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IN THIS ISSUE

THE LARGER GEMS OF THE CROWN JEWELS OF IRAN*

by

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During three months in early 1966, the Crown Jewels of Iran were studied by a team of scientists from the Royal Ontario Museum, the first scientific study ever made of this collection. The gems were the responsibility of the author and Mr. G. G. Waite, assisted during the third month by Mr. E. B. Tiffany, Chief Gemologist of Henry Birks & Sons, Canada. Both men are Research Associates of the Royal Ontario Museum. The documentation of all the objects was the responsibility of Dr. A. D. Tushingham, Chief Archeologist of the Museum.

Some of the results of the study of this magnificent collection of regalia, armour, *objets d'art* and gemstones, both set and unset, have been published elsewhere (1, 3, 4). It is the purpose of the present article to put on record the principal data for the most notable of the gemstones.

Most of the gemstones of the collection were acquired as loot in 1739, when the Persian ruler, Nadir Shah, sacked Delhi, the Mogul capital of India. There are hundreds of thousands of gems, most of which are diamonds, emeralds, red spinels and rubies. Also, pearls appear in countless profusion. Turquois and sapphires, in relatively small numbers, are present. Very few examples of other gem materials were recorded: amber, beryl (goshenite and aquamarine), chrysoberyl cat's-eye, red garnet, jade (both jadeite and nephrite), lapis-lazuli, opal, quartz (amethyst, carnelian, citrine, onyx, rock crystal and sardonyx), topaz and tourmaline.

The collection, now the property of the State, is in the custody of the Bank Markazi (Central Bank) and serves as partial backing for the note issue. It is displayed in a large, well-protected vault in the Bank Melli, Tehran, in 35 museum-type display cases and is avail-

*The costs of the fieldwork involved in this study were generously underwritten by the Birks Family Foundation, Canada.

The photographs were made by Leighton Warren, Chief Photographer, Royal Ontario Museum.

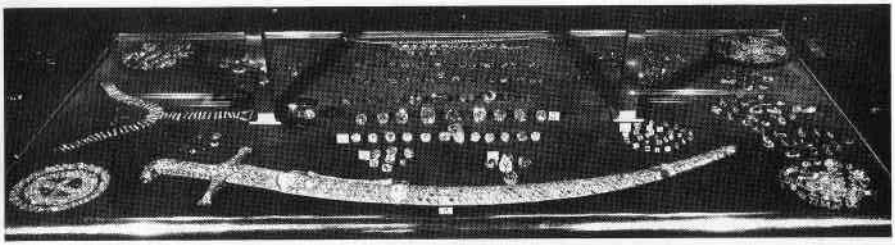

Figure 1

The lower shelf of the case is reserved for diamonds. In the foreground, the Nadir sword, which is entirely encrusted with diamonds (more than 750). Immediately behind it, to the right of center, is the *Taj-i Mah* and the other four diamonds of *Figure 4*. In the center, in a line between the two brass posts, are the nine South African diamonds of *Figure 3*.

able for public appreciation six afternoons a week.

Study was restricted. For two months all examinations were made through the glass of the cases, using specially modified Zeiss photomonoculars fitted with supplementary front lenses of +1, +2 or +3 diopter power. With these we could examine the condition of gemstones both externally and internally. By means of a net-grid cemented in the eyepiece, we could calculate the gems' dimensions. During the third month we were granted 56 hours in which to handle, examine, measure and weigh, where appropriate, objects and gemstones. In the following descriptions, dimensions are by optical determination, except where figures appear after the decimal. Weights are shown as estimated on the basis of all known facts or by actual measurement.

Diamonds

Since the bulk of the treasure was acquired in the sack of Delhi in 1739, most of the diamonds are of Indian origin. During the succeeding years some, notably the *Koh-I Nur* and the *Shah,* were given away, sold or lost and others have been added. The most obvious of these are several dozen cape and silver-cape stones from South Africa, which Nasir ud-Din purchased in Europe in 1889.

Diamonds are everywhere; one case *(Figure 1)* is devoted entirely to them. It was impossible to examine more than a small fraction of the collection, but data was obtained for 400, of which 128 unset stones were studied in some detail. Although this number includes the largest unset diamonds in the collection, it by no means includes all whose weights lie in the 20- to 50-carat range. The diamonds display very well the development of the lapidary's art (4).

The most important diamonds are the *Darya-i Nur* and the *Taj-i Mah,* both Indian stones with long histories. There is also a third named stone, the *Nur-ul Ain.*

Darya-i Nur (Sea of Light) *(Figure 2).* Rectangular, step-cut tablet, 41.4 x 29.5 x 12.15mm; off-center culet about 25mm square, 175 to 195 carats (estimated); pink, flawless, blue fluorescence (3600Å), extraordinary limpidity; Golconda stone; inscribed on a pavilion facet "Fath Ali Shah, 1834";

Figure 2
The Darya-i Nur Diamond. **A flawless, pink tablet, reported by the Bank Markazi to weigh 182 (old?) carats.**

thought to be the major portion of Tavernier's *Great Table* (3). (Case 34, No. 2.)

Rectangular old brilliant cut, 31.75 x 28.10 x 20.40mm, 152.16 carats; silver cape, slight fluorescence, clean, elaborately faceted girdle; unset South African stone. (Case 24, No. 32, part.)

High (old) cushion brilliant with extra facets around the culet *(Figure 3);* 31.67 x 26.70 x 21.00mm, 135.45 carats; cape, very clean and brilliant; unset South African stone. (Case 24, No. 33, part.)

High (old) cushion brilliant with naturals on the girdle; 27.10 x 25.32 x 21.44mm, 123.93 carats; silver cape, faint-blue fluorescence, very clean; unset South African stone. (Case 24, No. 32, part.)

Figure 3
Nine South African diamonds. Top row left to right: 57.15, 36.31, 39.02 carats; middle row left to right: 86.61, 135.45, 78.96 carats; lower row left to right: 44.49, 65.65, 75.29 carats.

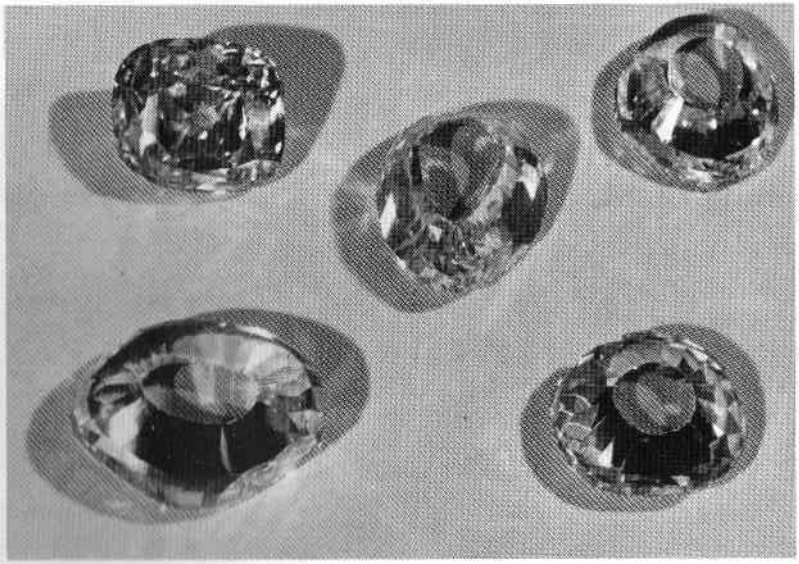

Figure 4

Five Indian diamonds. Upper left: 45.34 carats; upper right: 54.58 carats; center: 72.84 carats; lower left: *Taj-i Mah*, 115.06 carats; lower right: 47.31 carats.

Multifaceted octahedron, 29.10mm tip to tip (21.56mm normal to the side of the square section), 121.90 carats; cape, faint-blue fluorescence; several tiny black inclusions, otherwise very clean; unset South African stone. (Case 24, No. 32, part.)

Taj-i Mah (Crown of the Moon) *(Figure 4)*. Irregular oval, Mogul cut (4), 32.0 x 24.3 x 14.7mm, 115.06 carats; colorless, blue fluorescence, finest quality, slightly worn on top; unset Golconda stone. (Case 24, No. 36, part.)

High (old) cushion brilliant, 27.94 x 27.80 x 20.60mm, 114.28 carats; silver cape, very faint blue fluorescence, very clean, slight feathers and chips at the girdle; unset South African stone. (Case 24, No. 32, part.)

Rounded triangular brilliant cut with 12-fold symmetry *(Figure 3)*, 30.92 x 13.34mm, 86.61 carats; cape, faint bluish fluorescence, very clean; unset South African stone. (Case 24, No. 33, part.)

Irregular Mogul cut (4), 26.00 x 24.50 x 16.10mm, 86.28 carats; silver cape, strong-blue fluorescence, clean, large natural at the girdle; unset South African stone. (Case 24, No. 34, part.)

High (old) cushion brilliant *(Figure 3)*, 25.40 x 22.65 x 17.92mm, 78.96 carats; cape, faint-blue fluorescence, very clean; unset South African stone. (Case 24, No. 33, part.)

High (old) cushion brilliant with extra facets around the culet *(Figure 3)*, 23.43 x 23.33 x 17.70mm, 75.29 carats; cape, faint-blue fluorescence, very clean;

unset South African stone. (Case 24, No. 33, part.)

Pendeloque brilliant, 33 x 24mm, 75 carats (estimated); silver cape, nearly clean; one of a pair of earrings reserved for the use of the Empress. (Case 26, No. 5, part.)

Pendeloque brilliant, 33 x 25mm, 75 carats (estimated); silver cape, nearly clean; one of a pair of earrings reserved for the use of the Empress (Case 26, No. 5, part.)

Irregular pear shape, Mogul cut *(Figure 4)*, 25.90 x 22.03 x 13.97mm, 72.84 carats; slight champagne tint, greenish-blue fluorescence, finest quality; extremely limpid, worn on surface; unset Golconda stone. (Case 24, No. 36, part.)

Rounded, rectangular (old) brilliant cut *(Figure 3)*, 25.43 x 22.67 x 16.75 mm, 65.65 carats; cape, faint-blue fluorescence, very clean; unset South African stone. (Case 24, No. 33, part.)

Nur-ul Ain (Light of the Eye) *(Figure 5)*. Slightly drop shaped, oval brilliant cut, 30 x 26 x 11mm, 60 carats (estimated); pink, very limpid, incipient cleavage in pavilion; believed to have been cut from part of Tavernier's *Great Table* (3); center stone of the Empress' diamond tiara. (Case 26, No. 2.)

Cushion brilliant, 25.8 x 14mm deep, 60 carats (estimated); yellow, very clean; in Pahlavi Crown in center of front sunburst *(Figure 6)*. (Case 34, No. 1.)

Nearly round brilliant cut, 23.86 x 23.41 x 15.77mm, 57.85 carats; silver cape, faint-blue fluorescence, very clean, naturals on girdle; unset South African stone. (Case 24, No. 38, part.)

Cushion brilliant *(Figure 3)*, 22.50 x 22.20 x 14.90mm, 57.15 carats; silver cape, faint-blue fluorescence, very clean,

Figure 5
***Nur-ul Ain*, 60 carats (estimated).**

Figure 6
Pahlavi Crown. The yellow diamond in front is estimated to weigh 60 carats.

Figure 7
Terrestrial Globe, 43 inches high, reported to contain 51,000 emeralds, red spinels, rubies, diamonds and blue sapphires.

chipped at the girdle; unset South African stone. (Case 24, No. 33, part.)

Cushion brilliant, 22.87 x 21.78 x 15.52mm, 56.19 carats; silver cape, faint-blue fluorescence, very clean; unset South African stone. (Case 24, No. 32, part.)

Cushion brilliant, 21.5 x 21.0 x 15.75 mm, 55.67 carats; cape, faint-blue fluorescence, very clean and brilliant; unset South African stone. (Case 24, No. 32, part.)

Irregular oval Mogul cut (4) *(Figure 4),* 24.69 x 21.83 x 12.27mm, 54.58 carats; colorless, finest quality, worn on surface; unset Golconda stone. (Case 24, No. 36, part.)

High (old) cushion brilliant, with double-decked pavilion resembling the Cairo cut *(Figure 4),* 22.3 x 20.04 x 14.40mm, 54.35 carats; slight peach tint, very clean, finest quality; unset, probably recut from a larger Indian stone. (Case 24, No. 36, part.)

