Is it really jade or not?

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When questions regarding jade are presented to a mineralogist a number of small but perplexing problems arise. Probably the question that comes up most often is the one of authenticity. The truth is, whether a given piece of jade is truly jade is not a mineralogical question but a question of archaeological definition. Because the term *jade* is not a mineralogical word and does not have a precise mineralogical definition, the mineralogist is willing to accept anything the archaeologist defines as jade on the basis of whatever archaeological standards he chooses to use. Thus, as a whimsical example, if archaeological study were to turn up the heretofore unrecorded fact that the craftsmen of China have, for ten centuries, regarded carved green soap with the same high esteem as carved green rocks, and the Chinese refer to both with the same word, *yü* (jade), then by archaeological definition the green soap is jade also. To the mineralogist it doesn't matter in the least what archaeologists accept as jade, but the fact that they accept a good deal of different mineralogical material as jade makes it hard for the mineralogist attempting to ferret out fakes.

First off one thing must be made clear. The materials accepted as jade are not minerals in the strict sense, but rocks. A rock is an aggregation of grains of one or more minerals. For tens of centuries the finest Chinese jade consisted of a type of rock that is made up *almost entirely* of grains of the mineral *actinolite.* Actinolite characteristically occurs in the form of needle-shaped grains. When these are microscopically small and tightly interlocked, then the actinolite rock is called *jade.* The mineral actinolite varies somewhat in its chemical composition: when it contains a moderate amount of iron, its color is medium to dark green; when it is completely free of iron, it is white. The special mineralogical name for such iron-free actinolite is *tremolite;* the whole range of such minerals is called the tremolite-actinolite series. Thus, this rock can range in color from dark green to white. Archaeologists accept this range of colors in these rocks as jade.

It is rare for an actinolite rock to consist entirely of grains of only the one mineral. It commonly has grains of black magnetite, white quartz, white feldspar, white calcite, and even small amounts of green mica-like minerals. Some of the finest jade carvings show black streaks of magnetite in them. The question then arises, how much of what impurities will be tolerated and still permit a designation as jade? The answer to this is clearly an arbitrary matter of taste, esthetics, and tradition.

Since this form of jade is comprised of microscopic interlocking needles of actinolite (or tremolite), what does one do when the needles are so large they are no longer microscopic? What does one call a pure actinolite rock in which the green needles are an eighth of an inch long and clearly visible? If a fine-grained actinolite rock is jade, why not a coarser-grained one? Again it is a matter of esthetics. In both these cases, impurities and grain-size, the mineralogist can offer no answer.

About two centuries ago a new source of attractive green rock (also sometimes gray, or even blue) was discovered close to China in Burma. It was hard like jade, usually green like jade, and could be worked into pleasing carvings. Archaeological usage caused it to enter the ranks as jade. Mineralogically, however, this material is an entirely different rock, one composed of interlocking microscopic grains of a different mineral called *jadeite.* In fact, the mineral acquired its name because of the use of the rock in which it is found. This rock too possesses problems relative to acceptable impurities and size of mineral grains. Thus two materials are accepted, by archaeological definition, as jade. In the jade business these are usually distinguished by modifying words. The original actinolite rock is referred to as *nephrite jade,* and the jadeite rock as *jadeite jade.* The buyer of an object advertised as jade does not usually know which type he is getting. Both are jade; the value depends mostly on the age of the piece, craftsmanship, size, and archaeological factors. In general, the majority of pieces one sees sold are made from nephrite jade simply because it is a vastly more abundant rock type than jadeite rock in the earth's crust.

