

DIAMOND

Some Unusual Cuts

Most modern diamond cuts are symmetrical in shape and in facet arrangement, with proportions chosen to take maximum advantage of diamond's optical properties. By contrast, diamonds cut before the turn of the century were more likely to be characterized by "lumpy" shapes and an irregular placement of facets. Although modern-cut diamonds are generally more pleasing to the eye than the older styles, these earlier styles—such as the Mogul, table, rose, old mine, and old European cuts—often have considerable historic and aesthetic appeal.

A few months ago, the East Coast lab had the opportunity to examine some of these older cuts. One client submitted two Mogul-cut stones (figure 1). The Mogul cut is characterized by a broad, often asymmetrical base; a crown with either a table or four shallow facets in place

Figure 1. These Mogul-cut diamonds (9.27 ct, left, and 9.54 ct) may be from India's Golconda region, possibly fashioned several centuries ago.



of a table; and two or more rows of facets between the table and the girdle. (The 115.60 ct Taj-i-Mah [Crown of the Moon] diamond in the Iranian crown jewels is a famous example of a Mogul cut.) The client mentioned that these Mogul-cut diamonds might be several centuries old and may have come from the Golconda region of India, which gained broad fame as a source of spectacular diamonds after French gem merchant Jean-Baptiste Tavernier chronicled his 17th-century travels there.

A third example was a drilled diamond (figure 2) that our client said was old and came from India. It was cut and polished to follow and retain the external crystal shape, in contrast to modern cutting techniques which typically leave no evidence of the original external morphology. The hole, which ran along the longest dimension, had been drilled at an angle from each end to meet in the middle of one side of the stone. In the early days of diamond cutting, drilling holes in diamond was very time consuming. The worker could either use a diamond "sharp"—a small, sharp-edged crystal fragment—or continually load diamond dust onto the steel point of a bow drill. We suspect that the latter method was used for this stone because the hole was so deep. In outline, this stone resembles the Shah Jahan Table Cut diamond, which also was pierced. However, those holes were much shallower, and they probably were drilled with a "sharp," perpendicular to the longest dimension [see,



Figure 2. This diamond, which measures $11.65 \times 9.75 \times 5.60$ mm and weighs about 6.5 ct, was cut along the original crystal shape and drilled at an angle from each end for mounting.

e.g., E. A. Jobbins et al., "A Brief Description of a Spectacular 56.71 carat tabular diamond," *Journal of Gemmology*, Vol. 19, No. 1, 1984, pp. 1–7).

Figure 3 shows a 12-sided tablet cut, a variety of the table cut. This stone ($16.24 \times 15.73 \times 3.63$ mm thick) was probably cut recently, as indicated by its symmetrical facet arrangement and the lack of abrasions. The tablet cut resembles a rondelle (a thin, flat round bead) that has not been drilled. Historically, such tablet cuts, if used to cover watch faces or miniature portraits set in rings, were called portrait diamonds.

Editor's note: The initials at the end of each item identify the contributing editor(s) who provided that item.

Gems & Gemology, Vol. 32, No. 2, pp. 122–127
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Figure 3. Despite the antique cutting style of this 10.74 ct tablet-cut diamond, the facet symmetry and good polish indicate that it was probably fashioned within the last several years.

The last example was a thin, irregular but roughly oval-shaped tablet-cut diamond on which an inscription had been engraved (figure 4). The stone was probably cut from a cleavage piece. Our client informed us that this was an old cut, and we determined that the inscription was in Arabic. Because of diamond's extreme hardness, pre-modern examples of inscriptions are relatively rare. Perhaps the largest known inscribed stone is the Darya-i-Nur, also in the Iranian crown jewels, which has been variously reported to weigh between 175 and 195 ct.

Nicholas DelRe

Figure 4. Historic engraved diamonds, such as this 2.65 ct example, are relatively rare because of diamond's hardness. The inscription, in Arabic, reads "Ya Allah" and is an invocation of God.



Figure 5. These natural-color jadeite cabochons appeared red when examined with a Chelsea color filter, which could lead a gemologist to falsely suspect that they were dyed.

