

## GREEN OPAL FROM EAST AFRICA

By John I. Koivula and C. W. Fryer

*Bright green, nickeliferous, gem-quality opal from Tanzania, East Africa, is described and its gemological properties are given. Chemical analyses and structural data are provided as well.*

Chrysoprase, the nickel-bearing green variety of chalcedony, has been used as a gem material for centuries. However, nickel-colored green opal (called prase opal), from Poland and Tanzania (Webster, 1975; Schmetzer et al., 1976) and from Australia and Peru (R. Crowningshield, pers. comm., 1984), has been only briefly mentioned in the literature. Therefore, we were pleased to receive several pieces of nickeliferous opal for gemological study and experimentation. This Tanzanian opal is virtually the same color as chrysoprase. Like chrysoprase, the opal samples tested by the authors have a diaphaneity ranging from very translucent (figure 1) to semitranslucent. In addition, both gem materials are commonly associated with an earthy brown limonite matrix in the rough (figure 2). In light of this strong potential for mistaken identity, we conducted a thorough examination of this unusual opal. The standard gemological properties of this material, as well as the results of chemical and X-ray analysis, are described below.

### GEMOLOGICAL PROPERTIES

Several gemological tests were conducted to determine the properties of this material, especially as they compare to chrysoprase (table 1).

**Refractive Index.** A small piece was sliced from the main mass and an optical flat was polished on one side. Using the GIA utility lamp with monochromatic light and a Rayner DIALDEX refractometer, we determined the refractive index to be 1.452.

**Specific Gravity.** The same 3.06-ct piece used to determine the refractive index was used to measure the specific gravity. Using a Voland double-pan balance equipped for hydrostatic testing, we determined the specific gravity to be 2.125.

**Ultraviolet Radiation.** When exposed to ultraviolet radiation, the whitish areas in and on the opal



Figure 1. A faceted green opal from Tanzania (1.78 ct). Photo by Tino Hammid. Stone courtesy of Andreas Becker of Friedrich August Becker, Idar-Oberstein, Federal Republic of Germany.

all glowed bluish white, while the main mass of green opal and the brown limonite matrix were inert. With short-wave ultraviolet radiation, the reaction was strong to moderate; with long-wave U.V., a moderate to weak fluorescence was noted.

**Spectroscopic Analysis.** Using a Beck prism spectroscope, we observed a general absorption in the red from 660.0 nm upward, and a cut-off in the blue from 470.0 nm downward. Depending on the thickness of the material, the absorption areas increase as the thickness increases. Chrysoprase has essentially the same spectrum, which also depends on the thickness of the material tested.

### ABOUT THE AUTHORS

Mr. Fryer is chief gemologist, and Mr. Koivula is senior gemologist, in the Applied Gemology Department at the Gemological Institute of America, Santa Monica, California.

*Acknowledgments:* The authors would like to thank Julius Petsch and Dr. Peter C. Keller for supplying the opals used in this study. Dr. George Rossman, of the California Institute of Technology, performed the chemical analysis. William Kerr prepared the opal section for optical testing.

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Figure 2. A close-up of the opal and limonite matrix interface. Oblique illumination, magnified 25 $\times$ .

**Microscopic Observation.** With magnification, numerous white irregularly shaped spots were visible in the opal. Where these spots occurred on the surface, as in figure 3, it became evident that they were in fact tiny cavities or vugs, lined with small spheroids of botryoidal opal (figure 4).

#### CHEMICAL AND X-RAY ANALYSIS

A rough sample of the opal was sent to Dr. George Rossman for chemical analysis. Aside from silicon, the only significant element present in the analysis was nickel, the same element responsible for the coloring of chrysoprase.

An X-ray powder diffraction pattern was made at room temperature in a Debye-Scherrer camera using a copper target tube at 48 kV and 18 mA for 4.8 hours. The test revealed a cristobalite structure with stacking disorders attributed to tridymite. This agrees with an opal CT (cristobalite-tridymite) classification as proposed by Jones and Segnit (1971).

#### CONCLUSION

This interesting green opal bears a very strong resemblance to top-quality chrysoprase and can easily be confused with it on sight. However, a refractive index reading will easily separate the two. The

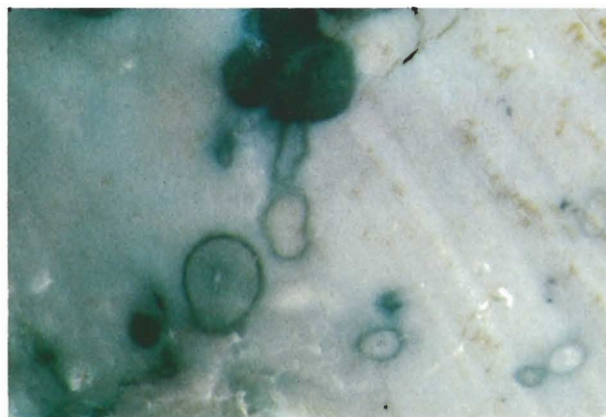


Figure 3. Thin chalky white coating, also of opal CT, on the surface of one of the rough opals. The green spots are areas where tiny cavities in the opal break or almost break the surface. Oblique illumination, magnified 30 $\times$ .



Figure 4. The interior of one of the numerous cavities in the opal decorated with a botryoidal lining. Transmitted and oblique illumination, magnified 50 $\times$ .

general availability of this material is not known, but several carvings up to five or six inches (12–15 cm) in height have been seen at recent gem shows. The classification of this opal derived by the authors agrees with earlier results published on similar opals (Schmetzer et al., 1976).

**TABLE 1.** A comparison of the gemological properties of chrysoprase chalcedony and Tanzanian green opal.

	Refractive index	Specific gravity	U.V. reaction
Green opal	1.452	2.125	inert
Chrysoprase chalcedony	1.535	2.620	inert

#### REFERENCES

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