortunately lost again and is still waiting for more successful rediscovery. The location may possibly be in the southern end of Chocolate Mountains where

there is a contact between the volcanic and pre-Cambrian formations, therefore favorable to gold deposits.

**LOST JOSEPHINE.** This is supposed to be a very rich old Spanish mine abandoned after its owners were murdered by Indians and possibly buried in the mine. It is located somewhere in the U M Valley, about ten miles north of Fish Lake, which is located high up in the mountains, east of Richfield, Utah. U M Valley is accessible only by a very rough wagon road, but for an aeroplane it offers some very favorable landing places. An autogiro may be able to land on almost level treeless ground on the side of a mountain. For an automobile trip the starting point should be Sigurd, Utah, from where a good, although in places very steep road, with sharp curves leads to Fish Lake. From the north end of the lake the trip to the valley has to be completed either afoot or with pack horses that may be rented there. The high elevation (close to 10,000 feet) makes walking quite difficult for one not accustomed to high altitudes. There is plenty of very good drinking water in the valley and on the mountain sides. Because of extreme winter cold, the trip should be attempted in summer only and even then the nights are quite cold.

**BELLE McKEEVER** discovery was made in 1869 somewhere north of Gila River by soldiers hunting Indians who had attacked a white camp and kidnapped Miss Belle McKeever. While digging for water the soldiers found nuggets of gold of considerable size, about 10 pounds of the precious metal altogether. Searching for original gold deposit they found a wide vein, the ore from which assayed almost \$5000 per ton. The region where the discovery was made, was covered with many low volcanic cones resembling one another so closely that it was impossible to tell them apart.

One of the soldiers tried subsequently to find this rich vein again, but several of his attempts proved unsuccessful.

**WHITE'S CEMENT MINE.** In 1858 an old prospector by the name of White came to Horse Head Gulch in Colorado with several pieces of light gray clay which was found to contain almost \$15,000 worth of gold per ton. When other prospectors heard of this rich strike, they forced White to lead them to the mine. For several weeks they were scouting in the hills of northern New Mexico where many of the adventurers died of thirst and privation. Finally White escaped and what remained of the party returned without having reached their objective. Several years afterwards White arrived at Salt Lake City with other samples of the rich ore. Since then nothing has been heard of him, and it is presumed that he perished on his adventures and the very rich strike made by him was lost again and is waiting for a new discoverer.

**LOST CABIN MINE** is located somewhere in the Big Horn Mountains either in southern Montana or northern Wyoming. Long ago, during the days when Indians were wild, three prospectors found unusually rich ore near the headwaters of a river. While returning in a boat to civilization, two of them were killed by Indians, the third one was saved after many hardships. Subsequently he became insane and was never able to tell the location of his rich discovery. The very rich samples, however, proved the truth of this discovery beyond any doubt. Later many prospectors attempted to locate this rich mine, but nobody succeeded yet. In 1877 a very rich outcrop of gold quartz was discovered by soldiers in Big Horn Mountains. They took some samples, but were unable to relocate the find even after many attempts. This may have been the Lost Cabin Mine.



OLD BEN SUBLETT'S MINE is supposed to be located on the eastern side of the Guadalupe Mountains that extend from Cerro County in New Mexico across the border into Hudspeth and Gulberson Counties in Texas, or in Rustler Hills, located between the Guadalupes and Pecos River. In one of the deep chasms, accessible only by a rope ladder, there is a cave, probably an old Spanish mine, from which the Spaniards had to flee before savage Indians. To prevent the exploitation of the mine by Indians they probably covered up the mine so that nobody would find it, hoping to be able to return to it some day in the future. They have never returned, however, and prospectors looked for the mine, without success, until "Old Ben" Sublett finally located it and found there gold in large nuggets. From time to time he used to go to the mine and return with a load of gold. He died in 1892 without revealing the location of his bonanza. Many attempts have been made since to locate his discovery, but up to this time no one was successful.

LOST NIGGER MINE is supposed to be somewhere in Chiso Mountains in the vicinity of Reagan Canyon, Brewster County, Texas, or across the Rio Grande in Ladrones Mountains in Mexico. Small, narrow canyon holds the ore, a sample of which brought by a negro ranch hand called Seminole Bill assayed several thousand dollars per ton. There were also small nuggets of pure gold found there. The Nigger Mine or some other equally rich deposit was subsequently discovered in that region, but for various reasons the locations were lost again and there is still a search going on for the Lost Nigger Mine.

YUMA'S GOLD is a name applied to a fabulously rich rose quartz ore contained probably in what is called a chimney formation. This deposit has been for a long time a jealously guarded treasury of Apache

Indians camping years ago in Arivaipa Hills in Arizona. It is located probably about midway between the town of Winkelman and Feldman, Arizona, in very steep and rough hills on the west side of the San Pedro River. In a small gulch there is a crater like depression of comparatively small size and shallow.

**THE LOST BREYFOGLE.** There have been so many contradictory stories told of the Lost Breyfogle Mine that it is well nigh impossible to conciliate them. One story says Breyfogle was coming from California and headed for Nevada. While camping at night in the southern spurs of the Panamint Mountains his party was attacked by Indians, two of Breyfogle companions were killed and he alone escaped barefooted across the Death Valley into Amargosa Desert in Nevada where he was finally rescued more dead than alive. Others say that he started from Austin, Nevada, going south, lost his horse, and while wandering about the country discovered rich gold ore. The samples which he brought back to civilization assayed more than \$100,000 per ton. Some think that his famous mine is located somewhere in Nye County, Nevada, while others place it in mountains on the eastern side of the Death Valley, California, somewhere south of the Daylight Springs, possibly as far south as the southern spurs of Black Mountains, the southernmost portion of the Amargosa Range. Breyfogle himself attempted to locate his bonanza number of times himself and also with the help of others, but never succeeded. Many others tried it after him and, although during this search number of new and rich discoveries have been made, it is generally thought that the original Lost Breyfogle has never been definitely located.

## CHAPTER VI.

### HOW TO PROSPECT.

(Placer prospecting)

Having arrived at the scene of your intended prospecting activities, what mode of initial attack will you select, what will be your opening move in playing the game? Ordinarily it will make little difference whether you are searching for a placer or a gold vein. You will look for a definite clue, and when found, you will follow it to its successful termination. The most reliable clue is "float", a term applied to small, sometimes minute pieces of gold and other vein material found in sand and gravel of the streams, in detritus of canyons and gullies, at base of mountains, in sand of the desert, etc. Originally gold was contained in a vein higher up in the mountains. In the course of long periods of time the surface part of the vein, called outcrop, was slowly eroded by water and wind and gradually disintegrated by complicated chemical agencies with the result that gold was gradually separated from the other component parts of the vein and set free. These particles of metallic or native gold were subsequently picked up by water during rains and transported for variable distances until finally, when the stream slowed down sufficiently to allow these particles to settle down, they were deposited on mountainsides, in gullies, canyons, in beds, banks and bars of either constant or intermittent streams where they formed deposits, which are, so to say, samples of the materials contained in the higher reaches of the

drainage zone. The following metals may occur in paying quantities in placers: Gold, platinum, silver, iridosmine, all of which have distinct metallic luster. Besides that the following minerals with non-metallic luster may be found: zircon, monazite, tin stone (cassiterite), cerium, uraninite (pitchblende) source of radium, yttrium, rutile, diamond, etc.

Repeated erosion, separation, transportation and deposition produced layers of gold containing sands and gravels, sometimes many feet in thickness, called gold placers. The placers that were formed many ages ago are called "ancient placers". They may be even several hundred feet in thickness. It is well to remember that in these ancient placers the upper layers usually carry lower values than the deeper ones, that is the value of gold per cubic yard of the material increases with the depth, though not at a uniform rate. Because of long continued exposure to chemical action produced by seeping-in water, in presence of iron, lime and other minerals, those deposits often became cemented together into a form of conglomerate. Some of the rivers that produced these placers changed subsequently their course due to changes in the elevations of earth surface or because the flow of lava in their upper course blocked the stream. Thus it happens that gold is found not only in the sands of presently flowing rivers (modern rivers), but also high up above the present streams in benches, that is, terraces, that ages ago formed the banks of the rivers, also in ancient river beds, on some hills and in deserts far away from any stream flowing now. Some of the ancient placers were subsequently buried by lava flow and others cut across by new rivers, thus forming modern placers by eroding, transporting and depositing material from the ancient placers.

Since the gold particles settle down wherever the

stream slows down sufficiently, the gold is most likely to be found wherever there is a change in the direction of the stream as for example on the concave side of the stream, also in holes and pockets in the river beds, on the down stream side of rocks and boulders, in the river bars, banks that were submerged during high water, around the roots of grass and trees growing on the banks, etc. It is always advisable to dig several feet down to what is called "hardpan", a name applied to a hard layer of gravel and sand or clay, or to the bedrock under the gravel. Black, rusty, yellow, red or any other conspicuous color is often a very favorable, though not infallible, sign of the presence of gold. Rich deposits occur in those places of the stream where a sudden change of direction occurs, where the tributaries empty into the main stream. Larger pieces of gold are usually found in the vicinity of the vein from which they came, while finer gold may be found many miles away from the lode deposit. Coarser gold is found with coarser gravel and finer particles with finer sand. Wherever black sand and other iron minerals accumulate, gold is liable to accumulate also, because both of these metals are quite heavy. Potholes are not favorable places for deposition of gold. Bars of rock running across the stream collect considerable amount of gold on their down stream side.

From its hiding places gold is dug out and separated from the admixture of worthless matter by the process designated as panning. This consists of mixing with water the gold containing sand, gravel or dirt in a pan made especially for this purpose and agitating the mixture in such a way as to allow the gold, that is heaviest, to settle down at the bottom of the pan, while the lighter particles of the soil, sand and other worthless ingredients are washed over the rim of the pan and discarded.

Since mastering the art of panning is essential to your success, you should study carefully the directions given below and then practice and practice until you acquire a high degree of skill in handling the gold pan. Following are the directions for panning:

1. Fill the pan about two-thirds full with "dirt" (gold bearing sand and gravel), immerse in water and holding it horizontally, soak its contents well, then with fingers crush under water all lumps and mix the contents thoroughly into thin, uniform mash.

2. Holding the pan with one hand on each side and still keeping it horizontal under the water, rotate it briskly in circles slightly larger than the pan itself, swinging the arms freely, the motion being more in the shoulder and elbow joints than in the wrists. Pick the larger pebbles out of the pan and discard them. By this time the coarser gravel and the lightest particles (dust, clay) should have been removed and the water in the pan is much clearer than at the start of panning.

3. Holding the pan in the same way under water, shake and rotate it with motions closely resembling those of sifting. Repeat several times.

4. Now begin to incline the pan slightly in such a way that the rim away from you remains under water, while the one close to you barely emerges above the water level. In this position shake and rotate the pan with sifting-like motions, allowing always little of the contents to wash over the depressed rim.

5. Remove from water and rotate in such a way as to produce a wave of water travelling around the sides of the pan from the depressed rim upwards and then sideways down towards the lower rim and carrying with itself over the lower rim always a little more of the lighter materials in the pan. This phase of the work has to be done gently and smoothly without jerking, in order to save as much of the fine gold as pos-

sible. Keep always enough water in the pan, repeatedly adding, as necessary, and continue this washing until about a teaspoonful or less of clean, sandy material is left in the pan. If gold is present, this residue will be chiefly gold sand or gold dust and "black sand" which is composed of minute dark grains of various minerals, chiefly iron minerals (magnetite, ilmenite, chromite), tinstone (cassiterite), tourmaline, etc.

6. When about a teaspoonful or even less of the material is left, the pan is given a sliding motion which is arrested with a sudden jerk. This procedure partially separates the worthless sand from the gold.

In this residue look for "colors" that is deep orange yellow specks with metallic luster. Use a magnifier if you see no colors with unaided eye. The orange yellow material, if found, has to be subjected to some of the previously described tests in order to differentiate gold chiefly from yellow mica, which is usually sharply angular and flattened, and pyrites, and establish its positive identity. It is impossible to separate completely black sand from gold by mere panning. If magnetic, the black sand may be removed by a magnet after previous drying of the residue left in the pan. The gold may also be extracted by amalgamating it with mercury (quicksilver) which method will be described later.

While, as a rule, the main component part of the black sand is worthless, being made of iron minerals, there are several other, chiefly very valuable minerals, that lag behind in the residue after the removal of its magnetic component. These minerals may be divided into two groups according to whether they have a metallic or non-metallic luster.

The following are the minerals with metallic luster that may remain with the black sand, and that are valuable:

**PLATINUM.** This is pale, steel gray or silver white in color, streak the same, harder and heavier than gold, infusible, soluble only in aqua regia, malleable easily into thin sheets and giving no odor on heating.

**PALLADIUM.** This is steel gray to silver white, often with bluish tarnish, scratched with glass, as heavy as lead, dissolved in nitric acid, flattens under hammer, no odor on heating.

**IRIDOSMINE.** Steel gray or silver white, scratches glass and is scratched by quartz, gives off peculiar odor when heated.

