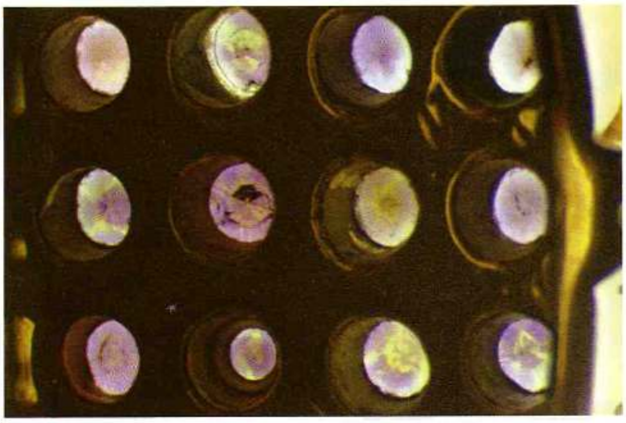

Figure 35. When viewed with diffused light while they were immersed in water, most of the synthetic diamonds in figure 32 showed distinct yellow and pink color zoning, another clue to their synthetic origin. Photomicrograph by S. Singbamroong, © Dubai Gemstone Laboratory; magnified 8×.

The infrared spectra of two samples revealed features that were a mixture of type Ib, IaA, and IaB (with IaA>>IaB, Ia>Ib). They also revealed a peak at 1450 cm^{-1}, providing additional evidence of irradiation and annealing (W. Wang et al., "Treated-color pink-to-red diamonds from Lucent Diamonds, Inc.," Spring 2005 *Gems & Gemology*, pp. 6–19). EDXRF chemical analysis of two samples revealed the presence of Ni and Fe.

On the basis of the color zoning, luminescence characteristics, and chemical/spectroscopic properties, we identified the 12 small round brilliants as treated-color pink synthetic diamonds.

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Figure 36. Represented as "chocolate pearls," these variously colored samples (up to 12.7 mm) were examined for this report. One of them (second from the left) proved to be silver treated, while no silver was detected in the other cultured pearls. The sample on the far left was bleached but not dyed. Slicing and/or polishing the other samples revealed narrow (~0.05 mm) concentrations of brown color at their surface. Photo by H. A. Hänni, © SSEF.

TREATMENTS

Update on "chocolate" Tahitian cultured pearls. Treated-color brown Tahitian cultured pearls were introduced a few years ago as "chocolate pearls," and there have been a number of conflicting reports about the coloration mechanism (see, e.g., "Trade raises questions about 'chocolate pearls,'" *Jewellery News Asia*, No. 241, September 2004, pp. 160–162; M. Zachovay, "'Chocolate' Tahitian cultured pearls," Summer 2005 Gem News International, pp. 183–184; "Better techniques improve brown pearls," *Jewellery News Asia*, No. 262, June 2006, p. 60). Good-quality but overly dark Tahitian cultured pearls are said to be treated to lighten the surface color. This treatment is claimed to be stable and to penetrate deeply into the cultured pearls, sometimes even turning their bead nuclei brown.

According to some of these reports, the treatment somehow affects the melanin (dark pigment) molecules in the nacre. It is not clear, though, how the surface color could be lightened by modification of the melanin, while at the same time the originally white bead in the center could turn brown. Though the color would still be considered "treated," the process is represented as superior to simple dyeing.

The SSEF Swiss Gemmological Institute has been seeking test material for some time to learn more about this mystery, and we recently received five samples represented as "chocolate pearls" from three different dealers (in England, Japan, and Switzerland) for research purposes (see, e.g., figure 36). Each sample was sawn in half, and/or a small flat spot was polished on the surface, to reveal the depth of color penetration.

The results were surprising and confirm that common sense is always helpful when facing such mysteries. One of the samples (far left in figure 36) was bleached but not dyed. The other four cultured pearls showed distinct color concentrations in their outermost layers, the thickness of which was about 0.05 mm (see, e.g., figure 37). The underlying nacre was gray to light brown (figure 38); in none of these samples was the underlying nacre darker than the surface. Furthermore, there was no apparent darkening of the bead in any of our samples. These results are nearly identical to properties exhibited by cultured pearls that have been dyed, such as those treated with silver nitrate or more modern dyes. When the samples were tested for the presence of silver using EDXRF spectroscopy, one revealed this element—indicating that it was treated by the traditional silver nitrate method—but silver was not found in any of the other cultured pearls.

