THE GEMOLOGICAL CHARACTERISTICS OF CHINESE PERIDOT

By John I. Koivula and C. W. Fryer

Significant deposits of gem-quality peridot have been found in the People's Republic of China. This Chinese peridot has geologic origins and gemological properties almost identical to the peridot found on the San Carlos Apache Reservation in Arizona, and cannot be distinguished gemologically, at this time, from peridots from other known localities.

In 1979, geologists from the Ministry of Geology and Mineral Resources discovered gemologically important peridot deposits in the Zhangjikou-Xuanhua area of Hebei Province, about 150 km northwest of Beijing (Peking), in the People's Republic of China. The peridot is found as gemmy nodules in extrusive vesicular alkali basalt lava flows (Keller and Wang, 1986). Like the peridot found in San Carlos, Arizona, which also occurs in basalt (Koivula, 1981), no well-formed single crystals of rough peridot have been found in the Chinese deposits. Gem-quality peridot nodules and fragments 2 cm in diameter and up to 25 ct in weight were examined by the authors (figure 1). Excellent gems (figure 2) can be cut from this rough.

GEMOLOGICAL PROPERTIES

Of a total of six rough nodules, three were selected for faceting so that they could be tested gemologically along with two other previously faceted stones. The faceted gems ranged in weight from 0.70 to 10.51 ct. A triangular mixed-cut 2.87-ct stone (figure 2) had the best clarity. The samples examined ranged in color from a light yellow-green

Figure 1. Two of the rough peridot nodules from China that were used in this study. The larger measures 20.6 × 13.7 × 10.1 mm and weighs 23.71 ct. Photo © Tino Hammid.

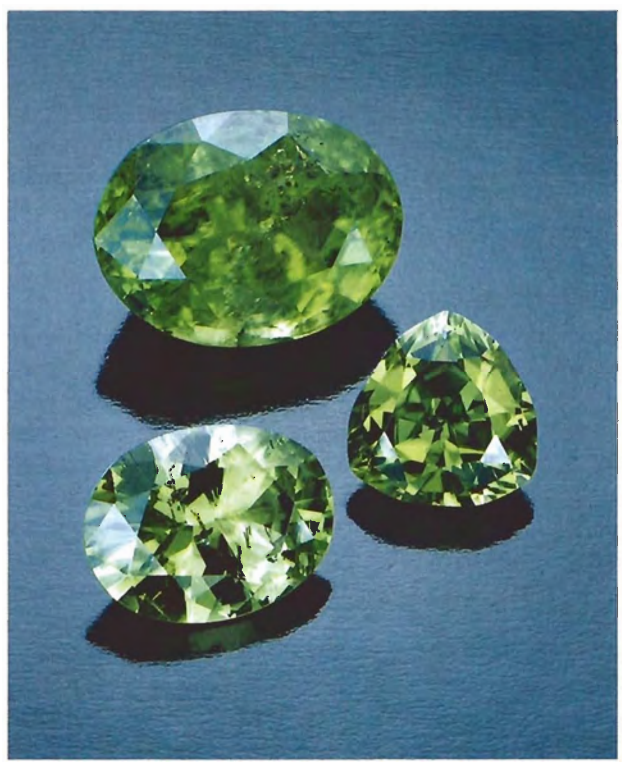

Figure 2. These three faceted peridots from China weigh 2.87, 3.86, and 10.51 ct, respectively. Stones faceted by William C. Kerr. Photo © Tino Hammid.

> **NOTE FROM THE CUTTER**
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> The Chinese peridot shows great promise as a gemstone. Unlike peridot from Arizona, the Chinese material exhibits no directional hardness variations during either cutting or polishing. Both processes took slightly longer than is typical for peridot, which suggests a slightly higher hardness. Transparency is excellent, and material free of all but the smallest inclusions could produce fine gems in the larger sizes.
>
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to a darker, richer yellow-green. Using a GIA-GEM ColorMaster on the darker stones, we determined a color equivalent reading of A-25/61/00.