Figure 8

Lower: emerald brooch; weight of the stones, 320 carats (estimated). Upper: gold box with rectangular carved emerald of 35 carats (estimated).

High (old) cushion brilliant, 22.92 x 21.75 x 15.0mm, 53.50 carats; silver cape, blue fluorscence, some inclusions; unset South African stone. (Case 24, No. 31, part.)

Elliptical Mogul cut (4), 31.67 x 24.19 x 6.55mm, 51.90 carats; colorless, blue fluorescence, few tiny inclusions, fine quality, surface slightly worn; unset Indian stone. (Case 24, No. 41, part.)

Emeralds

Although most of the emeralds were acquired in the sack of Delhi, most came originally from Columbia, and exhibit the characteristic soft velvet green of Muzo or the blue-green of Chivor. Emeralds from other occurrences are undoubtedly present, but their generally inferior quality precluded detailed examination when time for study was so limited.

Like the diamonds, emeralds are everywhere—in trays, boxes and adorning most objects. In addition, two cases are devoted to them. They have been fashioned in a variety of ways: polished lumps and crystals (mostly drilled), smooth and carved beads, cabochons, mixed cuts, step cuts and carved ornaments. Some bear inscriptions. More than 1000 were examined and measured. Of these, most exceed ten carats, ten percent weigh (by calculation or actual determination) between 50 and 99 carats, three percent weigh 100 to 149 carats, 12 stones (three weighed) weigh 150 to 199 carats, four stones (two weighed) weigh 200 to 249 carats, two stones weigh 250 to 299 carats, and five stones

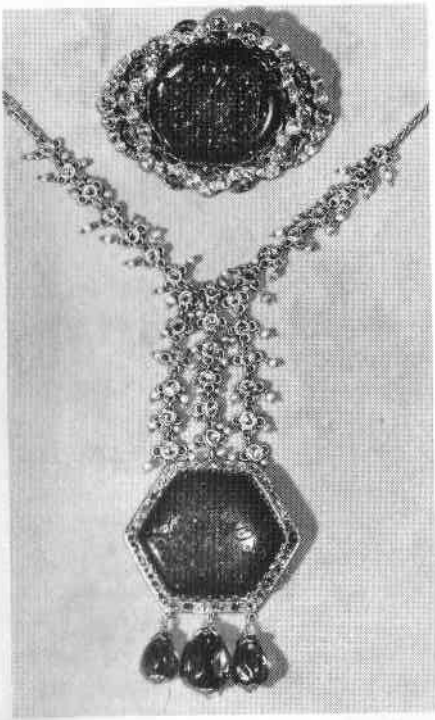

Figure 9
Emerald brooch and pendant, each 250 carats (estimated).

(four weighed) exceed 300 carats.

Unsymmetrical, very high, roughly hexagonal polished lump, 46.0 x 45.0 x 19.5mm, 335 carats (2); dark blue-green, considerable jardin; some inscriptions; unset stone. (Case 30, No. 50, part.)

Ovoid cabochon bead, 43.5 x 41.0 x 19.4mm, 320 carats (2); dark green, jardin; unset stone. (Case 27, No. 15, part.)

Shallow hexagonal tablet with rounded edges *(Figure 8)*, 61 x 53 x 52 (measured prism to prism) x 13.48mm, 320 carats (estimated); blue-green, considerable jardin, two conchoidal depressions in table; center stone in diamond brooch. (Case 27, No. 21.)

Lumpy drilled pendant, 56.5 x 46.0 x 17.2mm, 315 carats (2); blue-green, much jardin and many feathers; unset stone. (Case 30, No. 50, part.)

Drilled cabochon pendant, 48 x 39 x 21.3mm, 303 carats (2); dark green,

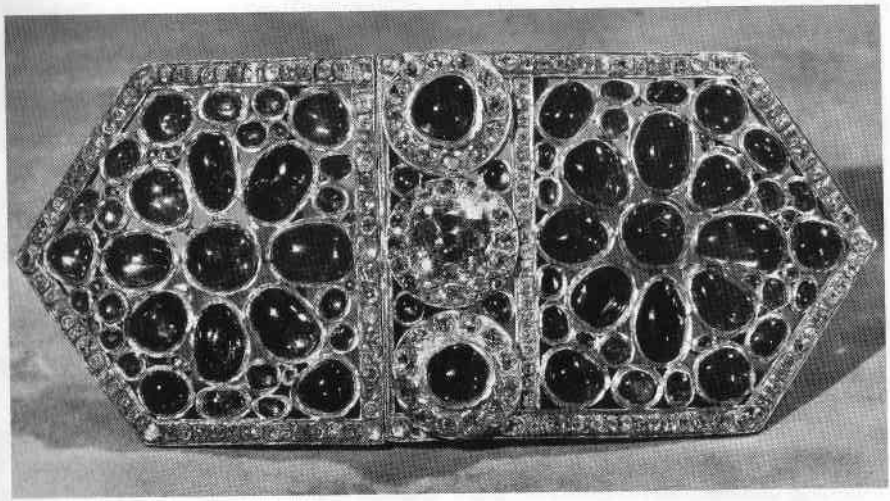

Figure 10
Ruby buckle, 16.7 cm. long. Each of the two largest of these Burmese rubies weighs 11 carats (estimated).

considerable jardin; fluting radiates from one end; unset stone. (Case 27, No. 15, part.)

Hexagonal with corners rounded, flat, engraved *(Figure 9),* 58mm diameter, 250 carats (estimated); green, considerable jardin; mended; brooch. (Case 30, No. 36.)

Hexagonal, inscribed cabochon *(Figure 9)* 52mm (prism to prism) x 9.65mm thick, 250 carats (estimated); green, considerable jardin; necklace. (Case 30, No. 42.)

Drilled, polished lump, 44.5 x 42.0 x 16.1mm, 238.85 carats; green, many inclusions; unset stone. (Case 30, No. 26, part.)

Drilled, drop-shaped bead, 44 x 25mm, 175 carats (estimated); blue-green, nearly clean, superb quality, chip out of top; set in Terrestrial Globe *(Figure 7);* first large emerald between the equator and the ecliptic west of Peru. (Case 37.)

Drilled, drop-shaped bead, 44 x 25mm, 175 carats (estimated); blue-green, nearly clean, superb quality, dimple in small end; set in Terrestrial Globe *(Figure 7)* to left of emerald described above. (Case 37.)

There are so many fine, large emeralds in the collection that it is meaningless to describe more. In general, the quality varies inversely with the size. The emeralds set in the crown and jewelry of Her Imperial Majesty the Empress are of particular note. (Case 35 and 26.)

Rubies

Red gems are also numerous, and there is one case devoted to them. Most are rubies and spinels, but there are a few garnets and tourmalines. Most of the rubies are cabochon cut, but many less than five carats in weight are faceted. The greatest concentrations of large, high-quality stones are in a plaque of 13 rings in Case 11 and in a ruby buckle in Case 35. The rubies in the rings and 20 of the 84 in the buckle *(Figure 10)* range in weight from eight to 16 carats (estimated) and average about 9½ carats.

Other examples of large rubies:

Flat oval pebble, *ca.* 44 x 22 x 13mm, *ca.* 100 carats; dark red. (Case 11, No. 9, part.)

Oval cabochon, 28 x 25mm, 75 carats (estimated); purplish red, beautiful; Terrestrial Globe, North America, latitude 23 to 30° north. (Case 37.)

Oval cabochon, 30 x 20mm, 55 carats (estimated); purplish red, asteriated, beautiful; Terrestrial Globe, central Africa, latitude 10 to 15° north. (Case 37.)

High, oval cabochon, 35 x 15mm, 50 carats (estimated); purplish red, beautiful; Terrestrial Globe, central Africa, latitude 10 to 15° north. (Case 37.)

Very high, oval cabochon, 27 x 15mm, 45 carats (estimated); purplish red, asteriated; Terrestrial Globe *(Figure 7),* western tip of South America below the equator. (Case 37.)

Irregular cabochon, 20 x 20mm, 35 carats (estimated); purplish red, beautiful; Throne, center of fan-shaped finial at top of Throne back of several other large cabochon rubies in the back, one is about 18 x 16mm, 22 carats (estimated) and asteriated. (Case 17.)

High, oval cabochon, 16 x 14mm, 15 carats (estimated); purplish red; Im-

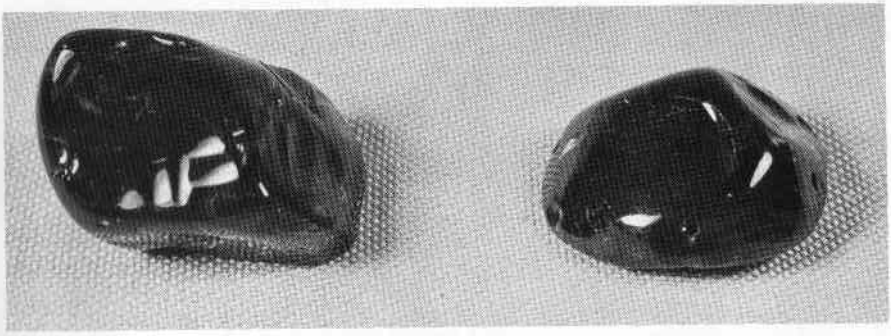

Figure 11

Red spinels. On the left is the largest on record, 500 carats; on the right is the fourth largest, 270 carats.

perial Sword in upper part of scabbard. (Case 30, No. 48.)

Spinels

Only red and occasional pink spinels were observed. The bulk are of two characteristic shades — slightly purple and slightly orange — and indicate that they are primarily from two occurrences. These were probably in Badakshan, a district in northern Afghanistan on the upper Oxus River (Amu Darya). This is the world's largest known collection of red spinels. Here, indeed, the gemologist can truly appreciate the beauty of this magnificent gem.

Data were recorded for 425 of the most significant spinels. Of these, 15 exceed 100 carats in weight and include the largest and fourth largest red spinels on record. This number by no means represents the total of all such stones in the collection. In some instances, only a sampling was made, as with the string of 20 stones (Case 11, No. 59), in which only the three largest were studied and each estimated to weigh 175 to 200 carats. Half the remainder would exceed 100 carats. Another sample is an eight-inch tray of polished spinels (Case 11, No. 12) up to 37mm in greatest dimension, in which only the three largest were weighed. Although many of the largest are polished lumps, usually drilled and often bearing inscriptions, there are thousands of faceted stones. Those in the scabbard of the Imperial Sword are particularly noteworthy.

Polished lump with one flat face *(Figure 11)*, 54 x 36 x 33mm, 500 carats (2); deep purplish red, some inclusions; drilled and plugged; unset gem. This is the largest red spinel on record. It is reported that it was once in the possession of the King of Abyssinia and had been hung around the neck of the Golden Calf (5). (Case 11, No. 38.)

Polished lump *(Figure 11)*, 45 x 20 x 21mm, 270 carats; deep purplish red, some inclusions, crack near the surface, drilled near one edge, inscribed (6). This is the fourth largest red spinel on record. The second (414 carats) is in the Russian Treasure, and the third (361 carats), is in the British Crown Jewels. (Case 11, No. 35.)

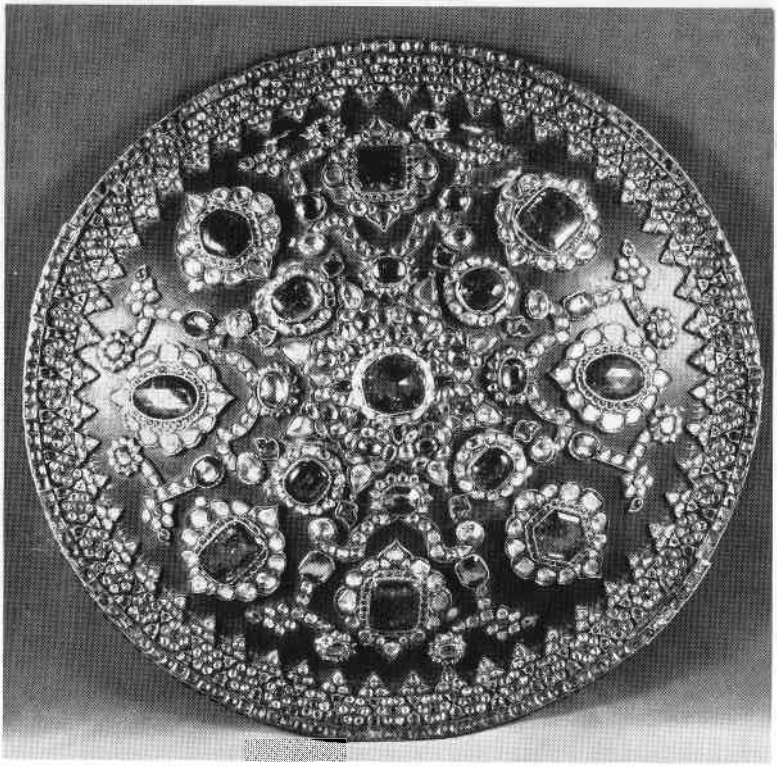

Figure 12

The 18-inch buckler of Nadir Shah, encrusted with a central 225-carat (estimated) red spinel, 12 large emeralds and hundreds of smaller emeralds, red spinels, rubies and diamonds.

