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## THE RUTILATED TOPAZ MISNOMER

By John I. Koivula

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*Recently a number of faceted Brazilian topazes containing brownish yellow acicular inclusions of what has been described by some gem dealers as the mineral rutile have appeared on the market. An investigation of this material shows that these inclusions are not rutile but rather are open channels colored by limonite.*

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Acicular (needle-like) crystals and crystal groups of brownish yellow to red rutile are relatively common as inclusions in both rock crystal and smoky quartz, so much so that quartz containing such inclusions is usually called rutilated quartz. Over the past two years, a small number of faceted colorless topazes containing what look like brownish yellow needles of rutile have appeared on the market. Because they are so similar in appearance to rutilated quartz, these topazes (see figure 1) have been marketed under the name "rutilated topaz."

These topazes are said to come from a pegmatite in Minas Gerais, Brazil (G. Becker and D. Epstein, pers. comm.). They are faceted, usually in a free-form cut, and range in weight from approximately 2 to over 20 ct. Most of the gems are colorless, but a few are blue. Undoubtedly the latter stones have been irradiated and heated; this treatment does not, however, appear to affect the color of the inclusions.

When one of these topazes is examined with the naked eye, the most obvious characteristic is the directional nature of the individual "needles." As illustrated in figure 1, the "straw-yellow" inclusions are quite obvious when viewed through the table and crown facets of the gem. When, however, one looks through the pavilion of this same topaz (figure 2), the primary images of the inclusions virtually disappear and only secondary reflections are visible. In fact, these inclusions are so ribbon-thin that for all practical purposes they are two-dimensional. When viewed in an edge-on direction, as in figure 2, they seem to vanish.

Rutile is not known to crystallize in topaz in a ribbon-like habit that would produce such a directionally dependent effect. This raises considerable

doubt that these inclusions are rutile, and led to the present investigation into the identity of this material. Because the inclusions were too small for X-ray powder diffraction to be performed and because there was no means of chemical analysis available (such as an electron microprobe), it was decided that microscopy would be the avenue for investigation. During this investigation, a total of nine stones were studied.

### MICROSCOPY

When first examined with a standard low-power stereo-zoom gemological microscope, the inclusions had the general appearance of essentially parallel, unbroken, thin, brownish yellow crystals that easily could be mistaken for rutile (figure 3). However, a more thorough examination revealed four features that, together with the nearly two-dimensional acicular habit, proved conclusively that these inclusions are not rutile.

The first of these features was a general observation that, on all of the cut stones examined, the brownish yellow inclusions always reached the surface. Not one of these inclusions was found to be contained completely within the topaz; at least one end, if not both, reached the surface of the stone. This finding suggested that the body color of the inclusions might have been derived from an outside source and was not necessarily inherent to the true nature of the inclusions themselves.

It was also observed that wherever these inclusions reached the surface, there was undercutting in the form of grooves or drag lines extending and

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*All photomicrographs were taken by the author.*

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Figure 1. Table-up view of this 19.77-ct Brazilian topaz shows the prominence of brownish yellow inclusions that have been mistaken for rutile. Photo © Tino Hammid.



Figure 2. The inclusions are so ribbon thin that many of them are barely visible in this pavilion view of the stone shown in figure 1. Photo © Tino Hammid.

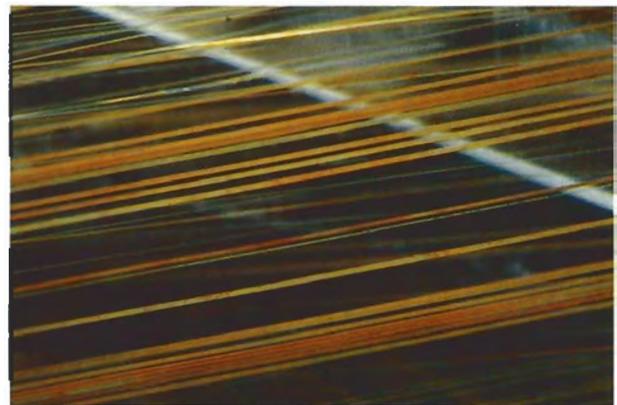


Figure 3. These inclusions in topaz could easily be mistaken for rutile. Darkfield and oblique illumination, magnified 35 $\times$ .

tapering away from the inclusions in the direction of polishing (figure 4). These are not the types of surface markings that one expects when slightly softer solid inclusions such as rutile, captured in a harder host material such as topaz, are cut through and polished over during lapidary treatment. They are much deeper and are reminiscent of the drag lines observed when preexisting fractures of similar surface-reaching hollows are polished over perpendicular to their length. The polishing-wheel action causes the spalling off of tiny chips from the rim of the fracture which are then pulled along by

the wheel. This scores the surface of the material being polished and produces the visual evidence we see in figure 4.

Incomplete filling of the inclusions provided additional proof that they are not rutile. Acicular rutile inclusions are single crystals and as such would not contain randomly spaced gaps at uneven intervals down their length. However, dislocation-caused growth tubes or voids that extend to, and are open at, a crystal's surface might contain incomplete fillings of epigenetically derived limonitic compounds. This latter phenomenon, re-



Figure 4. These polishing drag lines on the surface of a topaz extend from the ends of the "inclusions." Shadowed oblique illumination, magnified 25 $\times$ .



Figure 5. The incomplete filling of the inclusions provides further proof that they are not rutile. Oblique illumination, magnified 60 $\times$ .

