

# EMERALD CUTS FOR VERY LOW REFRACTIVE INDEX MATERIALS

By Tim Smith

The Emerald cut was designed to show the rich colour of emerald whilst having cut corners so that the brittle stones would not get damaged. As I investigated in an earlier article (Stonechat 72), for stones of refractive index below beryl (about 1.57) this style of cut is limited in brightness. This is a shame as the long facets down the side of the stone show colour very well and the general outline of the cut can be very attractive. Doing an Emerald cut in quartz is going to result in a stone with a dark centre or dark sides, depending on the culet angle chosen. For this reason, a simpler, unstepped pavilion with just one tier of facets may be preferred.

However, there are stones of even lower refractive index such as fluorite (1.43) where even a single tier of facets on the pavilion will not be enough to get brightness from an Emerald cut. One way to overcome this is to cut a retro reflector pavilion but this has some disadvantages. Primarily the awkward shape of the three-fold symmetry means that a very deep piece of rough is required. Not all rough is suitable and once cut the stones can be ungainly. This becomes more of a problem as the length to width ratio increases.

One way past this problem is to cut an apex crown and shallower pavilion but this leads to a stone without a table, preventing a clear view into the stone. There will also be a small dark area at the apex where it is impossible for light to be returned to the viewer. However, with Gemcad it is possible to use ray tracing to minimise this dark area. As a result the stone can be bright, even though the central part of the stone is not returning light. This point was made in the article on Nomog Stones (Stonechat 7) but is worth reiterating here. For example, a square stone with a small non-reflective table of 20% (0.2) of the width will occupy only 5% (0.2 x 0.2) of the area. Obviously in a rectangle the percentages will not be so favourable but even so, a non-reflective table does not necessarily reduce brightness significantly.

Having recently been given a few small but nicely coloured fluorite crystals from Weardale that were not suitably shaped for retro reflectors, I decided to test the concept. The basic idea is of a long apex crown with the central area cut away to give a mini-table, partnered with a pavilion where the angles are kept below the usual culet angle, useless for returning light through a table but very effective at returning light through other crown facets (see diagram).

I have produced two simple designs and have cut two small fluorites as a proof of concept. Both designs are for L/W ratios of 1:1.33 and the brightnesses given are for that ratio. However, both designs can be cut at any L/W ratio. Due to the essentially two dimensional ray paths taken through these designs by light, the brightnesses will not change significantly for different ratios.

The first design, the Mini Table Fluorite Bar is very simple yet gives a brightness of nearly 80% for fluorite. The accompanying photograph shows this in yellow fluorite from the Cement Quarry in Weardale. The stone is slightly cracked and hazy (as is most Cement Quarry material) but as can be seen it is very bright. It remains bright when tilted around the axis through the width dimension.

The second stone, the Mini Table Fluorite Opposed Bar, is designed to increase the complexity of the reflection patterns from the pavilion. At about 77% brightness, it is only marginally less reflective. As can be seen from the photograph, this has been cut in strong green fluorite, probably from Heights quarry. What cannot be seen is the pronounced purple fluorescence, common enough in the rough material but rarely displayed in the cut stone. However, in this specimen, with natural lighting, it really does have a velvety glow.

Both these stones are small and simple to cut. However, despite a lack of reflectivity in the central small table facets they remain bright. I shall certainly consider cutting my next large fluorite in a similar style, especially as this could well give a much larger looking stone for the a much deeper retro reflector of the same weight.

