This is not just another book of minerals or merely a book of tests, but is a new original SYSTEM in prospecting for, hunting and finding of 40 of the most im-portant elements and the quick and accurate identification of the 300 or more min-erals, rocks or ores in which they may be found, just as taught each winter since 1943 in our “Short Course in Prospecting and Mineral Identification” under our personal instruction in our laboratory, for which we charge a tuition fee of $25.
You now get the same course in lesson form for home study - all for only $5.

VOLUME ONE - PART ONE
“Systematic Prospecting and Mineral Identcation”
In this part we take up the prospecting end of the business. In the hunting and finding of minerals, and the basic principals of Mineral Identification; divided up into Five easy to understand and easy to follow lessons for, home study purposes.-

Lesson One: “The Mineral Situation”
Your opportunities in the newer and rarer minerals of today; what they are, why overlooked in the past - and how you can start finding and cashing in on them.

Lesson Two: “Systematic Prospecting”
Modern prospecting; where to go and what to do when you get there; the 5 geological formations in which all minerals are found, and how to identify them.

Lesson Three: “Mineral Identification”
The 92 elements from which everything else in the world is made, and how by the identifying of the elements we automatically identify all minerals, rocks or ores.

Lesson Four: “The Field Test Kit”
In this we teach you everything you need to know about chemistry; your few pieces of test equipment and how to use them; how to make a “Field Test Kit” to carry in the field - and quickly and accurately identify all minerals where you find them!

Lesson Five: “Quick Method of Learning”
Quick Method of learning all tests in Part Two just as taught in our laboratory, by which we guarantee to teach anyone, in the short space of ten day’s time, how to make a complete qualitative analysis of ANY rock picked up anywhere, and if any of the 40’ elements covered in Part Two ar present-you can and will identify them!

DUKE’S RESEARCH LABORATORY
TRUTH OR CONSEQUENCES, NEW MEXICO
DUKE'S
"SHORT COURSE IN PROSPECTING AND MINERAL IDENTIFICATION"

Foreword

This is not just another book of minerals or merely a book of tests, but is a new original SYSTEM in the prospecting for, hunting and finding of 39 of the most important mineral elements, and the quick and accurate identification of the 300 or more important minerals, rocks or ores in which they may be found, just as taught in my - "Short Course in Prospecting and Mineral Identification" - under my personal instructions in my laboratory since 1943.

Here is the situation: I am not a white collar professor in some eastern college, who never saw a mine or prospect hole in his life, but is dishing out volumes of "theory", which may work on the pure mineral specimens in the classroom or school laboratory, but will not work on the impure commercial or industrial minerals, rocks or ores as they are usually found in nature out in the hills! I am a practical prospector and miner who has made a success of the business by working out and following this new, easy, simple, quick and accurate system of finding and identifying minerals which will apply to all minerals, rocks or ores, as they occur in nature out in the hills - regardless of their names, chemical compositions, physical properties, impurities, or where found!

Here is how: Summers I spend in the hills prospecting and operating my own mines which I found by following this system, and so proving it will work! Winters I spend in my laboratory in research work in hunting newer, quicker, and more accurate tests for identifying of more mineral elements - and also operate a "School of Prospecting" where, for the past seven winters, I have taught Prospectors, Mine Owners, Mining Engineers, Geologists, Mineralogists, Mineral Collectors and Specimen Hunters, as well as many Amateurs and Greenhorns this new system of hunting, finding and identifying of minerals. Every winter I have taught dozens of men, as well as many women, boys and girls, from 14 to 76 years old this business; some came hundreds of miles to take this course under my personal instructions, for which I charged a tuition fee of $25.

I am now devoting my entire time to my mining interests, and so no longer teach by personal instructions. However, it is now no longer necessary to come to my school to learn this business - I now send my school to you! In this present course I now take up and cover exactly the same instructions, and the same method of procedure in learning, step by step, just as taught in my school under my personal instructions. In other words, this is the same "Short Course in Prospecting and Mineral Identification" by mail, in easy to understand and follow lessons, by which anyone, anywhere, may now learn this complete system right in their own home in their spare time - and all at but a fraction of the cost and expense of coming to my laboratory - a $25 Course all for $5.00!

Here is wishing you Pleasure, Profit, Prosperity, and Plenty of everything - they are all awaiting you in "them thar hills" with these instructions - IF you will go after them!

Your rock hound friend and assistant, R. H. (Duke) Maulsby.
FOR WHOM THESE INSTRUCTIONS ARE INTENDED

Introduction

If you are a Prospector hunting commercial or industrial minerals or ores as a business; or a Mine Owner who would like to know how to check up on your own mine for other valuable minerals which you may now be overlooking; or a Mining Engineer or Geologist seeking a quick and accurate means of checking mineralized zones or formations; or an Assayer seeking a quicker method of qualitative analysis; or a Mineral Collector seeking a quick method of identifying and classifying your mineral specimens; or an Amateur or Greenhorn who knows nothing whatever about prospecting, minerals, rocks or ores at present but would like to learn something about this interesting and profitable business - these instructions are for you:

They will teach you a new and amazing system which takes all the "guess-work" out of mineral identification, easy, simple, quick and accurate! A complete "Short Course in Prospecting and Mineral Identification" by this new system of prospecting for, hunting, finding and identifying of 39 of the most important mineral elements and their 300 or more important minerals, rocks, or ores!

A system which requires no higher education to understand; or no previous experience or special ability to do; and which requires no previous knowledge whatever of chemistry, or minerals, rocks or ores, and no costly laboratory or test equipment to buy - you can carry your complete laboratory in a shoe box! A system so easy to understand and so simple to follow that we absolutely guarantee that any average 14 year old boy can do the work!

A system which is revolutionizing the prospecting and the mining business: A system by which the prospector may now systematically look for, accurately identify, and thus successfully find 35 or 40 mineral elements with no more time and expense than he has been spending in the past in looking for 5 or 6 by the old hit-and-miss methods! A system by which the mine owner may now quickly and accurately check his own mine, find all the values it may contain, and thus increase his chances for success in the mining business!

A system by which the Mining Engineer or Geologist may quickly and accurately check-up on mineralized zones and formations. A system by which the Assayer may make a quick absence or presence check-up on all rocks in a few minutes time, and thus, not only save time and expense on blank quantitative assays, but may also discover unsuspected elements and by suggesting assays on the same to his clients, greatly increase his assaying business!

A system by which the Mineral Collector or Specimen Hunter may, not only quickly and accurately identify and classify his mineral specimens, but may also combine his hobby of specimen hunting with a knowledge of commercial or industrial minerals which may lead to the discovery of a rich mine and a fortune! A system which requires no previous knowledge of minerals, rocks, or ores, and thus gives the greenhorn an equal chance with old time prospectors regardless of their years of experience in hunting minerals by old methods!
SYSTEMATIC PROSPECTING AND MINERAL IDENTIFICATION

Introduction and General Information

SUCCESSFUL PROSPECTING: This, contrary to the general conception, or at least practice, is not a question of merely chasing around over the hills, covering a lot of territory and the picking up of a lot of rocks, which is just what the majority of prospectors are doing today, and which accounts for the fact that most of them are failures! Successful prospecting consists of two very important things: First, what to look for and where to look for it. Second, its identification - the identification being 90 percent of the business! Both branches of the business will be taken up and explained in these instructions, concentrating on the identification end of the business. For this purpose these instructions will be divided up into three parts.

PART TWO: This contains our "Quick Qualitative Analysis" in the identifying of minerals, as the "Method of Procedure" given there is the one we always follow in testing out any unknown rock or ore. This is the main part of, and the secret of success with our system not found in any other book ever published! This is the identification end of the business - and thus the object and purpose and chief value of our complete course. Part Three is merely a supplement covering individual and confirmatory tests for each of the 39 elements in Part Two, so may be considered part of the same.

As the "Method of Procedure" in Part Two is the one we always follow in testing out any unknown rock, it is 90 percent of our system; the two most valuable features being: the simplicity of explanations, and the condensed form in which the tests are written. So we will keep this separate and do all of our explaining beforehand, which is the object and purpose of Part One.

PART ONE: In this we will take up the prospecting, hunting and finding of minerals, and the basic principles of their identification; covering everything you need to know about minerals, rocks and ores, chemistry, your few pieces of test equipment, and how to use them, and thus successfully follow our "Method of Procedure" in the identifying of the 39 elements covered in Part Two.

Prospecting and mineral identification do not depend upon any one particular thing but upon a number of equally important things. This may be compared to a chain consisting of a number of links; as each of these links are of equal importance it will not be a question of learning any one particular link first or in any particular order, but will be a question of learning each link separately and then putting them all together to form the chain of our system. First read both Parts One and Two over carefully, to get the general idea of the system as a whole, then concentrate on Part One until you understand everything in it before taking up the actual work in Part Two. Remember - Preparedness is half the battle!

(1 - Part One)
LES S O N O N E

T H E M I N E R A L  S I T U A T I O N  -  P A S T ,  P R E S E N T ,  A N D  F U T U R E.

S O M E T H I N G  T O  T H I N K  A B O U T!

If you knew of a farmer who had 40 acres of good fertile ground, who went to the time, trouble and expense, to plow and plant that 40 acres, then let 30 or more acres grow up in weeds for lack of cultivation - because he did not know a cornstalk from a thistle, then in the fall harvested but six, eight or ten acres of his crop, what would you think of him as a farmer; would you say he was indolent, shiftless, lazy - or just plain nuts? But if you are the average prospector or small mine owner, maybe you better not express your opinion for a few minutes - for that may be just what you are doing in your MINERAL FIELD today! So just read it over again then let it sink in for awhile, we will come back to it again in just a few minutes and find out - just where YOU come in the picture!

P R O S P E C T O R S  -  O L D  A N D  N E W

A few years ago, literally speaking, there were but a half-dozen or so important mineral elements to look for - Gold, Silver, Copper, Lead, and Zinc, were the "Big Five"! It all started with the Gold Rush of the "Forty Niners; many of those who got in on the ground floor in virgin territory made a fortune! Thousands of others who heard of the fabulous fortunes being made over-night in that magic stuff called Gold rushed to, join them until the prospectors swarming over the mountainsides looked like ants on an ant-hill, and thus, in time, all the big surface "gold bonanzas"- were found!