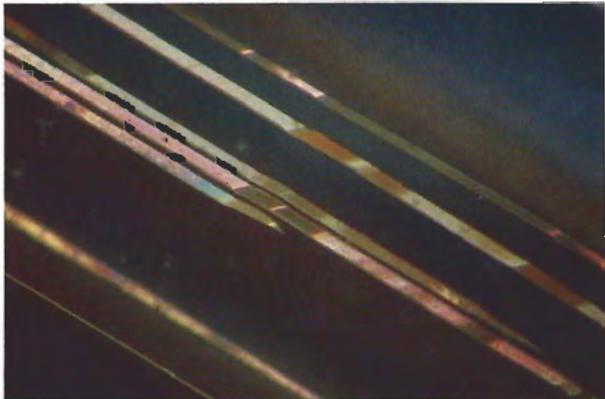


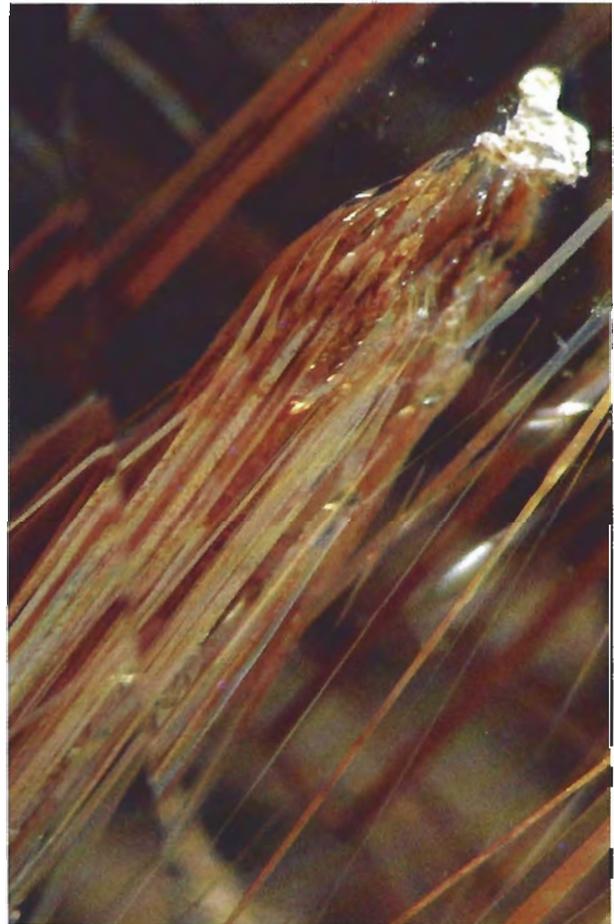
Figure 6. Thin-film iridescence from some of the unstained areas along the etch channels serves as additional support for the discontinuous nature of the inclusions. Oblique illumination, magnified 45 $\times$ .

sulting in discontinuous coloration (figure 5), was observed on close inspection of these inclusions.

When oblique illumination was used, the fourth feature, thin-film iridescence (figure 6), was observed wherever a gap was present in an inclusion channel. This provided additional proof of uneven channel filling, which is contrary to the continuous crystallization that would be expected if the inclusions were rutile.

As a final test, the thinnest portions of several of the inclusions were examined in polarized light to see if they were doubly refractive, which would also be expected of rutile. No double refraction was observed, so the possibility of rutile was once again negated.

Figure 7. This dense, broom-like cluster of iron-stained etch channels all propagate, as a result of growth blockage and disturbance, from the same solid inclusion. Darkfield and oblique illumination, magnified 40 $\times$ .



## CHARACTERIZATION OF THE INCLUSIONS

With this visual evidence, it is safe to say that the acicular inclusions observed in these "rutilated" topazes do not consist of rutile and are in no way related to rutilization. All of the above-noted observations, together with the previously published literature (Phakey and Horney, 1976; Roedder, 1984), point to the conclusion that these needles are the direct result of growth blockage caused by the presence of solid inclusions, which may or may not be microscopically visible, within the topazes.

Once trapped, the solid inclusions interfered with the ideal structural development of the topaz host as it grew away from them. This resulted in the formation of many dislocations leading away from the solid inclusions, often all the way to the surface of the topaz crystal. Such dislocations are a known invitation to etching (Phakey and Horney, 1976). Natural etching along these dislocations followed (or could have occurred continuously as the host topaz was growing). The final step was epigenetic iron staining through capillarity of the resultant etch channels. This epigenetic iron staining, incorporating a mixture of cryptocrystalline powder-like iron hydroxides and oxides referred to as limonite, gives the inclusions their brownish

yellow color and high visibility. Observations and illustrations of similar inclusions in topaz by Dr. Edwin Roedder (1984) strongly support this characterization (compare the photomicrograph on page 25 of his book with figure 7 here).

## CONCLUSION

Although these topazes have been sold as "rutilated," in reality they contain no rutile. Rather, limonitic stains filling, or partially filling, ribbon-thin etched dislocation channels in the topazes create the rutile-like effect.

A great deal of care must be taken during the faceting of these topazes because of the directional nature of the inclusions. The lapidary must orient the rough so that the inclusions will appear boldest to the eye when the finished faceted gem is in the table-up position. Referring back to figures 1 and 2 will show how important proper lapidary orientation is with this material.

## REFERENCES

- Phakey P.P., Horney R.B. (1976) On the nature of grown-in defects in topaz. *Acta Crystallographica*, Vol. A32, pp. 177-182.
- Roedder E. (1984) *Reviews in Mineralogy*, Vol. 12, *Fluid Inclusions*. Mineralogical Society of America, Washington, DC.

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