New or Unusual Gem Materials Encountered in the Institute's Gem Trade Laboratories

by

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One of the many joys of being associated with the Laboratories of the Gemological Institute of America is identifying unexpected gem materials that may heretofore not have been widely reported, if at all. Each year we receive for testing and also as gifts various unusual materials, some of which may have a commercial potential.

During the past year we have examined an unusual number of specimens that were technically rocks, being made up of more than one mineral. The first such stone came to our attention when some freshly polished lapis-lazuli tablets were used in class work. Students consistently misidentified the stones because they were obtaining an R.I. of 1.68 rather than 1.50, as universally recorded in textbooks and tables. X-ray diffraction, plus thin sections of the material made by Dr. Ralph Holmes of Columbia University, showed that the material was essentially lazurite granules evenly distributed in colorless diopside.

A mineral with which lapis is sometimes confused and that can occur technically as a rock is sodalite. Recently this mineral has been coming to the United States market from Ontario in great abundance. It is readily separated from lapis by its R.I. of 1.48 (as opposed to 1.50 for normal lapis) and its low S.G. of approximately 2.20 (as opposed to a low of 2.45 for lapis that is lacking in pyrite, to a high of 2.90 if much pyrite is present). Incidentally, the presence of pyrite is not proof of lapis, since specimens of sodalite with veins of pyrite are not uncommon.

Another rock that proved troublesome consisted of a group of tumbled stones that were composed of three distinctly colored materials, purportedly from the nephrite area of Wyoming. These stones were proved to be a rock composed of green nephrite, pink thulite, and a grayish-brown zoisite. We are indebted to Dr. Brian Mason of the American Museum of Natural History for the necessary X-ray diffraction work.

Another rock, the identification of which we also owe to Dr. Mason, was presented to the Laboratory as a string of spherical, mottled, white-and-dark-green beads. The beads were offered in New York as jade, but proved to be a combination of white albite feldspar and green actinolite. At the same time, a string of all white beads was proved to be composed of approximately equal numbers of albite and matching white prehnite beads; these were being offered as "Japanese" jade.

Another jade problem came to our attention when a manufacturer presented some pieces of carved jade in an attractive mottled green-and-white color, with the complaint that many of them broke readily in setting. Normal gemological tests, including R.I., S.G., and spectroscopic analysis, indicated jadeite, but under the microscope certain veins and areas showed great undercutting; and wherever veins of white occurred, one could pick away the white material with the fingernail. Again, it was necessary to resort to nongemological tests. Dr. Holmes was able to prove by X-ray diffraction that the green material was jadeite; however, a study of thin sections showed that it was highly brecciated and that the white, soft material was kaolinlike in nature, thus indicating that the material had been metamorphosed and recompacted at some time in the past. Again, we have what might technically be called a rock.

Another rock in the form of highly attractive cabochons came in for identification. The material consisted of opaque ruby-red patches in an opaque dark-green groundmass with an occasional black splotch. Tests quickly proved the red substance to be ruby and the green material to be zoisite. In a communication from Dr. Edward Gubelin, Lucerne, Switzerland, we learned that the rock occurs near the border area of Kenya-Tanganyika, and in the past has been found in large sizes suitable for carving into bowls, vases, etc.

Among the unusual specimens examined in the Laboratory can be mentioned a polished slab and several rough waterworn pebbles of sillimanite (or fibrolite) from Idaho. The material has been widely publicized as "gem sillimanite"; however, we have not observed any that would warrant such a description, for it is semitranslucent and only faintly chatoyant. Transparent violet-blue to grayish-green faceting-quality stones are known to have come from Burma and Ceylon, and some fibrous material from these localities has cut excellent cat's-eyes. The Idaho material we have seen, although it does not produce fine cat's-eyes, does take an excellent polish and would appeal to amateur lapidaries.

Some unusual cat's-eye-type stones were offered for sale briefly in New York as ulexite — the so-called "television stone" mentioned by Captain John Sinkankis in the Winter, 1955-1956, issue of Gems and Gemology. Specimens tested in the Laboratory appeared to have greater constants than those listed for ulexite in Dana, who lists an S.G. of 1.65 and a hardness of 1. Our specimens seemed to have a hardness greater than 2 and an S.G. near 2.00. Since we were unable to secure material for mineralogical tests, we cannot be positive if they are ulexite or some near-borax relative. Obviously, the stones are only suitable for collector's items, since they do not have sufficient durability for use in jewelry.