Those who came too late for the big surface strikes, started digging thousands of holes in the hillsides; all "kidding" themselves that just over the next hill, or the next three feet in that hole, they were going to find the "Mother Lode" - where they could cut the yellow stuff out with a hatchet! While a few made the big surface strikes, for each one who hit the golden jack-pot there were many thousands of others who, all they had to show for their years of efforts was - just a "worthless" hole in the hillside!

What is a "worthless" hole? A so-called "worthless" hole does not necessarily mean one containing nothing of value, but is simply one in which the digger did not find the particular thing for which he was seeking; and all the gold hunter knew about, or was interested in, or was seeking for - was Gold!

Then came the "Silver Boom"! History repeats itself; many of those who got in on the ground floor in virgin territory made a fortune; many of those fortunes were made from the old "worthless" and abandoned prospect holes and mine dumps of the gold hunters; many of these became the big "Silver Bonanzas" of the 'Eighties and 'Nineties! All laying there where they were abandoned by the gold hunters, either through the lack of knowledge of their identification, or passed up in their "pipe-dream" search for greater riches - just as the average prospector is doing today; passing up sure financial independence - for a million-dollar "Dream"!

(2 - Part One)
Then came Copper, Lead, and Zinc! History repeats itself, as it always has and always will: many of those who got in on the ground floor in virgin territory made a fortune; many of those fortunes were made from the old "worthless" abandoned prospect holes and mine dumps of the gold and silver hunters; cast aside or passed up in the hills, either due to the lack of knowledge of their identification, or because they had no value at the time, or as in many cases, due to the wild dream of easier and quicker fortunes!

Many of the later generation, reading the "rosy-stories" of the Big Five and the fabulous fortunes made over-night, became fired with the desire and ambition, or at least the desire to do the same thing! Once more the prospectors swarming over the mountain sides looked like ants on an ant-hill, and thus, in time, all the rich surface deposits of the Big Five were found! Those who came too late, as many did, and maybe you, started wildly digging more "worthless" holes in the hillsides - and they are still at it!

Do not misunderstand us; we are not trying to tell you that all the Big Five have been found, and that there are no more to look for; those are neither the facts nor our intentions. Many of the old timers will tell you, "There is more gold in them thar hills than has ever been discovered"! That is, no doubt true; but you will note we state and are dealing with "surface discoveries", or in the reach of the poor prospector or small mine owner with but limited capital, and so must depend, more or less, upon surface outcrops for their discoveries. Here are the records.

The records' show that 60 percent of all the big surface deposits discovered in the past 100 years were found in the 30 years between 1850 and 1880; 30 percent in the next 30 years between 1880 and 1910 and only 10 percent in the past 30 years between 1910 and 1940; Also, that in the last 30 years only one Big Fiver in 7,500-ever hits a real paying mine: That is the mining situation of the past and up to the present time.

BUT A NEW DAY HAS DAWNED!

Yes, a new day has dawned for the prospector and the small mine owner; a day of greater opportunities and greater possibilities than ever existed in the boom days of the Big Five! By this we do not mean, more chances to make greater fortunes; but we do mean - greater chances to make more smaller fortunes - to increase YOUR chances for success in the prospecting and mining business!

Here is the situation as we find it today: This is the age of the alloy metals! Our modern high-speed age calls for stronger, tougher, and more durable materials. Most of these are obtained from the newer, rarer, and less known elements, as covered in our instructions; these are the "overlooked fortunes" which the average prospectors are walking over in the hills today - and the Big Fivers have been throwing upon their waste dumps for the past 100 years! Today, get this, today there are some 40 or more valuable mineral elements to look for - all of which the prospectors of today have a chance to find and CASH IN on in the hills!

(3 - Part One)
Not one prospector in 1000 knows anything whatever about the majority of these new minerals; all are just waiting there for some "modern" prospector to come along with the proper knowledge to find their hidden values and turn them into paying mines. History will repeat itself: many of those who get in on the ground floor in this new virgin field with these new minerals will make a fortune; many of these fortunes will be made from the old "worthless" abandoned prospect holes and mine dumps of the Big Fivers!

40 MINERAL ELEMENTS TO LOOK FOR! Yet today we still find many prospectors, in fact the majority, and maybe you, still roaming the same old hills, stepping in the footsteps of the thousands of others who have gone before them - all looking for the same Big Five! In recent years a few may have added two or three more to their list, such as fluorspar, manganese, and maybe tungsten; a few of the more progressive ones may be looking for as many as 10 - TEN OUT OF A POSSIBLE 40!

What did you say about the farmer at the beginning of this lesson? But if you are the average prospector or small mine owner, that may be an embarrassing question - let's put it this way:

How many acres are YOU cultivating and harvesting the crop from in this 40 acre MINERAL FIELD OF YOURS? How many of these 40 mineral elements are YOU looking for? How many would YOU be able to recognize and PROVE YOU WERE RIGHT if you found them in your mine, prospect hole, or in the hills - are there as many as 10?

What about the other 30? Are they just "overlooked fortunes" as far as you are concerned - just growing up in weeds because you do not know a cornstalk from a thistle in your mineral field? Just laying there waiting for some "modern" prospector to come along with the proper knowledge to find their hidden values and make a fortune - a fortune which could have and should have been yours - If you had just spent a LITTLE TIME in gaining the necessary knowledge to find and identify them: The question now is - WHAT ARE YOU GOING TO DO ABOUT IT? Your success as a prospector of tomorrow will depend upon your answer, and what you DO TODAY!

This "Short Course in Prospecting and Mineral Identification" will tell you, show you, and teach you what you CAN DO to better your conditions; how you can easily and quickly gain the necessary knowledge in a few days time, in fact as little as 10 days time, how to tell a cornstalk from a thistle in this vast new mineral field, and thus make it possible for you to start gathering the FULL CROP from this 40 ACRE MINERAL FIELD OF YOURS!

On the cover of Part Two we show you 39 of the most important elements to look for today. On the next page we will tell you of some of the fortunes you may be overlooking, and why. Under "Systematic Prospecting" we will show you where to prospect and how to find them. In our "Method of Procedure" in Part Two we show you how any and all of them may be quickly and accurately identified by our new system, which ANYONE can follow and use.

(4 - Part One)
"OVERLOOKED FORTUNES"

Here are a few of the many you may be walking over - and why!

HINTS - IDEAS - SUGGESTIONS

We will give here a few examples of "overlooked fortunes" and a few of the chief causes why generally overlooked, and offer a few hints, ideas and suggestions, which, if you will read slowly and carefully and pause at the end of each question and do a little serious thinking, may recall to your mind similar cases in your own past experience, and by going back and investigating them - maybe hit the "jack-pot"! Or, we may offer valuable information which may put you on your guard and thus cause you to find a fortune in the future - which you may have otherwise overlooked.

A FEW CHIEF CAUSES

Are you still following the old horse-and-buggy day methods of trying to identify your rocks or ores by their Physical Properties, such as Specific Gravity, Hardness, Color, Streak, etc., as worked out by Dana in 1837, and still used in most books on mineralogy? This, and the use of the magnifying glass, are, no doubt, responsible for overlooking more fortunes than all other causes, for the various reasons as explained in Lesson Three under "Mineral Identification"!, and due to the following conditions.

1. Do you know that Gold, Silver and the Platinum Minerals, and in rare cases, but seldom in commercial quantities, Iron, Copper, Bismuth, Antimony, and Mercury, are practically the only ones of the 92 elements which ever occur in the metallic state in nature? You never see any metallic Lead, Tungsten, Molybdenum, Nickel, Tin, etc., in any rock or ore with a magnifying glass, and thus the only way to find their hidden values is by the use of chemicals or other means as given in Volume Two of these instructions.

2. Do you know that many valuable ores of Nickel, Cobalt, Bismuth, Vanadium, Uranium, Titanium, and many others, including Gold and Silver, may look just like common country rock - showing no mineralization whatever?

3. Or that certain ores of Platinum, Palladium, Iridium, Osmium, Ruthenium, Nickel, Cobalt, Tin, Arsenic, Copper, Bismuth, and many others, including Gold and Silver, may look just like common "Iron Pyrites", and usually mistaken and discarded for the same?

4. Or that certain ores, such as Columbite, Tantalite, Smaltite, Samarskite, Pitchblende, Microlite, Niccolite, Cobaltite, Cassiterite, Bismuthinite, Wolframite, Ferberite, Hubnerite, and many others, including Gold and Silver under certain conditions, may look just like common black, brown, red, or white iron? The above four conditions, and the use of the magnifying glass are, no doubt, the cause of throwing more valuable "mines" down the mountainsides every year than are ever discovered! On the following pages we will give a few of the many minerals usually passed up due to one or more of the above cases, some of which may apply in your own particular case.

(5 - Part One)
Do you know that "black heavy stuff" you are walking over every day and calling "worthless iron" may be one of these "Overlooked Fortunes"? Are you sure it is not Columbite, the chief ore of the element Columbium which may look like common black iron but may be worth $1.25 a pound as mined, or $2,500 per ton?

Or Tantalite, which looks like black iron; or Microlite, which looks like brown iron, but are both valuable ores of the element Tantalum, and that some ores may contain as high as 76% Tantalum as mined, and worth $2.50 a pound or $5,000 per ton?

Or Wolframite, Ferberite, or Hubnerite, all of which look just like common black or brown iron but are all valuable ores of the element Tungsten, and may be worth $3 a pound, or $6,000 per ton?

Or Pitchblende, which looks like black iron but is the chief ore of the element Uranium, the stuff they get Radium from, also the material for the Atomic Bomb, and maybe Atomic Power of the future, and may be worth $5,000 to $10,000 per ton, with a government bonus of $10,000 for new discovery?

Or what about those black, brown or red nodules which stick in your gold pan or sluice box and which you have been discarding as "hematite" or "magnetite" iron; but are you sure they are not Cassiterite, the main ore of the element Tin which is worth $1.00 per pound for the contained tin, and thus a 50% ore, which is not uncommon, is worth around $1,000 per ton at the present time?