**WOLFRAMITE.** Dark grayish black, as heavy as steel, hard to scratch with a knife.

**URANINITE** (Pitchblende). Black or brownish, easily scratched with knife, very heavy. Its luster is not typically metallic, sometimes almost non-metallic. Being a source of radium it is a very valuable ore.

The following valuable minerals without metallic luster remain with the black sand:

**CASSITERITE** (tinstone). Black or brownish black, not scratched with a knife, but scratched with quartz, three times as heavy as quartz.

**SCHEELITE.** White, cream, yellow, brownish, reddish, will not scratch glass, scratches copper coin, streak white.

**CORUNDUM.** Blue, gray, red, yellow, cannot be scratched by anything else, but diamond, will scratch quartz easily. Pure variety is sapphire and red variety ruby. Both are very valuable gems.

**DIAMOND.** It may be colorless, white, red, blue, orange or even black. Will scratch even corundum and cannot be scratched by any mineral. Is heavier than quartz, briskly rubbed (when dry) will flash light in the dark, becomes electric on rubbing.



TOPAZ. Glassy, pale yellow and other shades, scratches glass, is scratched only by corundum and diamond.

If you find anything that gives the above tests, or closely resembles some of the above described minerals, take several samples and have them thoroughly tested in a laboratory, since the find may be even more valuable than the gold itself.

For an amateur it takes about 15 minutes to properly work one pan, while an experienced man is able to do it in 10 minutes or even less. Start with at least 15 minutes and gradually, as your skill increases, shorten the time of working. Especially towards the end of the process, when only a small quantity of material is left in the pan, the amount of waste washed out by water with every movement should gradually be smaller and smaller and the work should proceed more carefully.

Before starting on an actual prospecting trip get outdoors and near some stream practice panning, as follows:

1. Half fill the pan with soil and mud and try to wash the heavier particles of sand clean.

2. Repeat the same operation with sand, separating the lighter from the heavier particles.

3. Get some fine shot, preferably No. 12, count them and then mix thoroughly with sand and try to recover all of them by panning.

4. Mix some clean (not oily) iron filings and recover them by panning. To measure the degree of your efficiency, weigh filings before mixing and weigh the filings recovered, after preliminary thorough drying.

5. Get some gold filings from your dentist, weigh them, mix with sand and then try to recover by panning.

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**TABLE FOR DIFFERENTIATION OF VALUABLE MINERALS LEFT IN THE GOLD PAN.**

	Color	Streak	Hardness	Heaviness	Malleability	Charasteristic Property
<b>Platinum</b>	Steel gray Tin white	Steel gray	Knife	Twice as heavy as lead	Very malleable	Not soluble in any acid, except conc. aqua regia
<b>Silver</b>	Silver white on fresh surface, often tarnished	White	Copper coin	As heavy as lead	Malleable	Soluble in nitric acid
<b>Iridosmine</b>	Silver white, steel gray	White or steel gray	Quartz	Heavier than lead	Malleable	Peculiar odor on roast- ing
<b>Palladium</b>	Silver white, steel gray	White or steel gray	Glass	As heavy as lead	Malleable	Soluble in nitric acid
<b>Wolframite</b>	Dark grayish, black, some- times greasy.	Reddish brown or black	Knife	As heavy as iron		Easily fuses into mag- netic pellet
<b>Scheelite</b>	White or other colors	White	Knife	Almost as hea- vy as iron		
<b>Cassiterite</b>	Usually brown, also black, yellow, red.	Pale brown, pale yellow, or white	Quartz	As heavy as iron		
<b>Corundum</b>	Blue gray, sometimes red, yellow, pink	White	Diamond only	Twice as heavy as quartz	Brittle, even tough	
<b>Uraninite</b>	Velvet black, brownish, green	Brownish black Grayish black	Knife	As heavy as iron	Brittle	Pitch like in appear- ance. Affects photographic film.

If after thorough panning no colors are seen, even if looked for with a magnifier, mercury amalgamation is resorted to in order to discover minute traces of the precious metal, when its presence is suspected in the dirt. Towards the end of panning, when only about a teaspoonful of material is left in the pan, add few drops of mercury (quicksilver) to the pan and continue panning for a little while longer. In this and in any other tests when the object is to determine the presence or absence of gold, use absolutely clean mercury that has not been used before. In extracting gold by amalgamation, the same mercury may be used over and over again. Work about ten pans, using the same fresh (not previously used) mercury, transferring it from one pan to another. Save the residue from all the ten pans, and when through with the last one, dump all the residues into the pan and work it once more with mercury. Or, if necessary equipment is available, transfer the reworked residue into an iron mortar and grind in a stream of water in the presence of mercury. In this way even the minutest traces of flour gold may be amalgamated. Dry the mercury with a blotting paper, transfer to a small iron spoon and evaporate over flame, being careful to stay on the windy side of the fire to avoid inhaling mercury vapors, since they are highly poisonous. If you have a blowpipe outfit, you may evaporate mercury on a clean charcoal with the use of blow pipe flame. Gold, if present, shows very well against the black background of charcoal. Another way of splitting the amalgam is to cut a small hole in a raw potato, put the mercury amalgam into it, then heat a shovel red hot and put it over the hole. This will evaporate the mercury and drive it into the potato, while free gold will remain in the cavity. After evaporating mercury by any of the above described methods, look carefully for gold with a high power magnifier. If none is seen

in the combined residue of the ten pans, you may be sure that the material is worthless. Dig deeper in another place or look for another location. Following the directions carefully and doing slow and careful work you should be able to detect gold even if one part of it is present in one million parts of dirt.

What to do when gold is definitely found, is not so easy to decide. The most important consideration in formulating the plans is the quantity of gold present, that is value per cubic yard. There are many other factors that have to be considered, the chief among them being availability of water, size of the placer both in surface and in depth, nature of the material (loose sand or cemented gravel), accessibility (condition of the roads and distance from transportation), possibility of discovering original deposits from which the placer was formed, etc. No definite rules can be formulated, no definite advice can be given as to what is the best course to pursue. We wish, however, to advance few useful, practical hints.

Although there is a very wide variation, it may be estimated that about 150 panfuls make one cubic yard. In Fairbanks, Alaska, they estimate that one heaping load on No. 2 round point shovel makes one panful and that 189 panfuls make one cubic yard. At other places the estimates run as low as 130 pans per cubic yard. This undoubtedly is due to different sizes of pans and their different filling. The time in which a pan of dirt can be thoroughly washed, varies also very widely. Cemented gravel and sticky clay make the work much slower. On an average it takes the beginner at least 15 minutes to wash one pan properly, while an expert may be able to do it even in less than 10 minutes. Basing our estimates on these figures we may say that it takes about three days to wash one cubic yard of dirt at the beginning and, with more ex-

perience, two days may be sufficient. If you then weigh the amount of gold recovered from 150 pansful and either weigh or measure it approximately in your horn spoon, then you will be able to roughly estimate how much gold there is per cubic yard and how long a time it will take to work one cubic yard, in other words, you will be able to estimate very roughly your earning capacity.

Thus, if values run about \$10 per cubic yard, it is possible to make moderate wages by working the placer with pan only, while the living expenses, everything included, are certainly below \$1.00 a day. By the use of rocker, one cubic yard can be washed in less than a day. If panning will wash 1 cubic yard of dirt in a given time, a rocker will wash 4, Long Tom or a sluice 20 and hydraulicking 100 cubic yards in the same time, provided the dirt is of about the same nature in all cases.

If the average values run below \$10 per cubic yard, it is necessary to use at least a rocker or some even more efficient equipment to make the placer mining profitable.

Values under \$1.00 and, under very favorable circumstances, even a fraction of this, will be sufficient to make large scale operations with proper equipment and machinery profitable. In these cases, however, the size of the placer, both in surface and in depth, is of even more importance than the value per cubic yard, since the big mining companies are not interested even in high grade placers, that are not large enough to justify heavy investment necessitated by purchasing, moving and installing expensive machinery. This explains why many, even moderately rich placers, have not been grabbed by the big capital, and remaining unoccupied, they offer the man of small means an opportunity of

making decent living while working for himself, living care free life under the blue sky in wide open spaces of God's nature and enjoying all the sweetness of primitive life.

A rich placer should yield sufficient gold to finance the purchase of better and more efficient equipment and machinery. Work the placer at first with the equipment on hand, be it a pan, rocker or dry working machine. When working the placer, after the presence of gold was definitely established, keep always about a teaspoonful of quicksilver in the pan. Whenever quicksilver becomes saturated with gold (unable to take any more) it looks granular and lusterless. It should then be removed and put into a buckskin bag. When enough of this gold amalgam is collected, the quicksilver is squeezed through the buckskin by twisting the bag. The gold remaining in the bag is subsequently heated in an iron spoon to remove the last traces of quicksilver and the clear gold dust saved in a bottle or any other convenient container.

Be sure to determine the surface area of the placer by panning the dirt taken from different places and its depth by digging or drilling with subsequent panning of the deep material. After you have panned gold in sufficient amount to purchase additional equipment, prepare to leave temporarily, but before leaving, be sure to do the following:

Mark the corners of the claim properly and do other things required by the law to make your claim valid. This procedure is given in detail under the heading of "The Placer Claim" in the Appendix. Collect few samples from different places and different depths for the purpose of submitting them to an assay office. Number the samples and enter the corresponding number on a carefully drawn plat of the claim.

Note the location of your claim on the topographic map. To do this accurately, you have to locate yourself with reference to topographic features. Prominent, easily recognized features, such as a steep hill, cliff, canyon, etc., or an elevation indicating bench mark placed by U. S. Geological Survey may often easily be recognized and found on the map as well as in the field. Very frequently, and especially if the view is not obstructed, you may be able to determine your position with considerable accuracy by observing it in relation to nearby peaks, prominent cliffs, buttes, valley intersection, etc. If possible, walk to the prominent landmark that is indicated on the map and is visible in the field. From there determine the direction towards your claim with a compass and then measure the distance in steps, feet, by pedometer or any other convenient way.

Draw on the same topographic map, if possible, a route leading from your claim to a definite, easily recognizable spot on the nearest highway, road or any other prominent and permanent landmark. Do not depend upon unstable markings that are liable to be altered by floods, snow slides, landslides, sand storm and any other natural agencies, and above all, do not trust your memory, even if at the moment you are absolutely sure that on your return you will have no difficulty in finding your claim. This trusting to memory has been an introductory chapter to many a history about rich gold mines that were discovered and subsequently lost because of failure to make an accurate and definite localization. A clear snapshot of the landmark selected or a panoramic view showing clearly an outline of the hills may be of inestimable value in doubtful cases. If you do not have a topographic map, draw one yourself as carefully and as accurately as you can, making on it the same notations as on a regular map.

After you have attended to all these necessary cautions, return to the nearest county seat or local office, as the case may be, and by recording your claim there you shall have completed the location.

Having completed the location and having so the gold recovered, it will be necessary to make a decision as to whether you are going to operate the claim yourself or whether it would be probably better to sell. Capital is not looking primarily for rich mines, but rather for the big ones. Even a very rich deposit, if not large, is not attractive to big companies. The prospector, sportsman, adventurer finding anything too low grade for him to work, if it is big enough, may have found his fortune. Capital will work it and permit him to retain an interest, or they might buy outright, or he might interest his own friend and organize his own company.

If you decide to work the placer yourself, procure at least a rocker, if water is available, or construct a sluice, or some dry washing machine for arid placers. Gradually, as your proceeds from mining increase, you should install more complete and large equipment to enable you to handle larger quantities. Working drawing of a rocker is given on page 111. Since all these considerations belong rather into mining proper and not into prospecting, we shall not go into details.

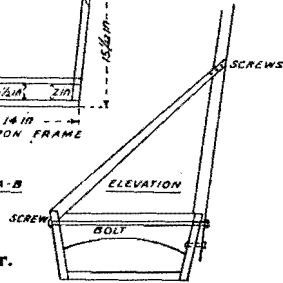
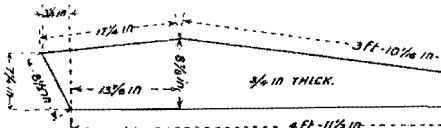
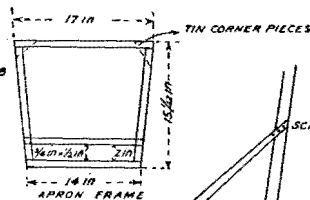
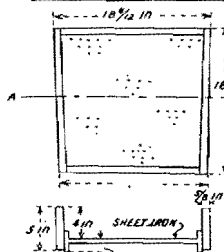
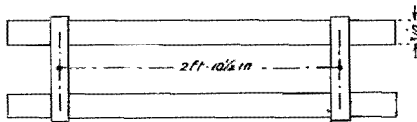
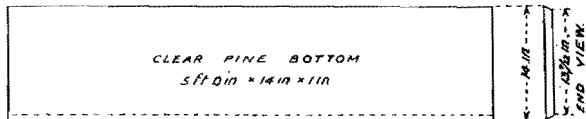
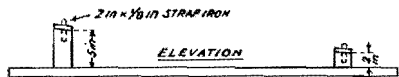
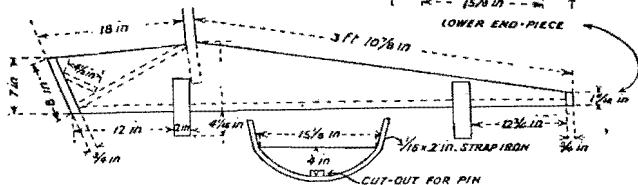
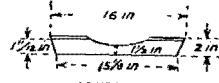
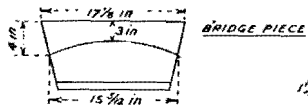
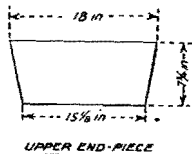
If you think of selling your placer claim, you should read carefully Charles F. Willis "Selling Prospects". You will find many valuable hints in this little pamphlet that was published as Bulletin No. 62 of the Bureau of Mines, Tucson, Arizona. (Price 10c.)