Synthetics in several little-known forms came to our attention last year. In one of these, an unusual treatment of synthetic spinel imitating lapis-lazuli, identification was made easy because of the high R.I. and because of the residual purple color as the stone was held over a strong light source. Professor K. Chudoba, writing in the Winter, 1956-57, Zeitschrift der Deutschen Gesellschaft Fur Edelsteinkunde, suggests that it should be correctly called lapis-lazuli-colored sinter spinel, rather than synthetic spinel, since it is a sintering process developed several years ago in West Germany. To date, no great commercial activity has been reported in the U.S. for this rather handsome and serviceable stone.

Another synthetic spinel, the only specimen of which we have seen was given to the Institute by student Aldert Breebaart, Nijmegen, Holland, is a rather good imitation of moonstone. Whether it becomes anything more than a scientific curiosity is still to be seen.

Perhaps in the same category are the tiny red spinel brilliants received by the Institute as a gift. They are clearly of Verneuil manufacture, and their small size perhaps suggests the diffculty in making this color of synthetic spinel.

For years we have sought a specimen of natural green spinel. Although this color is included in all lists of gem materials, we have never seen a salable green spinel. We were gratified to receive for testing three transparent dark-green stones that proved to be the zinc spinel (gahnospinel). The R.I. of the stones was approximately 1.805 and the S.G. 4.44. The polariscope showed that the stones were all fairly badly strained.

During 1956, several cases came to our attention where heat-crackled synthetic rubies had been represented as natural stones to uninformed and unsuspecting jewelers. Another swindle was attempted, probably by the same team, with green heat-crackled glass imitations of emerald. Although heat-crackled (or, as they have been called, quench-crackled) stones are not new, it was appalling to see how some jewelers could be so readily duped by stones whose style of cutting suggested synthetic or glass.

The emerald filter is gradually losing much of its former importance as a means of testing emeralds. First, the I.G. Farben synthetic emeralds and later the Chatham synthetic emeralds were developed, both of which turn red under the filter (as do natural emeralds). Later, natural emeralds from India reached the market; these stones, instead of turning red under the emerald filter, react in the same manner as glass; i.e., no reaction at all. Later, the appearance of triplets composed of two parts of rock crystal and a green cement that turns red under the filter further undermined the value of the filter. The latest reason to suspect the value of the filter with emeralds was the appearance of a green plastic coating on poor-quality emerald and pale-green beryl. The plastic makes the stones appear quite transparent as well as a highly desirable green. The plastic coating turns red under the emerald filter. Although normal instrument tests or an educated "feel" test would indicate that something was "wrong," we have encountered a suffcient number of stones that were accepted as natural to make it worthwhile to mention it here. In one case, an expensive pair of platinum-and-diamond earrings was completed before it was discovered that the stones about to be mounted were actually plastic-coated worthless beryl. Because of these reasons, we have begun to call the filter merely the "color filter" or "spinel filter," because of its value in testing synthetic blue spinels.

High-index glasses (i.e., those used for refractometer hemispheres and prisms) are universally quite yellowish, a color that is undoubtedly caused by the metallic oxides used in the melt to attain the high index. The Institute's student study sets do not contain any glass imitations with an R.I. higher than 1.70. A colorless brilliant with an R.I. of 1.78 was given to the Institute last year, but not before several file tests had proved its softness (approximately 5). The tests, of course, had been done on the

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of approximately thirty thousand dollars.

The Chivor Mines, operating under receivership for the creditors (with claims totalling 2,000,000 pesos), have installed their first automatic compressor and hope to increase production this coming year although the current output is of low quality.

Directly opposite Chivor, at a location known as Buena Vista, emerald of fine quality has been unearthed, although the sizes range from one-half to one carat only at the present time. When the new *Decree* is issued, Buena Vista will operate commercially.

Muzo Mines have been plagued with landslides during the recent wet season, but what rough is being mined, is of an increasingly better size and quality. All indications point to a sizeable recovery sometime soon. Cosquez, adjacent to Muzo and also leased by the Banco, is still inoperative.

The new Gachala Mines are under heavy police guard at the moment to prevent *contrabandistas* from operating further, although fine rough from unknown sources is currently being cut in Bogota. The writer has mapped and applied for all concessions with the Ministry of Mines, and the matter will be considered and delegated once the awaited *Decree* is in force.

