Trapiche-type Chrysoberyl

Numerous gem varieties showing a fixed star pattern within a transparent matrix have been designated 'trapiche'. In general, the non-transparent arms of the star pattern radiate from a central point or a central area toward the rim of the crystal, and they separate transparent (or at least translucent) areas of the specimen. If the transparent areas correlate with growth sectors and the arms of the star pattern represent the less transparent boundaries between such growth sectors, it is referred to as a trapiche pattern, as seen in some emeralds, rubies and tourmalines (e.g. Schmetzer et al., 1996, 2011). If the arms of the star pattern are formed by inclusions trapped within the centre of symmetry-equivalent growth sectors, it is referred to as a trapiche-type pattern, as seen in some beryls and sapphires (Schmetzer et al., 2011). Samples belonging to this second group of materials have also been designated 'trapiche-like minerals' (Pignatelli et al., 2015). In trapiche-type samples, the arms of the star pattern can become relatively wide and the transparent boundaries between growth sectors can be small.

The rough chrysoberyl described here was loaned by Farooq Hashmi (Intimate Gems, Glen Cove, New York, USA). The stone was purchased in the USA gem market and was said to have originated from Brazil. It measured 25 × 17 mm and weighed 10.18 g. Its identity as chrysoberyl was confirmed by Bear Williams (Stone Group Labs, Jefferson City, Missouri, USA) using Raman spectroscopy (GemmoRaman-532SG instrument). The sample showed one large planar face exhibiting a trapiche pattern consisting of relatively broad, milky arms separated by somewhat smaller transparent areas (Figure 6). Within the uneven part of the sample's surface, the trapiche pattern was not visible. Perpendicular to the large planar face were several crystal faces and one area with a larger re-entrant angle. In immersion and transmitted light (not shown) it could be seen that the entire sample, including the large planar face and the uneven parts of the surface, consisted of a cyclic twin (trilling). The crystal showed the common morphology of a chrysoberyl trilling with a large **a** {100} pinacoid and several smaller **i** {011} prism faces (see, e.g., Schmetzer, 2011).

By superimposing the photos taken in transparent light in immersion with those taken in reflected light in air (not shown), it was established that the twin boundaries ran through the transparent areas of the trapiche pattern, with the less transparent milky arms of the star located between the twin boundaries (Figure 7). Compared to the milky areas, the transparent zones were narrow, and different-sized areas sometimes appeared on the two sides of the twin planes. It was also apparent that the boundaries between transparent and milky zones were uneven and did not consist of planar faces or straight separation lines.

Examination of the area shown in Figure 7 at higher magnification in transmitted light (without immersion) was prevented by the combined effect of the low transparency of the chrysoberyl trilling and the approximately 9.7 mm thickness of the sample. In reflected light, the large planar **a** pinacoid of the trilling showed a dense pattern of growth striations oriented parallel to the

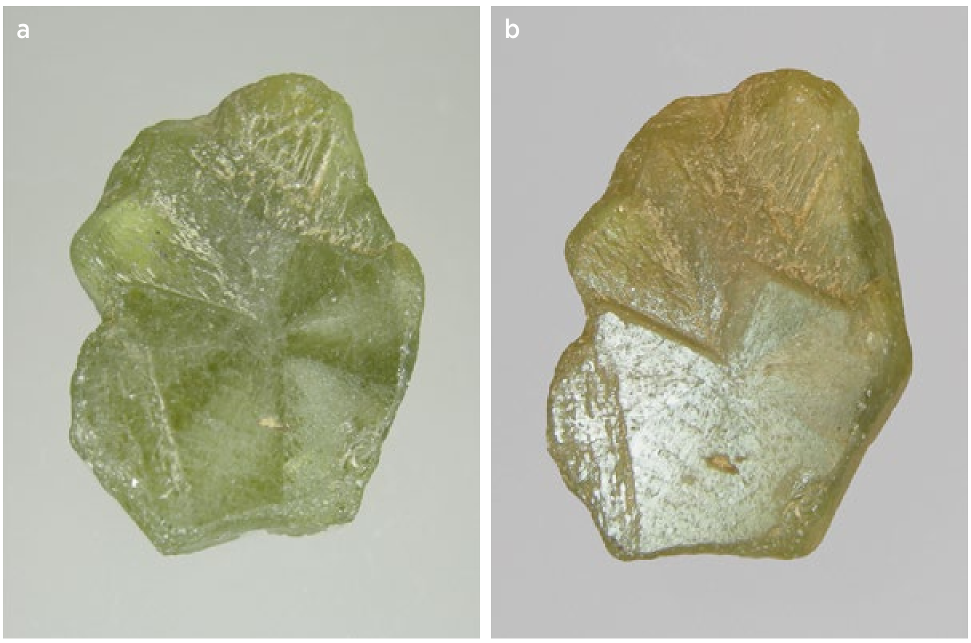

Figure 6: (**a**) This chrysoberyl trilling with a large planar face shows a trapiche-like pattern forming a fixed star consisting of larger triangular, somewhat milky areas separated by smaller transparent zones. (**b**) When the sample is tilted slightly, the larger planar face shows a homogeneous reflection. In the uneven part of the trilling (upper part of the sample), the trapiche-like pattern is not visible. The sample measures 25 × 17 mm; photos by K. Schmetzer.