JADEITE JADE

Natural Color

Recently seen in the East Coast lab were two slightly dark, but otherwise very attractive, jadeite cabochons (figure 5). Routine gemological testing established that the stones were jadeite; and chrome lines in the red end of the spectrum proved that the color was natural.

However, when we examined the stones with a Chelsea color filter, they appeared red. Usually, a red color under the Chelsea filter indicates that the stone has been dyed. However, we have seen that jadeite that is very rich in chromium (especially so-called "Yunnan jade"), may appear red under this filter, as well as show strong absorption in the red end of the spectrum. This should serve to remind readers that under some circumstances, the Chelsea color filter test is not reliable, and other means should be used to determine whether a stone has been dyed. GRC and TM

Figure 6. The green stone in this closed-back ring proved to be a jadeite imitation.



Imitation Jade

A stone in a closed-back ring (figure 6), seen in the East Coast lab, reinforced the fact that bleached, polymer-impregnated jadeite (so-called "B" jade)—although an ever-growing concern worldwide—is not the only challenge in the identification of translucent green gems. We must remain aware of the earlier attempts to imitate fine jadeite and be on the lookout for these as well.

Normally, a spectroscope will quickly prove the identity of natural-color jadeite. However, because of the closed-back mounting, we could not use transmitted light. Instead, we reflected light off and into the surface of the stone. Since we saw no jadeite spectrum, this test was inconclusive (sometimes reflected light will not reveal a spectrum that might have been seen easily with transmitted light).

The 1.63 spot refractive index was too low for jadeite, which is usually about 1.66. Close examination with magnification quickly revealed the piece's true identity—an imitation. A fern-like pattern (figure 7) distinctive of partially devitrified glass was present. This type of glass is known in the trade as "meta-jade" or "limori stone." GRC and TM

A PEARL Mystery

What started off as a routine investigation into whether a pearl was natural or cultured turned into a challeng-

Figure 7. Microscopic examination of the jade imitation in figure 6 revealed the fern-like pattern that results from the devitrification (partial crystallization) of glass. Magnified 20x.





Figure 8. This 14-mm-long drop-shaped pearl, here set as the pendant on a Retro-style necklace, was proved to be natural only after it was removed from its mounting.

ing task for our East Coast lab. The very light gray, fairly symmetrical drop shape measured about 10.5 mm in diameter by 14 mm long (figure 8). The yellow-metal Retro-style necklace from which it was suspended had a scroll motif that was popular in the 1940s and '50s. The necklace was also embellished with diamonds, blue sapphires, and smaller pearls.

The drop-shaped pearl did not

fluoresce to X-rays, which indicated a saltwater origin but not whether it was natural or cultured. Usually an X-radiograph readily reveals a pearl's mode of growth and, hence, its origin. However, this one was peculiar: Except for the thin outside nacreous surface layer, the interior appeared completely and uniformly black (figure 9). This indicates that either there was no material in this area or the substance present was transparent to X-radiation.

Figure 9. The X-radiograph of the drop-shaped pearl in figure 8 shows that the center is either hollow or contains a substance that is transparent to X-radiation.

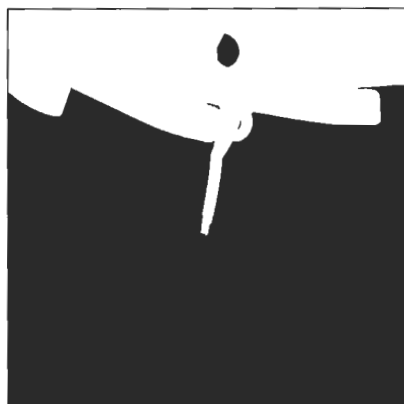
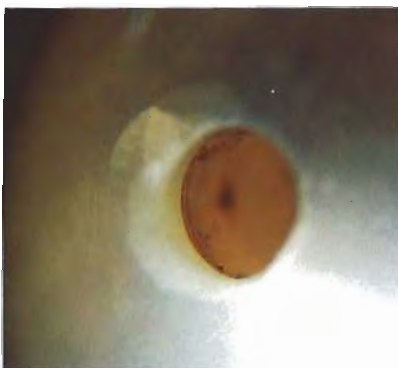


Figure 10. When we examined the pearl in figure 8 inside the drill hole, we found that it contained a natural organic substance.



