Origin and Composition Of Gems

Contributed by Administrator
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Natural gems are derived from the three kingdoms of nature: animal, vegetable, and mineral. To the first two belong all things that are living or have lived. These are called organic; examples of organic substances are rubber, wood, ivory, and pearl. The substances of the mineral kingdom consist of matter that has never lived, such as common salt, gold, and iron. These are called inorganic. Only a few gems, for example, pearls and amber, are organic in origin. The vast majority are inorganic and come from the mineral kingdom.
The earth is composed of many different kinds of rock, and if a hole were to be drilled from the North Pole to its center, it would require a drill 3,950 miles long. Nobody has so far been able to drill deeper into the earth than about 4% miles, and therefore our knowledge of the mineral kingdom is confined to a very thin layer of the earth's crust. Each of the many different kinds of rock that make up this crust is composed of individual substances called minerals. An example of a common mineral is salt. There are many

others, some extremely hard—diamond, for example—while others, such as asbestos, are comparatively soft. Some may be beautifully colored, while others are of indifferent shades. The most sought-after minerals for gem stones are those that are hard and tough, yet have an attractive appearance.

All minerals are composed of one or more elements. An element is a sub¬stance that cannot be split up into any other ones by chemical means. Gold and oxygen are examples of elements. The vast numbers of substances on earth, whether they are organic or inorganic in origin, are composed of ele¬ments. In fact, only 89 elements are found in nature. It is from these 89 ele¬ments that all other substances are formed by joining the elements together in vastly differing combinations and quantities.

To each of the elements has been allotted a special symbol by which they are internationally known. For example: aluminum is represented by the symbol "Al," and oxygen by the symbol "O." Some other important elements are barium (Ba), beryllium (Be), bromine (Br), calcium (Ca), carbon (C), chlorine (CI), cobalt (Co), copper (Cu), chromium (Cr), fluorine (F), gold (Au), hydrogen (H), iodine (I), iron (Fe), lead (Pb), magnesium (Mg), mer¬cury (Hg), nitrogen (N), potassium (K), sihcon (Si), silver (Ag), sodium (Na) and zinc (Zn).

Of all gem stones, the diamond alone consists of but a single element, carbon—the same carbon that comes down chimneys as soot or, as graphite, is used in pencils; all the others are compounds, made up of two or more elements joined together.
An example of a gem stone made of two elements is the ruby. It consists of aluminum and oxygen—the same aluminum from which the saucepans in the kitchen are made and the same oxygen that is in the air all around us and without which we could not breathe. The compound is called alumi¬num oxide, and it is represented by the symbols A1203.

One might ask how it is that carbon can compose the diamond, and yet at the same time can also be soot or graphite. To answer this question it is necessary to delve deeper into the mysteries of nature and find out what an element is made of. All elements and compounds, including gems, are composed of atoms; each element is composed of only one type of atom.

Suppose a bar of gold is cut into smaller and smaller pieces. First the bar would be cut in half, then one of the halves would itself be halved. Then one of the quarters thus obtained would be halved, and this halving process would be continued millions of times until at last an extremely tiny piece of gold would be obtained that would be the smallest piece of substance still possessing the properties of gold. To this final and chemically indivisible piece, the name atom has been given. Only a few of them can exist on their own; most must join together with others to form what are called molecules, the smallest particles of an element or compound that can normally exist. Thus, for example, oxygen in the air does not consist of a collection of in¬dependent oxygen atoms. It is known that the oxygen atoms unite in pairs to form molecules.

To return to the symbols for each element, each symbol represents one individual atom of an element. Thus O represents an atom of oxygen and O2 represents a molecule of oxygen, which consists of two oxygen atoms joined together. Two separate oxygen molecules are represented by 202. It should, therefore, be clear what the ruby is made of when its formula is written A1203. One molecule of the gem consists of two aluminum atoms and three oxygen-atoms in combination. This is called its chemical compo¬sition. There is also a minute amount of another element present, which gives it its beautiful red color, but for the time being this will be ignored. The number of atoms in a molecule vary from two, as in oxygen, to many hundreds, as in some organic compounds. Chemical composition is impor¬tant when determining the identity of a mineral. There is, however, another equally important factor.