### (Lode Prospecting)

As mentioned before, gold may be found in any geological formation, but with much more likelihood will be found in

1. The oldest formations,





Plans for construction of a rocker.  
Reprinted from C. S. Haley,  
"Gold Placers of California."

2. The formations that have undergone greatest alterations,

3. The formations that were affected by volcanic activity.

4. Those formations where one kind of rock penetrates as a dike or a vein into another rock.

### THE OLDEST FORMATIONS.

The commonly accepted belief is that the surface of the earth was originally gaseous, later fluid, and finally, due to cooling, it became solid. This solidification produced the first hard surface of the earth, the oldest formations that underlie all other formations, are closest to the earth's core, form the axis of the greatest mountain ranges and furnished the material from which different agencies produced all other rocks.

The oldest formations are designated by various names, some synonymous, some overlapping, there being no universally adopted nomenclature. They are composed chiefly of granite, gneiss, schists, serpentine, quartzite, conglomeritic gneiss, slates and crystallized marbles. Whenever these rocks are found on the surface, they have been exposed by relative elevations, tiltings and erosion.

The ability to estimate the nature of the formation by the general outline, contour and configuration of the hills is of great value to the prospector. As a rule, different formations produce different surface features and may be recognized with more or less certainty. Granite produces sharp, bold outlines, resembling castles with towers. Great masses of porphyry, diorite and other igneous rocks often appear as huge domes, their sometimes cut into sharp spires. Volcanoes assume the familiar conical shapes, often with blackened tops. Lava flows appear usually as extensive table

lands, capping the underlying rocks and presenting occasionally somewhat columnar appearance, at other times the superficial lava flows appear like rivers of big rocks and boulders. Rolling valleys suggest soft shales, smooth, rounded, gently sloping hills are usually underlaid with limestone, sandstone and other sedimentary rocks that are of value in gold prospecting only where they come in contact with igneous rocks.

### ALTERATIONS OF THE EARTH CRUST.

Ore deposits are more likely to be found where the earth's crust has undergone considerable, though not excessive changes, like elevations with resulting folding, fissuring, slipping, etc. This is the reason why mines are usually located in the mountains, since mountains are elevations of previously smooth earth's surface. And it is well to remember that, as a rule, the richest mines are located not in the main mountain chains, but rather in the secondary ranges. From the standpoint of the prospector, the most important results of the giant upheavals resulting in the formation of the mountains are fissures, that is cracks of various sizes from few inches to many miles both in length and depth and traversing many layers and formations. In some of these fissures metallic minerals were deposited from the molten masses emanating from the earth's interior and from circulating hot liquids and gases holding minerals in solution.

Fissures may sometimes be recognized on the surface, being marked by narrow gulches and ravines, sometimes with a small stream and comparatively luxurious vegetation (water oozing through the crack) and often the rocks in its vicinity may be stained green, brown or some other color. Quite often one wall of the fissure slips on the other producing what is known as "fault", which may be indicated on the sur-

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face by a little depression in the side of the hill, or step-like outline wherever there is much faulting. Near the line of a fault rock debris is often found and pieces of some rocks may have smooth, polished surfaces (slickensided). A series of hot springs may mark the line of faulting.

### VOLCANIC ACTIVITY.

Of paramount importance in the formation of gold ore is the volcanic activity, not that unaltered lava contains any gold veins, but because the heat produces favorable condition for gold deposits and also veins may be formed by intrusion or permeation. As a rule, the older the volcanic rock, the more likelihood there is of a gold deposit. Volcanoes appear chiefly as conical hills, sometimes crags of wild and weird formations, lava beds, occasionally as solid coverings of extensive surfaces and when decomposed, they form beds of large, usually dark boulders, often sharply outlined. Although volcanic cones and detritus lying on volcanic rocks should be examined for gold, the most important places are those where the volcanic rock comes in contact with some other rocks or penetrates other rocks producing what is called intrusions (dikes). Even a granitic country, if unbroken by volcanic forces and free from dikes, is not favorable for gold deposits. If the composition of the rock that has been intruded, is markedly different from the one that is intruding it, a great variety of metals may be deposited. This is best exemplified by the intrusion of granite and other rocks of the granitic series into limestone or dolomite. These dikes, as a rule, are well mineralized and, if not mineralized themselves, the region in which they occur contains valuable deposits somewhere else. Dikes vary in size from few inches to many feet in thickness and from few feet to many miles in length. When many dikes are found in one locality, they more often run

in the same direction, exceptionally only they cross each other. A dike is seldom uniform in appearance throughout; the center usually shows larger crystals, while the periphery is fine-grained. The country rock around the dike is usually considerably changed by the heat of the intrusive material, sandstone being changed to quartzite, limestone into marble and dolomite, shale into slate, etc.

### REPLACEMENTS and CONTACTS.

While intrusion, producing dikes, as described above, is probably the most favorable condition for ore deposits, there are other important agencies. Replacement of original rocks or filling of fissures by any other means than intrusion, also produces metalliferous veins. It is therefore not only for the signs of intrusion, but also for the signs of replacements and contacts that the prospector should look. Probably it will not be out of place here to state that gold never occurs as a solid metallic vein, but usually is disseminated, though not uniformly, throughout the worthless material (gangue) of the vein, or lines the walls of the vein on its surface, forms pockets, encloses crystals of other minerals or is even enclosed by them, rarely being found in sheets at the line of contact of different rocks. Especially favorable are the contacts of granite and porphyries on one hand and porous rocks like limestone and tuff on the other hand, even more so, when rocks show indications of having been altered by hot solutions. It is important to know, however, that not only at the line of actual contact, but also in close vicinity to it a diligent search for mineralization should be made. Sometimes the deposits are found at considerable distances from the actual contact, due probably to depth action of the intrusive. Most contact and replacement deposits contain iron which by the atmospheric action has been changed to iron

rust staining the surface rocks with characteristic reddish brown color, called "iron hat" which may sometimes be easily seen from a distance and is a very favorable indication of a valuable deposit and should therefore be thoroughly examined and tested for gold and other minerals. Lines of contact may easily be followed in the field according to indications given by geologic maps.

Since it is usually the gangue material that produces the visible float and since gold deposits have considerable predilection for certain minerals, the gold prospector should look for float of those rock forming minerals and then follow up this float to the edges, lodes or veins formed by them.

The most important association is gold and quartz or gold, quartz and pyrites. When there are more minerals associated with gold, the most frequent besides quartz and pyrites are blende, galena and limestone near igneous rocks.

QUARTZ is by far the most important mineral associated with gold. All quartz intrusions, especially those found in or near schist, slate, granite, breccia and limestone should be tested for gold. Quartz veins that contain pyrites usually show the "iron hat" and rustiness in their outcrops due to decomposition of pyrites. Sometimes, however, the outcrop may show clear, white quartz without any signs of staining, while several feet below the surface the iron stains appear. This is probably due to leaching and decolorization of iron compounds produced by atmospheric agencies. Therefore a quartz outcrop, even if it shows no iron stain, should be carefully examined for indications of free gold. Milky white, rose quartz and smoky appearing quartz are very favorable indications. Wherever quartz, granite and slate are found together, gold should be



suspected and searched for. Thin veins of quartz in an eruptive rock are often very rich in gold.

PYRITES are usually not found in the float as such, but rather their decomposition products, appearing as rusty, yellow, red, green and black stains derived from iron and copper pyrites, also free magnetite and other iron minerals. Pieces of float are often spongy, containing cavities left after the pyrites were leached out. The changes due to oxidation and decomposition should constantly be kept in mind and the prospector must never forget that the pyrites in the original undecomposed vein may look very unlike the float that he finds lower down in the drainage area of that locality.

LIMESTONE (calcite) and especially blue limestone and dolomite should be thoroughly searched, being of utmost importance when found near granitic and intrusive rocks. Contact places between igneous rocks and sedimentary rocks especially limestone, are very favorable for gold deposits. Therefore, when in generally granitic country, look not only for quartz, but also for limestone which seems to have extracted gold when in contact with the igneous rocks. When in a limestone country, look for signs of iron as gold indicator. Also wherever limestone is found replacing cavities in other rocks, especially in slates, it often contain gold in so-called "pocket deposits".

On the whole, the geological features are very valuable in directing the search for gold, but the actual gold deposit must be discovered by diligent searching. In other words, the indications given by geology are only possibilities or probabilities, while the search leads to actualities. It is well to remember, however, in this connection that the associations of minerals and conditions and circumstances of gold deposits are usually peculiar to the localities, gold deposits being

found in one association in one district while in another district they occur under altogether different conditions and associations.

Thus the "Mother Lode" of California is found in slate and other igneous rocks, at other places in California gold is found near or in intrusive granodiorite and in eastern California chiefly in phonolite, trachyte and andesite. Colorado gold bearing veins are mainly in granite, also in breccias and tuff of andesitic type, and in quartz veins that intrude volcanic rocks. This gold is often associated with considerable percentage of silver. Some gold is found also in quartzite and limestone. In Montana gold is extracted chiefly from lead, silver and copper ores, especially copper ores in intrusive granite. In Nevada the chief rocks associated with gold are porphyries (in dikes), andesite, rhyolites, basalts. The Comstock celebrated lode is a gold-silver ore in andesite. Limestone near volcanic rock is also productive of silver-lead ores containing gold. Quartzites in one place carry gold. South Dakota in Homestake District has schist intersected by quartz containing either free gold or gold in pyrites.

All the above considerations will be helpful in leading you to a promising field and will constitute special guides in the field where the actual search for the gold vein will in most cases begin with a search for float by panning. It is only so-called chimney deposits, especially when located in crater like depressions without an outlet, that do not broadcast their location by float and therefore are difficult to find, most of them having been discovered purely by accident. However, these chimney deposits are often extremely rich.

The first step in actual search, as a rule, will be the discovery of gold in the sand or gravel of a run-

ning stream, in a canyon, a gully or on the mountain-side. When you find gold in these locations, you are sure that it must have come from a location somewhere higher up. You will carefully study the minerals with which the gold was found in the pan, since these minerals will constitute the float and may give you a very valuable hint as to the line of search that should be followed. As a rule, the larger and sharper nuggets of gold indicate proximity of its source, while fine flour gold and well worn granules give a hint of its distant origin. And the same thing is true of other pieces of the float, although the effect of long water transportation will be less marked on the harder minerals.

As soon as gold is positively demonstrated in the pan, you will then look for float, that is pieces of rock with which gold was associated in the original deposit. All larger pieces of float should be numbered and corresponding members entered either on a topographic map or on a map made by yourself. If possible, co-ordinate these findings with a geologic map, since in this way you be able to gain valuable information. Pieces of float with rusty color (iron), blue or green (copper) or black (manganese) are highly suggestive.

Fragments of quartz, especially when colored (red, rose, smoky) or honeycombed are favorable as a clue. The cavities in the quartz may have been originally filled with pyrites that contained gold. They should be examined for signs of gold as wires, scales or even minute specks visible only with a magnifier, crushed and panned or tested chemically as described later on. Finding mere quartz, of course, is not conclusive evidence, the only conclusive proof being demonstration of gold itself either by panning or by a chemical test.

In panning, small particles left in the pan after the lighter material has been washed out, should be carefully examined. All colors are suggestive: Yellow particles may be gold, yellow mica, pyrites, red particles iron, cinnabar, red hematite, blue or green copper minerals, pink alunite, black magnetites, pyrolusite, graphite, hematite, pitchblende and other rare minerals.

After finding the float proceed up hill in the direction from which it probably came. From time to time pick up samples and examine them both with naked eye and also with a magnifier. Pan the dirt also as you proceed and pan also some samples of the float. Carefully scrutinize both sides, looking for signs of slides, cracks and fissures in the surrounding rocks. Examine with special care the contents of these cracks and fissures, be it debris on the rocks, or vein of material different from the rock itself. Cracks are especially favorable when they occur in schists, slate and granite. Lime intrusions in slate produce often so-called pocket deposits.

Finally you will come to a place where the float may suddenly cease or the gold may diminish greatly in amount or disappear altogether. This means that you have gone beyond the vein and that the vein may be in close proximity. Return to a place where you found colors in the pan last time or where the float was seen definitely and search the neighborhood carefully for further floats or signs of an outcrop, i. e. a surface indication of a vein.

