A large greenish yellow grossular from Africa.

The GIA Gem Tech Lab recently examined a 68.55 ct greenish yellow round brilliant (figure 6) that, according to the client, was a garnet from East Africa. This stone showed unusually intense greenish yellow coloration and exhibited very distinct roiled (" scotch in water"; figure 7) structure that is typical for the hessonite variety of grossular.

The sample was examined by standard gemological testing and various spectroscopic methods. The R.I. was 1.743, and the S.G. (measured hydrostatically) was 3.62. Viewed between crossed polarizing filters, the sample was isotropic but exhibited very distinct strain that followed the granular swirl-like structure seen with the microscope. These results, as well as the specular reflectance FTIR spectrum, provided a good match with hessonite. EDXRF chemical analysis was consistent with a calcium-aluminum garnet ($Ca_3Al_2[SiO_4]$), which confirms grossular, with a significant amount of Mn and Fe present. These impurities are commonly found in hessonite, but the quantity of Mn detected was greater than is typically seen in this gem variety.

Figure 6. This 68.55 et grossular from East Africas shows an unusually bright greenish yellow color. Photo by T. Hainschwang.

Figure 7. With magnification, the grossular in figure 6 showed the distinct roiled "scotch in water" appearance that also is typically seen in hessonite. Photo by T. Hainschwang; magnified Bx

The UV-Vis-NIR absorption spectrum (figure 8) also was unusual for grossular, with three strong bands at 372, 409, and 430 nm, and two weaker bands at 418 and 455 nm. These absorptions can be attributed to Mn^{2+} (see Winter 1991 Gem News, p. 258). The intense manganese absorptions cause the steep slope starting at around 500 nm and cut off nearly all the blue in the spectrum. This feature, combined with high transmittance from 500 to 750 nm, is responsible for the unusually intense greenish yellow color in this garnet. Manganese typically plays only a minor role in the coloration of grossular/hessonite. In the experience of these contributors, although Mn^{2+} bands are often present in this material, they are very weak. In typical orange hessonite, the spectrum is a featureless broad band with greater transmittance in the orange and red parts of the spectrum.

This broad band is attributed to Fe^{2+}-Ti^{4+} intervalence charge transfer, so the orange color in grossular is mainly due to this mechanism (E. Fritsch, pers. comm., 2005). The client did not know precisely where in East Africa the material was found or whether more of this attractive garnet is available in the market.

Thomas Hainschwang (thomas.hainschwang@gia.edu) and Franck Notari (franck.notari@gia.edu)
GIA Gem Tech Lab, Geneva, Switzerland

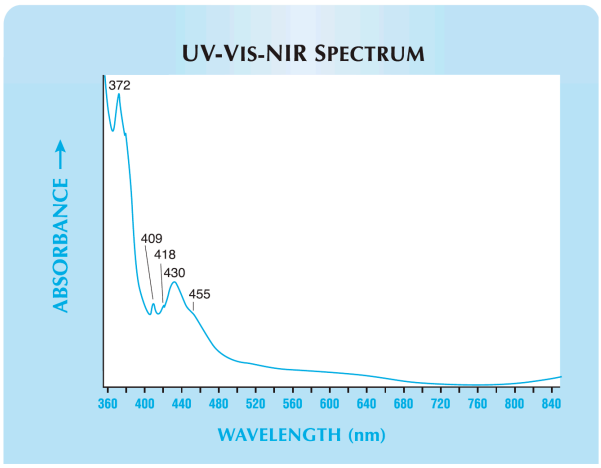

Figure 8. The UV-Vis-NIR absorption spectrum of the grossular showed very strong Mn^{2+} -related absorptions. These absorptions are responsible for the strong greenish yellow color, in contrast to the usual orange appearance of hessonite.