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Rocks and Minerals

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Published by

PETER ZODAC

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ROCKS AND MINERALS

Published quarterly, at Peekskill, N. Y., and devoted chiefly to rocks, minerals, ores, crystals and gems, in the interest of the General Collecting Public.

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The idea of publishing a magazine devoted to minerals was first suggested to me thru the large number of letters I received from collectors and would-be collectors who desired information on the subject, methods in analyzing minerals, hints on making a collection, and so forth. So many letters did I receive and so keen was their interest, that I was oftentimes swamped with correspondence. As a solution, I finally decided a magazine on minerals would be just the thing.

Before attempting a publication of this sort, I first sent out circulars informing collectors of my plan. That my idea met with approval, is well typified by the large number of replies received from collectors, all over America, who not only sent in subscriptions and heartily endorsing my move, but even offered to assist me by "boosting" the magazine with special articles, new subscriptions and advertisements. I trust, therefore, that "Rocks and Minerals" will be favorably received and generously supported, by each and every collector.

Tho there are hundreds of thousands of collectors, of all kinds in America, only a small number, possibly a thousand or so, are real mineral collectors. This is chiefly due to the difficulty a beginner has in learning about the subject. The purpose of this magazine is to give, in a non-technical way, enough information to interest a beginner in the collecting of minerals, and to instill in him a desire to know more about them. In order to achieve this aim, and to better serve our subscribers, we cordially invite you to assist us with articles on mines, minerals, gems, localities, and other interesting topics, so as to make this magazine, worth-while.

The success of "Rocks and Minerals" depends upon YOU! ! ! !

Criticisms of this magazine or articles are welcome.

MINERAL COLLECTING—THE OLDEST HOBBY KNOWN

The collecting of rocks and minerals has been going on for century after century; back to the time of the early Christians; back to the time of the early Romans and Greeks; yes, even back to the time of the Cavemen.

That the Cavemen really did collect minerals is well known, for remains have been found from which stone implements of various kinds were obtained in a well-preserved condition; even more, our reasons alone would tell us that he had to have a collection of rocks of some kind in order to exist. Now what would he collect, or rather what would he use? Rocks and minerals that were hard and durable, and easily obtained, would be the chief ones; such as flints, cherts, agates, jaspers, quartzites, and so forth, which were then and still are, very common and found all over the earth. To be sure, the rough and uncouth Caveman, living in dark and dismal caves, did not have his minerals displayed in an attractive cabinet, with labels under each specimen; neither did he collect his minerals as a pastime or hobby. Collecting minerals to him was a serious occupation; he had to obtain food to exist; he had to protect himself from enemies and wild animals; this he could best do by using weapons made of stone.

That localities existed from which a plentiful supply of good minerals could be obtained, sounds reasonable; these surely must have been jealously guarded and well hidden. From a trip to such a locality, the Caveman would come back with a large supply of minerals, sufficient to last him for quite some time, and on these he would work in his spare moments, grinding them down to certain sizes, or to fit certain tools; doing the grinding with rocks that were as hard or harder.

As the Caveman roamed over the countryside, he would, no doubt, pick up various pebbles that were bright-colored or curious; such as amethyst, rock crystals, garnets, agates, jaspers, and so forth. These would be brought back to the village and passed among his tribesmen, to be inspected and admired. Any excavations that were made, or large boulders broken open, might yield gemmy crystals of tourmaline, beryls, garnets, or the various quartzes, which would pass into the hands of the finder. Later as the tribes increased and prospered, longer trips would be undertaken, extending into territory never before visited by them. Stranger tribes were often encountered which meant war. The victors of such fights carried away spoils of every description among which might be many gems entirely different from their own native stock; gems that were beautiful and fascinating; and thus would a tribe or a family acquire diamonds, emeralds, rubies, topazes, turquoises, and so forth, which would be jealously kept and handed down from father to son.

During the time of the early Egyptians, Greeks, and Romans, not only were gems well known and collected, as articles of adornment, but many metals were likewise known and used. Copper, gold, silver, and tin, were some metals that were worked into various articles, ornaments, and later, coinage. These were often brought in from long distances; tin for example, was mined in England by the Phoenicians and carried to their country (now part of Asiatic Turkey), hundreds of years before the birth of Christ.

Gems were always in great demand and much sought after. The early people, being superstitious, endowed gems with many miraculous powers, such as talismanic, curative, and supernatural. Certain gems cured diseases or sickness; others gave protection from sorcery, dangers or calamities; others could foretell the future or review the past; certain stones brought good fortune, others evil. These superstitions are even prevalent today and many men carry small pocket-pieces of various gems, as charms, to bring good luck.

What is the use of collecting minerals, what good are they? Hundreds of reasons can be given but only a few need be mentioned. First of all, we are all students of nature, and we want to know something about this great world we live in. We know the earth is divided into three kingdoms; animal, vegetable, and mineral. The animal kingdom embraces man, animals, insects, birds, and fishes; the vegetable kingdom embraces plants, flowers, and trees; the mineral kingdom embraces rocks, waters, and air.

From rocks we can tell the changes that have taken place on this earth, millions of years ago—changes that are still in progress; we can tell what varieties of animal life, fish life, or plant life flourished ages ago; which came first, next, and so on. We can tell where once were seas, lakes, and mountains, that have long since disappeared or been worn down. The study of rocks is, therefore, a very interesting subject and we can read its lessons everywhere. We collect rocks to remind us of some particular change, form, or type, and to study them at our leisure.

There is another reason for collecting rocks and minerals, and that is, as a diversion from our regular work. We all should have a hobby of some kind to occupy our thoughts at our leisure moments, some hobby that will give us much pleasure and satisfaction. The collecting of minerals is an excellent hobby. Minerals are interesting, fascinating and instructing. They come in all varieties, sizes and forms; in all colors and variations; from clear and transparent, to dull and opaque; from very soft to the hardest substance known; from worthless pebbles to the most expensive gems.

Outside of their curious forms and beautiful coloring, minerals have another attraction; the purpose or use to which they are put. Some are used as ores; some as gems and ornaments; some as fuels; some in the manufacture of various articles: glass, paints, chemicals, medicines, and so forth. It is interesting, therefore, to collect types, representative of each group.

There is still another remarkable and interesting feature about minerals that fascinates us, and that is the changes that minerals undergo. We have beautiful examples of wood changed (petrified) into agate, jasper, opal and limonite; coral petrified into chalcedony; leaves, twigs, fishes and shells petrified into stone. These are only a few of the many wonders that occur in minerals. A collector can, therefore, spend many enjoyable hours among his minerals.

Besides the pleasurable interest and satisfaction that minerals will give a collector, there is another, a sociable advantage, which may often prove an asset, for, a good collection, well displayed and labelled, with its wonderful coloring, beautiful crystals, and curious forms, will astonish all visitors.

IDENTIFICATION OF MINERALS

Every collector of minerals ought to be able to identify many of his own specimens, especially some of the common varieties like the various ores of iron, lead, copper, zinc, manganese, etc., and the ordinary silicates, carbonates, sulphates, oxides, etc. There is nothing strange or mysterious in the process of identifying minerals, almost anyone over 16 should be able to make his tests without much trouble. To be sure, in order to analyze his minerals easily and intelligently, a beginner should possess some qualifications such as: good, common, ordinary sense: at least a high school education; a laboratory of some kind; and last but not least—patience.