Most outcrops are hidden from view, being covered with decomposed and shattered rocks, sand, soil, vegetation, etc. Abundant vegetation may mark the outcrop, due undoubtedly to water permeating through the fissure, or on the other hands a bald spot among vegetation may be the sign of the outcrop. Some plants show predilection for certain geological formations.

Thus cactus often grows at the contact of limestone and granitic rocks. A plant called "Spanish bayonet" prefers granite or quartz soil. Okoteya plant grows on slate and clay formations. Dikes carrying minerals high in potassium are marked sometimes by sage brush. Granite soil seems to be favorable for fir trees. Tuff and breccia support in some places growth of quaking aspen. All these growths, of course, are merely suggestive. In arid locations the outcrop is sometimes covered with what is known as "desert varnish", chemically manganese oxide. This usually appears as a black spot.

Whenever the float disappears from view or "goes down", in the language of the prospectors, and the outcrop cannot be discovered directly, it will be necessary to dig trenches at right angles across the supposed movement of the float and then, if necessary, other trenches at right angles to the first ones. The distance between the hidden outcrop and the place where the float goes down, differs widely. On slopes that are not steep and especially in desert regions, this distance is usually very small, couple feet only, while on steeper slopes the distance may be even 100 feet. Continue to follow the float by digging until you discover the hidden outcrop.

Do not expect to see glittering yellow gold in the outcrop. It may be in such a form, but usually the outcrop is liable to look entirely unlike gold, it may be dark or even black, yellowish red, even brown-black or gray, brass yellow and almost any color due to pyrites, other minerals and their decomposition products. Veins in metamorphic rocks (slates, schists, etc.) are often valuable. Heaviness of the rock is much more suggestive sign than color in the outcrop. The quartz veins, especially white, rose and gray greasy looking quartz may contain enough gold to make the

vein very valuable and yet the gold may not be visible, it being necessary to crush the rock to fine powder and extract gold by panning to demonstrate its presence. Make it a rule to collect samples of any heavy, colored or peculiar looking rock and test for gold by pulverizing, panning, amalgamation and other methods discussed under "Placer Prospecting".

By far the greatest majority of ore deposits have been discovered by finding their outcrops, much smaller portion by drilling, tunneling and other operations, and lately by the use of geophysical instruments. All the latter methods are outside of the realm of the amateur prospecting, with the exception of digging and limited amount of drilling.

Practically all outcrops have undergone some changes, due to exposure to air, water and other complicated mechanical and chemical agencies. Thus it happens that the minerals and rocks are not found in the outcrop in the same condition as they are in the deeper portions of the vein that is not affected by surface agencies enumerated above. The effect produced by these changes depends also on the metallic content and the chemical composition of the vein itself, upon the nature of the gangue material in the vein and also upon the nature of the surrounding (country) rock. Because of these changes, gold is usually found free (native gold) in the outcrop and can be demonstrated by panning and the value estimated roughly in the same way as described under placer prospecting. When an outcrop is discovered, proceed to test it for gold as follows:

1. Crush the material to size of fine sand grains and pan. Examine the residue with unaided eye and with a magnifier.

2. If no gold discovered, pan about ten pans of crushed material with mercury in the way described

under placer prospecting. If no gold is discovered even by this method, there is no free gold in the outcrop, but gold may still be present in some other form.

3. Take another sample from the outcrop, crush to fine powder and roast in an iron spoon below red heat until fumes are given off. Pyrites will give sulphur smelling fumes, tellurides will give off heavy, white odorless smoke, some of which may be deposited on a cooler portion of the spoon and when this powder is heated, it will fuse to yellow drops that become white on cooling. Stir the powder frequently with an iron rod or wire. When the fumes cease, heat to redness for at least 15 minutes. Do not heat above redness, since in this way you may produce fusion and prevent oxidation. When cool, pan the powder and examine for gold with a magnifier. If no gold is found, treat in the same way larger amount of the ore, pan with mercury and examine for gold.

4. If there is not trace of gold in ore when treated as described above, perform the following test: Roast the ore carefully as described above and then thoroughly mix with about four times the quantity of soda and four times the quantity of charcoal. Sodium carbonate should be used. If not available, ordinary sodium bicarbonate may be heated first. Instead of charcoal, flour may be used. Heat the mixture in an iron spoon in very hot flame until it fuses. A globule of gold may be separated and seen either by naked eye or with a magnifier and may be hammered into a thin sheet.

If gold is found, you will want to estimate the real value of the discovery. For this purpose samples should be taken not only from the outcrop, where the vein contents have been altered by exposure, but also, if possible, from the unchanged portion of the vein that is beyond the reach of atmospheric influences. Most mining authorities recommend a special procedure

by which it is possible to make the sample fairly representative of the real value of the vein. Besides this average sample it is advisable also to take two samples from the vein, one to show, not what the vein is on the average, but what it may be at its best (specimen), and the other from the poorest looking portion.

The sample for estimating the average value of the vein per ton is prepared in the following way:

From different places of the dep, preferably unaltered portion of the vein take several pieces, enough to make about ten pounds. Crush these to the size of peas and mix well. Heap this crushed ore into a cone, flatten its top to produce a truncated cone, and then divide it into four quarters by cutting across the truncated cone at right angles. Throw away two opposite quarters, crush the other two quarters a little finer and repeat this process until each quarter will weigh about a pound. Crush one of these 9 qts. to the size of fine sand, pan the gold out of it, if in native condition, and estimate yourself the value per ton to be compared later with the assayer's figures. Send the other quarter, weighing about a pound to an assayer's office for correct, dependable assay. There are private assayers in all larger cities of the mining districts. The samples may also be sent to United States Mint at Carson City, Nev., or U. S. Assay Offices at Boise, Idaho; Helena, Montana; Deadwood, S. D.; Salt Lake City, Utah, and Seattle, Washington. A charge of \$1.00 will be made for gold and silver assay of each sample and also many other metallic ores will be assayed in these offices at \$1.00 per each metal determined. The assay fee should be sent with the samples.

Before leaving the place of discovery, be sure to take all the precautions mentioned in connection with placer prospecting, i. e. accurate mapping and proper staking.



After you have received the assayer's report, there arises the question: "What to do with the prospect?" While many a placer, as explained before, may be exploited with little or no capital, most gold bearing veins require from the very start usually large investment in machinery for their successful operation. Unusually rich deposits, that may be sent to mills with a profit, are exceptions to this rule. How to proceed in selling is explained in previously mentioned booklet "Selling Prospects". It is almost always desirable not to sell outright, but to retain at least a part interest in the form of partnership or stock in the company, if and when organized. There are also a number of agencies that will undertake to sell your claim on the basis of commission. Be sure to have your claim properly recorded and all the requirements satisfied before starting any negotiations, and be always on the lookout for dishonesty with which the mining speculations have been tainted in the past.

The development of a prospect does not fall within limitations of this work and therefore will not be discussed here.

## CHAPTER VII.

### APPENDIX.

#### ELEMENTS OF THE MINING LAWS.

Even the amateur prospector should know at least the rudiments of the laws pertaining to prospecting and mining.

While in Canada a prospector is required to pay \$5 for the so-called "free miner's certificate" before he is allowed to do any prospecting, no such fees nor restrictions are in force in the United States and any citizen is permitted to prospect and to locate on the public lands, that is the lands that are not occupied and belong to the government. If the land is not fenced in, not cultivated, not occupied and not marked by any monuments and placement notices, you may be reasonably sure that it is public land. In case of doubt locate your claim definitely on a topographic map, local township maps, section posts, bench marks or any other landmarks and inquire in the nearest land office. The National Forests are open to prospecting, but not the National Parks. Railroad lands are open to prospectors. If anything is discovered on a railroad section, the discoverer can buy the section or any part of it for \$2 to \$3 an acre. Thus he can get a clear title to it and in majority of cases installment payment will be acceptable by the railroad company. The railroad companies want people to find mines and build business, thus to develop the country and furnish more business to the railroad. The law requires that a valuable mineral be found before allowing you to locate on

public land. Different states have different laws pertaining to locating and mining, and it is advisable to become acquainted with the mining laws of the state you are prospecting in. On the whole the variations as to locating are very slight and the laws may be briefly summarized, as follows:

**THE PLACER CLAIM** is limited by law to 20 acres (43,560 x 20 square feet) per person or a corporation or to 160 acres for un-incorporated association of 8 individuals. No definite shape of the claim is required, since the placer usually conforms to the shape of the river bed or of a deposit. Mark the corners of the claim by stakes about 4 feet high and 4 inches square, or if wood is not available, by so-called monuments which are piles of stone 3 square feet at the base and about 4 feet high. These dimensions are not infrequently slighted and they are never contested if they are placed right and the owner tried to do his best. In about the center of the claim or near a place of digging or even in one of the monuments put a notice of the claim in dry tin can, fastened with the bottom up to protect the paper from exposure to weather. Push the paper into the can, bend the lid back to hold the paper in the can. The blanks necessary for this purpose are included with this booklet and additional ones may be procured from local printers. Make out two copies of the claim paper, deposit one on the claim and keep the other copy for recording in county or district recorder's office. Fee for filing is usually \$1.00. For completing and recording the location the law allows you 30 days. To keep the legal right to the claim afterwards, it is necessary to do at least \$100 worth of labor or invest \$100 in improvements (reasonably permanent) on the claim each year, beginning with noon of July 1st after the discovery. It is advisable to note on your placement paper the

dates between which the so-called assessment work was done. This work should also be recorded, but it is not mandatory. If not recorded and should anyone contest it, the burden of proof rests on you to prove that it was done. If it is recorded, the burden or proof rests on the claimant to prove that you recorded your work falsely. If all these requirements are fulfilled, the placer may be held indefinitely, although if quite valuable, it is preferable to have it patented. This is somewhat complicated procedure, requiring surveying, publication of notices in newspapers, affidavit as to \$500 worth of work done or improvements made, payment of \$5 per acre and proof citizenship of the person applying for the patent. Inquire as to the details of this procedure in the land office of the district. Patented claims are subject to state and county taxes like any other real estates, while unpatented ones are free from taxes.

LODE CLAIMS are limited to 1500 feet along the vein and 300 feet on each side of the vein. The shape is immaterial, since it generally follows the course of the vein, but the end lines must be parallel. Staking must be done same as in a placer claim and besides that the point of discovery must be marked by a stake or monument containing notice of the location. The point of discovery is either an outcrop of the vein or a tunnel or shaft by which the vein was reached. Some states require the vein to be exposed at least 10 feet underground to make the location valid. Most laws say 4 by 4 feet in area and 10 feet deep, but it is usually interpreted as a hole from which 240 cubic feet of material is removed, the shape of it being immaterial. For this additional work you are allowed 60 days and additional 30 days for recording the claim, altogether 90 days. Assessment work and patenting is governed by the same laws as in the case of placer claims.

## DESERT LORE.

The most favorable gold prospecting districts in the great Southwest are located chiefly in arid desert and in mountains surrounded by the desert. It is therefore of great advantage for the prospector to become acquainted with several conditions that are peculiar to the desert. The following practical hints pertaining to travelling, living and prospecting in the desert may occasionally be the means of not only preventing much discomfort and suffering, but also of saving the very life of the desert prospector.

**WATER** in sufficient amount and of good quality is the first and the most important condition of desert travel. The water carrying receptacles have been discussed under the heading of equipment. The daily amount necessary has been stated at 2 quarts per day per person. This, however, is the very minimum, not allowing for any waste and not sufficient whenever there is more than average physical exertion. When travelling in an automobile it may be amply sufficient, but when much walking or working is to be done, it is better to double the minimum water requirement.

**POISONOUS SPRINGS.** Although poisonous springs, presumably containing arsenic, have been reported by some desert prospectors, actual chemical tests made by the U. S. Geological Survey failed to find any arsenic or similar poison. Large quantities of alkalis and purgative salts like magnesium sulphate (Epsom salts) and sodium sulphate (Glaubers salt) were found. Excessive consumption of water like this, or long continued, moderate consumption induces even in healthy and robust persons purging of the bowels and also swelling and cracking of the lips. The exhausted and famished prospector drinking without restraint may easily be killed by these waters, although

actually they contain no poison. As a rule, the bitter and alkaline (baking soda like) taste of the water is sufficient to warn you of the danger. Slight alkalinity, however, up to about 0.25 per cent is not harmful.

**DRINKING WATER.** Most of the springs, especially in California and Nevada are marked "Drinking water" or "Radiator water", that is water unsuitable for drinking purposes. But even the springs that are supposed to contain water fit for human consumption, may become temporarily unsuitable. The water may have evaporated and the spring reduced to a mud hole with abundant limy vegetation. Perfectly good water in a spring may entirely be spoiled by decaying bodies of desert animals that have fallen in and drowned or the spring may be choked by debris washed down during a storm. In these cases it may be necessary to clean the spring. The necessary tools for this purpose are shovel, pick, bucket and rope. Auto tow rope is quite handy for this purpose and usually long enough. To prevent contamination, some springs and wells are covered with boards or other covering, which in turn may be buried by drifting sand so that it may occasionally be quite difficult to find them. Pieces of broken earthen-ware and tin cans in a place where brush has been cleared and where there are other signs of previous camping, are usually highly suggestive of a spring in close proximity. Most likely indication of a spring, visible often for great distance, is fresh green vegetation, e. g. grass, bushes, etc. Palms are usually signs of water, often alkaline, near the surface, while mesquit trees indicate water too, but sometimes very deep down, since the mesquit roots in their search for water may penetrate even 50 feet down below the surface.