If only these two kinds of rocks were ever worked as jade, mineralogical problems would be relatively limited to those mentioned earlier. But native craftsmen over the centuries have, unfortunately, not always been discriminating in their choices of materials. A large variety of other rocks and minerals have also been utilized: such green rocks as serpentinite, metamorphosed basaltic lavas (called greenstone), soapstone, hard clays, and such minerals as green chalcedony and uvarovite garnet have shown up in some old collections. In some cases the craftsman may have had it in mind to defraud; however, in most instances lack of knowledge or lack of discrimination led to the use of any workable attractive green rock or mineral that would take a good polish. In more recent times dyed glass has been used extensively to simulate jade in an obvious attempt to

defraud. Frequently even the seller is unaware he is selling glass. A fairly common practice in costume jewelry is to mix the pieces with part of the object made of jade (usually nephrite) and part of it made from glass, soapstone, or serpentinite chosen (or dyed) to provide closely matched color. Thus such a piece can be sold as "jade," which lies just inside the border of truth.

For a mineralogist to pass on the authenticity of a particular piece, in most cases it comes down to determining if it consists mainly of either actinolite or jadeite. The first simple test is to scratch it with a common steel needle. Neither of these materials can be scratched; however, "look-alikes" such as serpentine, soapstone, and greenstone are readily scratched. Unfortunately, chalcedony and hard lead glass are not scratched. These can sometimes be distinguished from jades by optical tests. A severe limitation in applying such a test is that it is usually not possible to obtain a chip of a specimen on which to work. A valuable carving cannot be sampled in a cavalier manner with hammer and chisel. It is usually necessary to sample from down inside a carved hole or depression, or on some inconspicuous spot on the bottom of the object, if it has a bottom surface at all. Frequently, especially with small objects, the piece is fully polished on all sides and a sample removed from anywhere will ruin its appearance.

As a general practice the quickest and safest method is X-ray diffraction. This method is based on the fact that each kind of mineral has a characteristic chemical composition and the atoms of the chemical elements are arranged in regular three-dimensional symmetrical patterns. X-rays passing through such a three dimensional network are diverted (bent) into patterns of rays that reflect the characteristic arrangement of the atoms in the mineral. Each mineral has, in a sense, an X-ray "fingerprint" which permits its definite identification. For large objects, a minute amount can be scratched from an inconspicuous spot and mounted for X-raying. Small objects often can be fitted directly into the X-ray sample holder and X-rayed as a whole, unscathed. Thus the real jades and the "look alikes" can be readily distinguished. In preparing objects for installation in the new John L. and Helen Kellogg Hall of Jades, over one hundred pieces were checked by X-ray. These were chosen for examination because of questions regarding their authenticity. A relatively small percentage turned out to be non-jades, and these were omitted from the exhibit collection.

It would appear that the X-ray method solves many problems. Unfortunately, archaeological acceptance makes for other difficulties. Long ago Chinese noblemen frequently had nephrite jade objects buried with them at their funerals. Soil acids and moisture acted slowly on these objects to gradually alter their composition and form different minerals of them. This alteration may form only over the outside as a coating, or it may completely work its way through an object, especially if it is small. When such pieces were dug up, centuries later, they were found to be quite pleasing in appearance. They had become an off-white color and resembled polished bone material. These objects became prized and it is logical that someone should experiment in an attempt to learn how to speed up this slow alteration process. It was soon discovered that nephrite jade could be converted to this appearance if it were subjected to intense heating. Today both of these forms of bone jade are accepted as jade; however, neither one is nephrite jade any longer. Depending on the process, long-term burial or short-term heating, two different rocks result made of several entirely different minerals. They are, nevertheless, considered to be jades also.

These altered materials complicate matters. Both consist of mixtures of several minerals in varying proportions depending on such factors as temperature and time. It is not possible to distinguish these rocks formed by the alteration of original jade from the same kind of rocks formed by other processes from original material that was not jade at all. Thus for these materials archaeological definition generally confounds mineralogical determination.

The authentication of jade is clearly not as straightforward as one might imagine. For the majority of cases X-raying provides a simple and relatively nondestructive method. In a small number of cases the final decision will depend on what the archaeologist is willing to accept. Probably the only other material that raises even more difficult mineralogical questions regarding authenticity is amber. It is regrettable that once man attaches monetary value to a mineral or rock, problems are created that go outside the realm of the mineral kingdom.

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