A closer look at Vietnamese spinel

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Over the past couple of years, a supply of attractive spinel exhibiting various colors has been entering the international gemstone market from a relatively small mining region in Northern Vietnam. The majority of these gems are being processed and marketed through Bangkok, Thailand, and finding their way to the major American, European and Asian centers.

Spinel exhibiting a broad spectrum of colors is known to derive from many countries around the world, however, the two most well-known and historical deposits are found in Sri Lanka and in the area surrounding the Mogok valley in Burma (Myanmar). More recent finds of spinel in places such as Namya Zeik (northern Burma), Kenya, Tajikistan and Tanzania have led to an increased supply of this highly desirable and sought after gem material.

Spinel from the Luc Yen region of northern Vietnam began making its way into the market as mineral specimens and faceted gemstones during the late 1980s and the early 1990s. This coincided with the discovery of ruby deposits in Luc Yen and Quy Chau (Kane et al, 1991). More recently, Vietnam has re-emerged and made an exciting re-entrance into the world of fine gem spinel with its latest production. The main part of the most recent production yields faceted stones that range from below 1 carat to 1-5 carat sizes. More rarely, some fine spinels have been produced in sizes larger than 10 carats, and even up to 20 carats in very fine quality (M. Hatik pers. comm. 2008).

Color appearance

The most famous and popular color of spinel is red, although it actually occurs in a wide range of hues and saturations. The spinel from Vietnam is no exception, as it exhibits a number of very attractive colors and shades. The majority of Vietnamese spinel occurs in a deep red to purplish red hue. Additionally, a number of lively, attractive pink colors are also produced. Of the more exceptional colors, Vietnam has also produced a number of very attractive violet to violet-blue stones, as well as a small number of “cobalt-blue” spinel, which are highly sought after and prized by collectors.

Gemological properties

The standard gemological properties for a number of Vietnamese spinels examined...
by the authors are consistent with those reported in the gemological literature for natural spinel. The stones tested were all found to be singly refractive, with refractive index readings ranging from 1.712 to 1.718. Their specific gravity was determined hydrostatically to range from 3.54 to 3.71. The fluorescent reaction to both long-wave and short-wave UV radiation was strong red (LWUV) and weak to moderate red (SWUV) for the red group. The pink group exhibited a very strong red (LWUV) and moderate to strong orangy red (SWUV) reaction, whereas the violet-to-blue stones were inert to both LWUV and SWUV excitation.

When examined with a Chelsea filter over a strong transmitted light source, the “cobalt-blue” Vietnamese spinel exhibited a strong red reaction, while the violet-to-blue group exhibited a weak red or pink reaction.

**Absorption spectroscopy**

The absorption spectra of the spinel from Vietnam were tested using a standard desk-model spectroscope and a UV/Vis/NIR spectrophotometer (range 850-280 nm). The red-to-pink group possessed two dominant broad bands centered at approximately 540 and 388 nanometers (nm), with a shoulder positioned at approximately 415 nm, as well as a series of narrow, sharp peaks at approximately 694, 685, 665 and 640 nm. These absorptions are primarily due to chromium (Cr$^{3+}$) in octahedral coordination (see for example Fritsch and Rossmann, 1988).

All of the spinels in the violet-to-blue group showed a combination of spectral bands related to cobalt (Co$^{2+}$ in tetrahedral coordination) and iron (Fe$^{2+}$ in tetrahedral coordination). The Co$^{2+}$-related absorptions consisted of a series of three superimposed broad bands positioned at approximately 625, 585 and 550 nm. The Fe$^{2+}$-related absorptions consisted of a larger series of bands positioned at approximately 555, 477, 455, 385 and 370 nm. In the violet spinels, the relative ratio of these absorptions is Fe$^{2+}$>Co$^{2+}$, with decreasing Fe$^{2+}$ absorption and increasing Co$^{2+}$ occurring as the color trended towards a more blue color. No chromium related absorptions were recorded in the violet-to-blue group examined in this study.
Chemical composition

The samples were tested using energy dispersive X-ray fluorescence spectroscopy to determine their major to minor and trace element composition. Besides aluminum (Al) and magnesium (Mg), which are intrinsic to spinel (MgAl₂O₄), the red to pink spinels from Vietnam also contained iron (Fe), along with chromium (Cr) as major to minor elements. Other minor to trace elements included zinc (Zn), vanadium (V), titanium (Ti) and gallium (Ga).

The violet-to-blue group contained iron (Fe) and zinc (Zn) as major to minor elements, with only trace concentrations of manganese (Mn) and gallium (Ga). Cobalt (Co) was not detected in the violet-to-blue group stones using this method of chemical analysis. It is presumed that cobalt occurred below the detection limit of the spectrometer. These compositions are consistent with that of natural spinel from several other deposits (see for example Muhlmeister et. al, 1993).

Inclusion features

The red-to-pink spinels from Vietnam display a varied array of internal features. These consist of planar growth structures that follow octahedral crystal faces, healed fractures of various patterns, and a variety of foreign mineral inclusions. The violet-to-blue group possesses a more distinctive series of internal features. These consist primarily of arranged, planar concentrations of parallel needles which are either isolated in rather small “patches” or are longer and extend throughout the stone. On occasion, these small “patches” of needles are seen surrounding a tiny mineral inclusion or intersecting one another from multiple directions. Lines or stringers of pinpoint particles are also observed, as well as variously sized octahedra aligned along healed fracture planes.

Conclusion

Although Vietnamese spinel has been available for more than a decade, recently a significant supply of fine, gem-quality faceted stones has been entering the market from the Luc Yen mining region in northern Vietnam. These gems exhibit a wide range of colors and shades, from red to pink, as well as rarer colors that range from violet to blue. For the spinel enthusiast and collector, this production offers an opportunity not only to collect fine, gem-quality specimens from an unusual source, but to collect samples in a rare and appealing range of colors.

References


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