

Minerals critical thinking

[Sociology](#), [Slavery](#)



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Until today, over 2000 minerals have been discovered, and constantly on a daily basis, new minerals are discovered. Minerals just like matter is made up of atoms of elements arranged in a particular way together with a definite chemical composition. Notably, minerals are aggregates of nearly all rocks found on the earth's crust. Geologists define minerals as inorganic materials on and in the earth's crust with a specific chemical composition. Most minerals are always naturally occurring and it is worth noting that nearly all the minerals contain crystals. This is attributed to the fact that mineral particles are usually arranged in a regular pattern. Despite the tremendous number of minerals, only about 25 species of minerals are common. Minerals physical and chemical characteristics and due to the difference in these properties mineral differ in their occurrence and hence usage.

Optical and Physical properties of minerals

Different minerals have different physical characteristics that range from texture, Lustre, hardness, color, density to sensory characteristics such as

smell and taste, depending on the composition and atomic structure of the mineral (Cairncross 22). These characteristics are the principal components that enable identification on minerals, their uses, and occurrence (Dana 13). Minerals can increase in size as a result of addition of mineral components on their surfaces. In the same way, minerals can decrease in size following action of agents like runoff water, wind among other agents (Dana 16). This gives an insight to the notion that rock grow, bearing in mind minerals are cardinal components of rocks.

Optical properties of minerals play a significant role in the identification of minerals and hence making the basis of mineralogy (the study of minerals). Based on the optical properties, there are opaque minerals, isotropic minerals and anisotropic minerals (Norton & Chitwood 214). It is clear according to Norton and Chitwood that minerals respond to light in unique ways (214). This means that apart from the crystal shapes, cleavages and other useful properties, minerals are identified based on the combination of their optical signatures. Seen from a geological perspective, minerals can be either transparent or opaque. Transparent minerals can allow light to pass through a thin section. This therefore means that transparent light is viewed in the transmitted light. However, the opaque minerals allow no light to pass through them.

Transparent minerals viewed in thin sections can be isotropic or anisotropic. Isotropic minerals usually remain black under crossed polar when the stage has rotated. Such minerals appear black because they do not polarize light that passes through them. Examples of isotropic mineral include garnet, spinel, and the common table salt. They are symmetric and have only one

index of rotation. In these minerals, light travel only in one direction. On the other hand, in the anisotropic minerals, light split into two rays making it display the interference pattern (double refraction) since the light can follow two preferred optic axes (uniaxial and biaxial). The property that brings about the anisotropy of such minerals is the presence of deviatoric stresses that cause a preferred orientation of the mineral grains that would be otherwise randomly aligned (Stein and Wysession 179). Anisotropy can also result from asymmetric combination of materials. A good example of anisotropic minerals is olivine.

Color is yet another conspicuous physical property of minerals. The chemical composition of minerals influences the color of any given mineral. Stille in his book asserts that minerals come in a rainbow array of different spectacular colors that range from stark white to pitch black to deep red (18). The color of the mineral is due to the constituent minerals that form it. For instance, a red cinnabar gets its color due to the existence of red mercuric sulfide, a compound of mercury and sulfur. Some minerals however get their color from the impurities or other substances that are not part of the minerals. For example, quartz is a mineral that is colorless in its natural and pure state (Stille, 18). However, this is not the actual case with quartz that does often exist. This is because, it exist in several colors with the common one being the bluish-violet color called the amethyst.

Lustre is another property that is immensely useful in identifying minerals and it describes how light is reflected off the surface of the mineral. Lustre comes as a result of light being reflected back from the surface of a mineral, a property that is decisively dependent on the refractive index of a mineral

rather than color (Schumann 26). Lustre takes different descriptions; waxy, resinous, silky, vitreous, greasy and metallic among other descriptions (Schumann 26). Some minerals display metallic lustre while others display non-metallic (Stille, 21). Metallic lustre is shiny and is exhibited by pure metals, sulfides, and oxides (Schumann 26). Gold, for instance, has a metallic Lustre. Minerals with nonmetallic Lustre have different looks including pearly, glassy, silky, or dull. For example, talc has a pearly surface; quartz has a glassy Lustre whereas graphite is dull (Pough and Peterson 43). Fibrous minerals usually have a silky Lustre. According to Schumann, any mineral that does not have Lustre is said to be dull. (26) It is worth noting that a mineral can lose its Lustre as a result of discoloration, weathering, and tarnishing.

Fluorescence also falls amongst the most astonishing properties of minerals. Different minerals produce different colors of light when exposed to ultraviolet light. The first mineral to have been observed to produce light was Fluorite; hence the name fluorescence (Schumann 28). Most of the minerals produce white light. Interestingly, this property gave rise to the flame test on minerals that have since gained prominence in the test of minerals. The working hue in this test is the ability of a mineral to give a flame a different color and serves yet another outstanding hue in the identification of minerals.