Or what about that red or brown rock with the black specks which your "expert" friend examining with a magnifying glass classified as "biotite granite"; maybe he was right on the granite part, but are you sure those black specks were not Cassiterite and maybe a high grade tin ore? Or maybe Columbite, Tantalite, Samarskite, or a half dozen or more other rare minerals which may occur as black specks or nodules in granite - then test them out to make sure?

Do you know the best mineralogists in the country today do not attempt to tell any of the above from iron merely by looking at them, and that only a chemical test will tell? The "free" advice of the "experts", either friends or strangers, have been the cause of many an "overlooked fortune"! Do not "guess" - make a "test"!

Or what about that yellow "bronzy" looking stuff which you "knew" was "Just iron pyrites" - so got rid of it pronto before someone accused you of thinking it was Gold! But are you sure it was not Pyrrhotite, which might look like iron pyrites but is a valuable ore of Nickel? Or maybe Platinum? Or maybe Osmium? Or may have shown good values in Gold if you had first roasted it before panning! Or are you sure it was not Sperrylite, which might contain 56.5% Platinum? Or Chalcopyrites which may contain 34.5% Copper? You, no doubt, have learned by experience, "All that is yellow is not Gold"! It is now time to learn and add, "Neither is it always Iron Pyrites" - then test it out to make sure!

(6 - Part One)
Or what about that red brown rock which you called "iron oxide", crushed and washed hoping to find a $50 a ton gold mine, but seeing no metallics - threw it away; but are you sure it was not Bismite, which may contain 88 to 90% Bismuth worth $2 per pound?

Or that soft yellow rock, which you "Analyzed" (with a glass.), and seeing no metallics called it "sandstone"; but are you sure it was not Carnotite, which occurs in sandstone but is a valuable ore of Vanadium and Uranium and worth maybe $1,000 or more per ton?

Or that green rock, which you "guessed" was too low grade Copper to work - so passed it up; but did you "guess" it might be Garnierite or Zaratite, both green ores of Nickel and worth maybe $100 to $200 or more per ton?

Or those white or gray particles which stuck in your gold pan, which you threw away cussing your "luck" when you found they were not silver worth 700 an ounce; but are you sure they were not Platinum, Palladium, Iridium, or other minerals of the platinum group worth $24 to $125 or more per ounce? Many a prospector has starved out on the Big Five trail looking for 70 cent an ounce silver, while throwing away $70 or more an ounce platinum minerals! The big question is - are you SURE you are not doing the same thing?

Or those heavy steel-gray chunks which you found in your mine, prospect hole or in the hills and threw away when that old prospector told you they were "just white iron"; but are you sure they were not Niccolite containing 43.9% Nickel; or Cobaltite or Smaltite containing 28% to 35% Cobalt; or Bismuthinite containing 61.2% Bismuth - all worth $100 to $500 or more per ton?

Or that rock with the silver white specks which you panned for gold without success and called "just more white iron", but are you sure those silvery-white specks were not Tellurium? If it was it may be one of the richest of all gold or silver ores, and may contain $1,000 or $10,000 or more per ton in gold or silver - and yet never see a color in a gold pan! And so you throw it away and then start digging another "worthless" hole: That is just what prospectors have been doing for the past 100 years, and so their gold and silver tellurides are still laying there upon their abandoned prospect holes and mine dumps, waiting for some "tester" to come along with the proper knowledge to find their hidden values - and maybe discover another Cripple Creek! Maybe you!

We could go on and on - these are just a few of the 300 or more rocks or ores which may contain one or more of the 39 elements as covered in these instructions; just a few of the "overlooked fortunes" which you and others are walking over every day, simply for the lack of a little knowledge to find their hidden values - all of which can now be gained in as little as 10 days time in study and practice with these instructions, as explained later. In the following pages we will show you HOW and WHERE to find them; then in Volume Two we will show you how ALL may be quickly and accurately identified - and thus start cashing in upon them! (7 - Part One)
WHERE TO PROSPECT? Next to the question "what to assay for" we find this the most frequently asked question, not only by the amateur and greenhorn just starting out in the business, but also by most of the old timers, who, having no "luck" where they are at are looking for greener pastures; The answer to this depends upon two things: Prospecting for what, and how?

There is an old and true saying, "If you are looking for gold, go where gold has been found": This will also apply to most of the others of the Big Five; but in this remember, we will have to take our chances pretty much on "skimmed milk" from which others have taken the "cream"; which accounts for the fact that only one Big Fiver in 7,500 has found a paying mine in the past 30 years!

But with most of the newer and rarer minerals covered in these instructions the picture is much different - for the man who knows how to find and identify them, and thus the man who gets in on the ground floor in this virgin field has a chance to do some "cream skimming" himself just as the old timers did with the "Big Five"! With 35 or 40 elements and their some 300 or more rocks or ores in which they may occur to look for, some of them may be found most anywhere, and thus, the district one mile from your-home or camp maybe as good or better than that "dreamland" 100 miles away!

Another valuable feature of the newer and rarer minerals, especially for the man with limited capital is: while the most valuable deposits of the Big Five near transportation have been found, we are just as apt to find some of the newer minerals alongside of, or near a good highway as we are 50 miles back in the hills where it would cost a small fortune to get it out if we found it! Also, many of these are sold by the pound instead of the ton or carload, and thus bringing in quick and ready cash on which to expand.

We will now take up the systematic end of the prospecting business. This will consist of two important parts: First, the Field Work in which we find our rocks and ores. Second, the Laboratory end in which they will be identified.

The Laboratory: First get all your test equipment, then start in and practice up on your "Known Samples" as explained under "Quick Method of Learning", and thus be prepared to make a complete qualitative analysis on all the rocks picked up in the field.

Field Work: For this we should have all the following equipment: A prospector's pick. A pack sack. 6 or more sample sacks, say six by ten inches made of strong canvas. A few tobacco sacks or cans for dirt, clay, or fragile materials. A roll of common white adhesive tape. A note book and an indelible pencil. And a magnifying glass, which, by our system, may best be left at home! We are now ready to start out and do some real systematic prospecting!

(8 - Part One)
WHERE TO GO - AND WHAT TO DO

FIRST: If you are a prospector who has been at the business for any length of time, jump in on that rock pile of "overlooked fortunes" behind your house, or those few or many "pet" rocks you have been saving as you "Just know" they contain "something" of value but do not know just what! Maybe you will find something of far more value than what you picked them up for - providing you can remember just where you got them! That is the object of the adhesive tape, note-book and indelible pencil, which we will come to just a little later on.

SECOND: The old "worthless" and abandoned prospect holes and mine dumps of the Big Fivers: You will find these fertile fields. They have already found the most likely deposits - and done your digging! Pick up all the different looking rocks you find, put them in a sack - with written notes showing just what hole they came from and its location! DO NOT look at them with your magnifying glass or you are apt to say "no good" - remember that is just what the other fellow did! Also do not attempt to "guess" what they "might" contain then proceed as in Part Three; always start in at Test No. 1, Part Two and make a complete analysis!

CAUTION: In the above, also always watch for gold and silver; remember ores which would not pay to work 50 years ago in the days of the pack-mule and no roads, may be considered a "bonanza" today with our modern highways and truck transportation. So always watch all old holes for the Big Five as well as the newer minerals.

WIDICATING: This is the roaming of the hills picking up our rocks where we find them; or prospecting a new district in which mines have not been previously discovered; or prospecting an old district, trying to find something the other fellow overlooked. In prospecting a new district the most important thing is to find one which shows mineralization.

MINERALIZATION: This does not necessarily mean one in which mines have previously been found. Most mining districts are based chiefly on the Big Five, and a district which is unfavorable for any of these may be ideal for some of these newer minerals. The first sign of mineralization to watch for is - Iron and Quartz. There is an old and true saying, "In prospecting for metallic minerals if you find no iron or quartz you just as well move on"! To just reverse this we might say, any place you find iron and quartz IS a good place to start looking for metallic minerals!

FORMATIONS: While each element has its most favorable rock formation, it does not mean that it is always found in that formation, or never found in any other. Example: Quartz is often referred to as the "mother rock of gold", simply meaning quartz is the most favorable rock formation; however all quartz does not carry gold, and it has been found in practically all other rock formations. So in our work we pay little attention to rock formations, but go entirely on Geological Formations. There are just 5 geological formations in which all metallic as well as non-metallic minerals are found. (9 - Part One)
GEOLOGICAL FORMATIONS - WHEN TO LOOK

While there are some 50 or more rock formations in which minerals may occur, such as, Quartz, Porphyry, Monzonite, Limestones, etc., there are only 5 geological formations to look for: Veins, Dikes, Outcrops, Ledges, Deposits. All minerals, either metallic or non-metallic will be found in one of these! While some of these are closely related, they are all different for our purpose. All of these will be explained below; but we will first give the "key" for their identification: All of these but deposits are where we find a formation between two other formations; or we might say, like a piece of meat between two pieces of bread - it is the meat we are after! So the first and main thing is to look for a change in the general formation of the ground. Note: the following may not be all technically correct, but will do for our purpose.

1. VEINS: When the old earth cooled, or other causes, cracks were formed; at a later date the heat, steam, and pressure from below forced other materials up through and thus filling these cracks; in many cases carrying valuable metallic elements forced up from below, in which case the vein matter in the cracks will be different in character than the wall rock on either side, and thus easily identified if exposed on the surface, as given below.

2. OUTCROPS: This is the surface or exposed part of a vein or deposit, and the main thing to watch for in prospecting, and as stated above is easily seen and identified as it will be different than the wall rock on either side.

3. LEDGES: This is a flat body known as a "blanket formation" found between two different formations; usually found on hillsides or on the walls of canyons. Many minerals occur in this kind of formation. Or what may be mistaken for a flat body may be the exposed part of an incline-vein, and so should be investigated.

4. DIKES: These are also outcrops, usually in a vertical position; formed much the same as veins, but usually wider and extend some distance above the ground. However, they differ from veins due to the fact that the mineral values are usually found on one side or the other in contact with the wall rock, and thus is the beat place to take your samples rather than on top or center. One of the most important of these are the "Pegmatite Dikes", as explained in our book "Beryllium and the Rarer Minerals"; these contain a greater variety of minerals than any other one formation. In fact, most all metallic as well as many of the non-metallic minerals may be found in Pegmatite, and thus one of the most important of all formations to watch out for.