There are many minerals that are difficult to analyze, some that even an expert may have trouble with, but such minerals do not concern us in the least as we are only interested in the common varieties, which form by far the greatest portion of the earth's minerals.

In analyzing and identifying minerals experience is the best teacher. Every collector should, therefore, have a small collection of typical minerals on which he should practice at his spare moments until he becomes thoroly familar with their reactions and tests. These working minerals should be pure, illustrate fully their chief physical qualities, and be correctly identified.

It is of the utmost importance that every collector should know that most minerals do not occur in a pure form, that they are all mixed, more or less, with impurities that often give them a different color, for example; pure quartz is clear and transparent, like ordinary glass, the addition of a little manganese gives it a purple color and it is known as Amethystine Quartz or simply Amethyst; the addition of a little iron gives quartz a red or a brownish color and it is known as Ferruginous Quartz. These impurities in most cases are so slight that they can often be disregarded, but in many instances they occur in such large amounts that they have to be considered when analyzing. As the impurities in a mineral increase, a proportion may soon be reached whereby the impurities greatly exceed the original mineral, when this occurs the original mineral passes into another mineral, for example; calcite is calcium carbonate, $CaCO3$; magnesium, Mg, often replaces some of the Calcium, Ca, and then the calcite passes into Dolomite $(Ca,Mg)CO3$. Sometimes the original mineral is entirely replaced by its impurities. Boulders can often be found that are soft on the outside but if broken open are found to be hard inside and of a different color. This shows that the exterior is changing or altering into another mineral. These are some of the lessons that can be learned from minerals.

Laboratory:—Every collector who intends to do his own analyzing should have a little laboratory of some kind, where he can work conveniently and without interruption. As acids have to be used for most tests which are not only disagreeable and dangerous to handle but corrosive as well, it is best to have this laboratory in a separate building away from the house, as in a shed, etc., but if it must be in the house use a room where the acid fumes will do the least damage.

The laboratory should be located in a light, airy room, about 15x15 feet. Running water, illuminating gas, and electric lights should also be in this room but they are not absolutely necessary. Tables and shelves should be placed where convenient, the tables on which the work will be done while the shelves are to store all chemicals, apparatus, etc. The tables should be covered with slate, soapstone, or other acid-resisting material to prevent the boards from becoming unsightly should acid be spilled on them, if these are not available, ordinary oilcloth can be substituted. No good rugs or carpets should be on the floor, old pieces of linoleum can be used instead. No expensive pictures or other articles that may become damaged by the acid fumes should be in the room. All acids and chemicals should be plainly labelled so there will be absolutely no mistake as to what they are, and placed out of reach of children. When the laboratory is not used it should be kept locked.

It is most important that the acid fumes, which are given off when acids are boiled to dissolve minerals, are gotten rid of as soon as possible. If it can be arranged the working table should be placed in front of an open window so the fumes can pass off directly into the open air. If this is not possible, then a hood made of wood, clay or tile pipe can be constructed to carry off the gas into the open air. An ordinary stove pipe would be fine but the gases would soon corrode it unless it was painted on the inside with some acid-resisting paint.

Apparatus Needed

(Price List of Apparatus, Supplies and Reagents sent upon request)

Anvil:—A small block of ordinary steel often comes in handy.

Apron, rubber:—Used to protect clothes from acids but not necessary if careful.

Bags:—Good, strong duck bags are useful for carrying ores, minerals, etc.

Balance:—A good, small balance for weighing assays, chemicals, etc., is very useful and important, but it is high in price and for the small laboratory it is not really necessary.

Beakers:—Glass beakers, which are necessary for holding solutions, are made of a thin, tough glass that will stand considerable heat, so that solutions may be boiled in them. They come in "nests" of various sizes from 50 cc. to 1,000 cc., with or without lip. One or two beakers of 50 cc. may prove useful but is not absolutely necessary.

Blowpipe:—This instrument has been employed for hundreds of years by artisans for soldering, etc. It produces an intense heat and thru its means many ores can be melted down and their metals extracted in a pure state. It is of the utmost importance to mineralogists as many other tests may also be made with it. A blowpipe should be in every laboratory.

Blowpipe minerals:—A collection of at least 50 different ores and minerals, illustrating scale of hardness, fusibility, etc., should be in every laboratory. These do not have to be very large.

Bottles:—A good supply of various bottles should be in every laboratory, at least one dozen should be glass-stoppered for holding acids and solutions. All bottles containing acids, solutions, and chemicals, should be plainly labelled, so there will be no mistake as to their contents. Bottles used for patent medicines, perfumes, etc., are very good and should be saved. A few wide-mouthed bottles like ½ and 1 pint milk bottles should also be saved.

Boxes:—A good supply of small cardboard or wooden boxes should be on hand for storing away small minerals, chemicals, etc. Boxes about the size of pill boxes or small match boxes are plenty large enough.

Brushes:—About one dozen various brushes should be on hand to clean out tubes, bottles, vials, etc. Old tooth brushes, nail brushes, and even paint brushes will be found useful.

Casseroles:—Porcelain casseroles are used for dissolving ores in acids. They are particularly useful when the solution must be evaporated down to dryness, as with care they will stand this operation without any danger of cracking, whereas beakers would be very liable to crack as soon as the solutions in them are boiled dry. Casseroles come in various sizes but a 2-ounce is most convenient for ordinary work.

Charcoal:—The tests on charcoal are very important. By its use many ores are reduced and forced to give up the metals they contain. As these metals are extracted they often volatilize (pass off in smoke) and mixing with the air, deposit on the charcoal, coatings of various colors. About one dozen sticks of charcoal should be in every laboratory.

Clamps:—Clamps for holding test tubes, closed and open tubes, are necessary as tubes get so hot when heated that they can not be held in the hand.

Chisel:—A small cold-chisel for breaking up minerals may prove necessary.

Corks:—A good supply of corks, various sizes, should be on hand.

Cork gauge:—A cork gauge is an important article for determing easily and quickly the size of corks and stoppers needed to fit bottles.

Crucibles:—Crucibles are very useful in many ways, one important use is to examine some precipitate that may be present in only a small quantity. To do this the filter paper containing the precipitate is placed in the crucible, and the latter supported on a small triangle of iron wire, is heated over a flame until the carbon of the paper has completely burned away, leaving the precipitate together with the trifling ash of the paper.

Cylinders, graduated:—A cylinder graduated up to 50 cc. is an important article to measure water, acids, solutions, etc.

File:—A small 3-cornered file is used for cutting glass-tubing.

Funnels:—Glass funnels are very necessary to filter precipitates from solutions. About 2 or 3 small ones should be on hand.

Glass:—Small squares of ordinary glass are useful for covering beakers, casseroles, etc. Larger squares may often prove useful for examining powdered minerals, etc.

Gas generating Bottle:—Useful for generating hydrogen sulphide and other gases for certain tests. A small ½ pint bottle is sufficient.

Goniometer:—A very useful instrument for measuring plane angles on crystals. Every collector should have one.

Hammer:—A small ordinary hammer will suffice.