Polished lump, *ca.* 40mm in greatest dimension, 232.91 carats; purplish red, inscribed "Akbar Shah"; tray of assorted spinels. (Case 11, No. 12, part.)

Octagonal step cut, pavilion exposed, 34 x 34 x 20mm, 225 carats (estimated); purplish red, some inclusions; Nadir Shah's buckler *(Figure 12),* center of boss. (Case 28, No. 3.)

Drilled, nearly spherical bead, 30 x 28mm, 200 carats (estimated); raspberry red, nearly clean, inscribed at left end; Terrestrial Globe, above southeast Asia. (Case 37.)

Three polished lumps, 35 x 25 x 25mm, 35 x 30 x 21mm, and 35 x 25 x 19mm, 175 to 200 carats each (estimated); purplish red. (Case 11, No. 59, part.)

Rectangular, step cut, pavilion exposed, 36 x 26mm, 170 carats (estimated); pinkish red, two feathers, worn; Terrestrial Globe, North Africa south of Red Sea. (Case 37.)

Polished lump, 163.36 carats, purplish red; tray of assorted spinels. (Case 11, No. 12, part.)

Polished, ovoid drilled bead, 32 x 21mm, 130 carats (estimated); purplish red, some inclusions, a little abraded; Terrestrial Globe, Brazil. (Case 37.)

Irregular polished lump, 32.2 x 25.0 x 16.0mm, 120 carats (estimated); dark red; finial in Kiani Crown. (Case 36, No. 1.)

Polished lump, 34.0 x 26.5 x 24.0mm, 119.75 carats; dark red, very clean; tray of loose stones. (Case 11, No. 12, part.)

Drilled, nearly spherical bead, 30 x 18mm, 110 carats (estimated); raspberry red, nearly clean; Terrestrial Globe *(Figure 7)*, south-central United States. (Case 37.)

Octagonal step cut, pavilion exposed, 28mm square, 105 carats (estimated); raspberry red; Terrestrial Globe, northeast Asia, latitude 60 to 67° north. (Case 37.)

Sapphires

At first glance, sapphires seem to be lacking in the collection; however, data were recorded for 57 of the largest. Most of these were blue, six were yellow, three orange, three pink and one purple. The most notable are:

Rectangular cabochon with corners truncated and hollow back, 33.25 x 27.50 x 16.0mm, 191.58 carats; deep blue, feathers and crystal inclusions; unset stone. (Case 24, No. 46, part.)

Rectangular mixed cut with corners truncated *(Figure 13)*, 32.50 x 25.45 x 15.30mm, 141.91 carats; deep blue, strongly dichroic, quite clean, some scratches on the table, notched at girdle on each end; unset stone. (Case 24, No. 24, part.)

Oval with prominent step-cut pavilion and a few facets around the large

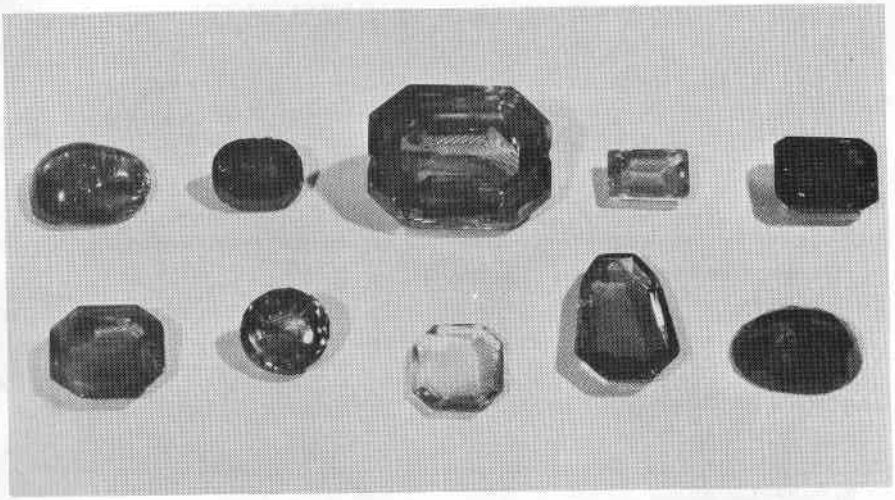

Figure 13

Ten blue sapphires. Left to right, top row: 24.48, 16.41, 10.42, 28.90, 30.41 carats. Left to right, lower row: 36.80, 17.61, 141.91, 9.79, 25.60 carats.

table, 34.14 x 27.32 x 11.54mm, 119.04 carats; yellow, large feather and a few inclusions, irregular notch in girdle; unset stone. (Case 24, No. 46, part.)

Oval cabochon, 29.1 x 24.5 x 5mm, 80 carats (estimated); deep blue, some crystal inclusions and feathers; set in gold-and-diamond brooch with a gold-and-diamond ornament attached to upper surface. (Case 10, No. 75.)

Oval brilliant cut, 30.0 x 23.2 mm, 75 carats (estimated); Kashmir blue, some small crystals and a veil; scabbard of Imperial Sword. (Case 30, No. 48.)

Oval cabochon, 27 x 15 mm, 35 carats (estimated); medium blue, some feathers and inclusions; center stone in a bracelet. (Case 23, No. 19.)

Octagonal, square step cut, pavilion exposed, 18mm, 35 carats (estimated); dark blue, a beautiful stone; Terrestrial Globe, on east coast of Africa, latitude 10 to 20° south. (Case 37.)

Irregular, step cut, pavilion exposed, 19 x 17mm, 30 carats (estimated); dark blue, a few inclusions, a beautiful stone; Terrestrial Globe, central Africa, latitude about 6° north. (Case 37.)

Round, step cut, pavilion exposed, 18 mm, 30 carats (estimated); Kashmir blue, clean, some scratches; tip of scabbard in Imperial Sword. (Case 30, No. 48.)

Step-cut drop *(Figure 13),* 27.77 x 18.05 x 5.36 mm, 28.90 carats; deep blue, strongly dichroic, very clean, surface scratches; unset stone. (Case 24, No. 24, part.)

Rectangular, mixed cut *(Figure 13),* 18.2 x 14.6 x 9.85 mm, 25.60 carats; deep blue, strongly dichroic, some color zoning and feathers; unset stone. (Case 24, No. 24, part.)

Admittedly our study was restricted to the more important gemstones of the collection. This report, of necessity, is restricted yet further to the more important of those studied. However, the data supplied should be sufficient to call attention to the Crown Jewels of Iran, a collection that, despite its previous obscurity, is nonetheless the world's finest.

Footnotes

1. Meen, V. B. & Tushingham, A.D.: *Crown Jewels of Iran,* University of Toronto Press, 1968.
2. Gemstones over 285 carats exceeded the capabilities of my gem balance and had to be weighed on grocer's scales.
3. Meen, V. B., Tushingham, A. D. & Waite, G. G.: *The Darya-i Nur Diamond and the Tavernier Great Table.* Lapidary Journal, Vol. XXI, No. 8, pp. 1000 ff., 1967.
4. Waite, G. G.: *Sixty-two Unusual & Historical Diamond Cuts to be Seen Among the Crown Jewels of Iran.* Lapidary Journal, Vol. XXII, No. 1, pp. 25 ff., 1968.
5. Feuvrier, Docteur: *Trois ans à la cour de Perse.* Paris: F. Juven, 1900, p. 209.
6. Inscriptions on 270-carat red spinel:
   (a) Jahangir Shah 1028 (son of) Akbar Shah (A.D. 1618-19).
   (b) Sahib Qiran Sani 1038 (A.D. 1628-29).
   (c) Alamgir Shah 1076 (i.e., Aurangzeb, A.D. 1665-66).
   (d) Muhammad Farrukh-siyar Padshah Ghazi.
   (e) Bazuband Shahshahan Sultan Nadir Sahib Qiran muntakhab jawhir khana Hindustan 1125 ("Armlet of the King of Kings, the Sultan Nadir, Lord of the Conjunction, a selected (piece from the) Jewel-Treasury of Hindustan A.D. 1739-40").
   (f) Al-'izza lillah ("Glory be to God") As-Sultan Sahib Qiran Fath Ali Shah Qajar.
   (g) As-Sultan Nasir ud-Din Qajar.

Developments and Highlights at the Gem Trade Lab in New York

by

Robert Crowningshield

"Fire Jade"

A mystery surrounds a stone that has been offered in mineral magazines as "Fire Jade." Specimens we have examined and that have been X-ray diffracted by the Los Angeles Laboratory have proved to be a rock mixture, mostly opal. Other sources of information indicate that the tiger's-eyelike appearance of the stone is caused by the mineral grunerite, possibly grunerite in opal. In either case, the term "fire opal" would seem to be a misnomer. *Figure 1* shows the typical surface appearance of this material.

Tanzania Garnets

We are indebted to Mr. Jean Naftule of NAFCO, New York City gem dealers, for a series of light-brown to darker orange-brown garnets on which research was conducted to determine their nature. The stones represent a cross-section of garnets recently mined in Tanzania and occasionally presented in the trade as spessartite. Students of gemology are well aware that most red to brown to violet garnets are mixtures of the two commonest species: almandite and pyrope. It should come as no surprise, then, to learn that research done at the Los Angeles Laboratory found these stones to be mixtures of spessartite, almandite, pyrope and andradite. This corresponds nicely with work on Amelia, Virginia, spessartites by Sinkankas and Reid and reported in the *Journal of Gemmology* for October, 1966. However, on the Tanzania garnets analyzed, not one specimen contained as much as 50% of any of the component species. In fact, the darkest material contained 39.2% spessartite, 30.5%

pyrope, 27.8% almandite and 2.4% andradite, whereas the lightest colored material contained 42% pyrope, 39.1% spessartite, 16.5% almandite and 1.5% andradite.

Sinkankas uses the term *pyralspite* to cover such garnet mixtures. Possibly the term garnet alone should be used, since, by normal gem-testing methods, it would be impossible to determine which molecule is present in the greatest quantity. And, even if this is determined, one is faced with calling a light-brown stone pyrope, because a few more percent of that molecule is present, yet the color is far from that associated with that garnet.

There is evidence that two nearly identically colored garnets from the Tanzania locality may differ as to which garnet is present in the greatest quantity, thus making it difficult without destruction of a disputed stone to settle arguments in terminology. Another answer may lie in the direction of choosing a name for these garnets, much as the term rhodolite was chosen for the violet-colored almandite-pyrope familiar to all.

Figure 2

Figure 1

Other Tanzania Minerals

We also wish to acknowledge with thanks the gift of several other Tanzania mineral specimens from Mr. Naftule. These include chrome-vanadium tourmaline, chrome-bearing grossularite, stibiotantalite and manganotantalite.

New Diamond Substitutes?

We have been impressed in recent months with the possibilities offered by two rare-earth laboratory crystals for diamond substitutes. One is colorless YAG (yttrium-aluminum garnet). With a reported refractive index of 1.833, a dispersion of .024, and a hardness slightly in excess of 8, stones cut by staff gemologist and lapidary Jerry Call have been most impressive.

