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Chapter 1 : - NLM Catalog Result

*Plattner's Manual Of Qualitative And Quantitative Analysis With The Blowpipe. From The Last German Ed., Rev. And Enl [Carl Friedrich Plattner] on calendrierdelascience.com *FREE* shipping on qualifying offers.*

The Georgia Mineral Society, Inc. In the very early days of mineralogy, simple chemical methods were used to determine the presence of key elements in a mineral specimen. Information on the physical nature of a mineral specimen, when combined with confirmation of elemental composition, provided positive identification of a mineral species. Chemical assay techniques could then be employed to provide quantitative data on the composition of a mineral specimen. For the mineral collector, the primary interest is in positive identification of a mineral specimen. Clearly for the vast majority of cases physical characteristics of a mineral specimen can be used to identify the mineral species. However, in some cases the use of qualitative analytical techniques can provide positive identification where physical characteristics alone do not afford a positive identification. In addition these qualitative analytical techniques can deepen an understanding of mineral chemistry, are a lot of fun and can provide an extra measure of enjoyment to mineral collecting. To better understand the techniques of qualitative analysis for minerals, we need to first take a trip back in time to the mid s in Sweden. In these early days of mineralogy, minerals were largely described by physical characteristics alone. Many scientists of the day began to apply the science of chemistry to the study of minerals. The Swedish chemist and mineralogist Baron Axel Fredric Croenstedt made a discovery that would change the young science of mineralogy forever. Croenstedt discovered that when intense heat was directed at a small sample of a mineral, certain elements in the mineral reacted in characteristic ways. This device was nothing more than a curved tapering brass tube that was used to direct a blast of air into a candle or lamp flame. The extra oxygen supplied to the flame increased its temperature, and the movement of air through the flame changed its shape and direction. Specific elements, when excited by the high flame temperature, would color the flame in a way that was characteristic of that element. In some cases, the vapors created and the oxides or metallic substances left behind were also characteristic of a specific element. Artisans of the time had been using variations on the blowpipe for some time to work with metals, but Croenstedt was the first to apply this tool to mineral analysis in a systematic way. The makers of stained glass had known for some time that certain metals could be introduced in small amounts into a glass melt to impart color to the glass. Borrowing a page from the stained glass makers, Croenstedt also discovered the ability of specific elements to impart a characteristic color to the glass created when reactive fluxes such as borax where heated in the blowpipe flame. Enough information was gained about minerals through this new blowpipe technique that Cronstedt felt justified in suggesting that minerals be classified not only according to their appearance but also according to their chemical composition. Cronstedt wrote a book detailing this new form of classification that was published in Although Cronstedt is primarily credited with the discovery of the element nickel, he is also considered the father of systematic blowpipe analysis. Now we move forward in time to the mid s to Yale University in the United States. Earlier discoveries in mineralogy were combined with considerable research of his own and contributions from most notably G. Penfield to create the Manual of Mineralogy published in In this classic work, Dana combined an understanding of crystallography, physical characteristics of minerals, and mineral chemistry to produce a system of mineral analysis and identification that is still used today. Brush and Penfield also published a separate work on using the blowpipe in the analysis of minerals. This publication is considered the seminal work on the subject. This was the first book specifically targeted to the non-professional. This presentation will examine some of the techniques used by mineralogists in the days before electronic instrumentation and how the mineral collector can enhance the study of minerals and increase the enjoyment of the mineral hobby by using some of these time honored analytical techniques. The most fundamental analytical techniques for minerals are their physical characteristics. It is important that a complete understanding of the following mineral physical characteristics is obtained before moving on to more involved chemical techniques. Very often a preliminary identification of a mineral species can be made from the physical characteristics alone, leaving chemical techniques to be used in a confirmatory role. Our purpose here is to examine some of the chemical techniques that can be used by the mineral collector. Perhaps the most readily available technique is Blowpipe Analysis. The equipment necessary for this technique is readily available, and it contributes immensely to the enjoyment of the mineral hobby. There are four groups of blowpipe tests: Fusibility - This is a measure of how easily a small fragment of a mineral melts in the blowpipe flame. Flame Colors - These are tests in which a small amount of powdered mineral is introduced into the flame and the resulting flame color observed. Only a few of the