**WATER PURIFICATION.** Water containing large amount of suspended, not dissolved matter, is cleared

for drinking purposes by filtering. A handy filter with a rubber tube has been described in the chapter on equipment. Filter alone will not, however, remove all the bacteria that may be present, neither the salts present in solution. Boiling will kill bacteria, but will leave the salts in solution, while distilling will both kill the bacteria and remove all dissolved salts. Although rarely necessary, distillation may sometimes have to be resorted to when the water contains decayed matter or excessive salts and for obtaining water from the sap of giant cactus (*Cereus giganteus*). Distillation disposes of all bitter and harmful substances contained in the cactus sap and the distillate may be freely consumed without any fear of poisoning or infection. In your mineral testing outfit you may include a flask, a rubber stopper with a hole and glass tubing of the size to fit tightly into the hole of the stopper. To condense water, the glass tubing carrying the steam from the boiling liquid has to be cooled and this is done by wrapping a piece of burlap or any other material around the tubing, keeping it constantly moist with water, or by running the tubing through a heap of dirt or sand dug out from some depth where it is cooler or by slipping the glass tubing through a hole in a cactus. This method is suitable for distilling only small amounts of water in emergencies, for larger amounts special stills have to be used which being too heavy to be carried, have their field of usefulness only in permanent or semi-permanent camps where transportation by an automobile or pack animals is available. The flat taste of distilled water is considerably improved by pouring it several times from one vessel to another or by blowing air into it by means of glass tubing.

#### WATER FROM DESERT PLANTS.

In total absence of water, recourse may be had to

some plants in the desert from which drinking fluid may be extracted.

**BARREL CACTUS** (*Echinocactus cylindraceus*), commonly called also *bisnaga* or *viznaga*, contains in its barrel like cylinder a fair substitute for water and has undoubtedly saved many a prospector dying of thirst. The clear liquid, with slightly salty and slightly bitter taste obtained from this cactus is safe to be used in any quantity without filtering. This cactus looks like a small barrel standing on its end, almost directly on the ground. When young, it looks like a big ball and grows up to about 6 feet in height. Its body is covered by long, sharp spines. It blooms in spring and its large greenish-yellow flowers are cup shaped and arranged in a circle on the top of the plant. Its flower buds are edible and when boiled, taste very well. To tap this desert barrel for a drink, cut away from the top a section about six inches thick or, if without tools, crush the top with a large clean stone, exposing the pulp inside. Crush the white tissue of the interior to a pulp with an ax handle, prospecting pick handle, clean sharp stone or any other suitable tool, or with you fists and fingers, should no tool be available. The fluid is squeezed from the pulp and scooped out with a cup or hollow of the hands. One plant may give as much as two quarts of the liquid, the larger ones even much more. Indians use this plant sometimes as a cooking vessel, boiling meat in the juice of the plant by dropping hot stones into it after the pulp was squeezed out and removed. When well covered, after dropping the stones in, it acts very much like a fireless cooker.

**GIANT CACTUS** (*Cereus giganteus*), also called *sahuaro* or *saguaro*, may be used as a source of water, but its sap, though it may be given to burros, must be distilled for human consumption, since it is very un-



pleasantly bitter and contains some harmful substances. A considerable supply of the liquid may be obtained by felling a large plant, breaking it in the middle and allowing this middle portion to sag over a bucket, while the ends are elevated above the ground. By building a fire under the ends the delivery of the liquid is hastened. The large white flowers of this plant and crimson fruit are edible.

### WHEN TO DRINK.

Under the fierce rays of the sun in the desert it is important not only to know what to drink, but also when to drink. In the morning and in the evening, when you stop for camping, you may drink as much as you like. During the day, however, restrain yourself from too much drinking. If in drinking cool water you notice that shortly after a drink profuse sweat breaks over the body, regard this as a signal to quit the cool liquids and turn to hot ones, if you want to be able to stand the intense heat. And after all, hot tea or hot coffee and tomato juice during the day are preferable to cool drinks. During periods of extreme heat it is very pleasant to wrap a wet cloth around the wrists and to put a water soaked handkerchief in the hat. Indians chew on a stick of creosote bush, when too thirsty and unable to get a drink.

**DECEIVING DISTANCES.** The clear air of the desert allows the details of distant objects to be easily seen, giving thus illusion of nearness, which is very deceiving to one not accustomed to it and may lead one not only into great discomfort, but also into serious danger to life. Never leave a camp, no matter how short you think your hike will be, without a full canteen and without at least an emergency packet of food. The goal of your travel may be far more distant than estimated and walking in loose sand may be slow-

er than expected. Walter C. Mendehall in U. S. Geological Survey Water Supply Paper No. 224 gives the following hints on travelling in the desert:

“Landmarks should be studied, so that they will be recognized from any point of view, that they may be known when they are reached again. Before he begins a journey that does not follow a beaten and unmistakable track, the traveller should determine his general direction by compass or map or inquiry, and should adhere to that direction. The inexperienced traveller often gets at once into a panic on losing his way, and wastes his remaining energy in frantic rushes in one direction and another. This tendency to become panic-stricken should be controlled, if possible. Sit down, get out your map and compass — if you are provided with them, as you should be — and study the situation carefully before acting. At least, rest a little and think it over. If it is hot and you are far from camp, get your head into the shade of a bush or rock, and wait till night. Thirst will be less intolerable then and endurance greater. If you have camp companions who are likely to look for you, start a signal fire by night or a smoke fire by day from some little eminence, and then stay by it until help comes. If you must depend upon your own exertions, think carefully over all the possibilities and adopt a plan of action and adhere to it. Remember the proneness of the lost person to exaggerate the distance he has travelled. It is well to count paces and to remember that about two thousand make a mile. You will thus have a good check on the distance that you go, and at the same time will keep your mind occupied. Keep your direction true by travelling towards or from some selected landmark, or by the sun during the day or a star at night, or by keeping with or against or in some fixed direction in relation to the wind. If you think these things out and

have studied the country beforehand, so that you know the relation of a road, or a ranch, or a spring, or a river to a given landmark or to the points of the compass, you should have no difficulty in finding your way out."

### ADVANCED STUDIES.

We are sure that many who have tasted the sport of prospecting, will be fascinated by its adventures to such an extent as to desire deeper insight into the mysteries of nature as exemplified in the deposition and formation of the earth's crust. To those we wish to give few practical hints and show them the way to the accomplishment of their desires.

The University of California offers a correspondence course in Determinative Mineralogy 1. B. This course is for the instruction of anyone, not in attendance at the University, who wishes to obtain a knowledge of minerals and learn the simple, practical methods by which they can be identified. The fee for the course, which is \$8.50, includes all mineral specimens and powders, a pad of report blanks and the assignment sheets. Besides that a set of laboratory apparatus will be necessary, costing about \$20.00. For those having access to a laboratory the cost of apparatus may be considerably reduced. Required textbook: Brush-Penfield, "Determinative Mineralogy and Blowpipe Analysis" costs \$3.75. Some knowledge of chemistry is necessary in order to pursue this course intelligently. If interested, write to: University of California, Extension Division, Berkeley, California.

Mineralogical, geological and mining literature pertaining to various states has previously been given, so that in the following chiefly books of general interest will be mentioned.

“Coronado’s Children. Stories of Lost Mines and Buried Treasures of the Southwest.” — J. Frank Dobie. Southwest Press, Dallas, Texas. — Contains delightful stories of many lost mines of the Southwest.

“Minerals of California”. — Arthur S. Eakle. 1923. 328 pages. California State Mining Bureau, Ferry building, San Francisco, California. (\$1.00). The book deals with minerals of California, but since almost all important minerals are found in this state, it is quite exhaustive. Gives chemical composition, tests and occurrences of minerals in the state.

“Mineral Tables for the Determination of Minerals by Their Physical Properties”. — Arthur S. Eakle. 1904. 73 pages. John Wiley & Sons, New York City. (\$1.25)

“Field Tests for the Common Metals”. — G. R. Fansett. Bulletin 128. Arizona Bureau of Mines, Tucson, Arizona. (10c.) — Very good for the beginner.

“A Glossary of the Mining and Mineral Industry”. — Albert H. Fay. 1920. 754 pages. Superintendent of Documents, Washington, D. C., (75c.) Contains definitions and explanation of terms used in mining, geology, mineralogy and prospecting.

“Dana’s Manual of Mineralogy”. W. E. Fort. 1916. 460 pages. John Wiley & Sons, New York City. (\$2.00)

“A Popular Guide to Minerals”. — L. P. Gratacap. 1928. D. Van Nostrand Co., 250 Fourth Avenue, New York City.

“Tables for the Determination of Minerals by Means of Their Physical Properties, Occurrences and Associates”. — Edward Henry Kraus and Walter Fred Hunt. 1911. 254 pages. McGraw Hill Book Co., Inc., 330 W. 32nd St., New York City. — Very good book

for determining the identity of 250 most common minerals chiefly by their physical properties and without the aid of reagents and apparatus.

"Blasters' Handbook". — Arthur La Motte. 1930. 238 pages. E. I. Du Pont De Nemours & Co., Wilmington, Delaware. — (Free.)

"Prospecting for Gold and Silver". — Arthur Lakes. 287 pages. — Good, but obsolete.

"Field Book of Common Rocks and Minerals". — F. B. Loomis. 1923. G. P. Putnam's Sons, New York City. Illustrated in colors. (\$3.50)

"Practical Instructions in the Search for, and the Determination of, the Useful Minerals, including the Rare Ores". — Alexander McLeod. 1921. John Wiley & Sons, New York City. (\$2.50)

"Minerals and How They Occur". — W. G. Miller. 1906. 252 pages. Copp, Clark, Ltd. Toronto, Canada.

"A Primer On Explosives for Metal Miners and Quarrymen". — Charles E. Munroe and Clarence Hall. Superintendent of Documents, Washington, D.C. (25c.) A very useful book.

"Prospector's and Miner's Manual". — O. H. Packer. 1913. 301 pages. Brown & Bower Stationery Co., San Francisco, California. (\$3.00)

"Mining Engineer's Handbook". — Robert Peele. 1927. 2,523 pages. John Wiley & Sons, New York City. \$10.00) An outline of all phases of mining engineering.

"Rocks and Rock Minerals".—L. V. Pirsson. 1910. 414 pages. John Wiley & Sons, New York City. (\$2.50) Contains a good table for determination of common rocks and minerals.

"Prospecting in Canada". By Officers of Geological Survey. 1930. 288 pages. (50c.) Canada Geological Survey, Ottawa, Canada. Make money order payable to: Receiver General of Canada.

"Introduction to the Study of Minerals". — A. F. Rogers. 1921. 527 pages. McGraw-Hill Book Co., New York City. (\$4.00)

"Prospecting, Locating and Valuing Mines". — R. H. Stretch. 1899. 381 pages. Scientific Publishing Co., New York City. (\$2.50)

"Handbook for Prospectors". M. W. von Bernerwitz. 1931. 359 pages. McGraw Hill Book Co., New York City. \$3.00)

Idaho Bureau of Mines and Geo., Moscow, Idaho.  
W. W. Staley:

"Elementary methods of placer mining".

A. W. Fahrenwald:

"The recovery of gold from its ores".

## GLOSSARY.

(The definitions that follow have been taken chiefly from "A Glossary of the Mining and Mineral Industry" published by the U. S. Bureau of Mines as Bulletin No. 95).

### A

- ACRE.** Land area of 43,560 square feet or 4,800 square yards or 160 square rods.
- AGGLOMERATE.** A breccia composed largely or wholly of fragments of volcanic rocks. More specifically, a heterogeneous mixture of fragments of volcanic and other rocks filling the funnel or throat of an extinct or quiescent volcano.
- ALLOY.** A compound of two or more metals usually produced by fusion.
- ALLUVIAL.** Relating to deposits formed by flowing waters.
- ALTERED** rock or mineral is one that has undergone changes in its texture or chemical composition after its original formation.
- AMALGAM.** 1. A native compound of silver and mercury or gold and mercury. 2. An alloy or union of mercury with another metal.
- ARCHEAN. ARCHAËAN.** Ancient. The term is sometimes used as equivalent of Pre-Cambrian, but is restricted by the U. S. Geological Survey and most American geologists to the oldest stratified rocks.
- ARRASTRE.** Spanish word denoting an apparatus for grinding and mixing ores by means of a heavy stone dragged around upon a circular bed. The arrastre is chiefly used for ores containing free gold and amalgamation is combined with grinding.
- ASSAY.** To test ores or minerals by chemical or blowpipe examination. To determine the proportion of metals in ores by smelting in the way appropriate to each. Gold and silver require an additional process called cupelling, for the purpose of separating them from the base metals.

