



Figure 32. These sapphires were treated by Be diffusion. Shown are a yellow (sample 45035, 1.22 ct) and an orangey red sapphire (sample 45033, 1.54 ct pear shape) that were treated in Thailand, as well as an orange sapphire (sample 48717, 0.86 ct) and ruby (sample 48878, 2.78 ct) that were treated by an unknown source. See table 2 for the chemical analyses of these samples. Photo by Elizabeth Schrader.

recalculated the concentration of Fe and Be in the previous analyses. We also reanalyzed several of the samples we had tested earlier (see table 2). Note that, in a few samples, Ti concentrations are not available because of technical problems with the original analyses. Also, Si concentrations were measured in some of our most recent analyses only.

The recalculated SIMS data indicate that although the concentrations of Fe and Be have changed, the relative relationships between the values remain the same; that is, in those sapphires that show clear color zonation from rim to center, the abundance of Be in the rim is still approximately 10 times greater than in the center. An analysis of the original (not repolished) surface of treated orange sapphire no. 48413 revealed that the Be concentration was as high as 99 parts per million (ppm). In some samples, Be had diffused through the entire crystal, so no color zoning was observed. We also conducted additional before-and-after experiments (samples 45493–45494) for which, as done previously for samples 45002 and 45031, we had an untreated natural pink sapphire from Madagascar sawn in half, and then had one half treated in Thailand using the same method as for the other treated sapphires. In both sets of samples, the treated halves showed a greater Be concentration than the untreated halves. Compared to the other elements analyzed, the Be concentrations showed the largest and most consistent changes caused by the treatment. The much smaller variations in the other elements could be due to chemical heterogeneity within the samples on a micrometer scale, the high-temperature diffusion process itself, and/or surface contamination introduced in the sample preparation for analysis.

Recent experiments have demonstrated that diffusion of about 10 ppm Be could create strong coloration in very pure originally colorless synthetic corundum (J. L. Emmett, pers. comm., 2002). We have also seen that the lattice diffusion of Be may not necessarily lead to color change in all natural sapphires. For example, a significant concentration of Be (11 ppm) was detected at the rim of one pink sapphire (sample 45082) that showed no apparent change in color after the treatment. In addition, as reported earlier, high concentrations of Be (recalculated to 73–113 ppm) were detected in a crucible we obtained in Thailand that had been used for the treatment.

The Be concentrations in natural, untreated corundum samples that we have analyzed were typically below 1.0 ppm. In most cases, diffusion of trace amounts of Be into the lattice of a corundum sample at high temperature significantly changed its color appearance. To date, we have seen end products that are yellow, orange, orangey red, or even red, depending on the properties of the original corundum and the conditions of the treatment.

On the basis of all these data and observations, we believe that our previously published findings and conclusions about the importance of Be diffusion in this new sapphire treatment process continue to be valid.

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**Orange topaz with synthetic hematite coating.** Recently, the SSEF Swiss Gemmological Institute received for testing two bright orange stones that were represented as topaz. A 6.97 ct stone was donated by Peter Groenenboom of the Amsterdams Edelsteen Laboratorium in Arnhem (Netherlands), and a 2.95 ct topaz (figure 33) was submitted by another client; both parties reported that such stones have been offered recently in Nigeria. The following gemological properties, obtained on both stones, confirmed that they were topaz: biaxial, R.I.—1.610–1.619, birefringence—0.009, S.G.—3.53, and inert to long- and short-wave UV radiation. However, their bright orange color, which is comparable to spessartine garnet, is unusual for topaz.

Microscopic examination of both stones revealed a bluish green iridescence on the pavilion facets. Careful inspection using brightfield illumination also showed small, colorless chips along the pavilion facet edges (figure 34) and some colorless scratches on the pavilion facets. These features indicated the presence of a coating. Pink, orange, and red coatings on topaz have been attributed to a sputter-coating process (see Summer 1998 Gem News, pp. 143–144); the color layers deposited by that process could easily be scratched and removed.

However, the coating on these stones could not be scratched with a needle. This is the first time that orange-coated topaz with a hard and rather stable coating has been reported. In addition, the spotty appearance typical of sputter coatings was not observed on these two stones.

EDXRF chemical analyses of the pavilion surfaces of



Figure 33. The orange color of this 2.95 ct topaz is caused by a thin coating of synthetic hematite applied to the pavilion. Photo by Michael S. Krzemnicki; © SSEF Swiss Gemmological Institute.