elements so excited will yield a flame color. Bead Tests - These are tests in which a small amount of powdered mineral is caused to react in the blowpipe flame with a molten reactive flux of borax or sodium ammonium phosphate. Specific elements will impart a characteristic color to the resulting glass bead. Charcoal Block Tests - In these tests a small amount of powdered mineral is roasted in a small depression in the charcoal block. Some minerals will produce sublimates on the block, specific odors, characteristic oxides, or metal residues. Although brass blowpipes are readily available, the advent of the small fine point butane torch has begun to displace the classical blowpipe. This is particularly the case with field mineral exploration and prospectors. To demonstrate the use of the blowpipe, I will recount the analysis of a mineral specimen found at a construction site just off of Peachtree Industrial Boulevard in Duluth, Georgia. The construction site had cut into the northeastern flank of the Wolf Creek Formation. The host rock was a graphite-bearing schist with pyrite and minor chalcopyrite found in the upper portion of the exposure. The mineral occurred filling a fracture cutting across the fabric of the host rock. The physical characteristics of the mineral are as follows: Pale sky blue Crystal form: Pronounced conchoidal The mineral specimen was tested for fusibility and was subjected to a borax bead test and charcoal block test. Before we begin a word about safety is in order. Always conduct tests involving open flame in a fireproof area and always have a fire extinguisher in the immediate area. The mineral was found to be infusible in the blowpipe flame. These are suggestive of the element copper. A small sample of the mineral was pulverized and ground to a fine powder with a mortar and pestle. A small amount of this powdered mineral is mixed with distilled water to make a paste. This is placed into a small divot carved on one end of a charcoal block. The mineral is heated very strongly with the blowpipe oxidizing flame. This action removes any volatile compounds and converts any metal elements present to oxides. The next series of tests are bead tests that respond best to oxides of metallic elements. A small amount of the powdered mineral roasted on the charcoal block is attached to the platinum loop by first moistening the loop with HCl dilute hydrochloric acid and then reintroduced into the blowpipe flame and any flame color was observed. A deep azure blue color for a brief period. This test again suggested the presence of the element copper in the specimen. A clean platinum loop was heated in the blowpipe flame and then dipped into powdered borax and reintroduced in to the flame. This was repeated until a clear glass bead was present in the loop. The bead was re-heated and a small amount of powdered mineral previously roasted on the charcoal block was attached to the molten bead. This was then re-heated to allow the borax flux to react with the mineral. Pale green Bead Cold: Pale blue Reducing Flame: Slightly Reddish It is important to know the difference between the oxidizing and reducing portions of the blowpipe flame. The oxidizing portion is just outside of the hottest part of flame, while the reducing flame is just outside the blue cone in the flame. These beads tests again strongly indicated the presence of the element copper in the specimen. In this test, a small amount of the powdered mineral was roasted with the blowpipe flame in a small depression in a charcoal block. Any fumes, sublimates, or residue were observed. Since the blowpipe bead tests were positive for copper, the mineral will be roasted on the block and then moistened with HCl, and then re-treated with the flame. The chloride ion in HCl will combine with any copper present to create copper chloride. A bright deep azure blue flame color is characteristic of copper chloride and is a positive test for Copper. Upon heating the treated sample with the blowpipe flame, a bright azure blue flame color was observed. Note that this is essentially the same result as the flame test conducted earlier. So once again we have a positive test for the element copper. The results of blowpipe tests show a strong indication for the presence of the element copper in the mineral specimen. Based on this information and observations of its physical characteristics I tentatively identified the mineral specimen as chrysocolla. Now that we have a good idea of some chemical elements in the mineral and a tentative identification, the next step is to use some wet chemical tests to confirm our observations. These kits are relatively inexpensive and include enough materials for quite a few tests. A note about chemicals is in order here. This is particularly true for acids used in mineral analysis. Hydrochloric acid can be purchased from most building supply stores as muriatic acid for swimming pools. In most cases this is the only acid you will need, and then it should be in dilute form. NEVER add water to the acid. Adding water to acid will cause the water to react violently resulting in splashing and acid burns. Nitric acid and sulfuric acid are difficult to obtain as just a private citizen. If you can find a source for these acids, try to obtain them in dilute form. You will not need very much as there are only a few tests that require these two acids. Acids are dangerous chemicals and MUST be handled with great care. Wear protective clothing and gloves when working with acids or other chemicals.

Chapter 2 : The Chemist's Manual

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