- CLAIM.** The portion of mining ground claimed and held by one person or incorporated association of persons that was located and recorded by them. Lode claims: Maximum size 600 by 1500 feet or 20.6 acres. Placer claim: Maximum size 660 feet by 1,320 feet or 20 acres. A claim is sometimes called a "location".
- CLAY SHALE.** Shale composed wholly or chiefly of material which becomes clay when exposed sufficiently long to atmospheric agencies.
- CLAY SLATE.** An argillaceous rock having a slaty or fissile structure. It differs from clay shale in that it has been altered by metamorphism.
- COLOR.** 1. The shade or tint of the earth or rock which indicates ore. 2. A particle of metallic gold found in the prospector's pan after a sample of earth or crushed rock has been "panned out". Prospectors say, e. g.: "The dirt gave me so many colors to the panful".
- CONGLOMERATE.** An aggregate of rounded and water-worn pebbles and boulders cemented together into a coherent rock, deposited by streams or waves, generally with some sorting and stratification.
- CONTACT.** The place or surface where two different kinds of rocks touch each other.
- CONTACT METAMORPHISM.** Changes which have occurred along the line of contact of two different rocks. Metamorphism produced by the heat of an igneous intrusion. Also called Thermometamorphism or Local Metamorphism.
- CONTACT VEIN.** A variety of fissure vein, between different kinds of rock occupying a typical fracture from faulting, or it may be a replacement vein formed by mineralized solutions percolating along the surface of the contact where the rock is usually more permeable and there replacing one or both of the walls by metasomatic process.
- CONTOUR.** 1. The outline of a figure or a body; periphery. 2. On a topographic map a line connecting the points of the same elevation or altitude.
- CONTOUR INTERVAL.** The difference in elevation between consecutive contour lines.
- CONTOUR MAP.** A map showing elevations or altitudes. The closer the lines, the steeper the grade.
- COUNTRY ROCK.** The general mass of adjacent rock as distinguished from that of a dike, vein or lode.



- CRADLE.** A wooden box, longer than wide, provided with a movable slide and hopper, and mounted on two rockers. It is used for washing gold-bearing earths.
- CREEK CLAIM.** Under the statutes of Oregon, a tract of land one hundred yards square, one side of which abuts on a creek or rather extends to the middle of the stream.
- CREEK PLACERS.** Placers in, adjacent to and at the level of small streams.
- CRETACEOUS.** 1. Of the nature of chalk; relating to chalk.  
2. The third and latest of the period of the Mesozoic era.

## D

- DACITE.** Generally volcanic igneous rock containing essential plagioclase and quartz, with or without hornblende and biotite or both; quartz andesite.
- DECOMPOSITION.** The breaking up or decay of compounds into simpler chemical forms.
- DEPOSIT.** The term mineral deposit or ore deposit is arbitrarily used to designate a natural occurrence of a useful mineral or ore in sufficient extent and degree of concentration to invite exploitation.
- DEPOSITION.** The precipitation of mineral matter from solution, as the deposition of galena, vein quartz, etc.; natural accumulation of rock material.
- DETRITUS.** Incoherent sediments of rocks shattered and decomposed by various agencies.
- DEVELOPMENT.** Work done in a mine to gain access to the ore bodies by shafts, tunnels, etc. Sometimes used synonymously with "Annual assessment work".
- DIKE.** Cracks in rocks filled by solidified igneous rock, of different nature.
- DIP.** The angle at which beds or strata are inclined from the horizontal, while underlie is the angle formed between a vein and a vertical line.
- DIPPING COMPASS.** A compass in which the needle swings in a vertical plane. It is used for detecting magnetic minerals and rocks.
- DIPPING NEEDLE.** Same as a Dipping Compass.
- DISINTEGRATION.** The breaking asunder and crumbling away of a rock, due to the action of moisture, heat, frost, air, and the internal chemical reaction of the component parts of rocks when acted upon by these surface influences.

**DRIFT.** Any rock material, such as boulders, till, gravel, sand or clay, transported by a glacier and deposited by or from the ice or by or in water derived from the melting of the ice.

**DRIFT DEPOSIT.** Any accumulation of glacial origin; glacial or fluvio-glacial deposit.

**DRIFT MINING.** A method of mining gold bearing gravel or cement by means of drifts and shafts, as distinguished from the process of hydraulic mining.

## E

**ELECTRUM.** A natural alloy of gold and silver containing approximately 40 per cent of silver.

**ELEMENT.** A substance which cannot be decomposed chemically into another simpler substance.

**END LINES.** The boundary lines of a mining claim which cross the general course of the vein at the surface. If the side lines cross the course of the vein instead of running parallel with it, they then constitute end lines.

**EPIDIORITE.** A name applied to dikes of diabase, whose augite is in part altered to green hornblende. The name was coined before it was understood that the hornblende was secondary in this way.

**EPIDOTE.** A basis orthosilicate of calcium aluminum, and iron.

**EROSION.** The wearing away of the earth's surface by running water, waves, glaciers and wind, resulting in weathering, solution and transportation.

**ERUPTION.** Ejection through a crater, pipe or fissure of lava, heated water, gases, mud, stones and dust.

**ERUPTIVE.** The name given to rocks that have burst through other rocks in a molten state or that have been thrust up bodily. Often used synonymously for igneous rocks.

**EXTRUSIVE.** Those igneous rocks which have cooled on reaching the surface.

## F

**FAULT.** A break in the continuity of a body of rock, attended by a movement on one side or the other of the break so that what were once parts of one continuous rock stratum or vein are now separated. The amount of displacement of the parts may be a few inches or thousands of feet.

**FELDSPAR.** A general name for a group of abundant rock-forming minerals, the names of which are orthoclase, microcline, anorthoclase, plagioclase, oligoclase, andesine, labradorite, etc., all containing chiefly aluminum, silicon, potassium, sodium, calcium.

**FISSURE.** A crack in the rocks. Where there are well-defined boundaries, very slight evidence of ore within such boundaries is sufficient to prove existence of a lode. Such boundaries constitute the sides of a fissure.

**FISSURE VEIN.** A cleft or crack in the rock material of the earth's crust, filled with mineral matter different from the walls and precipitated therein from aqueous solution, or introduced by sublimation or pneumatolysis.

**FLOAT.** A term used much among miners and geologists for pieces of ore or rock which have fallen from veins or strata, or have been separated from the parent vein or strata by weathering agencies. Not usually applied to stream gravels.

**FLOAT GOLD. FLOUR GOLD.** Particles of gold so small and thin that they float on and are liable to be carried off by the water.

**FLOURED.** The coating of quicksilver with what appears to be a thin film of some sulphide, so that when it is separated into globules these refuse to reunite. Also called Sickening and Flouring.

**FOOL'S GOLD.** Pyrite (iron sulphide) which because of its metallic luster and yellow color has often been mistaken for gold by the inexperienced.

**FORMATION.** As defined and used by the U. S. Geological Survey, the ordinary unit of geologic mapping consisting of a large and persistent stratum of some one kind of rock. It is also loosely employed for any local and more or less related group of rocks. In Dana's geology it is applied to the groups of related strata that were formed in a geological period. In chronological geology formations constitute as it were the units, and several formations may go to make up a system. The word is often loosely used to indicate anything which has been formed or brought into its present shape.

**FOSSIL.** Any remains, impression, or trace of an animal or plant of past geological ages which have been preserved in stratified deposits.

**FRACTURE.** The character or appearance of a freshly broken surface of a rock or mineral. Peculiarities of fracture afford one of the means of distinguishing minerals and rocks from one another.

## G

**GABBRO.** A finely to coarsely crystalline igneous rock composed mainly of lime-soda feldspar, pyroxene and frequently olivine. Magnetite or ilmenite, or both, and apatite are accessory minerals. It is generally dark colored. Gabbros composed largely or wholly of feldspar are called anorthosites, and those containing orthorhombic pyroxenes are often called norites.

**GANGUE.** The non-metalliferous or non-valuable metalliferous minerals in the ore.

**GASH VEIN.** A mineralized fissure that extends only a short distance vertically. It may be confined to a single stratum of rock, but is a comparatively shallow fill vein.

**GEODE.** A hollow nodule or concretion, the cavity of which is lined with crystals.

**GEOLOGICAL FORMATIONS.** Groups of rocks of similar character and age.

**GEOLOGY.** The science which treats of the history of the earth and its life, especially as recorded in the rocks. Three principal branches or phases are usually distinguished: 1. Structural or geotectonic geology, treating of the form, arrangement, and internal structure of the rocks. 2. Dynamic geology, dealing with the causes and processes of geological change. 3. Historical geology, giving history of the formation of the earth's crust. — Other subdivisions are: Economic geology, that branch of geology which deals with the applications of the science in industrial relations and operations. Legal geology, the application in litigation of the facts and principles of geology, particularly its subdivisions, mineralogy, economic geology, and mining geology. Mining geology, a subdivision of economic geology concerned with the application of geologic facts and principles in mining. Stratigraphic geology, a study of the succession of the beds of rock laid down during the progress of geologic ages.

- GNEISS.** A layered crystalline rock with a more or less well-developed cleavage, but without the fissility of schist. The commonest varieties are mica-gneiss, hornblende-gneiss.
- GOLD DIGGINGS.** A region where gold is found mixed with sand or gravel.
- GOLD DUST.** Fine particles of gold obtained in placer mining.
- GOLD MINE.** A mine containing or yielding gold or a deposit of gold. It may be either in solid rock (quartz mine) or in alluvial deposits (placer mine).
- GOLD WASH.** Same as placer deposit.
- GOLD WASHER.** One who recovers gold by washing away the dirt from the auriferous gravel, in a pan, cradle or the like. Also a mechanical device for this purpose.
- GOSSAN.** A rusty-red deposit filling the upper parts of mineral veins or forming a superficial cover on masses of pyrite. It consist principally of hydrated oxide of iron, and has resulted from the oxidation and removal of the sulphur as well as the copper, etc.
- GRANITE.** A granular igneous rock composed essentially of quartz, orthoclase or microcline, and mica. Commonly a part of the feldspar is plagioclase. Commercially almost all compact igneous rocks are called granite as distinguished from slate, sandstone, and marble.
- GRANITE-PORPHYRY.** Practically a quartz-porphyry with a coarsely crystalline ground-mass and preponderating phenocrysts.
- GRANITOID.** A textural term to describe those igneous rocks which are entirely composed of recognizable minerals of approximately the same size. It was suggested by granite, the most familiar of the rocks which show this characteristics. In the granitoid texture each kind of mineral appears in but one generation, and the individuals seldom have crystal boundaries.
- GRANODIORITE.** A term which has been given for the intermediate rocks between granite and quartz-diorites.
- GRAPHIC GOLD.** Crystals of sylvanite arranged regularly so as to simulate Hebrew letters. Called also graphic tellurium.
- GRAVEL.** Small stones and pebbles or a mixture of sand and small stones, more specifically, fragments of rock worn by the action of air and water, larger and coarser than sand.

- GRAVEL MINE.** A placer mine; a body of sand or gravel containing particles of gold.
- GRAYWACKE. GRAUWACKE.** Metamorphosed shaly sandstones that yield a tough, irregularly breaking rock, different from slate on the one hand and from quartzite on the other.
- GRAYWACKE SLATE.** Micaceous and sandy, fine-grained, slaty or shaly rocks.
- GRUBSTAKE.** Supplies, chiefly of food, furnished to a prospector with the understanding that the party furnishing it will share in the discoveries made by the prospector during a certain period of time.
- GRUBSTAKE CONTRACT.** An agreement between two or more persons to locate mines upon the public domain by their joint aid, effort, labor, or expense, and each is to acquire by virtue of the act of location such an interest in the mine as agreed upon in the contract.
- GULCH.** A narrow mountain ravine.

## H

- HANGING WALL.** The upper wall of a vein or mineral deposit.
- HARDPAN.** Layers of gravel which are usually present a few feet below the surface and which are cemented by limonite or some similar bonds and thus are made hard and resistant.
- HOMOGENEOUS.** Of the same kind or nature throughout.
- HORNBLLENDE.** A variety of the mineral amphibole. Color between black and white, through various shades of green, inclining to blackish green, also dark brown, rarely yellow, pink, rose-red.
- HORNBLLENDE SCHIST.** A schist composed chiefly of hornblende.
- HORN SILVER.** Chloride of silver. Cerargyrite. Usually in thin plates and crusts, sometimes massive. Color gray, but generally tarnished brown. Waxy appearance and can be easily cut with a knife.
- HORSE.** A mass of country rock lying within a vein.
- HYDRAULICKING.** Washing down a bank of earth or gravel by the use of water under high pressure.
- HYDRAULIC MINING.** A method of mining in which a bank of gold-bearing material is washed down by a powerful jet of water under pressure.

## I

- IGNEOUS.** Formed by solidification from a molten state.
- IMPREGNATED.** Country rock containing mineral similar to that in the vein.
- IMPREGNATION.** An ore deposit consisting of the country-rock impregnated ore, usually without definite boundaries.
- IMPROVEMENT.** As used in the mining statutes, is an artificial change of the physical condition of the earth upon or reasonably near a mining claim as to evidence a design to discover mineral therein, or to facilitate its extraction. It must be reasonably permanent in character.
- INTRUSION.** A mass of igneous rock solidified in another rock.
- INTRUSION DISPLACEMENT.** Faulting coincident with the intrusion of an igneous rock.