Future research on a broader selection of "chocolate pearls" is necessary before we can make a better determination of the treatment process. In our experience, a nondestructive gemological test to detect this treatment is not yet available; however, polishing a tiny flat spot (e.g., around a drill hole) would show a color concentration confined to a superficial layer. The SSEF laboratory would welcome additional "chocolate pearls" for further testing.

HAH

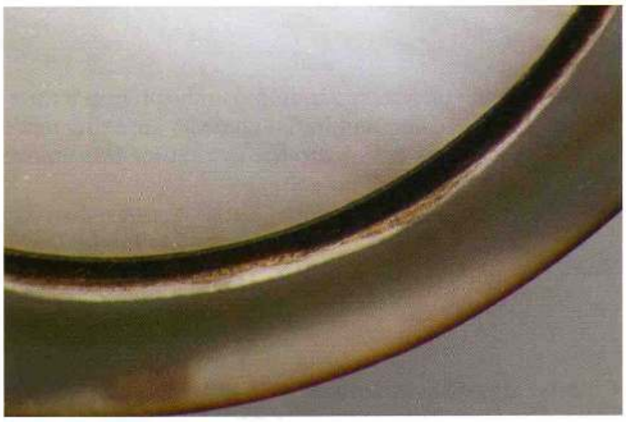

Figure 37. In this cross-section of one of the "chocolate pearls" (middle sample in figure 36), the white bead and a thin ~0.05 mm surface layer of brown coloration is clearly visible, while the nacre underlying the dark surface is lighter and predominantly gray. Photo by H. A. Hänni, © SSEF.

Figure 38. Polishing a small flat area (1.6 mm in diameter) on one of the "chocolate pearls" revealed the shallow depth of the surface-related color concentration. Photomicrograph by H. A. Hänni, © SSEF.

Treated violetish blue to violet quartz from Brazil. Blue quartz is quite rare, and the color of almost all such reported natural material is produced by mineral inclusions (see, e.g., K. Schmetzer, "Methods for the distinction of natural and synthetic citrine and prasiolite," *Journal of Gemmology*, Vol. 21, 1989, pp. 368–391). Such quartz has an orange tint when viewed in transmitted light, due to scattering by the minute particles. Thus far, the only blue quartz not colored by inclusions has been synthetic material that is colored by cobalt or heat-treated and iron-bearing (K. Nassau and B. E. Prescott, "Smoky, blue, greenish-yellow, and other irradiation-related colors in quartz," *Mineralogical Magazine*, Vol. 41, 1977, pp. 301–312).

Figure 39. The Montezuma area in Minas Gerais, Brazil, is once again being mined for amethyst (such as the 4 cm crystal pictured here). This material can be turned green by heat treatment and violetish blue to violet by subsequent irradiation. The cut stones weigh about 3–4 ct. Photo by R. S. Güttler.

A new variety of violetish blue to violet quartz (figures 39 and 40) has recently been produced through the heating and gamma irradiation of amethyst from a mine near Montezuma, in the Rio Pardo region in northern Minas Gerais. This deposit, often called the Montezuma mine, initially became famous during the 1960s for amethyst that could be turned green by heating, known today as "prasiolite" or "greened amethyst" in the trade (J. P. Cassedanne and J. O. Cassedanne, "Axinite, hydromagnesite, amethyst, and other minerals from near Vitória da Conquista (Brazil)," *Mineralogical Record*, Vol. 8, 1977, pp. 382–387; Summer 2004 Lab Notes, p. 167). One of the

Figure 40. These samples show the coloration of the Montezuma mine quartz as untreated amethyst (left, 2.40 ct), heated green quartz (center, 3.54 ct), and heated and irradiated violet quartz (right, 2.37 ct). Gift of Henrique Fernandes and Gabriel Freitas, Pinkstone International, Governador Valadares, Brazil; GIA Collection nos. 36697–36699. Photo by Robert Weldon.