In the past, pearls with similar X-radiographs have turned out to be hollow (see, e.g., Spring 1984 and Spring 1994 Lab Notes, pp. 48-49 and 45, respectively). However, most of those pearls were irregular in shape.

Since our findings were still inconclusive, the client removed the pearl from the mounting so we could examine inside the drill hole. Although the hole was narrow (1.1 mm), which made examination difficult, a combination of strong overhead and oblique illumination revealed that the pearl was filled with a substance (figure 10). A minute amount of this material, which appeared to be conchiolin, was removed and tested with a thermal reaction tester (hot point). It gave off an odor of burnt hair, proving that it was organic and the pearl was natural.

KH

PYROPE GARNET

Late last year, a 3.14 ct oval mixed cut arrived in the East Coast lab for identification. The stone's overall



Figure 11. This 3.14 ct pale brownish pink garnet was identified as pyrope.

color was a pale brownish pink (figure 11). This $9.53 \times 7.29 \times 5.79$ mm stone (reportedly from one of the new deposits in Tunduru, Tanzania) had the following gemological properties: diaphaneity—transparent; R.I.—1.735; optic character—singly refractive; S.G.—3.69; and fluorescence—faint red to long-wave ultraviolet radiation (inert to short-wave UV). A faint Fe^{2+} spectrum, with features

similar to those seen (in a much more pronounced fashion) in rhodolite and almandine, was visible in the handheld spectroscope: absorption below 430 nm, and lines at 505, 527, and about 576 nm. With magnification, we saw some intersecting coarse needles and interrupted needles. From these gemological properties, we readily identified the stone as a garnet. But which species? The spectrum was not consistent with the R.I. and S.G.

The most common pale pink garnets are grossular and hydrogrossular. However, pale pink pyropes are also known (see C. M. Stockton's "Pastel Pyropes," *Gems & Gemology*, Summer 1988, pp. 104–106). To obtain conclusive evidence, the stone was sent to the West Coast laboratory for X-ray diffraction analysis. The resulting pattern confirmed that the material had a garnet structure, with a unit-cell spacing of less than 11.49 Å. (Unit-cell spacing, the distance across one structural unit of a mineral, is measured by X-ray diffraction.) End-member pyrope has a unit-cell spacing of 11.459 Å, while grossular and hydrogrossular have quite different unit-cell spacings of 11.851 Å and 11.85–12.16 Å, respectively (W. A. Deer et al., *An Introduction to the Rock Forming Minerals*, 1974, Longman Group, London, pp. 21–31). To further confirm that this was pyrope, we also performed qualitative energy-dispersive X-ray fluorescence (EDXRF) analysis on the stone, which revealed major Mg, Al, and Si (consistent with pyrope garnet); minor Mn, Fe, Ca, and Zn; and trace amounts of Cr, Ti, V, K, Ga, Ge, Y, and Zr. (The chromium was probably responsible for the faint red long-wave UV fluorescence, rarely seen in garnets, and the iron was probably responsible for the spectral features). Note that although R.I. and S.G. do not distinguish grossular or hydrogrossular from pale pyropes, Stockton's (1988) criterion—the spectrum seen with the handheld spectroscope—still can separate them.

MLJ and TM



Figure 12. Note the uniformity of color in these cabochons (1–4 ct), all of which proved to be quench-crackled synthetic rubies.

SYNTHETIC RUBY, Quench Crackled

Occasionally over the years, we have tested synthetic stones that have been quench crackled to produce natural-appearing fractures. In some instances, the stones had been quenched in dye or (we have been told) in tincture of iodine. The coloring agent penetrated the induced fractures and crystallized to form very realistic "fingerprints."