## J

- JUMPING A CLAIM.** 1. Taking possession of a mining claim which has been abandoned. 2. Taking possession of a mining claim liable to forfeiture owing to the requirements of the law being unfulfilled. 3. Taking possession of a mine or claim by stealth, fraud or force. 4. The location of a mining claim on supposed excess ground within staked boundaries of an existing claim on the theory that the law governing the manner of making the original location had not been complied with.

## L

- LABOR AND IMPROVEMENTS.** Labor performed and improvements made for development in such manner as to facilitate the extraction of the metals, though such labor and improvements may not be on the particular location itself.
- LAURENTIAN.** The younger of the two series of rocks comprised in the Archean system, consisting of igneous rocks.
- LAVA.** A general name for the molten outpourings of volcanoes.
- LAVA CONE.** A volcanic cone composed wholly of lava.
- LAVA FLOW. LAVA STREAM.** A stream of lava either liquid or congealed.

- LAVA PIT.** A crater that is visibly floored with massive lava, either liquid or solid.
- LEACH.** To wash or drain by percolation. To dissolve minerals or metals out of the ores, as by the use of cyanide or chlorine solutions, acids, or water.
- LEDGE.** A name applied to the lode or to any outcrop supposed to be that of a mineral deposit or vein. The term ledge is ordinarily applied to several beds of rock occurring in a quarry. In some instances, however, the term is applied to a single bed.
- LENS.** A body of ore or rock thick in the middle and thin at the edges; similar to double convex lens.
- LOB OF GOLD.** A small, rich gold deposit.
- LOCATE.** To mark out the boundaries of a mining claim and establish the right of possession.
- LOCATION.** 1. The act of fixing the boundaries of a mining claim, according the law. 2. The claim itself. 3. The steps taken by the locator to indicate the place and extent of the surface which he desires to acquire, including the placing of a notice on the ground in some conspicuous position giving the name of the locator, with the requisite description of the extent and boundaries.
- LODE.** Strictly speaking a fissure in the country-rock filled with mineral; usually applied to metalliferous lodes. In general miners' usage, a lode, vein, or ledge is a tabular deposit of valuable mineral between definite boundaries. Whether it be a fissure formation or not is not always known, and does not affect the legal title under the United States federal and local statutes and customs relative to lodes. But it must not be a placer, i. e. it must consist of quartz or other rock in place, and bearing valuable mineral.
- LODE MINING CLAIM.** A mining claim including a lode, fissure, or fissure vein. In the United States the maximum length along the lode or vein is 1,500 feet and the maximum width is 600 feet, which is slightly more than 20 acres. A tract of land with defined surface boundaries including all lodes, veins, and ledges throughout their entire depth, the top or apex of which lies inside of vertical planes extended downward through the surface boundary lines, although such vein in their downward course may extend outside of the vertical side planes of the surface location.



**LONG TOM.** An inclined trough in which gold-bearing earth or gravel is crudely washed. It is longer than a rocker.

**LUSTER.** The character of the light reflected by minerals; it constitutes one of the means of distinguishing minerals.

## M

**MAGMA.** Liquid molten rock; the molten material from which igneous rocks are formed by solidification. An original, parent magma may break up into several derived ones.

**MALLEABLE.** Capable of being extended or shaped by beating with a hammer, as gold, silver, etc.

**MARKING** (of mining claims). These may consist of stakes, posts, piles of stones, boulders, posting a notice on the ground, placing a notice in a tin can attached to a stake, fastening a notice to a tree, or placing it in a box or frame, blazing trees along the boundaries or at the corners, cutting away undergrowth, making a trail through the timber along the sides or ends of the claim, or blazing stumps.

**METAMORPHISM.** Any change in the texture or composition of a rock, after its induration or solidification, produced by exterior agencies, especially by deformation and by rise of temperature. The processes and results of cementation and of weathering are not ordinary included. The most important agents are heat, moisture and pressure.

**MINE.** 1. In general, any excavation for minerals. More strictly, subterranean workings, as distinguished from quarries, placers, and hydraulic mines, and surface or open works. 2. Any deposit of mineral or ore suitable for extraction, as an ore deposit. 3. Discovery of a mine: In statutes relating to mines the word "discovery" is used, (1) In the sense of uncovering or disclosing to view ore or mineral. (2) Of finding out or bringing to the knowledge the existence of ore or mineral, or other useful products which were unknown, and (3) Exploration, that is the more exact blocking out or ascertainment of a deposit that has already been discovered.

**MINERAL.** A body produced by the processes of inorganic nature, having a definite chemical composition, and if formed under favorable conditions, a certain molecular

structure, is exhibited in its crystalline form and other physical properties. A mineral must be homogeneous substance, even when minutely examined by the microscope; further, it must have a definite chemical composition, capable of being expressed by a chemical formula.

**MONUMENT.** A stone or other permanent object serving to indicate a limit, or to mark a boundary, as of a mining claim.

**MOTHER LODE.** 1. The principal lode or vein passing through a district or particular section of the country.  
2. The "Great Quartz Vein" in California, traced by its outcrop for 80 miles from Mariposa to Amador County.

## N

**NATIVE.** Occuring in nature pure or uncombined with other substances, e. g. native gold, native mercury, native copper.

**NORITE.** A variety of gabbro consisting of plagioclase and orthorhombic pyroxene.

**NUGGET.** A water-worn piece of native gold. The term is restricted to pieces of some sizes, not mere "colors" or minute particles. Fragments and lumps of vein-gold are not called "nuggets", for the idea of alluvial origin is implicit.

## O

**OBSIDIAN.** 1. Extrusive igneous rocks which have cooled either without crystallization or with only partial crystallization. 2. A general name for volcanic glass.

**ORE.** A natural mineral compound, of the elements of which one at least is a metal. The term is more loosely applied to all metalliferous rocks, though it contains the metal in a free state, and occasionally to the compounds of non-metallic substances, as sulphur ore. Also material mined and worked for non-metals, as pyrite is an ore for sulphur.

**ORE BEDS.** Metalliferous aggregations occuring between (or in) rocks of sedimentary origin.

**ORE BODY.** Generally a solid and fairly continuous mass of ore, which may include low-grade and waste as well as pay ore, but is individualized by form or character from adjoining country rock.

**ORE POCKET.** A small isolated ore deposit, usually very rich.

**ORESHOOT.** A large and usually rich aggregation of mineral in a vein. It is a more or less vertical zone or chimney of rich vein matter extending from wall to wall, and has a definite width laterally. Sometimes called Pay Streak, although the latter applies more specifically to placers.

**OXIDATION.** A chemical union with oxygen.

**OXIDIZE.** To unite with oxygen.

**OXIDIZED ORE.** That portion of an ore deposit which has been subjected to the action of surface waters carrying oxygen, carbon dioxide, etc. That zone in which sulphides have been altered to oxides and carbonates.

## P

**PATENT.** Title in fee, obtained by patent from the United States Government when there has been done an equivalent of \$500 worth of work for each mining claim.

**PATENTED CLAIM.** A claim to which a patent has been secured from the Government in compliance with the laws relation to such claims.

**PATENT SURVEY.** An accurate survey of a mining claim by a U. S. deputy surveyor as required by law in order to secure a patent to the claim.

**PAY.** Profitable ore.

**PAY DIRT. PAY ROCK.** 1. Earth, rock, etc., which yields a profit to the miner.

**PAY GRAVEL.** In placer mining, a rich strip or lead of auriferous gravel.

**PAY ORE.** Those parts of an ore body which are both rich enough and large enough to work with profit.

**PEGMATITE.** Also called giant granite. An igneous rock, generally coarse grained but usually irregular in texture and composition, composed mainly of silicate minerals of large size, including quartz, feldspar, muscovite, biotite, tourmaline, beryl, lithia minerals, zircon, etc. Some pegmatites carry minerals containing rare earth metals, tin, tungsten, tantalum, uranium and others.

**PHONOLITE.** An aphanatic or aphanophyric igneous rock consisting of essential orthoclase or anorthoclase and nephelite and accessory amphibole, pyroxene or mica.

**PLACER.** A place where gold is obtained by washing; an alluvial or glacial deposit, as of sand or gravel, containing particles of gold or other valuable mineral. In United States mining law, mineral deposits, not veins in place, are treated as placers, so far as locating, holding and patenting are concerned.

**PLACER CLAIM.** 1. A mining claim located upon gravel or ground whose mineral contents are extracted by the use of water, by sluicing, hydraulicking and also dry washers. 2. Ground with defined boundaries which contains mineral in the earth, sand and gravel; ground that includes valuable deposits not fixed in the rock.

**PLACER DEPOSIT.** A mass of gravel, sand or similar material resulting from the crumbling and erosion of solid rocks and containing particles or nuggets of gold, platinum, tin, or other valuable minerals, that have been derived from rocks or veins.

**PLACER MINING.** That form of mining in which the surficial detritus is washed for gold or other valuable minerals. When water under pressure is employed to break down the gravel, the term hydraulic mining is generally employed. There are deposits of detrital material containing gold which lie too deep to be profitably extracted by surface mining, and which must be worked by drifting beneath the overlying barren material. To the operations necessary to extract such auriferous material the term drift mining is applied.

**PORPHYRY.** 1. Any igneous rock in which relatively large conspicuous crystals (phenocrysts) are set in a finer-grained or glassy groundmass. Porphyries are generally named in accordance with their rock composition (e. g. granite porphyry, trachyte porphyry) or with the character of the phenocrysts, as quartz porphyry. 2. Colloquially, the word "porphyry" is used to mean most any igneous rock occurring in sheets or dikes, particularly one that is spotted, soft, or light colored.

**PORPHYRITIC.** A textural term for those rocks which have larger crystals (phenocrysts) set in a finer groundmass, which may be crystalline or glassy, or both.

**PRE-CAMBRIAN.** Older than, or occurring before, the beginning of the Cambrian; especially all that part of geologic time represented by rocks older than Cambrian. Also such pre-Cambrian rocks, collectively.

**PROSPECTING.** Searching for new deposits; also, preliminary explorations to test the value of lodes or placers already known to exist.

**PROSPECTOR.** A person engaged in exploring for valuable minerals, or in testing supposed discoveries of the same.

## Q

**QUALITATIVE ANALYSIS.** Chemical process for determining the presence of certain elements.

**QUANTITATIVE ANALYSIS.** Chemical process for determining the amount of an element or elements in a given sample.

**QUARTZ.** Crystallized silicon dioxide. Amethyst is the variety of the well-known amethystine color. False topaz or citrin is a yellow quartz. Rock crystal is a watery clear variety. Rose quartz, the pink variety, and smoky quartz, the brownish variety, are often highly suggestive of the presence of gold.

**QUARTZ CLAIM.** A mining claim containing ore in veins or lodes, as contrasted with placer claims, carrying mineral, usually gold, in alluvium.

**QUARTZ DIRT.** Any loose rock material containing quartz fragments as a prominent constituent.

**QUARTZITE.** A metamorphosed quartz sandstone, formed by the deposition of secondary silica between the original grains, the resulting rock being more firmly cemented and less porous than before and tending to break across the grains.

**QUARTZ MILL.** A machine or establishment for pulverizing quartz ore, in order that the gold or silver it contains may be separated by chemical means.

**QUARTZ MINE.** A mine in which the deposits of ore are found in veins or fissures in rock forming the earth's crust. Usually applied to lode gold mines, but not to placers.

**QUARTZ MINING.** Mining on veins or ore bodies containing quartz in place for the purpose of extracting the gold, so called because quartz is the most common mineral associated with gold.

**QUARTZ PORPHYRY.** Any porphyritic rock in which the quartz occurs as phenocrysts.

**QUARTZ VEIN.** A deposit of quartz in the form of a vein. Auriferous veins are often called quartz veins.

## R

**REFRACTORY.** Resisting the action of heat and chemical reagents; quality undesirable in ores, but desirable in furnace linings, etc.

**REPLACEMENT.** The process by which one mineral or chemical substance takes the place of some earlier different substance, often preserving its structure and crystalline form.

**REPLACEMENT VEIN.** A vein in which certain minerals have passed into solution and have been carried away, while other minerals from the solution have been deposited in the place of those removed. The process is called Metasomatic replacement.

**RHYOLITE.** An igneous rock composed usually of quartz and alkalic feldspar, or of rock glass having substantially the same composition, with or without biotite, hornblende, or pyroxene. A lava, usually of light color, corresponding in chemical composition to granite.

**RIFFLE.** The lining of the bottom of a sluice, made of blocks or slats of wood, or stones, arranged in such a manner that chinks are left between them. The whole arrangement at the bottom of the sluice is usually called the riffles. In smaller gold-saving machines, as the cradle, the slats of wood nailed across the bottom are called riffle-bars or simply riffles. A groove in the bottom of an inclined trough or sluice, for arresting gold contained in sands and gravels.

**RIFFLE-BLOCKS.** Cross sections of timber set on the floor of a sluice, with irregular spaces between, in which the gold settles.

**ROAST.** To heat to a point somewhat short of fusing, with access of air, as to expel volatile matter or effect oxidation.