Fuels:—The most convenient fuel for blowpipe operation is ordinary illuminating gas, and the burner best suited for the purpose is a Bunsen burner. Illuminating gas is clean, gives a very hot luminous or a non-luminous flame, has no odor, and is satisfactory in every way. If gas is present in the house then by all means use it.

If gas is not present in the house, then a common ordinary candle can be used for most purposes. The chief objection to the use of candles is that in heating test tubes, etc., soot is deposited which is very annoying as many of the reactions cannot be seen. The flame also is not very hot. Alcohol lamps are often used, and tho they give a nice hot flame, with no soot, they are no good for obtaining a strong reducing flame.

Jar:—A large earthenware jar should be present in a laboratory to receive waste solutions, used filter paper, broken glass, etc.

Knife:—An ordinary pocket knife, with one blade magnetized, for testing hardness, magnetic minerals, etc. The blade of a pocket knife can easily be magnetized by stroking it a few times, from handle to point, with a strong magnet.

Labels:—A good supply of gummed labels should be on hand to label all bottles, boxes, vials, etc.

Lens:—A good magnifying lens is very useful and often necessary to examine small crystals, signs of fusion, etc. A lens of 12 diameters is the best.

Magnet:—A common horseshoe magnet is necessary to test for magnetic minerals.

Mortar:—Useful for reducing minerals to a fine powder. There are 3 kinds of mortars; agate, porcelain, and iron. In the agate and porcelain mortars, the mineral should never be pounded but powered by grinding as the mortar is liable to be damaged. If a mortar is not at hand a mineral may be powdered by wrapping in several folds of thick paper and hammered on the anvil.

Metals:—To assist beginners in recognizing the metals that can be easily reduced from their ores on charcoal, a collection of them should be in their possession. These are: bismuth, copper, gold, lead, silver, and tin.

Paper, filter:—Filter paper, about 7.5 cm. in diameter, is necessary to filter off precipitates. To make a filtration, a sheet of the filter paper is folded on itself twice and this is opened to form a round cup which fits snugly into the dry glass funnel. Clean water is then poured into the funnel to thoroly moisten the filter paper. The solution to be filtered is then poured into the funnel, care being taken not to have the liquid go over the top. When the liquid has all run out, clean water is again poured into the funnel, till even with the top of the paper, so as to moisten every part. By repeating this several times the soluble materials are wholly washed away from the insoluble materials.

Paper, test:—Litmus paper is necessary to test for alkalies and acids, the blue litmus paper turns red for acids, and the red litmus paper turns blue for alkalies.

Tumeric paper has a fine yellow tint, and is used to detect boron, zirconium, and the alkalies. Alkalies turn it brownish-red. The tests for boron and zirconium will be given under "Tests for the Elements" which will appear later.

Brazil-wood paper is used to detect fluorine, which gives it a straw-yellow color; also to detect the alkalies, which color it violet.

Pencil, wax:—Used for writing on glass and porcelain, red, yellow or blue.

Pipette:—A small pipette, graduated from 1 to 5 cc., is necessary to measure a small quantity of acid, water, etc.

Platinum-pointed forceps:—One important test in identifying minerals is to determine how easily a mineral can be melted or fused in a blowpipe flame. Many minerals will not fuse at all, while a few will fuse easily in a candle flame. To make these tests, a small, thin fragment is held by the forceps before the blowpipe and heated strongly for a minute or so, after which it is carefully examined for signs of fusion. It may be necessary to use a lens in some cases.

Care must be used not to allow minerals with a metallic luster to fuse against the red-hot platinum, since the latter may melt and form an alloy with arsenic, lead, or other easily reducible metal, thereby damaging the points. Should this take place the ends of the forceps can be cut off and reshapen with a file.

As platinum-pointed forceps are expensive, ordinary iron forceps can often be used for rough work. These get hot very quickly in the flame, so some wooden clamp should be provided, for holding them. An ordinary wooden clothes pin will do the trick.

Platinum wire:—Some very important tests are made with the use of the platinum wire. These are taken up in more detail under "Reagents." Platinum wire is also used for making flame tests. These tests are taken up in more detail under "Tests for the Elements."

Platinum wire is used for making the above tests as it withstands a high heat and is unaffected by the reagents or flame. Pieces about 2 or 3 inches long are used, held either in the forceps or one end fused into a short piece of glass tubing. Platinum wire No. 27 or No. 30 is the size generally used. At least one piece of platinum wire should be in every laboratory.

Pliers:—Cutting pliers are useful for detaching fragments from minerals.

Scissors:—A small pair may prove useful.

Stoppers, rubber:—About one dozen or so, of hard rubber stoppers; solid, 1-hole, and 2-hole, and of various sizes, should be in every laboratory.

Streak plate:—A small plate of unglazed porcelain is very necessary and should be in every labortory. A streak plate is used for obtaining the streak of minerals. The streak of a mineral is simply the color of its powder.

To obtain a streak, the mineral is simply rubbed over the plate, care being taken that 2 or 3 minerals are not rubbed together, but only 1 mineral at a time. If the mineral is hard, a little pressure may be necessary. The streaks are easily washed off with soap and water.

Spoon and spatula:—An ivory spoon is useful for handling powders and dry reagents. The handle of the spoon, if thin and flat, serves as a spatula for handling and mixing reagents. A knife blade also makes an excellent spatula.

Support:—Some support for holding beakers, casseroles, crucibles, etc., over a flame is necessary. These can be made without much trouble.

Tubes, test:—For making tests in wet-analysis, test tubes are very necessary. A supply of at least one dozen should always be on hand. The chief use for test tubes is to dissolve minerals in acids and to precipitate compounds that may be present in solutions. Some arrangement should be made for holding test tubes when cooling, etc. A piece of pine about 6 inches long, 5 inches wide, and 4 inches thick, in which holes are bored to fit the test tubes will prove very useful.

Tubing, glass:—A supply of hard glass tubing, from 3 to 6 mm. in internal diameter, is needed for making closed and open tubes.

A supply of soft glass tubing, about 6 mm. outside diameter is needed for experiments. About a pound of each tubing will be sufficient.

Tubing, rubber:—A supply of about 5 feet of good laboratory tubing will be needed for making experiments, etc.

Vials:—A good supply of small glass vials, with corks, are necessary to keep precipitates, minerals, etc., for future tests.

Wash bottle:—The mineralogist has constant use for clean water, to wash precipitates, dilute acids, etc. The common method is to use a wash bottle, which has 2 glass tubes passing thru the cork, and so arranged that by blowing in one, the air pressure forces the water up and out thru the other. It is not really necessary to have a regular wash bottle, as an ordinary bottle will suffice.

Watch glasses:—A number of these are useful for holding mineral fragments and powders, also for examining precipitates.

It is not absolutely necessary that all the apparatus, as set forth, should be in every beginner's laboratory, but the more equipment a beginner has the easier, quicker, and more satisfactory, will be the results obtained.