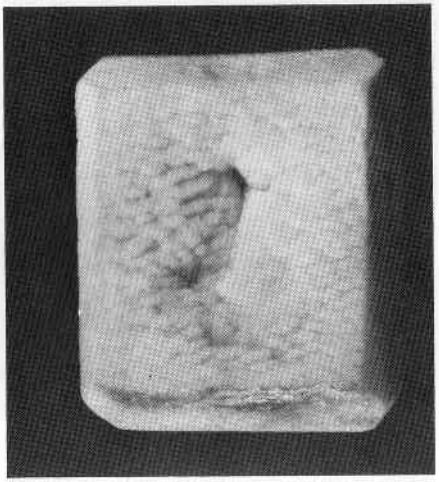

Figure 3

Another material shown to us is yttrium oxide; like YAG, it is cubic. However, with the reported R.I. of 1.92 and a dispersion of .050 (diamond is .044), the colorless stones are striking. Slightly softer than YAG (7½ vs. 8+), it nonetheless takes a high polish and is a very promising diamond substitute.

Poured Marble

We are indebted to Graduate Richard Geurringue for a lovely cameo *(Figure 2)* that proved to be something we had read about but never seen: poured marble. All tests that could be conducted — R.I., birefringence, acid effervescence and S.G. — indicated a calcium carbonate midway between calcite and aragonite. However, magnification revealed a mosaic texture and the back looked "poured" *(Figure 3)*. We have been unable to discover the process by which ground-up marble was compressed and poured in this manner.

Damaged Diamond Die

Our thanks to Mr. Fred Montezinos, New York City diamond dealer, for a gift of a wire-drawing diamond die. In *Figure 4* one can see the cleavage that developed that unfitted the stone for use after many months.

Emerald Imitations

Beryl-and-beryl triplets in excellent imitation of emerald have now become even more convincing. Some seen lately appear red under a color filter.

Unusual Inclusions

A most unusual inclusion in a large pink diamond, photographed under 45x, is pictured in *Figure 5*. It appears to be a fingerprint similar to that seen in sapphire. Another unusual inclusion in diamond is shown in *Figure 6*. The stone was a fancy yellow-brown and the inclusion, or color zoning, was deeper brown.

Damaged Diamond

Figure 7 illustrates a diamond worn for approximately a year as an engagement ring. It was submitted for suggestions as to why it should show so much damage in such a short time. It

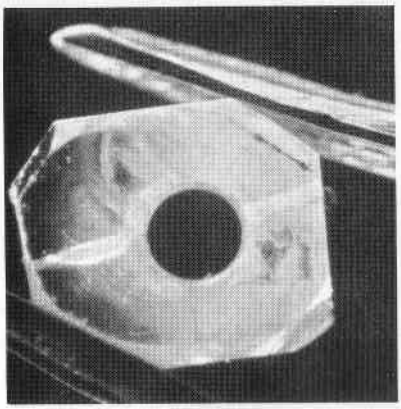

Figure 4

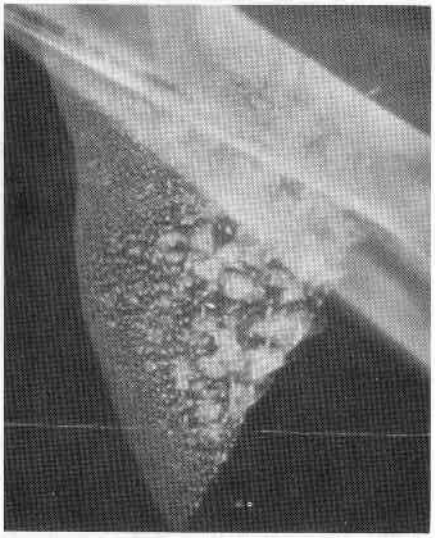

Figure 5

was our impression that the combination of a very thin girdle, plus main crown angles of 26°!, contributed to a very vulnerable situation. Such badly spread diamonds not only offer very little fire but are more subject to breakage. *Figure 8* compares the diamond with an ideal 34½°-crown stone.

Damaged Zoisite

A communication from Graduate John Furbach, Amarillo, Texas, described a round blue zoisite that broke following the use of ultrasonic in final preparation for an elaborate "ballerina" ring. This is the first we have heard of such difficulty, and inquiries in the trade and our own experience using ultrasonic on similar stones mounted by Lab staff members indicated no such trouble. However, it is well to add this information to our growing file on zoisite and hope it is a freak occurrence. We have heard of a fine stone that cracked when heat was applied to remove a setting from jeweler's shellac.

Cherrystone-Clam Pearl

Figure 9 illustrates an attractive cherrystone-clam pearl set in a diamond-and-platinum pin by Graduate Gordon Uhl, Dormont, Pennsylvania, for a musical client whose son discovered the pearl while enjoying clams on the half shell.

Zircons for Heat Treatment

We are indebted to Mr. Walter Arnstein, New York City gem dealer, for a selection of Thailand zircons for use in heat-treating experiments. One faded-blue zicron became a brilliant orange after heating at 1200°F. for two hours. Thus far, it has retained this attractive color.

Two Gifts

We are again indebted to student Marvin Zuckerman, Hempstead, Long Island, for a gift of stones. This time it was a selection of polished pink tourmalines. Also, through the good offices

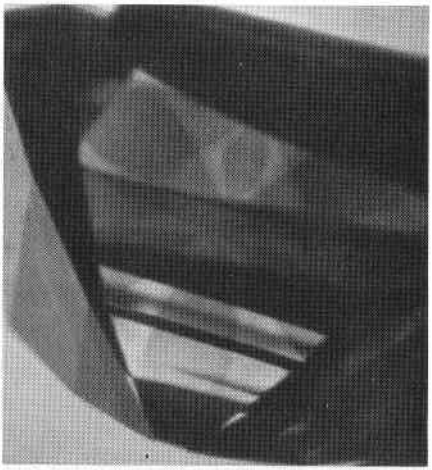

Figure 6

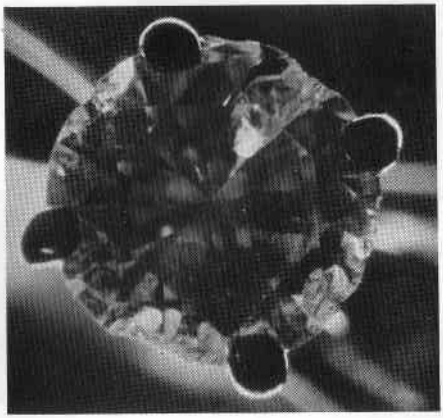

Figure 7

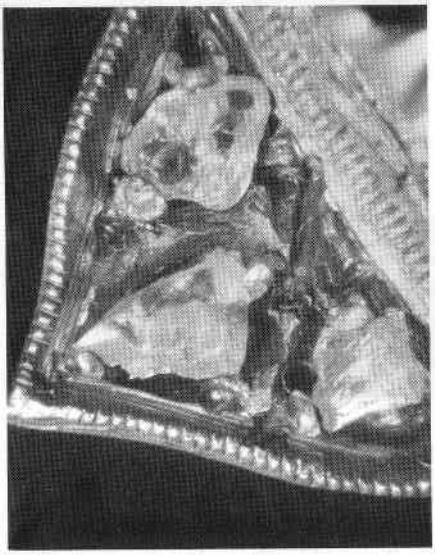

Figure 10

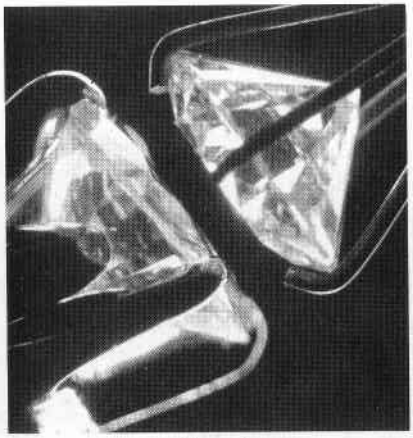

Figure 8

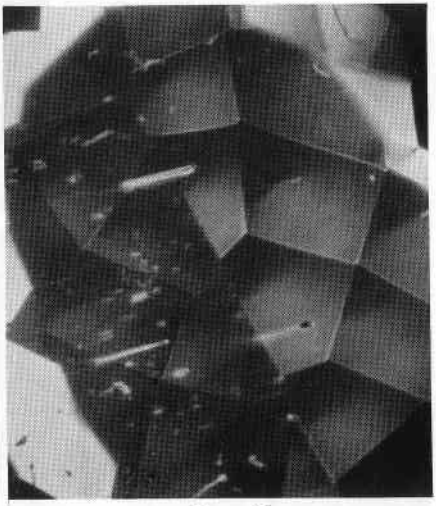

Figure 11

Figure 9

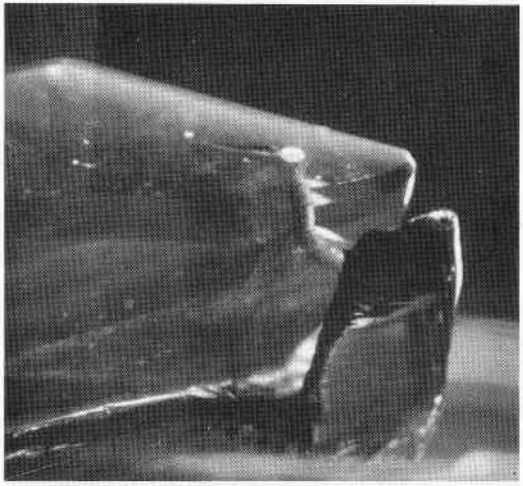

Figure 12

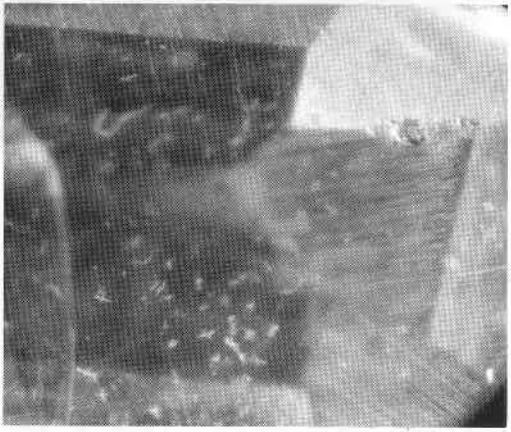

Figure 13

Figure 14

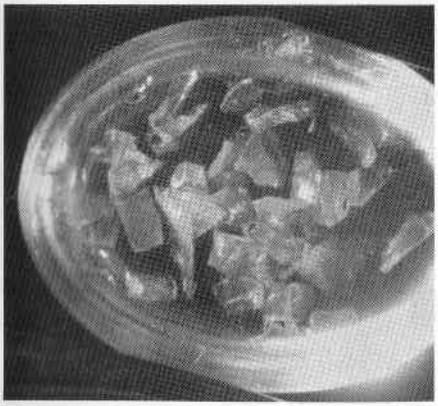

Figure 15

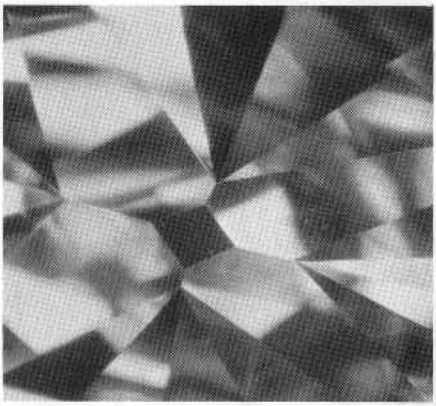

Figure 16

of Graduate Thana Rich we received from Mr. Lawrence Ford, antique-jewelry specialist from New York, a fine selection of many stones for use in student study sets.

True Diamond Chips

Figure 10 shows a portion of a European-made brooch containing true chips of diamond—a rarity in our experience—since the term "diamond chips" is more often than not used to refer to single- or rose-cut stones, rather than to unfaceted stones.

Inclusion Oddities

Figure 11 illustrates unusual inclusions in a fine-quality natural emerald. Several of the oddities were reminescent of torpedos or shooting stars.

Platinum in Hydrothermal Emerald

A small wire in one end of her marquise-shaped emerald caused a client to seek an identification. *Figure 12* shows what we assumed to be a bit of platinum wire in a hydrothermal synthetic emerald sold as a natural stone.

Needles in Glass

Needles that can be seen faintly to cross at angles were present in a green-glass stone *(Figure 13).* It is possible for glass to have very well-developed needles, as *Figure 14* shows. The stone is a tourmaline-green specimen from our collection. Needless to say, stones such as this are very confusing to a beginning gemologist.

Opal Imitation

Figure 15 shows a product that may or may not be appearing on the market. It is a hollow-backed cabochon of rock crystal filled with clear plastic and opal chips.

Unusual Faceting

Figure 16 shows unusual faceting around the culet of a pear-shaped diamond with only a 43% depth percentage.