Refractive index readings on the five faceted gems were identical: biaxial positive with indices of $\alpha = 1.653$, $\beta = 1.670$, and $\gamma = 1.689$. The corresponding birefringence was 0.036.

The visible-light absorption spectra of the Chinese peridots were studied using a Beck prism spectroscope. All of the stones showed the same pattern, typical for peridot: A band between 493.0 and 481.0 nm had its strongest absorption at 492.0 nm; the strongest single absorption line was visible at approximately 471.0 nm; another broad band, situated in the blue, covered the spectrum from 460.0 to 450.0 and was strongest at 453.0 nm.

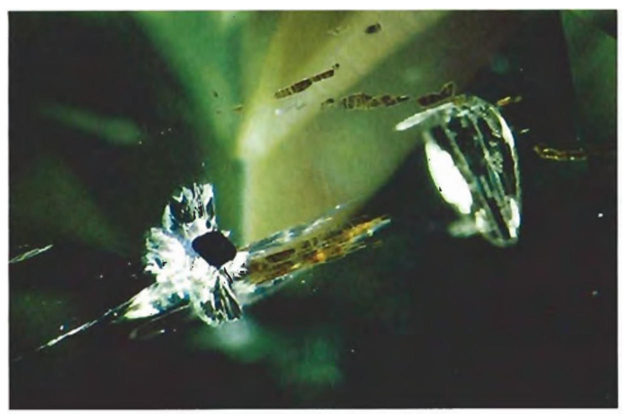
Using a Voland double-pan balance, we determined the specific gravity hydrostatically to be 3.36. The Chinese gems are inert to both long-wave and short-wave ultraviolet radiation.

Using standard hardness points, we determined hardness to be between 6½ and 7 on the Mohs scale, although observations about the hardness of these peridots made during faceting (see box) suggest that this material might be slightly harder than the 6½ normally attributed in gemological texts to peridot. It may be very near 7, the hardness assigned to forsterite, the magnesium-rich end member of the olivine series.

INCLUSIONS

The inclusions in this new material are typical of peridot formed in an alkali basalt. All of the inclusions observed in the Chinese peridots studied have also been noted in peridot from Arizona (Koivula, 1981). For example, in figure 3, the black opaque grain surrounded by a tension halo is a crystal of chromite, the transparent brown crystals are probably biotite mica, and a circular cleavage disc ("lily pad") is also visible edge-on. Partially healed secondary fractures, as shown in figure 4, were observed in all of the Chinese stones. In figure 5, a partially healed cleavage is pictured. The iridescent portion shows few signs of repair. The round white dot is the negative crystal that ruptured, producing the original separation. A dark "emerald-green" chrome diopside crystal (figure 6) was observed in only one of the Chinese peridots. Growth undulations were observed through the table of the triangular mixed cut. These growth undulations are the result of incomplete solid solution and visibly strained dislocations in the

Figure 3. This photo shows characteristic peridot inclusions of black chromite, brown biotite, and a "lily pad" cleavage as observed in a Chinese peridot. Dark-field and oblique illumination, magnified 25×.



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All photomicrographs in this article were taken by John I. Koivula.

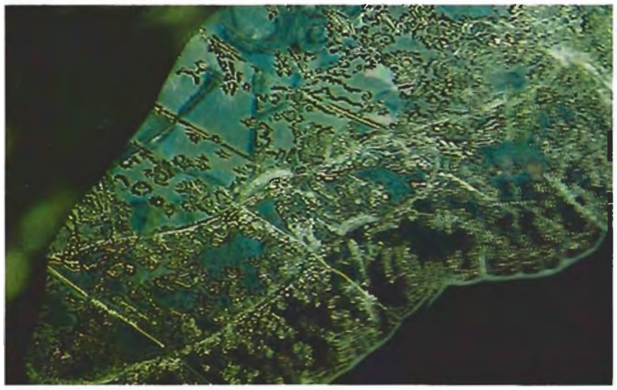

Figure 4. A delicately veined, partially healed secondary fracture is visible in this Chinese peridot. Dark-field and oblique illumination, magnified 45×.