**RUSTY GOLD.** Free gold, that does not readily amalgamate, the particles being covered with a siliceous film, thin coating of oxide of iron, etc.

## S

**SADDLE.** 1. A formation of gold-bearing quartz occurring along the crest of an anticlinal fold. 2. A ridge connecting two higher elevations; a low point in the crest line. A ridge whose strata dip away downward from the central axis on each side; an elevated anticlinal fold.

**SANDSTONE.** An indurated sedimentary rock formed of coherent or cemented sand.

**SCHIST.** A crystalline rock that can be readily split or cleaved because of having a foliated or parallel structure, generally secondary and developed by shearing and recrystallization under pressure.

**SEDIMENTARY.** Formed by deposition or accretion of grains or fragments of rock-making material, commonly from suspension in or transportation by water or air, or by the precipitation of such material from solution, with or without the aid of living organisms: said of one of the two great classes of rocks and contrasted with Igneous.

**SHALE.** A fine-grained, fissile, argillaceous, sedimentary rock characterized by rather fragile and uneven laminae and commonly a somewhat splintery fracture.

**SHOOT.** An elongated body of ore.

**SLICKENSIDE.** A polished and sometimes striated surface on the walls of a vein, or on interior joints of the vein material or of rock masses, produced by rubbing during faulting, on the sides of fissures or on bedding-planes. Also called Slicks.

**SLUICE.** A long, inclined trough, launder, or flume usually on the ground, for washing auriferous earth, floating down logs, etc. In gold mining such a contrivance is paved with riffles, etc., to hold the quicksilver for catching the gold. 2. To wash with or in a stream of water running through a sluice.

**SLUICE BOX.** A wooden trough for washing auriferous gravels and sands.

**SLUICING.** Washing auriferous earth through long races or boxes, provided with riffles and other gold saving appliances.

**SPECIFIC GRAVITY.** The ration of the weight of a body to that of an equal volume of some standard substance, water in the case of solids and liquids. Specific gravity may be roughly estimated by hefting.

**SPECIMEN.** Among miners it is restricted to selected or handsome minerals, as fine pieces of ore, crystals, or pieces of quartz containing visible gold.

**STRATIFICATION.** The deposition of sediment beds, layers, or strata; hence, further, the stratified structure resulting from such deposition and arrangement.

**STRATUM.** A bed or layer of rock; strata, plural.

**STRIATIONS.** Very fine parallel lines marking the surfaces or cleavage faces of minerals.

**STRIKE.** 1. The course or bearing of the outcrop of an inclined bed or structure on the level surface. 2. To find a vein or ore; a valuable discovery.

**STRINGER.** A narrow vein.

**STRUCTURE.** The part of the geology of a region which pertains to the attitude of the rocks, the nature and amount, if any, of the deformation which they have undergone, and the distribution and mutual relations of the structural features.

**SURFICIAL.** Pertaining to the surface.

**SYENITE.** Any granular igneous rock composed essentially of orthoclase, with or without microcline, albite, hornblende, biotite, augite, or corundum.

## T

**TALC-SCHIST.** Schistose rocks consisting chiefly of talc and quartz.

**TENDERFOOT.** A newcomer in a comparatively rough or newly settled region, especially when not inured to the hardship or rudeness of the life.

**TEXTURE.** The character, arrangement, and mode of aggregation of the fragments, particles or crystals that compose a rock; the sum total of those features of a rock which determine its physical structure and appearance as a rock.

**TINSTONE.** Cassiterite. Tin oxide, black tin.

**TOPOGRAPHY.** The physical features of a district or region, represented on maps, contour of the land. Topographic maps published by the U. S. Geological Survey indicate elevations, hills, springs, streams, etc.

**TOURNIQUET.** A device for stopping the flow of blood by means of compression of the blood vessel, as an artery or vein, on the side of the wound from which the blood is flowing, used also in snake bite, to prevent the free circulation of blood that would favor distribution of the venom throughout the body. It consists usually of a pad over the blood vessel pressed down by a strap, rubber band, twisted handkerchief, etc.

**TROY.** A system of weight measure used for weighing gold.



**TROY OUNCE.** The one-twelfth part of a pound of 5760 grains, equivalent to 480 grains. It equals 20 pennyweights, 1.09714 avoirdupois ounces, 31.1035 grams. Pure gold is worth \$20.67 a Troy ounce.

**TUFA.** A chemical sedimentary rock composed of calcium carbonate or of silica, deposited from solution in the water of a spring or of a lake or from percolating ground waters.

**TUFF.** A sedimentary rock composed of fine material — volcanic dust, so-called ash and cinders, and lapilli — explosively ejected from a volcano. Tuff may or may not be deposited in water; it may be either heterogeneous or rather well sorted, and it may be either incoherent or indurated.

## U

**UNPATENTED CLAIM.** Mining claims to which a deed from United States Government has not been received. These claims are subject to annual assessment work, in order to maintain ownership, and if the assessment work is properly performed in accordance with the law, an unpatented claim may be held indefinitely.

## V

**VEIN.** Ore, usually disseminated through gangue, or vein-stone, and having a more or less regular development in length, width and depth.

**VOLCANIC GLASS.** A volcanic igneous rock of vitreous or glassy texture, e. g. obsidian, pitchstone.

**VOLCANIC ROCK.** Any rock of volcanic origin: volcanic igneous rocks are those erupted as molten masses, forming lava flows, dikes in the crater walls, volcanic plugs, etc.; volcanic sedimentary rocks are the fragmental materials ejected in explosive eruptions, forming tuff, agglomerate, etc.

**VOLCANO.** A vent in the earth's crust communicating with a magmatic reservoir and commonly in the summit of a conical mountain build up of erupted material, from which are emitted molten rock or lava, fragmental solid material, hot water and mud, steam, and various gases. A volcano is called active while it is in eruption, dormant during a long cessation of activity, and extinct after eruptions have altogether ceased.

## W

**WASH GRAVEL.** Auriferous gravel which is washed to extract gold.

**WASHING.** Gold dust procured by washing, also a place where this is done.

**WEATHERING.** The chemical action of water, air and plants and the mechanical action of air, water, changes of temperature and other agencies contributing to weather, that change rocks on exposure either in their texture or composition and gradually make them to disintegrate into soil.

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# NOTICE OF LOCATION

NOTICE IS HEREBY GIVEN That the **undersigned**, having complied with the **requirements** of **Section 2324** of the **Revised Statutes** of the **United States**, the Laws of the State of \_\_\_\_\_ and the **Local Law**. **Customs** and Regulations of this **district** ha.....located **fifteen** hundred feet in length by **six** hundred feet in **width**, on **this**.....**Lode, Vein, or Deposit**, bearing **Gold, Silver, Copper, Lead**, and other valuable minerals, situated,

in the \_\_\_\_\_ Mining **District**, \_\_\_\_\_ County, State of \_\_\_\_\_, the location **being** described and marked on the ground as follows, **to-wit:**

Beginning \_\_\_\_\_ feet of this **location** (Place of **Discovery**) Monument, at the \_\_\_\_\_ end of center **monument**, and **running** thence.....0 feet to.....wmer monument No. 1; thence.....1500 feet to.....corner monument No. 2; thence \_\_\_\_\_ feet to.....end of center monument; thence.....300 feet to.....w m monument No. 3; thence.....1500 feet to.....comer monument No. 4; thence..... 300 feet to place of **beginning**, including all **Dips, Spurs**,

Angles and **variations**

**NOTE**

**\*Diagram of Claims:**The location (Discovery point) and corner monuments should be designated on the accompanying diagram to make the record of claim more perfect.

A **mining claim** must not exceed 1600 feet in length along the vein or lode, by 800 feet in width, 500 feet on each side of the center of the vein at the surface.

On location of a mining claim can be made until the discovery of the vein or lode within the limits of the ground claimed.

The claims must be marked distinctly on the ground so its boundaries can be readily traced.

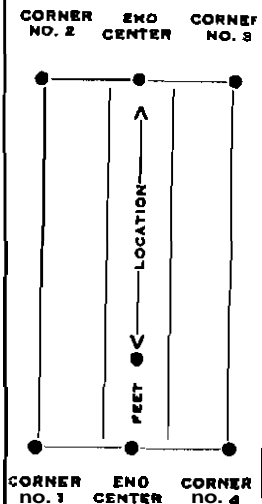
A severe penalty is provided by law for removing or defacing the stakes or monuments of a mining claim.

Claims located on Sundays or holidays are legal.

All valuable mineral deposits in lands of the Government are located by citizens of the United States only, and those who have declared their intention to become such.

The location notice must be filed for record with the County Recorder of the county in which the claim is located.

**DIAGRAM OF CLAIM**



The name of the **mining claim** above described is, and shall be known as the

Located this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_

Names of Locators





## CHECKING LIST

### PROSPECTING EQUIPMENT

N. Gold pan  
 Prospecting pick  
 Folding shovel  
 Chamois bag  
 Magnifier  
 Quicksilver

D. Magnet  
 Horn spoon  
 Pick  
 Shovel  
 Drills (4)  
 Scraper  
 Hammer  
 Mortar (small)  
 Iron spoon  
 Testing outfit  
   Sodium bicarbonate  
                                   1 pound  
 Charcoal sticks  
 Test tubes  
 Test tube holder  
 Soft Glass tubing,  
                                   7 mm flask  
 Perforated rubber stopper  
 Sterno heat (tube)  
 Alcohol lamp  
 Candles  
 Pocket scales  
 Plate Glass  
 Corundum  
 Streak Plate  
 Iron wire 4 in. long

O. Testing outfit (complete)  
 Dipping needle  
 Iron mortar (large)  
 Blasting equipment

### ORIENTATION

Maps  
 Auto  
   Topographic  
   Geologic  
 Compass  
 Telescope

### TRANSPORTATION

Auto  
 Full set of tools  
 Tire chains  
 Pressure gauge  
 Vulcanizing outfit  
 Tow rope  
 Block of wood  
 Oil can  
 Grease guns

### TRANSPORTATION (Cont.)

Extra tires & tubes  
 Extra Bulbs  
 Auxiliary tanks  
 (Gas, oil, water)  
 Insulating tape  
 Tire pump  
 Fan belt  
 Radiator hose  
 Spark plugs

### WEARING APPAREL

Wool socks  
 Heavy 2 prs.  
 Light 4 prs.  
 Boots  
 Walking shoes  
 Working shoes  
 Underwear (3)  
 Sport shirts (2)  
 Whipcord trousers  
 Hat  
 Overalls  
 Belt  
 Rain shirt

### HEALTH

First aid kit  
 Snake bite outfit  
 Water filter

### SAFETY

Guns  
 Ammunition  
 Sheath knife  
 Radio

### SHELTER SLEEPING

Tent (pegs, poles)  
 Sleeping bag  
 Pillow  
 Air mattress

### COOKING OUTFIT

Mess kit for four  
 Boy scout outfit  
 Frying pan with folding handle  
 Knives, forks, spoons  
 Egg box  
 Gasoline stove  
 Folding Sterno stove  
 Stove stand  
 Sterno heat (can, tube)  
 Gasoline Syphon  
 Water bags  
 Canteen

### RATIONS

**Carbohydrates**  
 (2 lbs. per man per day)  
 Flour  
 Prepared flour for "flap jacks"  
 Potatoes  
 Oatmeal  
 Cornmeal  
 Rice  
 Beans  
 Peas  
 Sugar  
 Chocolate

**Proteins & Fats**  
 (1 lb. per man per day)  
 Bacon  
 Pork  
 Beef  
 Butter  
 Cheese  
 Condensed milk  
**Vitamins**  
 Fruits  
 (fresh and dehydrated)  
 Eggs  
 Lemon juice powder

**Stimulants**  
 G. Washington Coffee  
 B. W. Tea  
 Yerba Maté

**Condiments**  
 Salt (0.5 oz. per man per day)  
 Baking powder  
 Pepper & spices  
 Evaporated soup vegetables  
 Vinegar

### MISCELLANEOUS

Matches  
 Flashlight  
 Knapsack  
 Handkerchiefs  
 Towels  
 Soap  
 Safety pins  
 Thread and needles  
 Toilet kit  
 Can opener  
 Diary  
 Camera  
 Films  
 Pencil or pen  
 Toilet paper  
 Fishing outfit  
 Pail

To further stimulate the interest in prospecting for gold and to be of assistance to the amateur prospector, I shall be pleased to furnish the readers of this book with any practical advice pertaining to the subject, to assist them in procuring the proper equipment either by furnishing addresses of dealers or by purchasing at the lowest possible price, either complete equipment or any articles desired, to make interested parties acquainted with each other for the purpose of organizing prospecting expeditions, in other words anything reasonable to make it easier for the amateur prospector to enter the field and turn to practice the theory written in this book.

The inquiries should be written on the other side of this sheet in order to identify you as an owner of the book and must be accompanied by a self-addressed stamped envelope to insure a reply.

The correspondence will receive prompt attention, except at times when I may be away on a prospecting trip.

With sincere wishes for the highest enjoyment in the search for your "bonanza",

I remain,

Sincerely yours,

Dr. L. Stolfa,  
2401 Gunderson Ave.,  
Berwyn, Illinois.