5. DEPOSITS: These may be in the form of Placer, such as gold; or may be in solid rock, such as the great copper deposits of Utah, Arizona and New Mexico. No doubt many of these newer and rarer minerals will be so found when prospectors learn how to identify them.

6. FLOAT: This may also be included to watch for as many of the largest mines were so discovered. Here is the idea: If we are walking over say a mountain side where the formation is all the same, then come upon an odd looking rock which is entirely different, it may be a piece broken off a vein or dike, or from a deposit, which has rolled down from the same. In which case you go up the hill to see if you can find where it came from. The above are the places in which all minerals have been and will be found!

(10 - Part One)
PROCEDURE IN SYSTEMATIC PROSPECTING

1. Always have a name for your camp or district. Here is a personal experience for illustration. I was in the Black Mountains looking for a place to camp. I found a big tree under which was an old stove - so I called this my Stove Camp; a definite location I would always remember. All rocks picked up while in this camp will be listed in my note book under this heading.

2. I start out with my field equipment, as previously listed. I am looking for the geological formations as previously given.

3. I come to a dike in which the formation is different from that on either side; if there are any minerals in this district I know this is one of the logical places to find them. I know I am going to test out a sample of this rock regardless of what it might look like - so I do not bother to look at it with a glass: I also know that many valuable mines have been lost depending on memory in which the prospector could not go back to them; I take no chances on memory - I have no "lost mines" if I once find them: I simply proceed as follows:

4. I knock off a chunk about the size of my fist (I may take two to a half dozen more from different parts of the deposit before I leave). I now cut a small piece off my adhesive tape, paste it on the first rock, dampen with tongue and with indelible pencil mark it No. 1 and throw it in my sack. I now take my note book and make a record, which may look like the following.

5. Stove Camp; dike, about 6 feet wide. On second ridge, near center, about 1 mile northwest of camp; big standing dead tree about 50 yards north; two rocks at dead tree. (Before I leave I will put two rocks at dead tree). And so I continue for the rest of the day - recording each rock as I pick it up!

6. At the end of the day, or when I get this sack full, I then tear the pages from note book and put them in this sack and tie it up. However, before tearing out last page of notes, I write the next number on the blank page to follow for my next sack, and thus have no two rocks with same number.

7. Results: When I get ready to test the notes will tell me just where each rock came from, type of formation, etc. If I find anything of value in testing I can go back and investigate it.

FINAL RESULTS

That is all there is to the prospecting business. First: Veins, Dikes, Outcrops, Ledges, Deposits, and Float, in which all minerals will be found, and all of which will be different from the surrounding rock formation, and thus may be easily seen and distinguished. Second: The keeping of notes where each one found, and thus - no "lost mines" after we once find them!

Any greenhorn who will follow this procedure has just as good a chance as the old timer; in fact, a better chance, due to the fact that most old timers know just a few pet rocks and formation and will pick up no rock unless it conforms to one of these. While the greenhorn following these instructions will cover the ground more thoroughly, and thus - if there is anything of value in that district exposed on the surface he will find them;

We now come to the important part - their identification! This is 90 percent of the business, all of which will be taken up and explained in the following lessons.

(11 - Part One)
NOTE: As explained in the previous pages, this does not consist of any one particular thing but of a number of equally important things, in which there is no particular order of either writing or learning them, and thus is simply a question of learning each link separately. Then put all together to form the chain.

WHAT TO ASSAY FOR?

This is the most perplexing and serious problem facing the prospector of today with all the newer elements coming into use and all their various minerals of which the average prospector knows nothing about. That is the object and purpose of a qualitative analysis: to find out WHAT valuable element or elements your rock or ore contains in order to know what to have it assayed for.

There is a difference between an Assay and an Analysis, and also a difference between a Qualitative and a Quantitative Analysis.

An Assay is to determine the percentage or value of only certain specified elements, such as, Gold, Silver, Tungsten, etc.

An Analysis is to determine the absence or presence of ALL elements your rock or ore may contain, and may or may not include the percentage or value of any, depending upon kind of analysis made.

A Qualitative analysis is to determine the absence or presence of all elements, but not the percentage of any.

A Quantitative Analysis is to find every element present, and the percentage or value of each of the element found.

A Qualitative Analysis usually costs from $5 to $15, and in many cases the money spent only to find out your rock or ore contains nothing of value, in which case your money is simply thrown away; but if you do not have it made, then you worry and wonder if you are passing up a fortune - and maybe you are; Very few people can afford to send all their rocks away for a complete Qualitative Analysis, and so the majority of their valuable ores wind up behind the house in the rock pile of "overlooked fortunes"!

That is the object and purpose of these instructions - to help the little fellow; the poor prospector or a small mine owner who cannot afford to send all his rocks away and pay out $5 to $15 for a complete qualitative analysis, or cannot afford a costly laboratory or a hired assayer to do their testing. These instructions now make it possible for ANYONE to make a complete qualitative analysis on all their own rocks or ores in a few minutes time and at a total cost of less than $5 per rock, and if any of the 39 elements covered in these instructions are present in that rock or ore - they can and will find and identify them!

Results: If you find anything of value, you can then afford to send it away and have assayed for just what you already know it contains; if you find nothing of value, you have then, not only saved $5 to $15, but have also relieved your mind of wondering and worrying if you are passing up a fortune!

(12 - Part One)
THE ELEMENTS

"The 92 Things From Which Everything In The World Is Made"

Alphabetical List - With Their Symbols.

Actinium - - Ac. Helium - - - - He. Radium - - - Ra.
Aluminum -- Al. Hydrogen - - - - H. Rhenium -- Re.
Antimony -- Sb. Illinium - - - I1. Rhodium -- Rh.
Argon -- A. Indium - - - - In. Rubidium -- Rb.
Arsenic -- As. Iodine - - - - I. Ruthenium - Ru.
Barium -- Ba. Iridium - - - Ir. Samarium - - Sa.
Beryllium - Be. Iron (Ferrum) - Fe. Scandium - - Sc.
Bismuth -- Bi. Krypton - - - Kr. Selenium -- Se.
Boron -- B. Lanthanum - - - La. Silicon -- Si.
Bromine -- Br. Lead ------------ Pb. Silver -- Ag.
Cadmium -- Cd. Lithium - - - Li. Sodium -- Na.
Calcium -- Ca. Lutecium - - - Lu. Strontium -- Sr.
Carbon -- C. Magnesium - - - Mg. Sulphur -- S.
Cerium -- Ce. Manganese - - - Mn. Tantalum -- Ta.
Cesium -- Cs. Marsurium - - - Ma. Tellurium - Te.
Chlorine -- Cl. Mercury - - - Hg. Terbium -- Tb.
Chromium -- Cr. Molybdenum - - - Mo. Thallium -- Tl.
Cobalt -- Co. Neodymium - - - Nd. Thorium -- Th.
Columbium - Cb. Neon - - - - Ne. Thulium -- Tm.
(Niobium -- Nb) Nickel - - - - Ni. Tinn -- - Sn.
Copper -- Cu. Nitrogen - - - N. Titanium -- Ti.
Dysprosium -- Dy. Osmium - - - Os. Tungsten -- W.
Erbium -- Er. Oxygen - - - O. Uranium -- U.
Europium -- Eu. Palladium - - - Pd. Vanadium -- V.
Fluorine -- F. Phosphorous - - P. Virginium -- Vi.
Gadolinium -- Gd. Platinum - - - Pt. Xenon -- - Xe.
Gallium -- Ga. Polonium - - - Po. Ytterbium -- Yb.
Germanium -- Ge. Potassium - - - K. Yttrium -- Y.

IMPORTANT: Anyone studying minerals should first learn all the elements by
name and their symbols; this will take but an evening or two study and will
be found valuable in all mineralogy.

THE SYMBOLS: These are the abbreviations of the elements, used for the
sake of brevity instead of writing out the full name as found
above., following the. names of the elements.

FORMULAS: These are the grouping of the symbols following name of a mineral
or compound, denoting all the elements it may contain. If we first learn the
symbols of the elements we can then easily and quickly read the formulas of
the various minerals and chemicals and thus know what they contain.
Example: if in chemistry we see Hydrochloric Acid (HCl), we know
H is the symbol for Hydrogen and Cl the symbol for Chlorine, so
we know by the formula that it is made up of Hydrogen and Chlorine. If
in minerals we see Hessite AuTe. - we know it contains Gold and
Tellurium, etc.

(13 - Part One)
THE ELEMENTS

The Foundation of All Mineralogy

This is the foundation and starting point not only of mineralogy, but of everything in the world! It is with the identifying of the elements with which we deal in our new system of mineral identification. When the student once understands the importance of the elements, their relationship to, and the part they play in the construction and formation of minerals, it will then be easy to see and understand why our system is, not only the easiest to understand and quickest to do, but also the most positive and so most practical of all methods of mineral identification.

THE ELEMENTS: When old Mother Nature made this world she used just 92 things - THERE ARE NO MORE! These 92 things man has called ELEMENTS. That is, everything in this world, including the human body, everything we eat, drink, wear or use in any manner; all dirt, rocks, sand, clay; or to be brief, everything IN or ON or ABOVE the earth - are all made up of just these 92 elements, used either alone or in different combinations!

WHAT IS AN ELEMENT? An element is a single thing in a pure state which is complete within itself; that is, which cannot be divided up into anything else nor can anything else be taken from it. Example: Gold is an element; if pure it contains nothing else but gold, therefore, cannot be divided up into anything else but gold nor can anything else be taken from it, and so is complete within itself - and thus an element. It is the same with all the other 91 elements, as listed on the previous page.

COMPOUNDS: We seldom if ever find any one of the elements alone or in a pure state in nature, but in practically if not all cases are mixed with and thus a combination of two or more elements; a combination of two or more elements is called a compound. Results: while there are but 92 elements, these may be mixed in different combinations and proportions to form millions of compounds; just as we may form millions of sentences with the 26 letters or the alphabet. Compounds may be divided up into two classes. A: Compounds mixed by nature. B: Compounds mixed by man.