Developments and Highlights at the Gem Trade Lab in Los Angeles

by

Richard T. Liddicoat

Synthetics Examined

During the period since the last report from the Laboratory, we have examined a large number of synthetic materials, some of them new to us. *Figures 1* and *1a* show square plate-like negative crystals in synthetic periclase which was marketed under the name of Lavernite. Periclase is a magnesium oxide that crystallizes in the isometric or cubic crystal system. Its habit is the cube. This was colorless, with a hardness of 5, a refractive index of 1.736; and a specific gravity close to 3.6. We also examined synthetic greenockite and various colors of synthetic scheelite. One of the other synthetics of interest that we examined was YAG, the synthetic yttrium aluminum oxide with a garnet structure, and which is therefore called synthetic garnet by those who make it. The Airtron division of Litton Industries is making YAG, and is planning to put it on the market immediately.

We understand that the colors in which it will be available will be colorless, green, and probably a rather intense yellow. The green material is unlike any other gem material in that light transmitted is a very strong red, much stronger than the early synthetic emeralds made hydrothermally by Linde. The green stones show a rather strong curved striae, with a superimposed irregular structure which may be seen at right angles to the curved striae.

In *Figure 2,* the curved striae runs from left to right and lines that appear almost like twinning lines or glide lines appear at right angles, running from approximately 11 to 5 o'clock. We do not know the cause of the latter lines.

In *Figure 3,* a slightly different effect

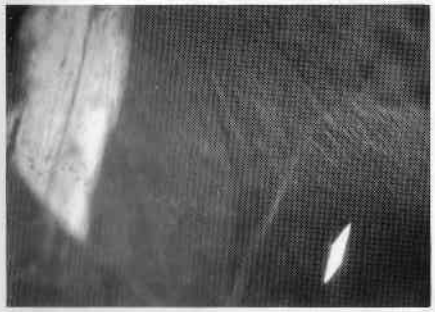

Figure 1

Figure 1a

is noted, the curved striae run from about 10 to 4 and there is another set of lines very similar to curved striae that run approximately from 9 to 3. The curved striae in the green YAG appear to be circular rather than the fairly short arcs of a circle with a long radius with which we are familiar in the flame-fusion synthetic ruby. Inclusions, when present, appear to be gas bubbles, but there are also elongated gas inclusions to be seen, as in *Figure 4*. In the colorless form, YAG is a fairly effective diamond substitute; it has a 1.833 refractive index, and a hardness of 8 - 8½.

As examples of his product, we were given two small crystals by a mineralogist and chemist who is making synthetic phenakite, a beryllium silicate. It has refractive indices of 1.654 and 1.670; it is hexagonal, has a hardness of 7½, and a specific gravity of 3.0. The two crystals are pictured in *Figure 5*. His plans call for yet another synthetic emerald.

Changes in Synthetic Emerald

Recently, in New York and in Los Angeles both, we have encountered synthetic emeralds with almost no fluorescence and with refractive indices of 1.568 and 1.572 or 3. Fortunately, these synthetic emeralds have a number of wisplike flux inclusions that have always characterized flux-fusion synthetic emeralds. The inclusions are shown in *Figure 6*. The fluorescence has undoubtedly been dampened by the use of iron. In addition to the usual chromium spectrum of emerald, an iron line is visible in the upper violet at about 4300 Å. Between studies of these unusual synthetic emeralds just described, we had a natural emerald for identification with indices of 1.565 - 1.570 that was so

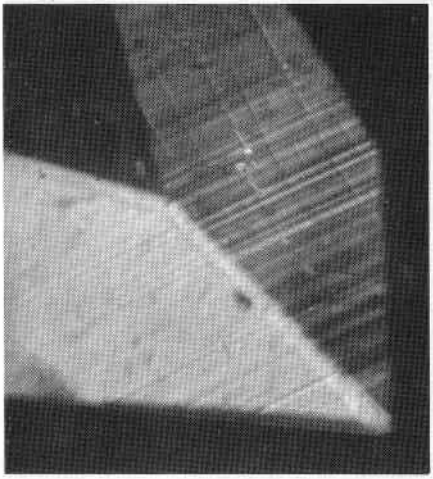

Figure 2

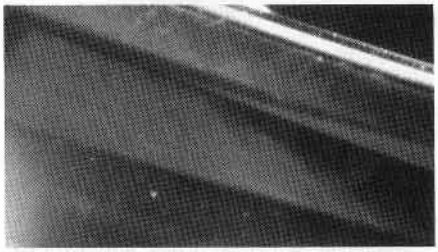

Figure 3

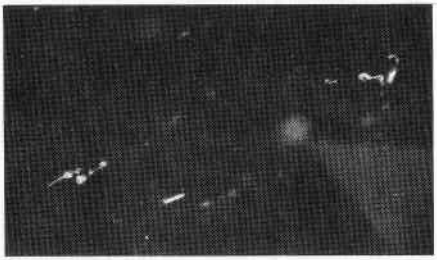

Figure 4

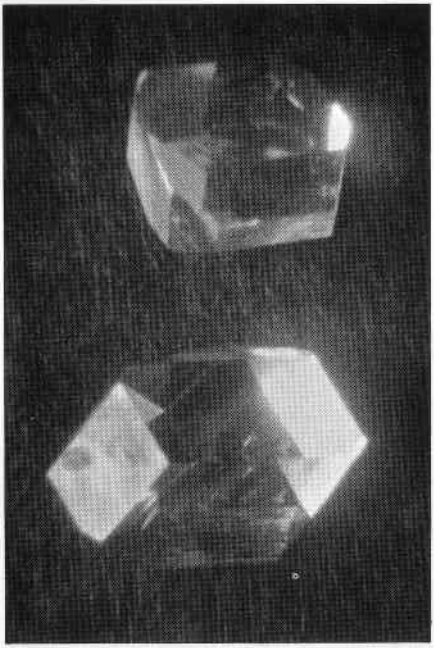

Figure 5

light that it floated in an emerald liquid set at 2.67. The presence of a pyrite crystal in the typical pyritohedron habit, plus three-phase inclusions, showed the stone to be natural, even though it fluoresced rather strongly.

Montana Sapphire Doublets

Much of the product of the Yogo Gulch Sapphire Mine is very thin. The crystals are so thin that only very small stones can be cut from much of the rough. To take advantage of material of this sort, someone recently has been making doublets, using two parts of natural Montana Sapphire. One of them with an imperfect bond is shown in *Figure 7*, where a dendritic pattern is seen in the cement. Most of these are quite attractive, and appear to be effectively bonded.

Beryl Triplet

Figures 8 and *9* show two phase inclusions in the bottom half of a triplet, the top half of which was beryl. The bottom was concealed in the mounting, so we could not identify it, but in the process of examination under the microscope, immiscible liquids

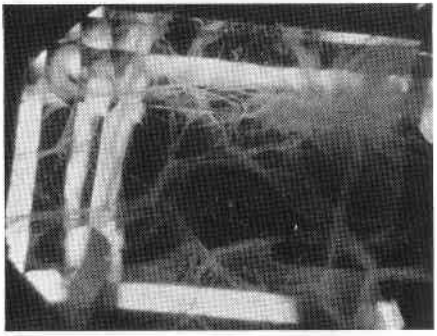

Figure 6

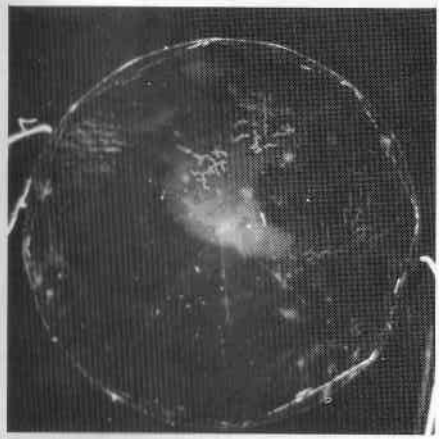

Figure 7

showed up in bubbles. After the light in the instrument had been on for just a moment, the line denoting the second liquid disappeared, as shown in *Figure 9*.

Happy Gift

We received for identification a large colorless fragment polished on one side which appeared to be topaz, (see *Figure 10)*. It weighed 10 and 3/8 oz. or about 1470 carats. Upon testing, it proved to be not topaz, but phenakite — by far the largest ever reported to our knowledge. We feel that this will soon be in a museum.

The story surrounding it is quite interesting. The present owner had been buying colored stones in Ceylon. He had completed his purchases when the dealer literally tossed to him this colorless stone, saying, "Take this along as a gift."

At the time, both dealer and purchaser felt that the stone was topaz. That was several years ago. Recently, the jeweler employed a gemologist, who in checking over some stones in his employer's stock questioned the identification of the stone as topaz, and sent it to the Institute for checking, and

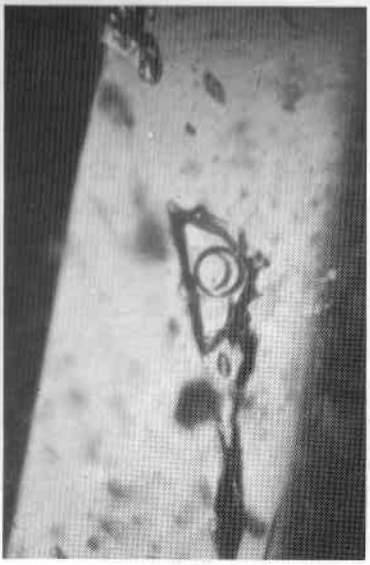

Figure 8

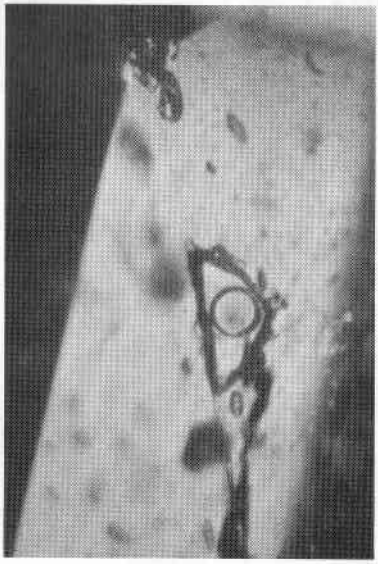

Figure 9

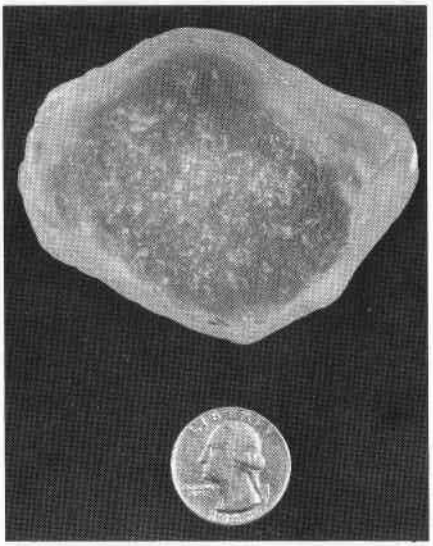

Figure 10

confirmation of his identification as phenakite. The last quoted price we heard was $25,000.

Dirty Triplets

We received an opal and glass triplet for identification, and were rather surprised to see the amount of debris that had been left in the cement layer. One piece seen as a dark line at the upper right, was the bristle from a brush, probably one used to apply the cement. On the upper left hand side is seen a sliver of wood *(see Figure 11)*. The conditions under which the work was being done was certainly not conducive to producing undetectable assembled stones.

A Flood of Unusual Opals

We received a large opal of the type usually called Mexican Opal, but this had an especially interesting pattern.