Reagents Needed

Reagents are substances employed to produce changes in other substances in order to detect, or examine, their composition. The reagents are known as dry, wet, or gaseous, according as they are used in the solid, liquid, or gaseous form. The solid and liquid reagents should be carefully labelled and kept in well-stoppered bottles, while the gaseous reagents are made when needed and never saved. To obtain good results, only pure reagents should be used and these carefully handled so that they will not become adulterated or impure. Use just enough of each reagent to make your tests complete, and never pour back into its bottle any reagent you may have left over, otherwise you may adulterate the whole bottle and thus make it worthless. If contents from a bottle are taken out on a knife blade, be sure the knife blade is always clean.

Dry Reagents

Bone-ash:—This is needed for assaying for silver.

Borax, or Sodium Tetraborate, $Na_2B_4O_7 10H_2O$:—The most important blowpipe flux is borax, and thru its means most metals are easily dissolved before the blowpipe and in dissolving most of them yield various colors which are often characteristic. To make these tests, the end of a clean platinum wire is made into a small hook or loop, about ⅛ inch in diameter, and the loop dipped first into clean water and then into borax, and finally heated before the blow pipe. At first, the borax puffs up and swells greatly from the slow expulsion of the water it contains; this should be driven off and the borax heated until it becomes perfectly quiet, clear and colorless. Do not heat too greatly, otherwise the drop, or bead as it is called, may drop off. If the bead is very small, dip again into borax and heat over again. The final result should be that the bead is absolutely clear and colorless. While the bead is still hot, touch a very small particle of the mineral to be tested, and heat again before the blowpipe in the oxidizing and reducing flames (oxidizing and reducing flames are described in detail under "Uses of Flames").

Copper Oxide, CuO:—This is useful for detecting chlorine.

Ferrous Sulphide, FeS:—This is useful for generating hydrogen sulphide gas. It is best to have this in stick-form.

Glass, powdered:—Useful for detecting fluorine. Glass may be powdered by heating it red hot and plunging it into cold water. After it is dry it can be sifted to remove all large lumps.

Magnesium:—Useful for detecting phosphoric acid. It is best to use this in ribbon form.

Fluorite, powdered:—Useful for detecting boron, but must be mixed with Potassium Bisulphate.

Phosphorous Salt, or Hydrogen Sodium Ammonium Phosphate, $HNaNH_4PO_4, 4H_2O$; also called Salt of Phosphorous and Microcosmic Salt:—Useful for making beads in the same way as with borax. In making beads the salt may become very liquid and drop off the loop when first heated. This may be avoided, however, by heating gently at first, and adding more salt, until the desired size is formed.

Potassium Bisulphate, $HKSO_4$:—Useful for testing for certain acids and as an acid flux. It is best to have this in crystal form.

Potassium Bisulphate and Fluorite:—Three parts of Potassium Bisulphate and one part of powdered Fluorite are mixed and finely powdered. This mixture is useful for detecting boron in some of its combinations. The mixture when heated liberates hydrofluoric acid: $2HKSO_4 + CaF_2 = K_2SO_4 + CaSO_4 + 2HF$. The hydrofluoric acid, 2HF, combines with boron, forming boron fluoride, BF_3.

Potassium Iodide and Suphur:—These 2 powdered materials, mixed in equal proportions, are useful in detecting bismuth and lead.

Potassium Nitrate, KNO_3:—Useful for fusing with minerals when an oxidation is required.

Sodium Carbonate, Na_2CO_3, also known as Soda:—Useful for testing for sulphur and extracting metals from their ores.

Test Lead:—Useful for a silver assay. Must be finely granulated and free from silver.

Tin:—Useful for obtaining a strong reduction. Finely granulated tin or tin shavings are chiefly used.

Zinc:—Useful also for obtaining a strong reduction. Should be finely granulated.

Gaseous Reagents

Chlorine, Cl:—This reagent is seldom needed, but when necessary it can be prepared by warming powdered manganese dioxide, MnO_2, with concentrated hydrochloric acid, HCl, and carrying off the chlorine by means of a bent glass tube running thru a perforated cork. This can best be done in a gas generating bottle, heating the acid first before pouring it into the thistle tube. Chlorine is a very poisonous gas so should be handled very carefully. It should not be allowed to escape and if it has been taken into the lungs, ammonia should be immediately inhaled to counteract it. In preparing chlorine, the acid should not be heated too strongly but just warmed a little, otherwise it might crack the thistle tube or bottle. The reactions between manganese dioxide and hydrochloric acid are as follows: $MnO_2 + 4HCl = MnCl_2 + 2H_2O + 2Cl$. Chlorine water, that is, water saturated with chlorine gas, is often used instead as it can be kept in a glass-stoppered bottle.

Hydrogen Sulphide, H_2S:—This reagent is often used for many tests. When a little of it is needed it can be easily prepared in a gas generating bottle. A few small fragments of ferrous sulphide is placed in the bottle and dilute hydrochloric acid added thru the thistle tube, as the gas is formed it is carried off thru the bent glass tube. Hydrogen Sulphide is easily recognized by its odor, which resembles rotten eggs.

Wet Reagents

Wet reagents, especially acids, should be kept in glass-stoppered bottles, as they corrode and destroy corks. Acids when boiled give off disagreeable and corrosive fumes, so its very important that these fumes be gotten rid of as soon as possible. The fumes can be carried off into the open air or else into a chimney-flue. If acids are spilled upon clothes, table, or floor, the spots should be immediately moistened with ammonia to neutralize the acid, and then washed thoroly with water. In diluting acids, never add water to the acids, but always acids to the water, the reason being that water added to acids liberates heat, if enough acid is present the heat may be high enough to crack the test tube or bottle; adding acids to water this danger is averted. Never add acids to hot solutions, wait until they are cold. Acids and all liquid reagents should be added, drop by drop, and never poured in. All acids and solutions that are used for tests should be kept in small bottles, about 5 inches high as these are most convenient to work with, the excess of course, can be stored in larger bottles. In keeping acids and other corrosive liquids, the mouths can be sealed air-tight by covering with melted parafine or candle grease, the bottles placed in sawdust, excelsior, or paper, and stored away in a cellar or other safe place.

In testing the odors of acids and unknown solutions, never inhale into empty lungs but always have the lungs almost full, and then test the odor. Odors from chlorine, bromine, sulphur, lead, mercury, etc., are very poisonous so should be tested carefully. It is also equally important not to spill any acids or solutions on the hands, as bad burns may result.

Acids are chiefly used for dissolving minerals.

Acids:—**Hydrochloric.** HCl—This reagent is a solution of hydrochloric gas in water. It is the most important acid used. The pure acid is very strong and is known as concentrated acid which for ordinary use is too strong, so should be diluted with water, in the proportion of 1 part acid to 1 part water; this can best be done by filling a bottle half-full of clean, distilled or rain water and then pouring slowly the acid until the bottle is full. A few tests require concentrated hydrochloric acid so a small bottle of it should be on hand.

Hydrochloric acid is known commercially as Muriatic Acid.

Nitric Acid:—Useful for dissolving many minerals tho not as important as hydrochloric acid. In its concentrated form it is a very powerful oxidizing acid. It should be diluted like hydrochloric acid. It is very corrosive.

Sulphuric Acid, H_2SO_4, also known as Oil of Vitrol:—This acid is the least used, but nevertheless, it is an important acid. When added to water, a great deal of heat is generated, so it should be handled carefully. NEVER POUR WATER INTO SULPHURIC ACID. It is best to dilute the acid in the proportion of 1 part acid to 4 parts water.