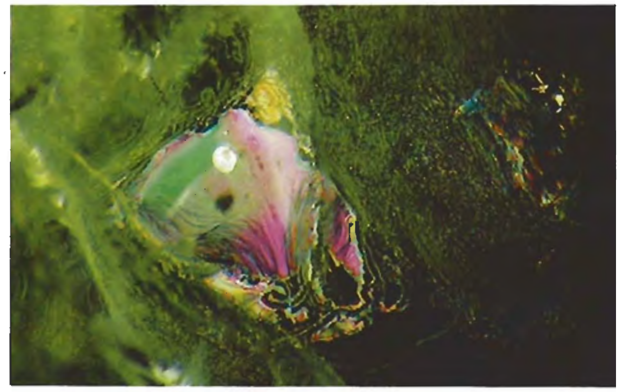

Figure 5. This partially healed cleavage shows brightly colored iridescent thin-film areas where no repair has occurred. The white circle is the negative crystal that ruptured and produced the original separation. Oblique illumination, magnified 50×.

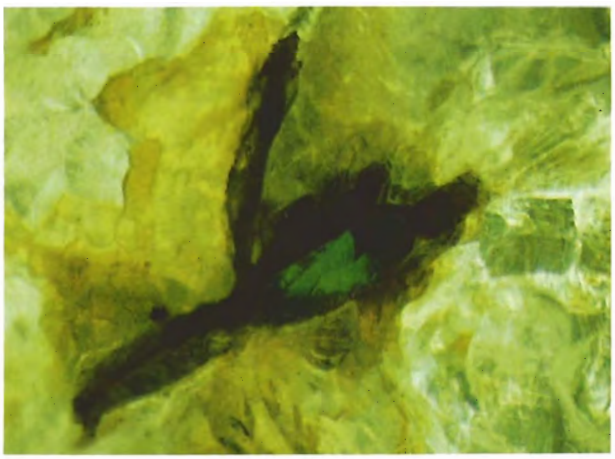

Figure 6. A dark green chrome diopside crystal is surrounded by dark tension cracks in a Chinese peridot. Diffused transmitted and oblique illumination, magnified 40×.

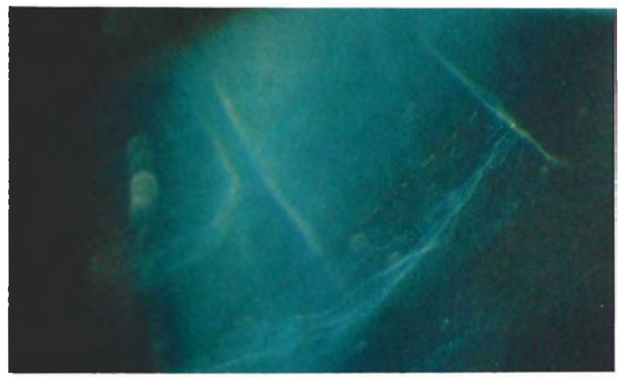

Figure 7. The growth undulations in a Chinese peridot appear as delicate wispy, smoke-like veils when observed in dark-field illumination. Magnified 50×.

peridot (Koivula, 1981). With dark-field illumination they usually appear as smoke-like veils (figure 7).

CONCLUSION

Because of the limited sample of stones available for study, only a narrow range could be determined for the gemological properties of the Chinese material, although a wider range of properties is known to exist for other peridot from similar geologic environments (Koivula, 1981). However, the Chinese peridots examined show gemological characteristics similar to and within the range noted for peridot from any other known locality. Thus, on the basis of the samples examined, we do not feel that the Chinese stones can be separated from peridots from other localities by means of their gemological properties.

The Chinese government and specifically the Chinese Gem and Mineral Development Company, headquartered in Beijing, are now actively mining and cutting the peridot for commercial purposes (Keller and Fuquan, 1986). Therefore, it should not be surprising if significant amounts of Chinese peridot begin to appear on the world gem market in the near future.

REFERENCES

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