COMPOUNDS OF NATURE: While there are many compounds mixed by nature, such as water, gas, oil, air, etc., we are interested in the present work only in those found in the crust of the earth, such as dirt, rocks, sand, clay, etc.; all of which are made up of just two or more elements in which case they are called Minerals.

MINERALS: A mineral may be considered as any solid part of the earth containing any two or more of the 92 elements. These may be further classified as dirt, rocks, ores, etc. However, minerals, rocks, and ores, all mean the same thing for our purpose, and so may be referred to, for sake of brevity, as rocks. There are some 5000 known named and classified rocks in the world: (Keep this in mind as we will come back to it again a little later on).
COMPOUNDS OF MAN: Man takes the compounds mixed by nature, such as rocks or ores, separates and saves the elements in which he is interested from the others which have no value for his particular purpose, then mixes them in different combinations, but in definite proportions, to make all of the different things of our man made world; such as different kinds of steel, medicines, etc. It is the rocks or ores containing these elements mixed by nature for which the prospector or mine owner are seeking in the hills.

CLASSES OF MINERALS: Minerals, for identification purposes as well as uses, may be divided up into two classes: A: Metallic Minerals. B: Non-Metallic Minerals. This is important to understand in this work, as we use a different method of determination for each of these two classes. It is due to the misunderstanding of these two classes of minerals and their identification which accounts for the fact that so few prospectors ever find any of the metallic minerals and thus make a failure of the prospecting business; and also why you may have studied minerals for years, and wind up just where you started, as will be explained later.

METALLIC MINERALS: These are minerals which are mined and used for their metallic content, or more properly speaking - for their metallic elements; such as, the mineral Cassiterite for the element Tin; Columbite for the element Columbium; Pitchblende for the element Uranium, and so on. In other words, with metallic minerals it is the ELEMENTS which we sell and get paid for - not the particular minerals. Example: Lead is an element; Galena is an ore. We do not sell and get paid for galena, we sell and get paid for, and Only for the quantity of Lead which it contains. So in this case it is the elements which we should be looking for and learn how to identify instead of the rocks or ores it may be in.

NON-METALLIC MINERALS: These are minerals which are mined and used for purposes other than for their metallic content, or might say, not for the particular elements which they contain, but for the compounds mixed by nature "as is", such as Coal, Cement, Mica, Asbestos, Dumortierite, Perlite, etc. Example: Dumortierite is a compound mixed by nature consisting of the 4 elements: Aluminum, Silicon, Hydrogen, and Oxygen; one of its chief uses is in making spark plug porcelains or other insulating materials, in which case it is simply ground up and used "as is" without the separation of the different elements. Therefore, in this case, it is the compound Dumortierite itself for which we are seeking, and not the particular elements which it may contain. The same applies to practically all other non-metallic minerals. However, there are a few non-metallic minerals which may be used either for their element content, or for both. Example: Lepidolite is a mineral containing the element Lithium; may sometimes be used for the extraction of the Lithium, such as used in medicines, but mostly ground up and used "as is" in the making of "heat-proof" glass, etc.

MINERAL IDENTIFICATION: There are two general methods, ways or means, used in the identifying of minerals. A: 'By Physical Properties. B: By the use of chemicals or other means.

(15 - Part One)
IDENTIFYING MINERALS BY PHYSICAL PROPERTIES

PHYSICAL PROPERTIES: This is the identifying of minerals by the characteristic look or general appearance as they appear to the eye, that is without the aid of chemicals. This consists of some 50 or more different things, such as, specific gravity, hardness, crystal form, etc. But in this we must remember - the physical properties for minerals as given in books are for PURE minerals or minerals in a fairly pure state! In this we will find the following conditions, not generally understood.

1. Non-Metallic minerals ARE usually found in a fairly pure state in nature, or must be so found to be of any commercial value, and thus can usually be fairly accurately identified by their physical properties alone by an experienced mineralogist.

2. Metallic minerals are seldom found in a pure state in nature, or at least in commercial quantities, but are found mixed with, and thus their values hidden by much rock and other impurities in which case they can NOT be identified by their physical properties alone! In this case, remember, we are looking for metallic elements; the average prospector spends much time looking at his rock with a magnifying glass and if he sees no metallics he throws his rock away as worthless; which accounts for the fact that more valuable mines are thrown down the mountain sides every year than are ever discovered! For reasons explained below.

3. Here is the situation: Gold, Silver, the Platinum minerals, and in rarer cases, Copper, Iron, Bismuth, Antimony, and Mercury, are practically the only elements ever found in the native or metallic state in nature! The first three are practically the only ones ever found in commercial quantities, and even gold and silver are more apt to be found mixed with or in chemical combinations with other elements, with the following results.

4. With the exception of alloys, when a metallic element is in chemical combination with another element it is no longer in the metallic state! Example: Sodium is a metallic element, but when in chemical combination with Chlorine it is no longer in the metallic state, and makes up our common table salt! The most common element found in chemical combination with metals in nature is Oxygen, acting much the same as above, with following results.

5. Trying to see with a magnifying glass a metallic element in chemical combination with Oxygen, is like trying to see metallic Sodium in common salt! It just cannot be done as the element, what ever it may be, is not in the metallic state! Yet, that is just what prospectors have been trying to do all these years, and on seeing no metallics - their "mine" goes down the mountain side!

6. Here is a tip which may be of value: Whenever you see the letter or letters (O. Te. or S.) in the formula following the name of a mineral you know the main element, whatever it may be - is not in the metallic state, and thus cannot be seen or identified with a magnifying glass! However, these are not the only cases in which the elements occur as a salt instead of in the metallic state, but it covers most of the metallic elements. In any of these cases the only way to identify a metallic element is by the use of chemicals or other means. This is the method used in our system, which will now be explained under "Chemical Tests".

(16 - Part One)
OUR SYSTEM: There are three chief ingredients towards success in any business or line of work: First, to believe in what we are starting out to do and, that it CAN BE DONE. Second, faith and confidence in our ability TO DO IT. Third, and most important - to get started DOING IT! On the cover and elsewhere we have made you many broad and seemingly impossible statements: We have told you we have a new system which takes all the "guess-work" out of mineral identification, easy, simple, quick and accurate; that it requires absolutely no previous knowledge whatever of chemistry, minerals, rocks or ores; that it is all so simple any average 14 year old boy can do it, and that it can all be learned in the short space of 10 days time! In the following pages we will PROVE all these statements, and thus prove that it CAN BE DONE and that YOU CAN DO IT - the starting into DOING IT will be up to you!

1. BASIC PRINCIPLES: The basic principles of our system may be explained in a few words: We deal with the identifying of the ELEMENTS - not rocks or ores! In the previous pages we have learned: First, that there are some 5000 known named and classified rocks in the world. Second, that there are just 92 elements in the world from which everything in the world is made! We will now show how they may be quickly and accurately identified.

2. IDENTIFICATION: We now come to the important part of the business: THERE IS A "KEY" TO EACH ELEMENT BY WHICH IT MAY BE IDENTIFIED: The "master key" or basic principle will be explained in the following paragraph; this is the foundation and starting point of the whole business; the better you understand this one single paragraph below, the easier it will be to understand our system and the information and instructions to follow, in which we will show how these things are brought about. Now get this!

3. The "MASTER KEY": Each element, under certain conditions, (such as by the use of chemicals or other means will produce its own individual and characteristic reaction (such as color, etc.), which is entirely different than that produced by any other element under the same conditions!

4. RESULTS: As there are but 92 elements in the world from which everything in the world is made, if we had a simple "key" or test for the identifying of each of these 92 elements, we could then, naturally, identify anything and everything in the world - including each of these 5000 known named and classified rocks!

5. ELEMENTS COVERED: In these instructions we do not cover all the 92 elements for the following reasons: First, with the exceptions of chlorine, fluorine, sulphur and carbonates, we deal only with metallic elements. Second, we cover only those metallic elements for which we have a simple test which has been tried and so proved any average 14 year old boy can make - all with an inexpensive "Field Test Kit" which even the poorest can afford to buy!

(17 - Part One)
6. **EXAMPLE No. 1:** For Vanadium. Vanadium is an element; for the "key" of its identification proceed as follows:
   1. Place a little vanadium, or ANY rock or ore containing vanadium in a porcelain dish or test tube.
   2. Add 3 or 4 drops of cold strong hydrochloric acid.  
   **RESULTS:** The element vanadium will cause the solution (acid) to turn red or brown immediately! As no other element but vanadium will give this same reaction (color), under these same conditions (cold hydrochloric acid) we have the "key" to its identification: The "key" (or test, which are the same) simply means - what to use - what to do - how to do it - the reaction (color) produced - and what element it represents for its identification.

7. **EXAMPLE No. 2:** For Tungsten. Tungsten is an element; for the "key" of its identification proceed as follows:
   1. Place a little tungsten, or ANY rock or ore containing tungsten in a porcelain dish or test tube.
   2. Add a little strong hydrochloric acid. (Note: we will not get a red or brown color as in above test for vanadium!)
   3. Add a small piece of pure metallic tin.
   4. **Boil over** lamp flame until solution turns colorless or blue.  
   **RESULTS:** The element tungsten, together with the boiling hydrochloric acid and tin, will cause the solution (acid) to turn blue! As no other element but tungsten will give this same reaction or blue color, under these same conditions (boiling hydrochloric acid and tin) - we have the "key" to its identification!

8. **CONDITIONS:** In Example No. 1 for Vanadium the condition was merely cold hydrochloric acid. In Example No. 2 for Tungsten we changed the conditions, that is, added tin and boiled the acid. And so we continue to change the conditions, use something different or do it in a different way for each of the other elements.

9. **FINAL RESULTS:** If we were to take any unknown rock or ore we might pick up in the hills or elsewhere, and proceeded as in the Example No. 1 above and got a red or brown color we would know that the element Vanadium was in that rock or ore! If we proceeded as in Example No. 2 and got a blue color, we would know the element Tungsten was in that rock or ore - regardless of what that rock or ore might look like, or whether we knew anything whatever about minerals, rocks or ores or not!