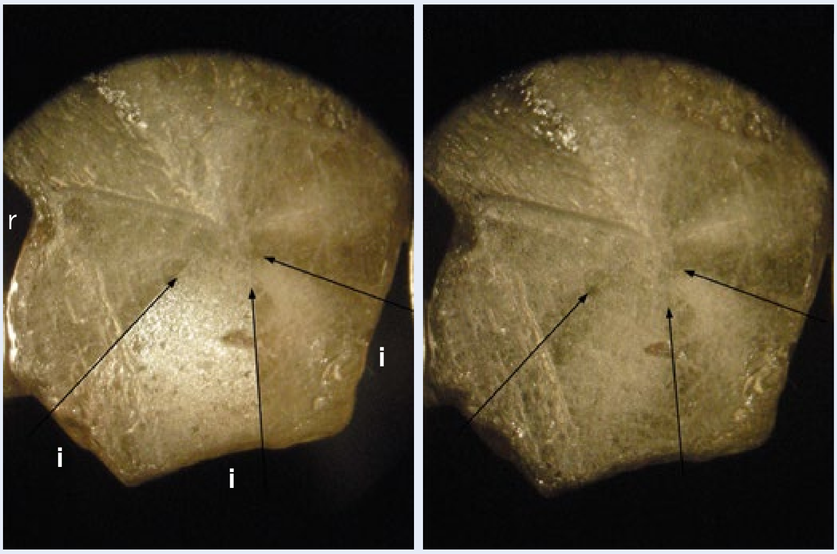

Figure 7: Viewed with reflected light at slightly different angles, the planar **a** pinacoid of the chrysoberyl trilling is seen here, as well as some **i** prism faces (perpendicular to the **a** pinacoid) and one re-entrant angle (r). Twin boundaries (black arrows) are perpendicular to the **i** prism faces and the **a** pinacoid, running through the more transparent areas that separate the milky zones forming the arms of the fixed star. Photomicrographs by K. Schmetzer; image width 16 mm.

c-axes <001> of the different parts of the chrysoberyl trilling (Figure 8). Due to the presence of these dense patterns of growth lines, which were observed in all the more-or-less transparent parts of the trapiche pattern, it was impossible to observe different concentrations of inclusions within the sample at high magnification (without polishing the surface of the specimen) in order to identify such inclusions.

Using the established definitions (see above), this chrysoberyl trilling should be described as trapiche-type chrysoberyl. In this special case, the different zones of the star pattern are separated by twin boundaries and not—as is commonly observed in trapiche specimens—by the boundaries between different growth sectors.

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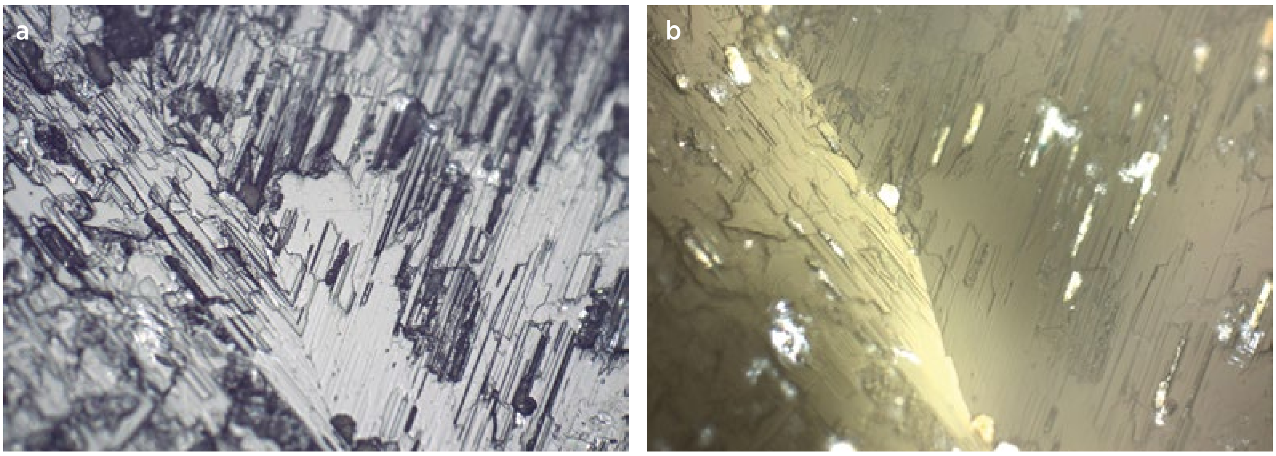

Figure 8: (**a**) At higher magnification, the chrysoberyl trilling shows a dense pattern of surface features and growth striations in reflected light; the growth features run parallel to the c-axes of the different parts of the trilling. (**b**) Viewed with crossed polarisers, the different parts of the trilling are clearly separated. Photomicrographs by H.-J. Bernhardt; fields of view 560 × 420 μm.