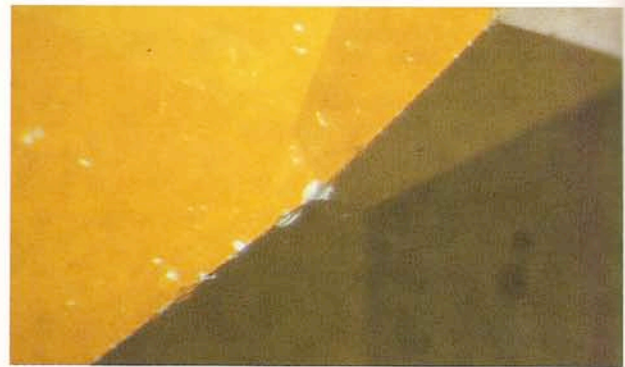


Figure 34. Minute colorless chips are visible along the edges of the pavilion facets on this coated topaz. Photomicrograph by Michael S. Krzemnicki, magnified 35x; © SSEF Swiss Gemmological Institute.

edge, this is the first time that synthetic hematite has been used as a coating on a gemstone.

This investigation reinforces the importance of carefully inspecting faceted gems from all angles. Analysis of only the crown of these stones with standard or advanced techniques would not have revealed their true nature.

Although the surface coating of topaz has been known for quite some time, such stones are often sold as "diffusion" treated. The two coated samples reported here showed no evidence of diffusion into the stone.

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## CONFERENCE REPORTS

**Diamond presentations at the annual Australian Diamond Conference.** Attendance at the annual Australian Diamond Conference, held in Perth on December 2–3, 2002, was just over 200, down from last year's 240 (see Winter 2001 Gem News, pp. 333–334). There were 26 presentations and a concluding panel discussion. The few non-Australian presenters included **Susan Shabangu** of the Ministry of Minerals and Energy, Johannesburg, South Africa, and **Nirupa Bhatt** of Rio Tinto Diamonds, Mumbai, India. Ms. Shabangu emphasized that the new South African mining law will give the indigenous people more control over mining their resources without nationalizing the industry. Ms. Bhatt discussed the enormous growth of the Indian diamond cutting and polishing industry, which now employs over one million people. Its success is due to the abundance of low-value rough produced by Australia's Argyle mine, the low cost of competent labor in India, and the marketing efforts of the Indo-Argyle Diamond Council.

Following the opening address by **Ewen Tyler** of Striker Resources, Perth, **John Hughes** of De Beers Consolidated Mines, Johannesburg, said that De Beers was committed to continuing diamond prospecting in Australia where, in 2002, it spent 8% of its global US\$40 million exploration budget. **Carl Pearson** of Econunit, London, discussed the importance of branding to promote diamonds and stated

that the diamond industry must increase its advertising budget, which is approximately one tenth of the ad budgets for other luxury goods such as watches. **Mike Mitchell** of Rio Tinto Diamonds, Perth, emphasized complete accountability "from cradle to grave" in all aspects of prospecting and mine development, awareness of socio-economic and environmental impacts on the region and its indigenous people, and involvement in downstream marketing.

Many speakers reported on the results and progress of their respective companies, the most important being **Miles Kennedy**, **David Jones**, **Nick Yiannopoulos**, and **Peter Danchin** of Kimberley Diamond Co., Perth, who were happy to announce that the Ellendale diamond mine has a higher grade (as reflected by current mining activities of 15 ct/100 tonnes) and value per carat (as indicated by the latest sales in Antwerp of US\$155/ct) than predicted by the feasibility study (see, e.g., Fall 2002 Gem News, pp. 258–259). **Max Cozijn** and **Linda Tompkins** of Elkedra Diamonds, Perth, reported on the discovery of numerous chromites of possible kimberlitic origin in Australia's Northern Territory. According to a subsequent company news release, the loam samples from which many of these chromites were recovered occurred in a 2.5-km-diameter ring-shaped structure. **Karl Simich** of Namakwa Diamonds, Perth, presented results of their bulk sampling of uplifted beaches on the coast of Namaqualand, South Africa; the production was better than the expected economic grade of 10 carats per 100 tonnes. **Phil Crab** of Thundelarra Exploration, Perth, announced the discovery of four new small kimberlite pipes, south of the large 20 ha (noneconomic) Aries pipe in the Kimberley Plateau of Western Australia. **Tom Reddicliffe** of Striker Resources, Perth, reported an unexpectedly high grade of 225 carats per 100 tonnes from a 183 tonne bulk sample taken from the Seppelt 2 pipe, located in the northern part of the Kimberley Plateau of Western Australia. Plans to drill for a deeply buried (up to 280 m) large kimberlite pipe beneath the Springfield Basin in South Australia were discussed by **Kevin Wills** of Flinders Diamonds, Perth.

Several speakers gave presentations on new exploration methods. **Richard Russell**, consulting geomorphologist to