We have seen numerous other stones that have been quench crackled in various dyes. Quartz that has been quench crackled and dyed green to imitate emerald is the most common. We also have encountered quartz dyed purple to imitate amethyst and quartz dyed red to imitate ruby. Some years ago, we were shown a necklace of quench-crackled red stones that had been purchased, incredibly, as "Swiss Jade" in Europe.

More recently, the East Coast lab was asked to identify a group of red cabochons that the client thought were suspiciously uniform in color (figure 12). Routine gemological tests proved that the stones were ruby. However, although they appeared highly flawed, as cabochon rubies usually are, these flaws seemed too uniform. In fact, on the surfaces of some of the cabs, the fractures



Figure 13. A distinctive honeycomb-like pattern was evident where the fractures reached the surface of the synthetic ruby cabochons shown in figure 12. Magnified 13 $\times$.

formed a distinctive honeycomb appearance (figure 13). Some of the fractures resembled fingerprint inclusions (figure 14), and some seemed to contain a substance which gave them a more believable appearance than a fracture alone would have had. Fortunately, subtle curved striae—crossing the fractures—were visible when the cabochons were examined in the microscope with darkfield illumination. This proved that these rubies were actually synthetic.

GRC and TM

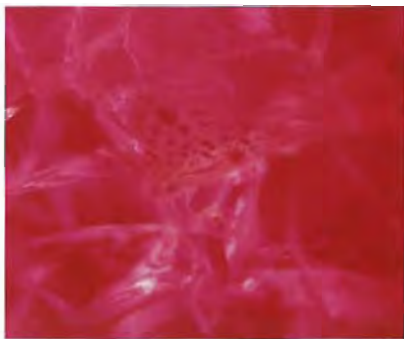


Figure 14. Some of the fractures induced in the synthetic ruby cabochons shown in figure 12 had the appearance of natural finger-print inclusions. Magnified 40 $\times$.

SAPPHIRE

A Natural Stone Mistaken for a Doublet

Shortly after issuing a laboratory report on a ring-mounted natural sapphire (figure 15), staff members at the East Coast lab received a call from the client, who insisted that an error had been made on the report. In fact, he was so certain of our error that he had already sent the ring back to us for reexamination. Eventually, we were able to convince him of the accuracy of our conclusion.

His confusion was due to a distinct separation of colors in the girdle plane that made the sapphire appear as if it had been assembled, with a blue crown and a colorless pavilion. We explained to him that this separation was caused by well-defined blue and colorless zoning, not by the boundary between two pieces of an assemblage. Our original observations revealed fluid-filled "finger-prints" that were perpendicular to the girdle plane and extended across it into *both* the crown and the pavilion. Furthermore, when the ring was immersed in methylene iodide, a routine procedure for all corundum that we examine, the side view (figure 16) showed both color zoning and the lack of a cement plane, the latter an unavoidable feature of any sapphire doublet.

Because of the nature of sapphire crystals, we more commonly see color-zoned stones in which the color is confined to the pavilion (see, e.g., figure 17). Although such stones appear evenly colored face up, they are much less likely to be mistaken for an assembled stone than this stone, in which the apparent color zone separation was straight and lay in the girdle plane.

GRC and TM

With an Unusual Star

As heat-treated rubies and sapphires becoming increasingly common, it is a pleasure to see inclusions that prove that a natural sapphire has not been treated. The gemologist gets an added bonus when the arrangement of these diagnostic inclusions also creates a beautiful internal scene. Such was the case when a 2.22 ct



Figure 15. Our client mistakenly thought that this 8.2 $\times$ 6.6 mm natural sapphire was an assemblage.

cushion-shaped, modified brilliant-cut sapphire was submitted to the West Coast Gem Trade Laboratory for identification.