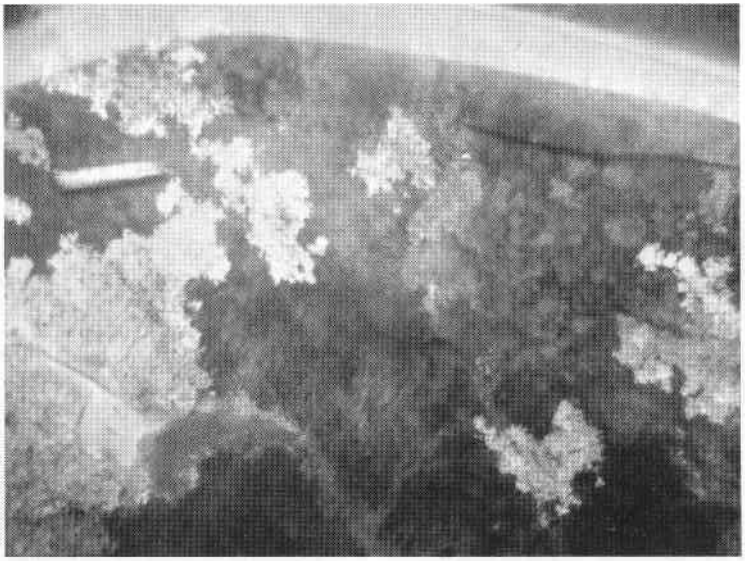

Figure 11

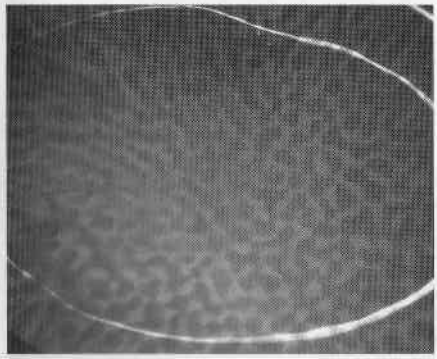

Figure 12

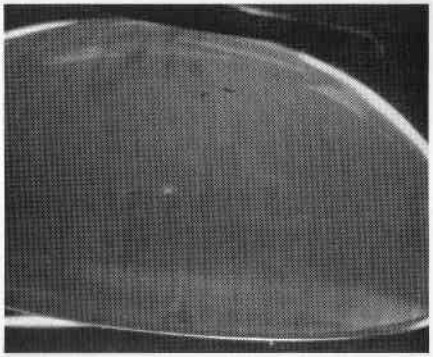

Figure 13

It appeared as if the opal (with a nice play of color) must have replaced an organic material. The view toward the base of the cabochon resembled somewhat the odd pattern seen in reflected light on the surface of the conch pearls, see *Figure 12.* From the side, a lined effect showed that the dark patches extended vertically through the stone, *(see Figure 13).*

Another unusual opal was a white opal, but it appeared to have cylindrical tubes of transparent material running from the base to the crown of the cabochon. There was just as much play of color in the tubes (shown in *Figure 14*) as in the milky portions of the opal.

Still another opal (the one shown in *Figure 15*), had a very roiled effect, similar to that seen in hessonite garnet. We had never seen one quite like it.

Another opal showed some very odd inclusions that resembled high altitude weather balloons before they were fully inflated extending in all directions from a crystal inclusion, (shown in *Figure 16*). We were unable to identify the nature of these inclusions, but were intrigued by their unusual appearance.

The strangest inclusion of all was seen in another opal *(Figure 16a).* We encountered what appeared to be nega-

Figure 14

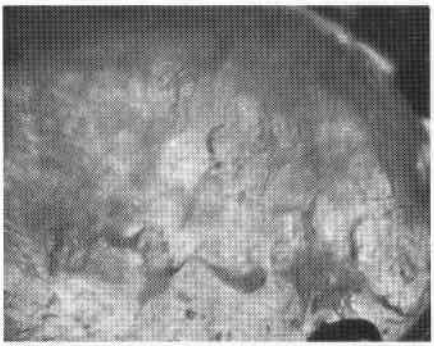

Figure 15

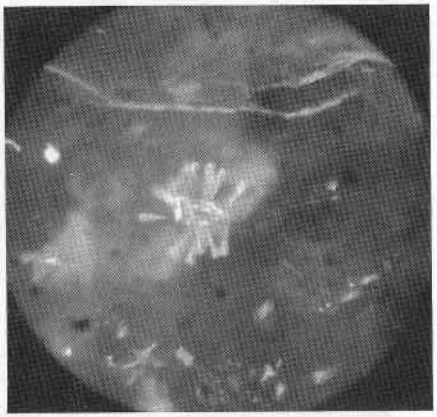

Figure 16

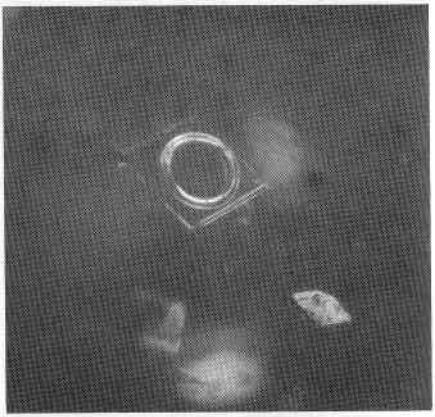

Figure 16a

tive crystals. In an amorphous material, a negative crystal is manifestly impossible, so it is exceedingly puzzling. The only reasonable explanation is that the parallelogram outline with a large gas bubble must have been a thin shell of crystalline material with a liquid and gas two-phase inclusion contained within it.

Iridescent

We were sent an unknown for identification that showed a strong iridescence reminiscent both of laboradorite and opal in appearance. The effect was caused by interference of light in very strong banding caused either by twin ning, or very abrupt compositional changes repeated frequently. In very sharp light, the result was something along the lines of the legs of a star as seen in *Figure 17*. Under more diffused lighting, the appearance was shown better in *Figure 18*. The material turned out to be an andradite garnet.

Gift of Synthetic Emerald

Pierre Gilson, Jr., son of the French ceramics engineer who manufactures Gilson synthetic emeralds was in to visit the Institute. He brought us as a gift, a beautiful cluster of large crystals of his father's product. Some of the

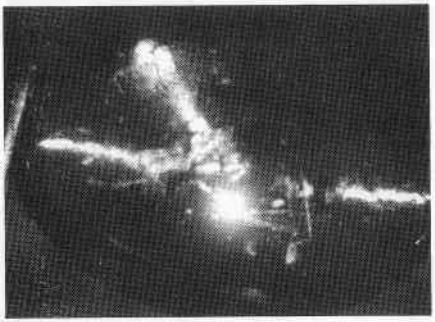

Figure 17

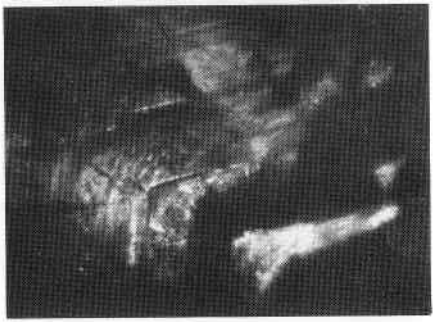

Figure 18

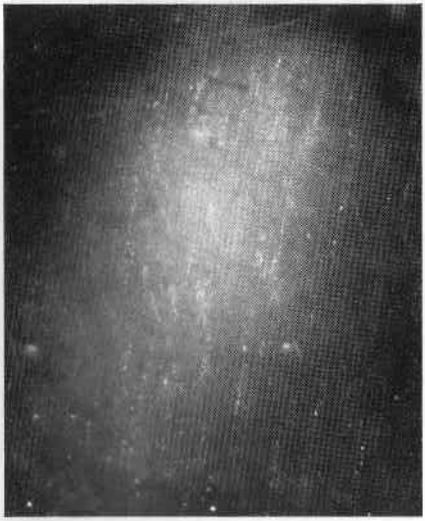

Figure 19

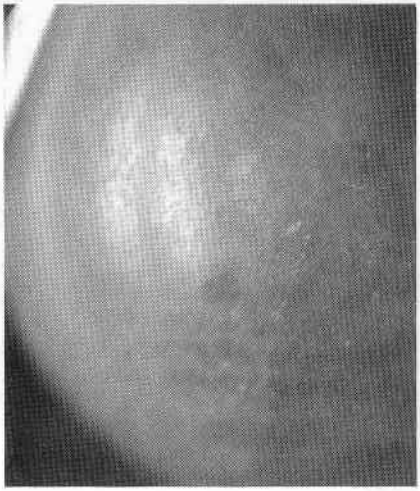

Figure 21

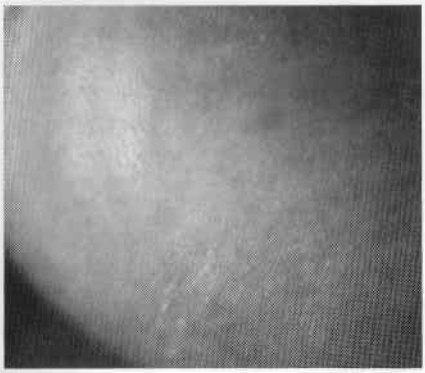

Figure 20

cut stones he had with him from the latest production showed inclusions unlike any we have encountered in earlier products. They appeared to be minute flux inclusions arranged in the pattern shown in *Figure 19*. The color was a beautiful, slightly yellowish green, and the stones had normal flux-fusion emerald properties, namely 1.561 and 1.564, and a specific gravity of about 2.66. They were rather strongly fluorescent in a deep red color. There were wisps of flux inclusions in some of the stones, but others were devoid thereof.

Vegetable Ivory

Recently, we have had occasion to encounter a few necklaces made of beads that are supposed to have been some sort of vegetable ivory. We identified the beads as shown under magnification in *Figures 20* and *21* as from the nut of the doum palm. The specific gravity is approximately 1.385, the refractive index about 1.54, and the odor given off to the hot point is approximately similar to that of burnt sugar. *Figure 20* shows the lined effect on the sides of the bead, and *Figure 21* the little openings where the tubes making the lined appearance on the sides reach the top surface.

Acknowledgements

We wish to express our sincere thanks for the following gifts:

To **George Harvey,** Denver, Colorado, for one faceted yellow-glass stone.

To **Ben Gordon,** Gordon's Jewelry Co., Houston, Texas, for assorted stones for our Gem Identification classes.

To **John Furbach,** Jonz Jewelers, Amarillo, Texas, for rough apatite specimens and assorted stones for student study sets.

To **Hugh Francis,** F. W. Francis, Ltd., Victoria, BC, Canada, for assorted stones for student use.

To **Lloyd Stanley,** Stanley Jewelers, N. Little Rock, Arkansas, for a number of stones for use in student-practice sets.

To **John Tobias,** Montreal, Quebec, Canada, for rough specimens of ivory, ruby, beryl and marble.

To **Sallie Morton,** Morton's Jewelers, San Jose, California, for assorted stones for student study sets.

To **Birnies Jewelry,** La Grande, Oregon, for assorted stones to be used in Gem Identification classes.

To **Ben Hammond,** B. M. Hammond, Inc., San Antonio, Texas, for assorted stones for student-identification sets.

To **Pierre Gilson,** Pas de Calais, France, for a 166-carat synthetic-emerald crystal group.

To **C. D. Parsons,** Burbank, California, for specimens of phosphophyllite, scheelite, siderite and rhodonite. They will be a welcome addition to display cases for study purposes.

To **Robert Nordbye,** student, for a gift of rough black star sapphire material.

To **Gordon (Joe) Bailey,** for a beautiful chalcanthite blue barite spodumene, epidote and tourmaline crystals.

* * * * *

Kashan Flux Grown Rubies

The Ardon Associates flux-fusion synthetic rubies are going to be marketed by Designers Ltd. of Houston, Texas. This is a firm operated by GIA student Robert Sandler. They will be marketed as "Rubies Grown by Kashan." They are characterized by many dot-and-dash flux inclusions, as shown in *Figure 19*, together with the wisp-like or veillike inclusions that are typical of flux-fusion products, such as synthetic emeralds. Their properties are almost identical to those of natural stones, except in transparency to short-wave ultraviolet light, and the difference of inclusions.

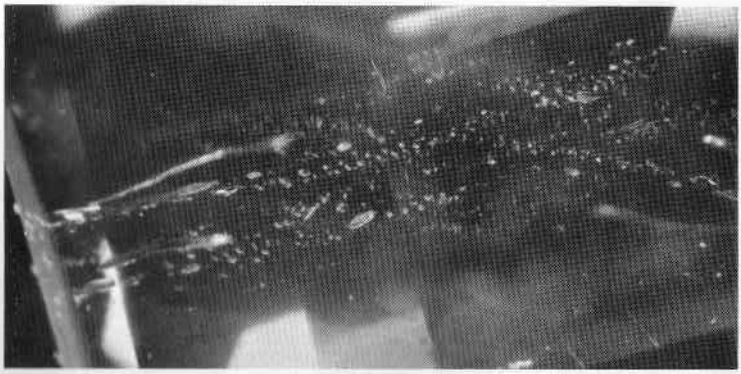

Figure 1
Typical dotted or dashed lines of small flux inclusions, about (20x).