10. **WHAT TO TEST FOR?** By the old method of chemical tests, you first had to identify your rock or ore in order to know what element or elements to test for. Example: you took your rock or ore, examined it with a magnifying glass, then proceeded to try and figure out by its physical properties which one of the 5000 known named and classified rocks it resembled: If you "guessed" it might be a tungsten ore, you looked up the test in the book, and then proceeded to test for tungsten. If no tungsten present, you then proceeded to "guess" and test for something else. Results: If you did not find what you "guessed" it might contain, you threw it away as "worthless", and so maybe threw away a fortune - simply because you did not "guess" the right thing: (18 - Part One)
11. OUR SYSTEM: By our system we do no "guessing! We pay no attention whatever to what any rock or ore may look like. In Part Two we will find the tests are all arranged in a systematic order by which we identify the various elements - AS WE COME TO THEM in the systematic series of tests.

Example: In Test No. 1 we identify the two elements Vanadium and Manganese, and also catch the Sulphides and Carbonates. In Test No. 2 we identify Molybdenum Lead and Oxide. In Test No. 3 we catch Tungsten. In Test No. 4 we catch Tin. In Test No. 5 we catch Silver, Lead, Bismuth, Thallium, Tellurium, Nickel, Cobalt, Copper, Molybdenum, Arsenic and Sulphides, if are present in ANY rock! And so we continue until we have covered all the 39 elements as given in our "Method of Procedure" in Part Two.

12. "METHOD OF PROCEDURE": This is the secret of success with our system not found in any other book ever published, and the one we always follow in testing out any unknown rock or ore. You simply proceed as follows: Just take your rock or ore (any rock or ore regardless of what it may look like) and powder up a little of it as fine as possible. You then start right in at Test No. 1, then proceed to make each additional test just as given until you have completed your analysis for all the 39 elements covered there.

RESULTS: If any of the 39 elements covered in these instructions are present in that rock or ore, you can and will find and identify them WHEN YOU COME TO THEM in the tests - regardless of what that rock or ore may look like, or whether you know anything whatever about the various minerals, rocks or ores or not! You simply follow the method of procedure as given under "Systematic Prospecting!" in Part One for finding your rocks; you then follow the "Method of Procedure" in Part Two for their identification!

FINAL RESULTS - AND THE PROOF

1. Observing the simplicity in examples 1 and 2 on previous page for the elements Vanadium and Tungsten, you can see why we can say, "So simple any average 14 year old boy can do the work"! Also why we need not know anything whatever about what any certain mineral, rock or ore may look like. Also why it requires no higher education to understand, or special ability to do the work.

2. Also why no previous knowledge of chemistry is required; all acids and chemicals are in labeled bottles, so if our instructions say "use 20 drops of Hydrochloric Acid", you simply take 20 drops from the bottle labeled Hydrochloric Acid. And so on.

3. Now the most seemingly impossible of all that - "learning in 10 days time" business. As we cover but 39 elements in these instructions we have but 39 "keys" or tests to learn, and in noting examples one and two above and their simplicity, we think you will admit that anyone who could not learn 39 of these in 10 days time would be pretty dumb indeed! However, you do not have to LEARN any of them; with Part Two before you, you just simply start following the instructions and making the tests the first day you get the instructions and your test equipment! In the following lessons we will teach you everything you need to know about-chemistry, and your few pieces of test equipment and how to use them - and thus be prepared to make a complete qualitative analysis on any unknown rock or ore you may pick up in the hills or ANYWHERE!
LESSON FOUR
TEST EQUIPMENT - AND ITS USE

General Information

NOTE: In this and the following pages we will cover everything you need to know about chemistry, your test equipment and its use. Read this over carefully before buying your chemicals or equipment, or preparing your reagent solutions as given on following pages.

1. QUANTITIES: The quantities given under "Dry Reagents and Powders" on following page are, in most all cases, not the quantities actually needed, but the smallest quantities one can buy. Example: 1 ounce of Cobalt Nitrate Crystals may make 5 gallons of solution; as this is used but seldom, and then only one drop per test, this would last a dozen prospectors for a number of years; but as one ounce is the smallest amount one can usually buy, it is so listed. The same applies to many of the other chemicals as listed.

2. REAGENT: This means any material used in testing to bring or help to bring about a chemical or other reaction.

3. REACTION: This means simply a color or other effect brought about by the use of chemicals or other means.

4. SOLUTION: This is where we dissolve chemicals or any other material in water, acid, or other liquids.

5. SATURATED SOLUTION: This is one in which the liquid will dissolve no more of the material. Most home-made solutions, as given later on call for a saturated solution; so if quantities given in the instructions do not all dissolve after much shaking, ok.

6. HANDLING SOLUTIONS: The handiest method is to use common medicine droppers, which may be obtained at most any drugstore.

7. CC: This is the abbreviation for Cubic Centimeter, a given quantity used in measuring liquids in chemistry; but as this means nothing to the average prospector, let us say - 20 drops with a medicine dropper equals approximately 1 cc, or near enough.

8. CC SCALE: Take small board, say 1"x2"x6", tack thin strip of wood upright on one end as high as test tube. Now take test tube, place against upright; add 20 drops of water and draw a line at water level, mark 1 cc. Add 20 more drops and mark 2 cc; and so continue to near top of tube. Results: Now if a test calls for 2 cc of acid, place tube against measure and fill to the 2 cc line.

9. USING DROPPERS: One should have a separate dropper for Nitric Acid, Ammonia, Dimethylglyoxime, and Cacothelin solutions, and use for nothing else. The rest not so particular if rinsed out well each time. Keep glass of water handy for this purpose.

10. C.P.: This means Chemically Pure. Always use C.P. chemicals and acids if possible to get; but USP or ACS will usually do.

11. ACIDS: All strong acids such as Hydrochloric, Sulphuric and Nitric should be kept in glass stoppered bottles; original containers will do, but best to have one ounce bottles for handy use.

12. OTHERS: Other liquids, containing no strong acids, may be kept in common cork, or better, in screw-cap bottles.

13. STABILITY: Most reagent solutions will deteriorate in time, some quite soon, some will last for months, so always best to mix in smaller quantities, as given later. Best to have one ounce bottles for handy use, then fill but 1/2 full, then renew more often.

(20 - Part One)
14. HANDLING ACIDS: Many people are afraid of acids and hesitate to take up this work for this reason. Acids, like a gun, are not dangerous if properly handled with proper precaution; in our some 16 years of experience we have never had a serious burn on hands, face, or in the eye — it is simply a question of being careful!

15. CAUTION: Always keep mouth of test tubes pointed away from face in adding an acid to a mineral, a mineral to an acid, or in boiling solutions. Never add Ammonia to a hot solution!

16. GLASSES: It is best to always wear a cheap pair of glasses in testing, and thus protect the eyes in case acid "pops", or from hot particles when heating materials on charcoal.

17. HOLDER: In handling acids in test tubes in boiling over the lamp flame, one should always use a holder as explained later on under "Home-Made Test Equipment".

18. TEST TUBES: These are used for boiling solutions over lamp flame. 1/2" x 4" best size for our use. In heating it is best to pass tube back and forth through lamp flame until starts to boil, rather than holding steadily in flame. Where "slow heating" is called for, hold tube or dish higher above or to one side of the lamp flame, so solution just keeps boiling.

19. EFFERVESCENCE: This is a boiling or "fizzing" action which takes place when acids are added to some materials, such as carbonates; in this case add minerals slowly to acid, or vice versa, then heat very slowly until fizing stops or tube will boil over.

20. EVAPORATING DISHES: These are small porcelain dishes used for boiling or evaporating solutions; No. 000 best size for our purpose. These are handier to use, easier to clean, and in most cases can make test quicker than in test tubes, as given later.

21. CLEANING: Tie a rag around a small stick to use as a swab for cleaning test tubes, then rinse well. To remove stains from dishes, use a little common kitchen scouring powder.

22. IMPORTANT: Be sure everything is clean before starting. any tests; dishes, test tubes, charcoal, platinum wire, etc. Especially if a reaction was obtained in a previous test; if no reaction, they need not be so particular. If a reaction is obtained in any test, then clean everything thoroughly, then repeat test to make sure it was not "salted" or due to a previous test.

23. LAMP: It is always best to keep lamp sitting in a saucer in making tests, then if tube should break the saucer will catch the acid, and thus keep from your table or work bench.

24. FILTER PAPERS: Used in filtering solutions. Get round 3" or smaller, usually 100 in package. To use in glass funnel: fold twice in center, this makes 1 thickness on one side, 3 on other.

25. "SPOT PAPER": This is filter paper cut in say 1" squares, or cut 3" paper twice in center making 4 pieces. To use for spot test it is best to place paper on a piece of clean glass.

26. POWDERED MINERALS: Usually takes but very small quantity for making tests, as explained later. For use we give quantities which are generally understood, such as, a grain of rice, size of a navy bean for approximate amounts; more or less is immaterial.

27. WHERE TO BUY: All acids and liquids (which cannot be sent by mail) can usually be obtained at most any drugstore. For chemicals and test equipment, see classified section in Popular Mechanics or like publications for addresses of chemical houses.

(21. - Part One)
TEST EQUIPMENT

(Laboratory Supplies)
1 Alcohol Lamp with wick; small 2 ounce best size for our use.
1 Blowpipe; just common plain brass is as good as any.
1 Platinum Wire, with glass holder; for making bead tests.
1 Porcelain Mortar and Pestle; for powdering up fusions.
1 Small Glass Funnel; small 2" top for filtering solutions.
1 Package 100 Filter Papers; round 3" or smaller best size.
1 Pair Tweezers; for handling tin or small objects.
2 Charcoal Blocks (sticks) for making fusions and color tests.
2 Small Porcelain (evaporating) dishes; #000 best size.
6 Test Tubes for chemical tests; 1/2" by 4" the best size.
1 One ounce glass stoppered bottle for hydrochloric Acid.
1 One ounce glass stoppered bottle for Nitric Acid.
1 One ounce glass stoppered bottle for Sulphuric Acid.
1 One ounce screw-cap bottle for Dimethylglyoxime solution.
1 One ounce screw-cap bottle for Cacothelin solution.
1 One ounce screw-cap bottle for Strong Ammonia.
1 One ounce screw-cap bottle for Silver Nitrate solution.
1 One ounce screw-cap bottle for Cobalt Nitrate solution.
1 One ounce screw-cap bottle for Sodium Sulfide solution.
1 One ounce screw-cap bottle for prepared "Charcoal Flux".