In addition, minerals differ also in hardness and tenacity. According to Stille a mineral's hardness describes how easily a mineral can be scratched (22). Fredrich Moh, a German mineralogist, invented a scale for measuring hardness and came up with a conclusion that hardness of any mineral

depends on whether it can be scratched with another mineral in the year 1822 (Stille 22). From his research, he realized that diamond is the hardest mineral and only another diamond mineral can scratch it. Graphite is one of the soft minerals and talc is the softest. With his invention, Moh managed to come up with a scale outlining ten mineral arranged in increasing hardness and tenacity as follows: Talc-Gypsum-Calcite-Fluorite-Apatite-Orthoclase feldspar-Quartz-Topaz-Corundum-Diamond.

Again, Cleavage, the ability of the minerals to split when hit, is exhibited by almost all minerals (Stille, 24). Minerals with cleavages often split when hit along the points of weaknesses. Minerals with unfailing cleavage split into pieces with flat surfaces or planes. There are three chief types of cleavages; blocky, prismatic, and platy cleavage. In blocky cleavage, the cleavage totally bounds the broken portion. In prismatic cleavage, the plane of the cleavage elongates to form a crystallographic axis. Platy cleavage on the other hand has only one surface on which the cleavage occurs. Cleavage occurs with varying degrees of perfection depending on the structure of the mineral. Some minerals undergo cleavages with ease while other experience difficulty during the process of cleavage. Minerals with poor cleavage include quartz split into jagged pieces while mica, due to its soft nature undergoes cleavage with much ease (Hurlbut, Sharp, and Dana 65).

Classification of minerals

Minerals are made up of specific chemical composition with some variation in these compositions normally indicated by parentheses in their chemical formula and separated by commas (James R. Wilson, Utah Geological Survey 2). Minerals are in most case classified by their chemical composition crystal

structures

The most abundant of these classes of minerals are the silicates, which contain silicon and oxygen. Some silicates, in addition to silicon and oxygen, contain iron or magnesium and are referred to as mafic silicates. The most abundant silicate is quartz found in sand followed by feldspar (Stille 32).

Carbonates, the second most abundant minerals, are minerals that contain carbonyl groups as the anion and one or more cations. Bjorlykke asserts that rock-forming minerals are in most cases calcite and aragonite minerals carbonates (141). Below is a list of other leading classes of minerals and some examples of minerals in specific classes.

- a) Sulfides e. g. pyrite, and galena
- b) Nitrates
- c) Borates
- d) Phosphates e. g. apatite
- e) Silicates e. g. quartz and olivine
- f) Carbonates e. g. calcite and dolomite
- g) Halides e. g. fluorite
- h) Oxides e. g. hematite and chromite

All the above classes of minerals have specific chemical properties. The chemical properties of these minerals can be determined in two ways; action of acid on the mineral and action of heat on the mineral (Dana 87). Some mineral do not react with acid while others react with acid thereby producing characteristic gases which can be tested to ascertain the composition of the given mineral.

Occurrence of minerals

Geologically, minerals form in all environments under the influence of different physical and chemical conditions. The physical conditions include pressure and temperature while the chemical conditions are conditions such as availability of water, oxygen or any other chemical compound. As Overman suggests, the distribution and occurrence of minerals follows a specific pattern (13). Graphite, usually form as a result of metamorphosis, occurs in small scale in rocks such as marble, schist, and gneisses. Large deposits of graphite are found in Madagascar and United States whereas high quality graphite is found in Sri Lanka. Ferro-hornblende and magnesio-hornblende are constituents of iron and magnesium rich minerals (Mafic) (Cairncross 26). Such minerals are widespread in Namibia, Zimbabwe, and South Africa, just to mention but a few countries. Andalusite is a type of mineral found in slates and schist (Cairncross 29).

Uses of Minerals

Granite, the oldest mineral on earth, is extremely useful in building since it is extraordinarily durable (Overman 15). There is extensive use of granite, also called primitive rock due to its age, in cities like Boston, and New York. Moreover, granite can be used in smelting iron and macadamizing roads (Overman 15). Diamond because of its hard nature is used in making bits of drills and cutters. Such can be used in mining and cutting of glass. Graphite can be used to make lead pencils and crucibles for use in the laboratory (Hurlbut, Sharp, and Dana 149). Graphite is used for making crucibles due to the nonreactive nature of graphite. Gold I used to make durable ornaments due to its non-reactive nature. Quartz is used in the manufacture of glass

while talc, jade and serpentine can be used in carvings due to their soft nature to produce pleasant smooth figures. Silicon extracted from quartz is used in the computer technology to manufacture microchips. To top it off, feldspar can be use in making porcelains. Moreover, phosphates like apatite provide phosphorus which if applied to the soil can improve the soil fertility. The body of animals needs various minerals like sodium, magnesium, and potassium. Lack of these minerals can lead to complications such as goiter. Sulfur is a constituent of the skin. At the same time molybdenum is a crucial component of enzyme whose deficiency can lead to neurological dysfunction. Manganese is an essential component of the bones, the functioning of the central nervous system agents (Peckenpaugh and Poleman 120). Manganese is also useful in reproduction and forms part of some enzymes. Zinc is another crucial constituent of enzymes while selenium prevents the body against oxidation by strong oxidation agents (Peckenpaugh and Poleman 119).

Harmful Minerals

Essentially all minerals, despite their imperative uses and applications, are harmful in excess amounts. For instance trace amounts of arsenic, the most common toxic mineral, is particularly essential for normal body functions. Another example is mercury which if consumed in excess exhibits toxin properties.

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