Figure 2
Even smaller dashed lines (45x).

Figure 3
A typical coarse flux inclusion (45x).

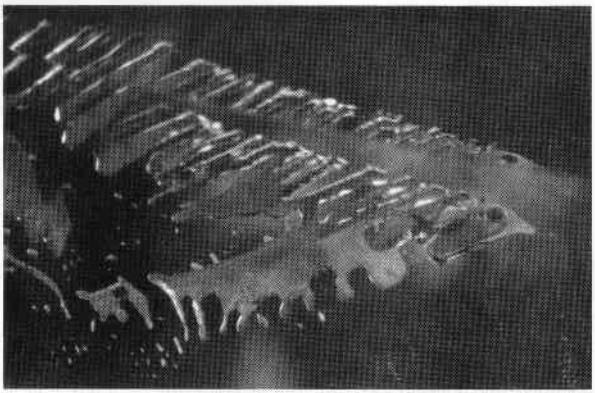

Figure 4
Dashed lines of coarse flux (45x).

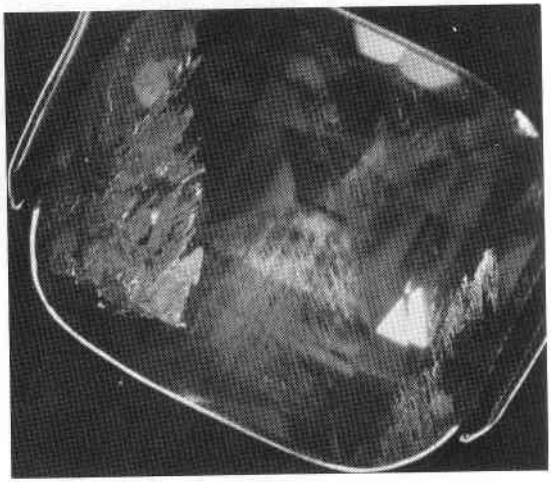

Figure 5
Most of the types of inclusions seen under low magnification.

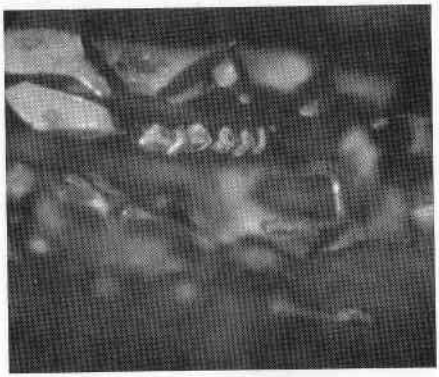

Figure 6
Negative crystals — flux filled (15x).

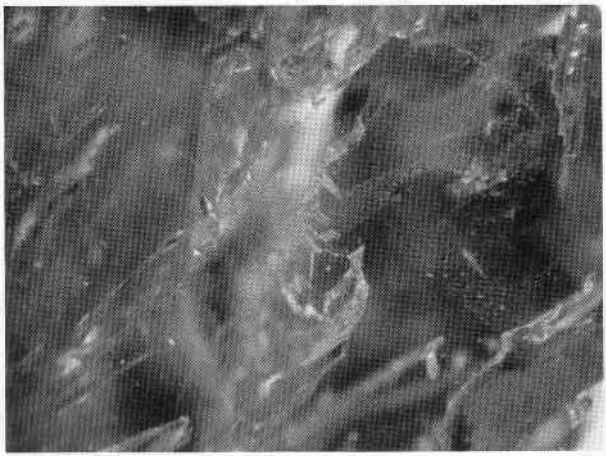

Figure 7
Veils of flux (45x).

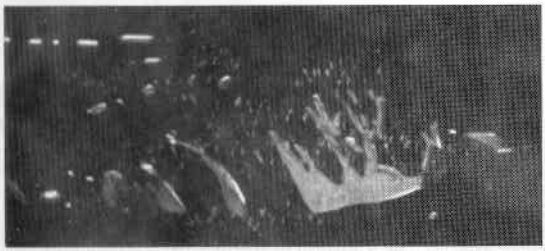

Figure 8
Flux inclusions (45x).

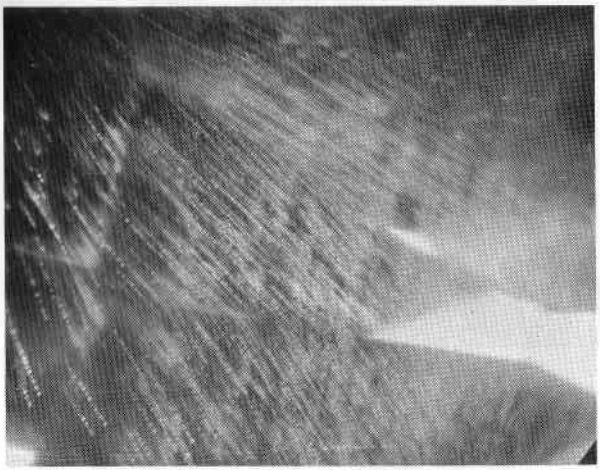

Figure 9
Typical dashed lines (25x).

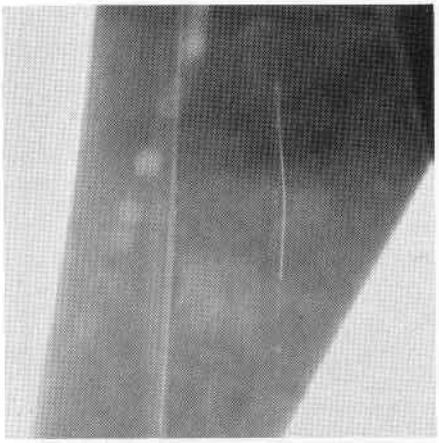

Figure 10
A needlelike inclusion (60x).

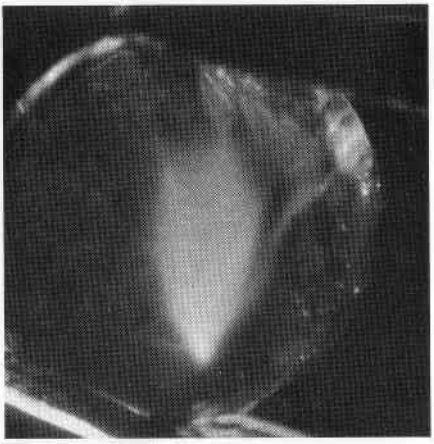

Figure 11
An area of white fluorescence under shortwave ultraviolet as seen in about one of five examples.

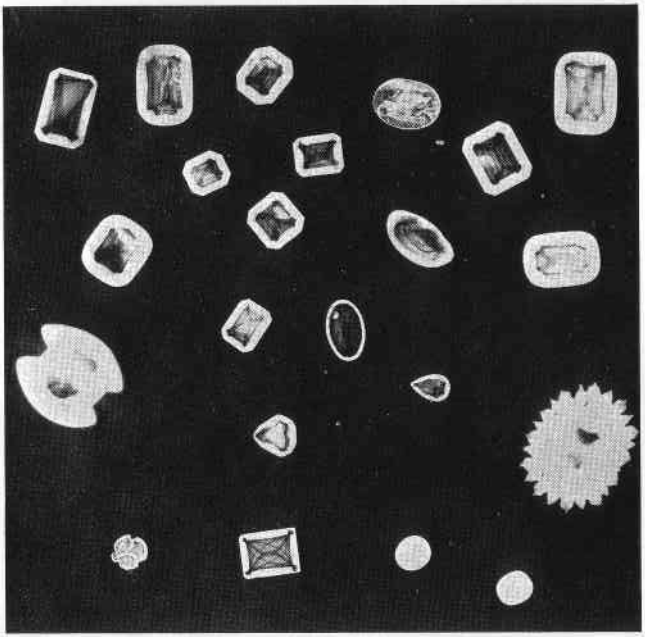

Figure 12
Eighteen Kashan-grown rubies including two in rings are at the top of this 4-second exposure to short wave ultraviolet. The three rounded stones at the bottom are natural and the rectangular one is a flame-fusion synthetic.

Book Reviews

THE MINERAL KINGDOM, by Paul E. Desautels. Published by Madison Square Press, a division of Grosset & Dunlap, Inc., New York City, 1968. 252 pages. Clothbond. 8½ x 11½" format. Illustrated with black-and-white and more than 140 color photographs. Price: $14.95.

This is a fascinating book written by a well-known mineralogist, Paul E. Desautels, Supervisor of the Department of Mineralogy, Smithsonian Institution. Its style of presentation makes it equally appealing to the mineralogist and geologist and to the gemologist, hobbyist and rockhound.

Essentially, the author tells, in nontechnical and attention-arresting style, how minerals are formed, found and used. His consideration of the mineral kingdom ranges from the history, lore and romance of the ancient world to the marvels of present-day earth science, in ten fascinating chapters. The section on gemstones is of particular interest to the gemologist, gem fancier and collector.

The book contains certain basic facts about mineralogy and geology, so that the reader can more easily understand the exploitation for, and the acquistion of, minerals for industrial use, beauty, personal adornment and value. Also explained in an enlightening manner is how the social, political and economic nature of our civilization is affected by the kingdom of minerals. A number of classic minerals and gems have been chosen for discussion, describing the miner and mining methods and comparing the historical differences of the sites selected.

The black-and-white illustrated material, including the reproduction of some interesting old engravings, is excellent, but the color photography is truly superb and worth the price of the book itself. Many of the minerals and gems photographed in color belong to the Smithsonian's unparalleled collection, and represent some of the world's most remarkable specimens. The double-page color introduction to each of the chapters is a splendid example of creative and imaginative book production. Lee Boltin's color photography has won him critical acclaim among experts.

In the author's foreword, Desautels states: "Whatever man's contact with the mineral kingdom — for his science, his industry or his cultural pursuits — the hope is that it will have been touched on in this book to a stimulating degree." He has succeeded in every respect.

PRECIOUS STONES, by Dr. Max Bauer. Published by Charles E. Tuttle Co., Rutland, Vermont, 1969. 647 pages. Clothbound. 8½

x 11" format. Illustrated with 95 black-and-white photographs and line drawings and 20 color plates. Price: $17.50.

This monumental work, which was translated from the German in 1904 by L. J. Spencer, Ph.D., is now offered to gem lovers and connoisseurs in a popular-priced reprint edition. Called *Edelsteinkunde,* the German name for *Precious Stones,* it has for so long been a rarity on the book market that original copies of the English edition have been selling for $150 or more. It is the most all-encompassing and highly detailed gemological text in the English language.

Part I is devoted to a consideration of the mineral characteristics that are of importance to the specialist in gems, a general consideration of the occurrence of gem materials, and information relating to the application and working of gemstones.

Part II contains a detailed account of every mineral that has been used for ornamental purposes, with special emphasis on the more important gemstones.

Part III stresses the physical and optical properties to be relied on in identifying gems and distinguishing them from their substitutes.

The new edition contains 20 color plates, with new appendices on synthetic gems and cultured pearl. It is a large (5 pounds, 7 ounces), handsome volume that has immediate appeal to all those connected with the gem world.

CROWN JEWELS OF IRAN, by V. B. Meen, Ph. D., and A. D. Tushingham, Ph.D. Published by University of Toronto Press, Toronto, Ontario, Canada, 1968. 159 pages. Clothbound. 9¼ x 14¼" format. Illustrated with black-and-white and 83 full-color photographs. Price: $20.

Until a few years ago, the dazzling, breathtaking collection of gemstones and jewelry that comprises the Crown Jewels of Iran were little more than a legend. Then, in 1960, the most important pieces were put on exhibition at the Bank Markazi (Central Bank) in Tehran and, in 1965, V. B. Meen and A. D. Tushingham of the Royal Ontario Museum, Toronto, Canada, were privileged to make a thorough scientific study of the fabulous treasures. They photographed, measured and weighed for approximately three months, always overseen by five of the nine-man Supervisory Board of the Collection. This magnificent book represents the culmination of their paintaking, exacting work.

The authors describe a profusion of gems and gem-encrusted objects without equal in size, quality and quantity. The collection includes half of the world's known cut diamonds exceeding 100 carats, an enormous 500-carat spinel, an unusual array of rubies, and scores of emeralds two inches or more in diameter. Of the 35 large showcases comprising the exhibit, two are devoted to emeralds, the largest display of this gem known. Many of the gems have only been rumored in the past, and others were completely unknown to gemologists.