NOTE: See "Additional Equipment Made at Home" on page 25.

CHEMICALS AND REAGENTS

(Ready Mixed Acids and Liquids - cannot be sent by mail)
1 Pound Hydrochloric Acid (CP). 1 Ounce Strong Ammonia.
1 Pound Nitric Acid (CP). 1 Oz. Pure Grain Alcohol
1 Ounce Sulphuric Acid (CP). (or Acetone, see later).
1 Ounce Acetic Acid (Glacial). 1 101 Hydrogen Peroxide.
1 Pint Denatured Alcohol; for operating the Alcohol Lamp.
1 Pint Pure Distilled Water to prepare Reagent Solutions.

(Dry Chemicals and Powders)
1 Oz. Sodium Carbonate. 1 Oz. Tannic Acid Powder.
1 " Powdered Borax. 1 " Ammonium Carbonate.
1 " Charcoal Powder. 1 " Pyrolusite (MnO).
1 " Pure Tin Metal. 1 " Sodium Hydroxide
1 " Zinc Metal Powder. (Caustic Soda).
1 " Pure Sulphur; sublimed. 1 " Sodium Nitrate.
1 " Potassium Iodide. 1 " Sodium Sulfide.
1 " Potassium Nitrate. 1 " Cobalt Nitrate.
1 " Potassium Hydroxide, 1 " Lead Acetate.
(Caustic Potash).
1 " Potassium Ferrocyanide. 1 " Salt of Phosphorous.
1 " Potassium Pyrosulphate. 1 Gram Silver Nitrate.
1 " Potassium Chlorate. 10 " Dimethylglyoxime.
1 " Potassium Acetate.

NOTE: Under "General Information" previously given, and "Solutions to be mixed at home" on the following page we take up and explain everything you need to know about the above and their uses.

(22 - Part One)
1. **MATERIALS:** The following solutions are all made up at home by using Dry Chemicals or Powders as listed on previous page. NOTE: See "General Information" before preparing solutions.

2. **PURE WATER:** In all cases where solutions are to be prepared with water we should use pure distilled, rain, snow or other water free as possible from injurious impurities; most common injurious impurity, especially in testing for silver or lead in Part Two, is Chlorine, usually due to salt as found in most well or other common water. Can usually get a pint of pure distilled water at most any drugstore for around 10 cents for making up reagent solutions, then first chance catch a gallon or two of rain water. Test this for chlorine with Silver Nitrate Solution as given below; if free of chlorine, keep in well closed glass jugs or bottles. Use this in all tests, especially for silver or lead, where water is used.

3. **SILVER NITRITE SOLUTION:** To prepare.
   1. Fill an ounce bottle about 1/2 full of pure distilled water.
   2. Add Silver Nitrate Crystals equal to 2 or 3 grains of rice.
   3. Shake bottle to help dissolve. This keeps for a long time.

4. **TO TEST FOR CHLORINE IN WATER.**
   1. Place about 2 cc of water to be tested in a clean test tube.
   2. Add 8 or 10 drops of pure Nitric Acid.
   3. Heat to boiling; let set until cold.
   4. Now add one or two drops of Silver Nitrate Solution.

   **RESULTS:** If chlorine in water it will have a curdy, milky-white, or opal-like color. If so, cannot use in preparing reagent solutions, or in making silver or lead tests. See page 10, Part Three.

5. **CACOTHELIN SOLUTION:** To prepare - for Tin Test.
   1. Fill one ounce bottle about 1/2 full of pure water.
   2. Add Cacothelin Powder equal to about 2 or 3 navy beans.
   3. Shake bottle to help dissolve (all may not dissolve, ok).

   **STABILITY:** Keeps well; but as use only 1 drop per tin test 1/2 ounce lasts long time; so if stood over 3 months check stability before test unknown ores. To check see Stannous Chloride below.

6. **STANNOUS CHLORIDE:** To Prepare Solution.

   **NOTE:** We seldom ever use the crystals as the solution does not keep well. Here is the idea: When we dissolve metallic tin (Sn) in Hydrochloric Acid (HCl) we have Stannous Chloride (SnCl). So when needed we place say 2 cc (or amount needed) of HCl in a test tube, add 1 or 2 small pieces of metallic tin, and boil slightly.

   **NOTE:** This also does not keep well, so should always be prepared fresh, say within 8 hours of using.

   **TO CHECK:** If Cacothelin Solution is known to be good, can check stability of SnCl as follows: Place a piece of spot paper on a piece of clean glass; add a drop of Cacothelin Solution; now add a drop of SnCl. **RESULTS:** A lavender spot if SnCl is good.

   **NOTE:** Can also check stability of Cacothelin Solution in same manner with freshly prepared solution of Stannous Chloride.

(23 - Part One)
7. **DIMETHYLGlyOXIME:** To Prepare Solution (for Nickel Test).

   **NOTE:** Should be mixed with Pure Grain Alcohol if possible; but as this is sometimes hard to get, we find Acetone will do about as well, and can get an ounce at most drugstores for around 14.
   1. Fill an ounce bottle about 1/2 full Alcohol (or Acetone).
   2. Add Dimethylglyoxime powder equal to 2 or 3 navy beans.
   3. Shake bottle to help dissolve (all may not dissolve, ok).

   **NOTE:** Use one drop of this per nickel test; see Test No. 6.

   **STABILITY:** May keep a year if bottle well corked; but if stood over, say 3 months, should always check stability before testing any unknown rock or ore for nickel.

   **TO CHECK:** Make test with known sample Nickel ore as is given in Test No. 6 in our "Method of Procedure" in Part Two.

8. **COBALT NITRATE:** Dissolve crystals equal to about 2 or 3 navy beans in 1/2 ounce of pure water. This is seldom used.

9. **SODIUM SULFIDE:** Dissolve crystals equal to about 2 or 3 navy beans in 1/2 ounce of pure water. This is seldom used.

10. **OTHER SOLUTIONS:** The following are seldom used, and then only a few drops per test, and as they do not keep well in water solutions, it is best to mix in a test tube as needed.

11. **AMMONIUM CARBONATE:** Dissolve powder equal to about 1/2 the size of navy bean in 2 or 3 cc of pure water; shake to help dissolve.

12. **POTASSIUM FERROCYANIDE:** Dissolve flakes or powder equal to about 1/2 navy bean in 2 or 3 cc of pure water.

13. **CHARCOAL FLUX:** This is not a solution, but as it is to be prepared at home will be given here. This is used in all tests in Part Two where fusions are made, unless otherwise stated. It will work on practically all minerals, and thus save making up a different flux for each element, as was required by old methods.

   **TO PREPARE:** Mix thoroughly 4 volumes of Powdered Borax; 4 volumes of Sodium Carbonate (anhydrated, not common baking soda), and 2 volumes of powdered Charcoal.

   **NOTE:** As this is much used a good idea to keep an ounce bottle of this made up for handy use, rather than making up as needed.

14. **BISMUTH FLUX:** This is another powder mixture to prepare at home. It is used in the testing of Bismuth, or to distinguish bismuth from lead, as given in Test 25, Part Three. As it is used mostly as a confirmatory test, best to mix up as needed.

   **TO PREPARE:** Mix equal parts Potassium Iodide and Sulphur.

15. **GYPSUM TABLETS:** While "Bismuth Flux" may be successfully used on charcoal, the colors, especially for low-grade lead or bismuth, will show up much plainer on white gypsum tablet. Can also test Antimony or Arsenic by first blackening the tablet by holding in smoky flame, such as with match or coal-oil lamp.

   **TO MAKE:** See "Equipment to make at home" on following page.

   **TO USE:** See Test No. 25, in Part Three.

(24 - Part the)
ADDITIONAL EQUIPMENT TO BE MADE AT HOME

1. BOX - for "Field Test Kit" : This should be about 7" high by 7" wide by 12" long. Has one tray and a 2 piece lid; one piece for cover fastened at back with pair small hinges; one piece for "flap" for front of box fastened to lid with another pair small hinges so will raise with lid, and thus make every thing handy to get at in testing.

   TO MAKE: 1. Nail bottom and back to end boards. 2. Cut a board 1-1/2" wide and nail to front of box at bottom. 3. Cut board to fill in front of box, but do not nail. 4. Cut cover and fasten at back with small hinges. 5. Now fasten above front board to cover with another set small hinges so will raise with lid.

   TRAY: Place tallest article in box for height, then make tray to fill in rest of box flush with top. Use thin boards for tray, also for partitions to hold every thing in proper places.

2. TEST TUBE STAND: A: Take a thin board or plywood for top 2" wide and 6" long; space out and bore 6 holes just large enough for test tubes to slide in and out easily. B: Take a 1" board of same size for base. C: Tack pieces on the ends so top and bottom are about 2" apart so solution colors can be seen in test tubes.

3. TEST TUBE HOLDER: For holding hot tubes over the lamp flame. A: Take a piece of single strand insulating wire (as used for electric lights); bend this in middle so ends are even. B: Now bend each and rounding so the two will form a loop size of test tube. C: Fasten with small wire above loop to hold ends in place.

4. GYPSUM TABLETS: For purpose see previous page. One should make up a couple dozen of these and have handy.

   TO MAKE: 1. Get 2 or 3 pounds of Plaster of Paris. 2. Now take a common window glass, or any flat glass; make a frame around the same about 1/4" higher than glass. 3. Now take amount of material you think will take to fill space; be sure and have enough as it costs practically nothing. 4. Add plenty of water and mix quickly; make into thin sloppy paste. 5. Pour on glass, then immediately take a long knife blade or piece of tin which will reach to both frames, and level off smooth; by wetting knife blade or tin make slick as possible. 6. When thoroughly set, remove from the frame, mark off and with hacksaw cut into blocks about 1" by 2-1/2".

5. CROCKERY: Some fusions made with flux may sometimes be made on crockery (or flat piece of chinaware, such as broken plate), and thus save charcoal blocks. Have pieces about 1" square or may be larger; can usually pick up around home or trash dump.