Prices for good- and fine-quality cut stones remain relatively high on this market, due to the influx of buyers from as far away as Japan and India. However, with eleven applications for new emerald locations already on file with the Ministry, the prospects are bright for more and better rough and consequent leveling of emerald prices.

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table of the stone! To date, we have not seen this glass being used in any commercial quantity, although it is undoubtedly being used in costume jewelry.

One of the most commercially significant stones to be identified in the New York Laboratory in 1956 was dyed-green jadeite. Heretofore, it was believed impossible to inject dye into jadeite, the crystalline aggregate structure supposedly being too compact. It was a surprise, therefore, to find that half of a green cabochon lost all of its green color when heated in sulphuric acid. A similar piece of untreated jadeite lost some of its polish, but none of its color.

In August of 1956, a Midwestern jeweler asked if jadeite fades. We told him that we had no record of such occurrence. He complained that a green jadeite cabochon had faded after being exposed to strong sunlight in his west-facing store window. Recent light tests have shown that some dyed material will fade both in sunlight and if exposed for varying lenths of time to a lighted 40- or 60-watt bulb. At this writing, the tests for fading are being continued.

Tests for the identity of the material are not difficult. First of all, the green coloring appears to be confined to tiny fractures that have the appearance of threads in a bank note. It should be mentioned that this appearance is also seen at times in provable untreated material. If a drop of cold (room temperature) acid is placed on the dyed material and observed under magnification, the green color soon begins to disappear and is replaced by a brown to blackish color. Through the spectroscope, the dyed material does not show the three absorption bands in the red (due to chromium) that are characteristic of similarly colored untreated material, but instead shows one broad absorption band in the medium red. Should any doubt remain, and if a stone can be sacrificed, one can use the sulphuric acid test mentioned above to remove all color. Color can be removed equally well by heating the stone in a concentrated solution of boracic acid and water (one teaspoonful boracic acid crystals, 1 teaspoon water). Also, all color can be made to disappear quickly by placing a small piece of alum on the stone and applying heat.

At about the same time as the tests for

dyed jadeite were being conducted we were shown a cabochon triplet that had been made by hollowing out a piece of nearly colorless, translucent jadeite, filling the depression with an unknown transparent green material, and then cementing to the back of the cabochon a flat piece of jadeite. Mounted in a bezel setting to hide the separation plane, these stones have been reported to sell for hundreds of dollars, as well they might, since they imitate the rare Imperial-green jadeite. Again, the spectroscope gives an immediate indication that something is amiss, since the absorption is "wrong" for natural chrome-colored jadeite. Under magnification, some of the more recent triplets have shown bubbles just under the "shell" of jade at the apex of the cabochon next to the green filling. Out of the mounting, the separation plane of a stone of this type would be visible, thus making identification an easy matter.

DIAMOND SUBSTITUTES

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together by any one of various cements, one of the best of which is said to be garlic juice. Careful observation, even with low magnification, will easily identify these doublets, although stones that are mounted with closed bezels can easily be overlooked with just normal inspection under a bright light.

A number of doublets have been made with diamond crowns and other materials used for the pavilion. These include synthetic corundum, quartz, glass, etc. It would not be unreasonable to expect the appearance on the market of doublets consisting of a diamond crown and a strontium titanate pavilion.

GLASS. Glass has probably accounted for the greatest number of diamond substitutes sold in America, if we take into consideration costume jewelry. Rarely, a rather large, beautifully cut piece of glass will be encountered in an expensive mounting as a diamond substitute; however, this combination is unusual. Even the finest glass substitutes do not possess properties that take them out of the range of normal glass, and thus a combination of refractive index and optic character will easily identify them.

AN INTRODUCTION TO SPECTROSCOPY

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strument is in not adjusting the slit, which should be manipulated with the left hand in the Beck-Hand instrument. The slit must be adjusted for each stone if the intensity of color varies from the last stone observed; however, it must be as nearly closed as possible and still allow the colors to come through. Frequently, horizontal lines will be seen running the length of the spectrum. These lines are caused by dust in the slit, and it must be carefully removed with a fine brush. A few such lines are not serious; in fact, they usually indicate that the slit is not opened too far.

Depending on the diffusion of the light used, a phenomenon consisting of bright red lines caused by ultraviolet fluorescence may be observed in the far red in rubies, synthetic rubies, and in some red spinels and synthetic red spinels.

Although the spectroscope has been generally slighted in American gemological literature, it is heartening to see that more and more gemologists are working with it and finding it to be a useful instrument.

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