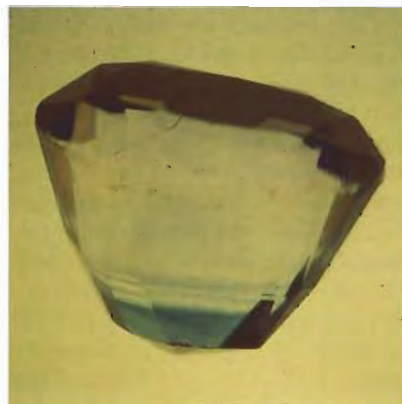
The transparent blue gem contained both fluid inclusions, which proved that the stone had not been heated to the temperature needed to alter its color, and a bold display of rutile needles that painted an obvious picture. The specific arrangement of the rutile needles and their orientation to the table facet made this stone unique.



Figure 16. A side view of the stone in figure 15 shows that the color is confined to the crown, but there is no cement plane.

As can be seen with darkfield illumination (figure 18), the rutile formed a six-spoked stellate pattern of thin, white-appearing needles that are oriented in a planar arrangement perpendicular to the optic axis. There is little or no rutile between the spokes. The six wedge- or V-shaped areas that are devoid of rutile needles extend outward from the center of the

Figure 17. Unlike the stone in figures 15 and 16, color-zoned sapphires more typically reveal color confined to the pavilion, toward the culet, as illustrated by the stone shown here (immersed in methylene iodide). Such stones usually appear evenly colored when viewed face up.



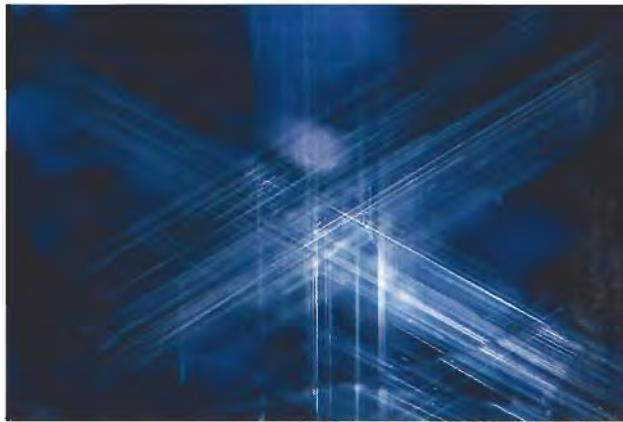


Figure 18. The spoked arrangement of the rutile needles in this natural sapphire creates a pleasing star pattern, but not true phenomenal asterism. Magnified 10 $\times$.

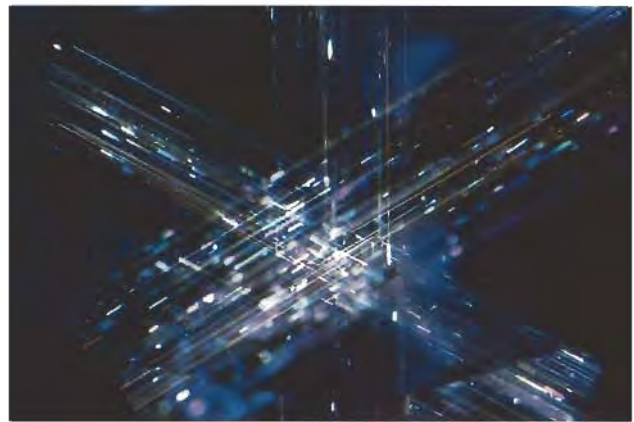


Figure 19. The star pattern becomes iridescent when illuminated by a strong fiber-optic light directed through the table facet from above. Magnified 10 $\times$.

"star" formation, which results in the isolated rutile star seen in this stone.

Another interesting feature of this stone was visible because the plane of the table facet was cut just off-parallel to the plane of the rutile star. This orientation results in a beautiful iridescent display by the

rutile needles when they are illuminated through the table from above by intense fiber-optic lighting (figure 19).

Although iridescent needles have been observed many times in the past, the combination in this stone of the vibrant iridescence and the unusual spoked star pattern make

this a most pleasing inclusion display.

John I. Koivula

PHOTO CREDITS

Nicholas DeRe supplied the pictures used in figures 1–10 and 12–16. Figure 11 was taken by Maha DeMaggio. Figure 17 is courtesy of the GIA slide library, photographer unknown. The photomicrographs in figures 18 and 19 were taken by John I. Koivula.

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