Ammonium Carbonate, $(NH_4)_2CO_3$:—Useful for precipitating calcium, barium and strontium carbonates from solutions made alkaline by ammonia. It is best to dissolve a little of the powder in water and add it to the solution.

Ammonium Hydroxide, NH_4OH; commonly called Ammonia:—This important reagent is a solution of ammonia-gas, NH_3, in water. It is a strong alkali and should not be added to acids unless they are cold and dilute. Ordinary house-hold ammonia can often be used if strong and clear. Ammonia is useful for precipitating various metals from solutions, as hydroxides.

Ammonium Molybdate, $(NH_4)_2MoO_4$:—Useful for detecting phosphates. It is best to buy this already prepared, but it can be made in the laboratory by dissolving Molybdic Oxide, MoO_3, in ammonia, and pouring the solution into dilute nitric acid, being careful that there is more acid present than ammonia. The solution should stand about 12 hours, and anything that may separate out is filtered off and the solution bottled-up.

Ammonium Oxalate $(NH_4)_2 C_2 O_4 2H_2 O$:—Useful for detecting calcium. It is prepared by adding 1 part of ammonium oxalate crystals to 20 parts of water.

Ammonium Sulphide, $(NH_4)_2 S$:—When this reagent is needed it can be easily prepared by passing some hydrogen sulphide gas into a little ammonia, and then adding more ammonia to the solution (about same amount as was used before the gas was passed in). This reagent does not keep very long so it should be prepared as needed.

Aqua Regia:—This is prepared by mixing 1 part of nitric acid and 3 parts of hydrochloric acid. Many minerals that are not dissolved in nitric or hydrochloric acids, are usually dissolved in aqua regia.

Barium Chloride, $BaCl_2$. $2H_2O$:—Useful for detecting sulphates. It is prepared by adding 1 part of barium chloride crystals to 10 parts of water.

Barium Hydroxide, BaO_2H_2:—Useful for detecting carbonates. It is best used by dissolving 1 part of barium hydroxide crystals in 20 parts of warm water, allowing it to cool and filtering all material that may separate out and throwing it away.

Calcium Hydroxide, CaO_2H_2:—This is also known as lime-water and may be substituted for barium hydroxide. It is prepared by shaking up a little quick-lime with water, allowing this to stand for a few hours, and filtering.

Cobalt Nitrate, $Co(NO_3)_2$:—Useful for testing certain minerals, especially, those containing aluminum and zinc. It is prepared by dissolving 1 part of cobalt nitrate crystals in 10 parts of water. This is a poison and must be carefully handled.

Hydriodic Acid, HI:—This is needed for only a few tests, but as it does not keep very well, it is not recommended.

Platinic Chloride, H_2PtCl_6:—Useful for detecting potassium in presence of lithium and sodium. Its preparation is explained under platinum, "Testing for the Elements."

Potassium Ferricyanide, $K_6 Fe_2 (CN)_{12}$:—Useful for detecting ferrous iron. It is best to keep this in crystal form and dissolving a little in water as needed.

Potassium Ferrocyanide, $K_4Fe(CN)_6$. $3H_2O$:—Useful for detecting ferric iron. Use same as the ferricyande.

Potassium Hydroxide, KOH:—A strong alkali, useful for precipitating metals from solutions as hydroxides. It is best to have this in stick-form, broken up and kept in a well-corked bottle. When needed, a small quantity can be dissolved in water and added to the solution.

Silver Nitrate, $AgNO_3$:—Useful for detecting chlorine, bromine and iodine. It is prepared by dissolving 1 part of silver nitrate crystals in 20 parts of water, and the solution kept in a dark bottle (amber-colored like an ordinary peroxide bottle). If silver nitrate solution be kept in an ordinary bottle it will be affected by the light.

Sodium Hydroxide, NaOH:—This is used the same as potassium hydroxide and can be substituted for it.

Sodium Phosphate, Na_2HPO_4. $12H_2O$:—Useful for detecting magnesium. It is prepared by adding 1 part of sodium phosphate to 10 parts of water.

Water, H_2O:—Useful for diluting acids, etc. Distilled water is the best, but clean rain-water can be substituted. Always have a good supply on hand.

The list of reagents, both wet and dry, can be considerably enlarged for making other tests and experiments, and it is recommended that collectors enlarge their list as much as possible. Further, it is advised that pieces of various metals, as aluminum, copper, lead, tin, zinc, etc.; or alloys as pewter, brass, solder, etc.; or foils as tin, lead, etc., be saved and experimented upon. If the tests and experiments prove interesting so that the collector would like to continue further with the work, it is suggested that a good book on chemistry be obtained.

(To be Continued)

IDENTIFICATION DEPARTMENT

To this department, subscribers may send in minerals to be identified—free. Only the common minerals will be identified at present, as we haven't the time or facilities to do any analyzing. Give name of locality where found with each specimen, and if minerals are to be returned, remit enough stamps for postage.

SOME BOOKS ON MINERALS, ROCKS, GEOLOGY, ETC., WE CAN SUPPLY

Postage extra, or will send C. O. D.

Butler—A Pocket Handbook of Minerals—311 pages, 4x6¾. 89 figures....$3
Gives all the details needed to identify most of the minerals which collectors, prospectors, etc., are apt to encounter, and the emphasis is always placed upon characteristic physical features.

Butler—Geometrical Crystallography—155 pages, 4x6¾. 107 figures....$1.50
It aims to give the reader the ability to recognize crystal forms and especially systems at sight, and with the use of few, if any, instruments.

Butler—Pocket Handbook of Blowpipe Analysis—80 pages, 4x6¾ $1.25
Contains simple directions for identifying many minerals.
The above 3 books combined in one volume $4.00

Dana—Minerals and How to Study Them—380 pages, 5x7. Over 300 figures $2.00
A book for beginners in mineralogy. It describes in simple language hundreds of the commonly occurring minerals, and will serve as a foundation for a more extensive study.

Dana—Manuel of Mineralogy—460 pages, 5x7. 357 figures $3.50
More advanced than "Minerals and How to Study Them."

Dana—Text-book of Mineralogy—720 pages, 6x9. 1050 figures $5.00
More advanced than the "Manuel." It describes hundreds of minerals, with tests for same, localities where found, etc. A very good book.

Dana—System of Mineralogy—with Appendices 1 and 2—1323 pages, over 1,400 figures $15.00
Describes minerals, tests, localities, etc., of every mineral found up to 1909. The most complete book on minerals in America.

Dana—Ford—Third Appendix to "System of Mineralogy"—87 pages, 7x10, $2.00
This completes the work up to 1915.

Eckel—Building Stones and Clays—264 pages, 6x9. 37 figures $3.00
This book gives data on the examination and valuation of clay and stone properties.

Brush—Penfield—Manuel of Determinative Mineralogy—312 pages, 6x9. 375 figures $3.50
This book contains a very good introduction on blowpipe and chemical analysis of many of the common minerals.

Lewis—A Manuel of Determinative Mineralogy—298 pages, 5x8. 81 figures $3.00

Merrill—The Non-Metallic Minerals—432 pages, 6x9. 55 figures $5.00
Relates to minor minerals, and non-metallic compounds of a mineral nature. Includes cement, coals, phosphates, etc.