Other pieces described and illustrated in color include the Pahlavi Crown, containing 3388 diamonds weighing 1144 carats, five emeralds weighing 199 carats, two sapphires weighing 19 carats, and 369 pearls. The Gold Girdle is made of delicately woven gold, and the clasp is 175-carat emerald surrounded by 205 diamonds. A globe of the world, two feet in diameter, called the Globe of Jewels, is made of solid gold and thickly encrusted with more than 5100 gemstones that weigh a total of 18,200 carats. One of the great historic diamonds of the world, the 186-carat *Darya-i-Nur,* is also the most famous gem in Iran. The Nadir Throne consists of gold and enamel encrusted with 26,733 rubies, sapphires, diamonds, emeralds and spinels. The 60-carat *Nur-ul-Ain,* which is the central stone in a tiara, is the world's largest recorded rose-pink diamond.

In addition, this astounding collection includes a wide variety of other objects, the majority of which are embellished with gemstones: necklaces, armbands, hat ornaments, brooches, earrings, rings, mirrors, walking sticks, swords, daggers, firearms, gold dishes,

water and wine flasks, tea and coffee cups, snuff and pill boxes, candlesticks and waterpipes.

The setting for the gems — whether an article of jewelry, a royal toy, part of the Royal Regalia, or an object of dinnerware — are remarkable for their artistry and craftsmanship.

Each of the objects illustrated is placed in historical context, and each is also accompanied by gemological data. The story of the Crown Jewels, which were accumulated by conquest, purchase and gift, reflects the nation's past, the societies and personalities for which they were fashioned.

Probably the bulk of the important gems in the collection represent what survives of Nadir Shah's booty taken from Delhi in 1739, although there may be stones with a longer history, now unidentifiable. Of the jewelry and other objects, there is little that can be dated earlier than the time of Fath Ali Shah (1797-1834), that luxury-loving and artistic monarch who created the Regalia and the opulent fixtures of the Qajar dynasty. Of his successors, only Nasir ud-Din Shah, in his long reign (1848-1896), added substantially to the collection and, apparently, renovated some of his ancestor's creations. Since his time, with the exceptions of the crowns, scepter and jewelry created for the Pahlavi dynasty, the collection remains almost static.

The *Crown Jewels of Iran* is a book that will be treasured both for its wealth of information as well as for the sheer beauty of its superb five-color photographs. It deserves a prominent place in the library of every gemologist and gem fancier.

CHINESE CARVED JADES, by S. Howard Hansford. Published by the New York Graphic Society, Ltd., Greenwich, Connecticut, 1968. 277 pages. Clothbound. Illustrated with numerous black-and-white photographs and line drawings and nine color plates. Price: $16.50.

Chinese Carved Jades is a serious, scholarly study of the work of the Chinese jade carver in all ages, and of the designs, purposes and usages of ancient jades.

The author, who is Professor Emeritus of Chinese Art & Archeology in the University of London, wrote *Chinese Jade Carving* in 1950. In this earlier book he stated, "The modest purpose of this study has been to bring together and interpret facts regarding the material and techniques of the Chinese jade carvers, which, it is hoped, will assist the student in his appreciation of the jades and their significance in the history of Chinese civilization. Further study and the scientific arrangement of the great fund of ancient jades that now exists in Europe and America are greatly handicapped by the absence of documentation and the lack of authenticated types from properly controlled excavations."

The present volume attempts to show to what extent these hopes have been fulfilled, the present state of our knowledge and understanding of Chinese jades, and how these have been, and can, be supplemented by deduction from the still meager fund of demonstrable fact.

Professor Hansford's study is based on personal observation, on earlier writings of Chinese and Western scholars, on references to jades in the Chinese Classics, and on the evidence of archeological excavations in China. He sheds new light on many of the perplexing problems in which this subject abounds. In his search of Chinese literature in which he has found references to ancient jades, he has evaluated these critically in the light of recent archeological discoveries, paying particular attention to finds of carved jades reported in Chinese journals and monographs. He considers the impact of historical events on the supply of raw material and the progress of the craft, and seeks explanations for the wide varation in the quantity and quality of the product at different periods. New arguments are advanced for determination of the origin and date of some famous problem pieces.

The book contains illustrations of more than two hundred important and beautiful jade objects from collections and museums in

Europe, America and China. It is unfortunate, however, that some of the illustrations, because of the lack of original prints, had to be reproduced from Chinese publications and are therefore below average in quality. The price of $16.50 seems somewhat high for a book of this modest size.

Chinese Carved Jades should prove enlightening and informative for any serious student of this complex subject.

FINGER-RING LORE, by William Jones, F.S.A. Reissued by Singing-Tree Press, Detroit, Michigan, 1968. Illustrated in black and white. 567 pages, Clothbound. $14.50.

Together with George Frederick Kunz's *Rings for the Finger,* published in 1917, this book ranks as one of the most comprehensive ever written on the subject of rings. It was originally published in 1890.

Jones's detailed study recounts inumerable instances in which rings have figured importantly in literature, having a rich symbolism in religion, folklore, magic, funeral customs, public offices, fashion, astrology and even medicine.

The book discusses the many times that rings have had a material effect on the course of history. That a noble lady squirted the French ambassador to the court of Frederick II with her squirt ring is a matter of record, as is the ambassador's reply with a glass of water. Immediately hushed up, the exchange failed to cause an international incident. Hannibal, Demosthenes and Condorcet are among those who allegedly died by poison rings. A counter-revolution in favor of Mary Queen of Scots was avoided when Sir Robert Melville paid the popular queen homage by a visit and the return of a ring in which she invested considerable talismanic importance. A ring was often considered a seal of international alliance by marriage, as of that between the Duke of Austria and the Princess of Burgandy in 1477.

Jones describes some grotesque and beautiful examples of the imagination and art worked into unusual rings throughout the ages, among them Martin Luther's betrothment band, and an initial ring taken for Shakespeare's.

The three hundred illustrations are very detailed, adding even more interest to an already fascinating literary and historical effort. *Finger-Ring Lore,* now available for the first time in many years at a modest price (compared with much higher prices for original editions), will be welcomed by all those having serious interest in the history and legend of rings.

TURQUOIS DEPOSITS OF NEVADA, by Frank E. Morrissey. Nevada Bureau of Mines Report 17, published by the MacKay School of Mines. University of Nevada, Reno, Nevada, 1968. Illustrated with black-and-white photographs and a large locality map in a back pocket. 30 pages. 8½"x11" format. Softbound. Price: $1.50.

The principal purpose of this report is to record all the information and data pertaining to the locations, history and production of the turquois mines in the State of Nevada. The counties considered are Elko, Clark, Esmeralda, Eureka, Lander, Lyon, Mineral and Nye.

The basis of the report is the accumulated information gathered and compiled by the late Frank Morrissey (a serious collector and cutter of turquois) during his many personal interviews and extensive correspondence with miners, prospectors and property owners, and from data contained in early volumes of *Mineral Resources of the United States,* having produced more than $30 million worth of rough material of all grades in its history. In addition, the State has the distinction of having produced the largest single turquois nodule on record, measuring 31"x17"x7" and weighing an incredible 150 pounds.

This report has been published to preserve historical data on Nevada's turquois deposits. Another important reason for documenting the deposits is that they may serve the ex-

ploration geologist searching for important deposits of metallic ores at greater depths that sometimes appear to be related to the turquois deposits.

The Turquois Deposits of Nevada is a significant contribution to the geology of that state.

THE COMPLETE BOOK OF ROCKS, GEMS & MINERALS, by the staff of Rocks & Minerals *magazine. Published by Peterson Publishing Co., Los Angeles, California, 1968. Illustrated with black-and-white photographs and line drawings and color cover. 192 pages. Softbound. Price: $2.*

This book is intended to fill a void in the otherwise extensive literature of the gem-and-mineral hobby. In spite of excellent technical coverage, there has never been a combination handbook and directory that could serve at once as an introduction for the beginner and a useful source and guide for the experienced.

It is not a textbook, although enough technical information is given to permit readers to make judgments. It is not an instruction book, but enough how-to-do-it information is presented so that the novice can begin gem cutting, jewelry making and mineral collecting without the need for additional information. It tells about the fascination and interest offered by each phase of the hobby, and answers the majority of the numerous questions that newcomers always ask. Particularly helpful is a listing of all the nation's gem-and-mineral clubs and a directory of suppliers and services.

The beginner, especially, should profit from the great amount of varied, simply written information given.

AUSTRALIAN GEMSTONES IN COLOUR, by Nance & Ron Perry, FGAA. Published by A. H. & A. W. Reed, Sydney, Australia, 1968. 112 pages. 7x7" format. Hardbound. Illustrated with black-and-white and 83 four-color photographs. Price: $3.95.

Although this book was written primarily as a gem-locality guide for the Australian reader, it will be of interest to gem lovers everywhere because of its wealth of excellent color plates showing the gemstones for which this Continent is noted. Forty-one different gem materials, in both rough and cut form, are pictured.

The brief commentary accompanying each plate is divided into paragraph headings entitled "finding localities, how to locate, how to test, value and how worked." A complete, up-to-date discussion of the cause of the play of color in opal, based on electron microscopy, is given. The book begins with a brief introduction to the gemstones of Australia and a short chapter on the formation of gems, concluding with tests for identification, an abbreviated table of properties and a brief glossary. Descriptions of the individual gems consumes the major portion of the book.

Mr. and Mrs. Perry are members of the New South Wales branch of the Gemmological Association of Australia and the Sutherland Gemcraft Guild. They have traveled extensively on the Australian mainland, and have covered many thousands of miles doing research into the occurrences of gemstone materials.

This attractive, inexpensive little book should find ready acceptance wherever it is sold.

Correction

In the Winter, 1968-1969, issue of *Gems & Gemology* three errors occurred in the article by Paul W. Johnson entitled, *Common Gems of San Diego Co., California.* The first was on *page 361* after the second paragraph under *Spessartite.* The omitted paragraph reads: "Interesting facts: Spessartite from San Diego Co. is associated with albite, quartz, perthite and black tourmaline. For a long time these garnets were thought to be hessonite, which is a variety of grossularite. Finally, gemological tests, backed up by X-rays, led to the correct designation of spessartite. When fused with sodium carbonate, it gives a bluish-green bead (the test for manganese). This rare garnet exhibits a very pronounced steplike growth on the crystal faces and most crystals have been etched.

"Spessartite commonly has two-phase inclusions with a gas bubble. It also has liquid inclusions that are very irregular in outline, as well as wispy veillike inclusions. What looked like a quartz-crystal inclusion was found in one crystal. Spessartite rarely has angular three-phase inclusions that contain a liquid, gas bubble and a crystal of some unknown mineral.

"A garnet found in the pegmatite dikes just west of Tule Mountain, in the Jacumba area, was found by X-ray examination to be half spessartite and half almandite. This garnet, quite a bit redder than the orange spessartite, occurs on white feldspar and makes very attractive specimens, besides cutting into very colorful gems."

The second error concerns *Figures 8, 9* and *11,* on *pages 368 and 369.* To correspond with the accompanying captions, these photographs should have been turned end for end.

Page 361, after the third paragraph in the right-hand column, a new heading entitled *Spodumene* should begin: "Crystal description: Monoclinic system; prismatic class. In San Diego Co., the crystals are prismatic, often flattened (lathe shaped) and vertical planes striated and furrowed. Spodumene nearly always shows lamellar twinning on the front pinacoid, with the twin plane parallel to their flat sides. Crystals as long as nine feet and 14 inches wide have been found.

"Varieties occurring in San Diego Co.:
Blue spodumene — Light blue
Green spodumene — Light green
Kunzite — Pale to rose-pink, violet, lilac
Triphane — Colorless to yellow

"Occurrence: In San Diego Co., spodumene occurs at Aguanga Mountain, Mesa Grande, Pala and Rincon. Most of the gem material has come from the Pala Chief, Katerina and Vanderburg Mines in the Pala district. The Pala Chief Mine, on Chief Mountain, has been the foremost producer of gem-quality spodumene in the United States."

On *page 361,* under *Tourmaline,* two new sentences have been added, as follows: "Interesting facts: Some of the small, thin, black-looking tourmalines from the Ramona district are actually a beautiful brown when viewed by strong transmitted light. Small, usually less than an inch, radiating groups of pink tourmaline associated with lepidotite, cookite and quartz (that was the last to form) have been found.