6. HOLDER: For holding gypsum tablets, crockery or small pieces of charcoal for heating with blowpipe. A: Take a piece of fairly heavy galvanized iron 1" wide by 5" long; bend up one end about 1/4". B: Take a piece of tin can about 2" square; bend one end of this about 1/4" to match longer piece; cut where necessary and bend around long piece, so will slide back and forth on the long piece to act as a clamp to hold pieces of crockery, etc.
THE BLOWPIPE: ITS PURPOSES AND OPERATION

NOTE: The operation of the blowpipe is the only thing in our complete instructions which requires any skill or practice. However, this can all be learned in an evening or two practice by following the instructions given below, and well worth the time spent as we may identify more elements in less time than by any other method; and also important in other tests where fusions are required. See "Tests Made on Charcoal" on pages 6 and 7 in Part Two.

OBJECT OF BLOWPIPE: To change the normal vertical lamp flame into a horizontal direction controlled by the operator, and thus concentrate the heat of the lamp flame into a long slender cone which may be directed against the assay or object to be tested.

FLAMES: It will be noticed there are two cones to the flame; each has a different color, and each one used for a different purpose:

A: An outer yellow cone which is called the Oxidizing Flame.

B: An inner blue cone which is called the Reducing Flame.

NOTE: Place a cardboard behind lamp to better see flame colors.

THE OXIDIZING FLAME: Some substances when Oxidized produce certain reactions, as explained on page 6, Part Two, which is the object of this flame. The best point for Oxidizing purposes is within the yellow flame just outside the blue cone with the blowpipe.

THE REDUCING FLAME: Some substances when melted, fused or reduced to the metallic state, produce certain reactions as explained on pages 6 and 7, Part Two. The object of this flame is to fuse or melt the object being tested. The best point for this purpose is just within the tip of the blue cone. We will also find some materials must be melted or fused with some flux before they will become soluble in water or acids, as explained in Part Two.

OPERATING THE BLOWPIPE

One of the first and most important things to learn in operating is to blow a steady blast of air, and thus produce a steady flame. The following will give the general idea, and may be learned with just a little practice. NOTE: The blast of air is not produced by the lungs, but by air held in the mouth, replenished by a gulping action as explained below. You simply proceed as follows:

1. Place the mouthpiece between the lips; lips closed.
2. Now place tip of blowpipe just within flame of lamp, to the right hand side and just above the wick.
3. Now distend or blow up cheeks.
4. Breathe in through the nose - never through the blowpipe!
5. Exhale, slowly, through the blowpipe (little air is required) at same time breathe naturally through the nose.
6. When more air needed in cheeks, make a sort of gulping action with cheeks (do not suck air through the blowpipe).
7. Keep cheeks distended at all times, only the fraction of a second necessary for the gulping action; the object is to try to blow as steady a stream of air as possible, with as little break as possible. Practice extending time between gulping actions.

Practice on making actual fusions and bead tests.

(26 - Part One)
LESSON FIVE

QUICK METHOD OF LEARNING THESE TESTS

General Information

The best way to learn anything is by PRACTICAL EXPERIENCE, and so the easiest, quickest, and most practical way to learn how to make all the tests in our "Quick Qualitative Analysis" in Part Two, is to practice on KNOWN SPECIMENS; that is materials which you know do contain the elements being tested for. This is the method we use in teaching this business under our personal instructions in our laboratory, and so will be included here.

Here is the idea: After you have learned how to test, and how to recognize the characteristic color reactions of the elements in the known specimens, you can then, naturally, do the same if present in any unknown rock or ore you may be testing. For practice purpose you should buy your known specimens from a reliable dealer, or use those you have previously had assayed and so know the elements in question are present in your rock or ore.

The main object in this work is to learn how to identify all of the ELEMENTS listed, and so in buying specimens for this purpose, in most cases, we do not care what particular-rock or ore we find them in. Example: There are some 10 ores of Nickel; any and all of these will be identified by our one Test No. 6 in Part Two, and so ANY one Nickel ore will do for our purpose. The same with Lead, Cobalt, Tungsten, Silver, Uranium, and most of the other elements.

However, there are certain cases in which we will also want to identify our particular rock or ore, due to the fact some are more valuable than others. Example: Galena-PbS may be more valuable or easier sold than Cerussite-PbCO; or Molybdenite-MoS more valuable than Molybdate-MoO. For this reason the Carbonates and Sulphides are included in this work, as well as certain tests to distinguish MoS from Moo or MoPb, etc., and so should be considered in buying your known test specimens for practice purposes.

On the following page we will give a list of the 26 elements and minerals we use for practice purposes, all of which may be bought at reasonable prices from specimen dealers. Many of the others we cover in this course, such as the 6 platinum group minerals, gold, thallium, etc., being too rare and costly for the average person to buy; but they will not be necessary, for by the time you have gone through the first 26 you will have the idea of testing, and will have no trouble with the others if present in any rock or ore you may be testing - simply follow the instructions. The minerals of the other elements covered in this course may be found in most any good book on mineralogy.

Using: In making the tests the minerals should always be well powdered; so you simply break a piece off your known specimens, powder them up as fine as possible, then using the amount stated in the instructions you proceed to make your tests as given.

(27 - Part One)
NOTE: In the list below we will take up the 26 elements and minerals we will use for practice purposes in learning to make the tests. These will be listed in the order of their identification in our "Method of Procedure" in Part Two; so your known specimens should be arranged and numbered in like manner, in order to best follow the procedure in practicing tests on the following page.

1. Carbonates -- CO. Carbonates will do for this test.
2. Sulphur -- S. Sulphides, any ore with S in formula.
3. Vanadium -- V. Carnotite, or any vanadium mineral.
4. Wulfenite -- MoPb. To distinguish from Molybdenite-MoS.
5. Tellurium -- Te. Any ore containing tellurium will do.
6. Tungsten -- W. Scheelite-CaWO, or any tungsten ore.
7. Tin -- Sn. Cassiterite-SnO, or any tin ore.
10. Lead -- Pb. Galena-PbS, or any other lead ore.
12. Cobalt -- Co. Cobaltite-CoAsS, or any cobalt ore.
13. Molybdenite - MoS. To distinguish from MoPb or MoO.
14. Arsenic -- As. Realgar-AsS, or any other arsenic ore.
15. Silver -- Ag. Native silver, or any silver ore.
17. Cadmium -- Cd. Greenockite-CdS, or any ore with Cd.
20. Magnesium -- Mg. Magnesite-MgCO, or any magnesium ore.
21. Columbium --Cb. Columbite-CbTa, or Tantalite TaCb.
22. Tantalum -- Ta. Tantalite-TaCb, or Columbite-CbTa.

NOTE: In Part Two we will find many elements will give a reaction in more than one test, so we should learn them all, then if we overlook a reaction in one test we may catch it in another; so make all tests for each element as is given on the following page. It is also a good idea to use fairly low-grade samples to practice on, and thus learn to watch for slight reactions, as we may find them in low-grade materials in testing unknown rocks later on.

POWDERED MINERALS: Most people have the idea that they must use a lot of powdered mineral and a lot of acid to get a good reaction in testing, and that the more of each they use the better will be the reaction obtained; however, just the opposite is usually true! In most all cases we will get a much better reaction (plainer to see) by using powdered mineral equal to from 1 grain of rice up to one navy bean in 2 cc of acid than we will by using a teaspoonful of powdered mineral in an ounce of acid! Remember this in practicing on your known specimens, and thus, save your specimens as well as your acids. Use the approximate quantities as given.

(28 - Part One)
PROCEDURE IN PRACTICING TESTS

1. CARBONATES-CO: Any mineral with CO in the formula will do for this test; try Calcide-CaCo, by Test No. 1.

2. SULPHUR-S (Sulphides): If sulphur is present in any ore in the form of Sulphides (sulfides) you must first roast your mineral before panning for gold! Any ore with S in the formula will do for this test. Try Galena-PbS; or Zinc Blende-Zns, by Test No.1. Then make Test 11. Then Test 12. Then try Test No. 5.

3. VANADIUM V. (any ore): Make Test No. 1; confirm by Test 60-D in Part Three. Then make Test 17.

4. WULFENITE MoPb. (Lead Molybdate): Make Test No. 2 for Mo. Then make Tests 5 and 7 for Lead. Then Tests 11 and 12 for Lead. Then make Test 13 for Molybdenum (a red or rose any Mo. ore).

5. TELLURIUM-Te: Any mineral with Te. will do for our purpose. Make Test 3, then confirm as given there. Then make Tests 5 and 9 to learn reactions there. NOTE: If Tellurium is present you must roast mineral thoroughly before panning for Gold!


7. TIN-Sn. (any ore): Make Test 4. Then try Test 12. (Also see Test 56 in Part Three, for additional information).


9. NICKEL-Ni. (any ore): Make Tests 5 and 6. (See Test No. 42 in Part Three, and proceed as given there).


12. COBALT-Co. (any ore): Make Tests 5 and 8. Then try Test 16.

13. MOLYBDENITE-MoS: To distinguish from MoPb or MoO. Make Tests 5 and 9. Now try Test 13 (a red or rose with any Mo. ore).


15. SILVER-Ag. (any ore): Make Tests 5 and 10; proceed as given.

16. ANTIMONY-Sb. (any ore): Make Test No. 11. Then try Test 12.

17. CADMIUM-Cd. (any ore): Make Test No. 11. Then make Test 12.


19. ALUMINUM-Al. (any non-fusible ore): Make Test 11; reaction N.

20. MAGNESIUM-Mg. (any non-fusible ore): Make Test 11; reaction O.


22. TANTALUM-Ta: See page 12 Part Three. Make Test 13-A. Then try Test 13-B for Columbium; this is usually sufficient, but can try Test 53 Part Three, but usually unnecessary.

23. TITANIUM-Ti. (any ore): Make Test 13-A. Then try 13-B. Then try Test No. 57-A Part Three (most positive test for Ti).


25. URANIUM-U. (any ore): Make Test 16. Then 17. This is usually sufficient, but can make Tests 59-B and 59-C.

26. MERCURY-Hg. (any ore): Make Test 40 Part Three (positive).

**FINAL RESULTS**: With the above known specimens to practice on the average student usually learns all the tests in 3 to 5 days time, then ready to test out any unknown rock or ore they may pick up ANYWHERE by following the "Method of Procedure" in Part Two.

(29 - Part One)