Hayes--Paige—Handbook for Field Geologists—166 pages, 20 figures .. $2.50
Outlines methods of procedure in field work found by experience to be best.

McLeod—Practical Instructions in the Search for, and the Determination of the Useful Minerals, including the Rare Ores—254 pages, 4x6...$2.50

Martin—A Laboratory Guide to Qualitative Analysis with the Blowpipe—47 pages, 5x7 .... 60c

Pirsson—Rock and Rock Minerals—414 pages, 5x7. 74 figures $3.50
A very good book on rocks.

Pirsson—Schubert—Text-book of Geology:
Part 1—470 pages, 6x9. 311 figures ....$3.00. Physical Geol.
Part 2—622 pages, 6x9. 211 figures ....$3.50 Historical Geol.
Complete in one volume .... $5.50.

Ries—Economic Geology—856 pages, 6x9. 291 figures $5.00
Describes uses, occurrences, deposits, etc., of the economic minerals, ores, etc.

PETER ZODAC

157 WELLS STREET, PEEKSKILL, N. Y.

INQUIRY DEPARTMENT

Under this head we will gladly answer questions pertaining to rocks, minerals, ores, etc.; mining, geology, etc.

A FEW CHOICE LOOSE CRYSTALS

Postage extra, or will send C. O. D.

Most of the crystals are from ¼ to 1 inch in size, those in vials are less than ¼ inch, while all over 1 inch are so stated. See also, Minerals of the Rare Earths.

Andalusite, Tyrol 25c
Anorthite, Japan, rough xls 10c
Apatite, brown, rough xls, Canada, 1 in. x 1, 15c; 2 in. 25c, 35c
Apatite, gemmy, Sweden, in vial .. 20c
Apatite, white, Japan, in vial 25c
Aphrosiderite (Pseudo garnet) Mich. 30c
Apophyllite, India, in vial 15c
Aragonite, Spain, 1 in. x 1 ...... 35c
Axinite, France, in vial 50c
Barite, England 15c
Bixbyite, Utah, in vial 60c
Borax, Asia, in vial 15c
Brucite, Penn. 1 in., 50c; 2 in. 75c
Calcite, England, ... 15c, 30c, 35c
Calcite, brown, Mich., 10c; 2 in. .. 30c
Calcite, golden, Mo., 3 in. 50c, 75c
Calcite, enclosing copper, Mich...$1.00
Celestite, Ohio 10c
Copper, Mich. 50c
Corundum, N. C., rough, xls .. 15c, 25c
Corundum, Africa, choice xls 35c
Corundum, Ruby, rough xls .. 25c, 50c
Corundum, Sapphire rough xls. Mont. 25c
Corundum, Sapphire, N. C. in vial 15c
Cuprite, France 20c
Diamond, Africa, small, in vial .. $2.00
Dolomite, Switzerland 30c
Epidote, Tyrol, in vial 35c
Galena, Okla., in vial 15c
Garnet, Almandite, Conn. 10c
Garnet, Almandite, N. C., 15c, 25c, 35c
Garnet, Almandite, Colo., coated with Aphrosiderite, 3x3 ...... $1.50
Garnet, Grossularite, Siberia, 35c, 50c
Garnet, Pyrope invial, Mont. 10c

Glauberite, Calif., in vial 30c, 35c
Gypsum, Selenite, Ohio 15c
Gypsum, Selenite, Germany, in vial 20c
Gypsum, Sicily, Twins, in vial 20c
Gypsum, Sicily, 2x2, 3x3, 25, 50, 75, $1
Gypsum, Sicily, 3x8 .... $2
Hanksite, Calif. 20c, 35c
Hematite, Urals, ... 35, 50 and $1
Iron, Pyrite, Ariz. 15c
Iron Pyrite, Sweden 20c
Iron Pyrite, Elba .... 25 and 35c
Iron Pyrite, Twins, Brazil 30c
Iron Pyrite, cubes, Pa., in vial ... 10c
Limonite, pseudo. magnetite, Kas..10c
Limonite, pseudo. pyrite, Penn. .. 15c
Leucite, Italy 30c
Magnetite, Urals 25c
Marcasite, Okla., in vial 15c
Microcline, Pa., 1x1, 35c; 4x4 ... 75c
Microcline, Amazonstone, Colo. .. 15c
Muscovite, N. C. 10c
Orthoclase, flesh-color, S. D. 10c
Orthoclase, red, Nev. 15c
Orthoclase, white, Colo. 10c
Orthoclase, Adularia, Switzerland 50c
Orthoclase, Sanidine, Italy 20c
Pyroxene, Augite, Italy 10c
Pyroxene, Augite, Austria 25c
Pyroxene, Diopside, N. Y., gemmy 50c
Pyroxene, Diopside, Canada, rough xls, 3 in. $1
Quartz, Amethyst, N. C. 15c
Quartz, Amethyst, Urals, 50c and $1.25
Quartz, Amethyst, parallel growth on smoky quartz, Mont. 50c
Quartz, Citrine, Brazil 25c
Quartz, Ferruginous, red, Mich... 25c
Quartz, Ferruginous, yellow, Ger. in vial 10c
Quartz, prisms absent, Italy 20c
Quartz, Milky, Germany 15, 25 and 35c
Quartz, Rock xls, Ark., N. H., Penn. 15c
Quartz, Rock xls, Switzerland, 3 in. 50, 75, $1
Quartz, Rock xls, modified, N. C.. 20c
Quartz, Smoky, modified, N. C. .. 20c
Quartz, Smoky, Colorado, 1-3 in. 25, 50, 75, $1
Quartz, Smoky, with tourmaline inclusions, Mont., 1-3 in. 30, 50, 75, $1
Quartz, Rock xls with clay incl. N. C. 25c
Sphalerite, Okla., in vial 15c
Staurolite, twins, Ga. and Va., 15c, 25c
Struvite, Germany 25c
Sulphur, Sicily 25c
Topaz, brown, gemmy, Brazil .. $1.50
Topaz, brown, rough xls Brazil .. 25c
Topaz, colorless, Clear, Utah, in vial 25c
Topaz, colorless, Urals 75c, $1
Topaz, yellow, Germany 20c
Tourmaline, black, Japan, 25, 40, 50c
Tourmaline, black, N. Y. .. 15, 25, 50c
Tourmaline, brown, N. Y. 15c
Tourmaline, green, N. C. in vial .. 10c
Tourmaline, Calif., grayish-green 15c
Tourmaline, Calif., pink and green 15c
Tourmaline, Calif., Rubellite, in vial 10c
Tourmaline, Calif., Various colors, (in vial), gemmy 10, 15, 25c

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LOCALITIES DEPARTMENT

Under this heading we will gladly publish clippings, original articles, etc., on mineral localities, minerals found there, etc. Please give as much information as possible.

A FEW CHOICE MINERALS OF THE RARE EARTHS

Postage extra, or will send C. O. D.

Allanite, Amherst Co., Va., 1x1, 15c; 2x2, 25c.
Allanite, Amherst Co., Va., rough xls, 1x1, 25c; 2x2, 50c; 2x3, $1.
Allanite, Orthite, Hittero, Norway, 1x1, 15c; 2x3, 50c.
Amblygonite, cleavable, Keystone, S. D., 1x1, 15c; 2x2, 25c; 2x3, 35c.
Astrophyllite, El Paso Co., Colo., xls in rock, 2x2, 50c; 1x1, 25c.

Autunite, coating Serpentine, Easton, Pa., with Pitchblende, 1x1, 25c; 2x2, 50c; 3x3, $1.
Baddeleyite, massive, Minas Geraes, Brazil, 1x1, 15c; 1x2, 25c.
Benitoite, loose xl in vial, San Benito Co., Calif., 30c.
Beryl, greenish-blue, Acworth, N. H., 2x2, 35c.
Beryl, green, pale, Bedford, N. Y., 1x1, 10c; 2x2, 15c; 2x3, 25c.
Beryl, green, New Milford, Conn., 1x1, 10c; 2x2, 15c; 2x3, 25c.
Beryl, green, pale, partly gemmy, Chester Co., Pa., 1x1, 15c; 2x2, 25c; 2x3, 35c.
Beryl, pink, Branchville, Conn., 1x1, 10c; 2x2, 15c; 2x3, 25c.
Beryl, yellow, Bedford, N. Y., 1x1, 10c; 2x2, 15c; 2x3, 25c.
Beryl, Aquamarine, Mitchell Co., N. C., small fragments, 15c.
Beryl, Aquamarine, Minas Geraes, Brazil, small fragments, various shades, 15c, 25c.
Beryl, Aquamarine, Minas Geraes, Brazil, small xls, 25c.
Beryl, deep green xls, Emerald Mines, Urals, rough xls, ½ in., 35c; 1 in., 50c; 2 in. $1.
Beryllonite, near Stoneham, Me., small xl fragment, 30c.
Blomstrandine, Hittero, Norway, pure lustrous masses, ½ in., 25c; 1x1, 50c
Brookite, Magnet Cove, Ark., small xls, 25c.
Carnotite, Lisbon Valley, Utah, coating quartzite, 1x2, 15c.
Carnotite, Mauch Chunk, Penn., coating Sandstone, and Conglomerate, 1x1, 25c; 2x2, 50c; 3x3, $1.
Chrysoberyl, var. Alexandrite, Urals, loose xls, ¼-½ inch., $1.$1.50, $2.
Columbite, Portland, Conn., ¼ inch, xls., 15c.
Cookeite, Paris, Me., scales in rock, 1x1, 10c; 2x2, 15c; 2x3, 25c.
Cuprodescloizite, Bisbee, Ariz., 1x1, 50c.
Cyrtolite, Bedford, N. Y., 1x1, 35c.
Descloizite, near Mommoth, Ariz., xls in rock, 2x2, 75c.
Descloizite, Lake Valley, N. Mex., xls in rock, 1x1, 25c.
Descloizite, Grootfontein, S. W. Africa, xled, ½ in., 25c; 1 in., 50c; 1x2, $1.
Dysanalyte, Magnet Cove, Ark., xls in calcite, 1x2, 35c; 2x2, 50c.
Eucolite, Kola Peninsula, Siberia, 2x3, $8.
Eudyalite, Kola Peninsula, Siberia, 2x2, $5; 2x4, $10.
Ilmenite, Kragero, Norway, xline, 1x1, 15c; 2x3, 50c.
Ilmenite, Mitchell Co., N. C., small xl fragments, 5c.
Lepidolite, San Diego Co., Calif., pale lavender, 1x1, 10c; 2x2, 15c; 2x3, 25c
Lepidolite, Black Hills, S. D., dark lavender, 1x1, 10c; 2x2, 15c; 2x3, 25c.
Lepidolite, Keystone, S. D., cream, 1x1, 15c; 2x2, 25c; 2x3, 35c.
Lithiophilite, Branchville, Conn., from ¼ to 2x3, 25c, 50c, 75c, $1, $1.25, $2.00.
Malacon, Hittero, Norway, small xls, 10c.
Molybdenite, Peekskill, N. Y., flakes in granite, 1x1, 15c; 1x2, 25c; 2x2, 35c.
Molybdenite, Easton, Penn., flakes in serpentine, 1x1, 25c; 2x2, 50c; 3x3, $1.
Monazite, Iveland, Norway, broken xls, 1x1, 25c.
Monazite, Raade, Norway, broken xls, ½, 10c
Monazite, Sand, Cleveland Co., N. C., about 25-50%, in vial, 10c, 25c, 35c.
Monazite, Sand, Travancore, India, about 85%, (8% thoria), in vial, 15c, 35c, 50c.
Perovskite, Urals, xls in rock, 1x1, $2.50; 2x2, $5.
Perovskite, Urals, xled, choice, 1x1, $12; loose xls, ½, $2.
Pyrochlore, Urals, xled, 2x2, $3.
Pyrrhotite, platiniferous, Nye, Mont., 1x1, 25c; 2x2, 50c.
Roscoelite, Placerville, Colo., minute scales in sandstone, 1x1, 15c; 2x2, 30c; 2x3, 50c.
Rutile, Magnet Cove, Ark., loose xls, 20c.
Rutile, Hiddenite, N. C., loose xls, 15c.
Rutile, Constitution, Penn., loose xls, 15c, 25c, 35c.
Rutile, massive, Nelson Co., Va., 1x1, 25c.
Rutile, Nigrine, Magnet Cove, Ark., 1x1, 15c; 1x2, 25c; 2x2, 35c.
Samarskite, Mitchell Co., N. C., lustrous mass, ½ in., 25c; 1 in., 50c.

Scheelite, White Pine Co., Nev., white, massive, 1x2, 50c.
Schorlomite, Magnet Cove, Ark., 1x1, 15c.
Sipylite, Amherst Co., Va., in rock, 1x1, 50c.
Spodumene, Branchville, Conn., cleavable, 1x1, 10c; 2x2, 15c; 2x3, 25c.
Spodumene, San Diego Co., Calif., colorless gemmy xls, ½ in., 35c; 1 in., 50c; 2 in. $1.
Titanite, Ontario, Canada, broken black xls, 1x1, 30c; 2x3, $1.
Titanite, Rudeville, N. J., xled, with hornblende, brownish, 2x2, 50c; 2x3, 75c.
Titanite, Tavetsch, Switzerland, yellow, twin, loose xl in vial, 25c.
Titanite, Sand, El Dorado Co., Calif., in vial, 15c, 25c, 35c.
Torbernite, coating rock, Germany, Penn., etc., 1x1, 25c.
Uraninite, var. Pitchblende, Yancy Co., N. C., with its alterations Gummite and Uranophane, from ¼ to 1 in., 25c, 50c, 75c, $1.
Uraninite, var. Pitchblende, Easton, Pa., in Serpentine, 1x1, 25c; 2x2, 50c; 3x3, $1.
Vanadinite, Lake Valley, N. Mex., brown xls in rock, 3x4, $2.
Vanadinite, Yuma Co., Ariz., minute red xls in rock, 4x6, $2.
Xanthitane, Jones Mine, N. C., (after Titanite) loose xls, ½ in., 15c; 1 in., 25c.
Zinnwaldite, Zinnwald, Saxony, 1x1, 15c; 1x2, 25c.
Zircon, Henderson Co., N. C., xls in feldspar, 1x1, 25c; loose xls, 15c, small xls in vial, 15c, 25c, 50c.
Zircon, var. Alvite (altered zircon) Helle, Norway, small xl fragments, 10c.
Zircon, var. Hyacinth, Tasmania, small gemmy pebbles, in vial, 25c.

PETER ZODAC

157 WELLS STREET, PEEKSKILL, N. Y.

GLOSSARY DEPARTMENT

A list of various mining, mineralogical and geological terms, with explanation of each one. Free use has been made of the various publications on mining, mineralogy and geology, including bulletins issued by the U. S. Bureau of Mines and U. S. Geological Survey. The Century, Standard and Webster dictionaries, have also been consulted.

A

Abrade:—To rub or wear off; to waste or wear away by friction, as to abrade rocks.

Abrasion:—The act or process of rubbing or wearing away by one substance in contact with another.

Abrasive:—A substance used for abraiding, as for grinding and polishing. The chief substances used as abrasives are: Burstone, corundum, diatomaceous earth, emery, garnet, grindstone, infusorial earth, millstone, novaculite, oilstone, pumice, scythestone, tripoli, volcanic ash, and whetstone. Certain artificial products, as carborundum, etc., are also used as abrasives.

Absarokite:—A general name given by Iddings to a group of igneous rocks in the Absaroka Range, in the eastern portion of the Yellowstone Park, Wyoming. They have porphyritic texture with phenocrysts of olivine and augite in a groundmass, that is either glassy or contains leucite, orthoclase or plagioclase, one or several.

Absorb:—To drink in, to suck up, as a liquid by a solid like a sponge or Fuller's earth.

Absorbing well:—An excavation in the earth thru which surface water finds its way to a permeable stratum and is drained away. A cesspool.

Abstract:—To absorb (the waters of a neighboring stream) by abstraction: said of water courses.

Abstraction:—In geology, the withdrawal of a stream from a lower portion of its course by an adjoining stream having more rapid corrosive action.

Abysmal sea:—That part of th which occupies the ocean proper.

Abysmal rocks:—Plutonic, o seated rocks.

Acanthite:—A silver sulphid It contains 87 per cent silv

Accessory minerals:—Those constituents of a rock that such small amounts that disregarded in its classific definition. Opposed to minerals.

Accretion:—The process by whic organic bodies grow larger, by addition of fresh particles to outside.

Accretion hypothesis:—Any hypothesis of the origin of the earth which assumes that it has grown from a small nucleus by the gradual addition of solid bodies, such as meteorites, asteroids, or planetesimals, formerly revolving about the sun in independent orbits, but eventually drawn by gravitation to the earth and incorporated with it.

Acetone:—An inflammable liquid (C_3H_6O) with a biting taste, obtained by the destructive distillation of acetates and various organic compounds. It is used in making chloroform and as a solvent for fats, camphor, and resins.

Acetylene:—The most brilliant illuminating gas (C_2H_2); it may be produced synthetically from its elements by incomplete combustion of coal gas, and commercially from calcium acetylid (CaC_2) (Calcium carbide) by the action of water. The ease with which it can be used and the good results obtained makes this gas very popular with circuses, carnivals, etc. Also used for lighting on automobile trucks, subway excavations, mines, etc.

Achroite:—A colorless variety of tourmaline. Used as a gem.

Acicular:—Needle-shaped; slender, like a needle or bristle. Many chystals occur in this form.

Acid:—Sour, sharp or biting to the taste. In chemistry acids are compounds resulting from the union of non-metallic elements, with hydrogen or hydrogen and oxygen, in which the hydrogen atoms may be replaced by metals. The common

... mean ... 1. An igneous rock ... 60 per cent or more of silica, SiO_2, free or combined, in this respect being nearly equivalent to acidic. 2. An igneous rock in which minerals high in silica, such as quartz, alkaline feldspar, and muscovite, are the most numerous. 3. Very loosely, an igneous rock composed chiefly of light-colored minerals. In all three cases compare with basic rocks.

The term acid rock is misleading and undesirable and is going out of use.

Acid salt:—A salt in which the replaceable hydrogen of the corresponding acid is only partly exchanged for metallic atoms or basic radicals.

Acid steel:—Steel manufactured by a process in which the converter or open hearth is lined with siliceous material.

Acidulae:—Cold mineral waters, especially those impregnated with carbonic acid.

Acidulous water:—Mineral water charged naturally with carbon dioxide. Also applied to waters containing sulphur compounds, especially sulphates.

Acieral:—An alloy containing 92 to 97 per cent aluminum and offered as a metal of strength and lightness and noncorrosive, suitable for use in the construction of automobiles, aircraft, military equipment, railroad cars, valves, mining machinery, etc. It was discovered by M. de Montby. It is silver white, and has a specific gravity of 2.82, and a melting point of 1,382 degrees. Its tensile strength in castings is given as 30,000 pounds per square inch, and in rods and sheets as 28,000 to 64,000 pounds and heat-treated as upward of 70,000 pounds per square inch.

Acinose:—Granulated, like small seeds; applied to mineral texture.

Aclinic:—Having no inclination or dip situated where the compass needle does not dip, as the aclinic line, or magnetic equator.

Acmite:—A brown or green silicate of sodium and iron, belonging to the pyroxene group.

Acmite-trachyte:—A trachyte whose pyroxene is acmite or aegirite and whose feldspar is anorthoclase. It therefore differs from normal trachyte in its prevailing soda instead of potash. The acmite-trachytes are intermediate between the true trachytes and the phonolites. They were first described from the Azores Islands and have also been found in the Crazy Mountains, Montana.

Acrotomous:—In mineralogy, having a cleavage parallel with the base or top.

Actinolite:—A light-green calcium-magnesium-iron amphibole, 3Mg (Fe) O. Ca O. 4Si O2. Sometimes used as a gem and as an ornamental stone.

Acute bisectrix:—The line which bisects the acute angle of the optic axes of biaxial minerals.

Adamant:—A stone imagined by some to be so hard it could not be scratched; a name given to the diamond and other substances of extreme hardness; but in modern mineralogy it has no technical significance.

Adamantine:—Like a diamond in hardness or luster; made of, or having the qualities of adamant; crystallized boron; a commercial term for chilled steel shot used in well drilling.

Adamantine drill; Shot drill:—A core drill employed in rotary drilling in very hard ground. A steel-cylinder bit with a diagonal slot cut in the lower edge is attached to a core barrel and a small quantity of steel (chilled) shot fed in with the water at intervals. These find their way beneath the bit and wear away the rock as the bit rotates. A core from 4 to 30 inches in diameter is obtained.

Adamantine spar:—A variety of corundum, Al2 O3.

Adamellite:—A name proposed by Cathrein as a substitute for tonalite, on the ground that tonalite means a hornblende-biotite granite, rich in plagioclase, whereas adamellite, which better describes the rocks at the Tyrolese locality, means a quartz-hornblende-mica-diorite with granitic affinities. Adamellite emphasizes the dioritic characters; tonalite, the granitic. The name is derived from Monte Adamello, near Meran, Tyrol, the locality of tonalite.

(To Be Continued)