CHAPTER V

TRIGONS ON OCTAHEDRAL CLEAVAGES OF PANNA DIAMONDS

5.1 Introduction

The studies of micro-structures on Panna diamonds as described in the previous chapter are pursued further. While studying the surface features on the dodecahedra from Panna mines, a very interesting crystal was found, the observations on which lead to the thinking that the 'trigons' are a result of dissolution process and not of a growth process. This chapter deals with the observations made on this crystal.

5.2 Trigon pattern on the matched faces of a Panna Crystal

This was also one of the crystals obtained from Pankaj Diamond Die Works, Surat, India. It was a rounded dodecahedron.

In order to make investigations on the cleavage faces of this crystal, it was subjected to the usual process of laboratory cleaving and two matched cleavage faces were thus obtained. Along with these two cleavages, cleavage also took place in some other parts of the crystal, thus producing two additional matched faces. The latter matched pair of cleavage faces was obtained by chance in the process of producing the earlier pair ; no effort was made to cleave along these faces. These faces were therefore examined optically, to find out why cleavage took place along this plane. Thus figures 51 (a) (X 175) and 51 (b) (X 175) are photomicrographs of the latter matched pair. It was surprising to find that they were covered partly with triangular depressions and partly with the usual cleavage pattern. (It should be pointed out that the crystal was not etched at all in the laboratory before or after cleaving). That the two faces are a matched pair can be seen immediately by comparing the cleavage patterns in the two photographs. Later it will also be shown that a more detailed examination of the triangular patterns in the two photographs leads to the same conclusion, i.e. that the two figures represent the matched pair. The triangular patterns on these faces were studied more critically in order to investigate the cause of their formation. Thus figure 52 (X 850) is a magnified picture of a region of the cleavage face having the triangular depressions. It is clearly seen that

(1) The triangular depressions have rectilinear sides and sharp corners.

(2) In certain cases, corners of some triangular pits make precise contact with the sides of the neighbouring pits but do not overlap.

(3) Some of the triangular pits can be seen to have basal extensions.

(4) It has also been verified, which will be shown later, that the orientation of the triangular pits is the same as that of trigons on the natural (111) faces.

(5) The orientation of the triangular pits on the matched pair is exactly opposite.

Thus these triangular pits possess all the characteristics of trigons.

5.3 <u>Cause of the formation of the trigon pattern</u>

Now it has to be seen how these triangular depressions might have been formed within the body of the crystal. If one is of the opinion that trigons are formed during growth, one might argue that these trigons could have been formed during the growth of the crystal and later on filled in as growth proceeded. Now when the cleavage passed through this plane, it might have proceeded in such a manner that the filled in [redacted] trigons section remained with one part of the cleavage, thus leaving triangular depressions on its counterpart. In this case, there must be triangular elevations on one part, and triangular depressions on the other part, of the same orientation. But this is actually not true in the present case, as (1) the triangular patterns on both faces are depressions, and (2) the orientation of the triangular patterns on the matched pairs are opposite to each other. The alternative explanation would be to assume that the crystal might have been etched in nature and the triangular pattern described above may be the result of the etching process. How the triangular pattern may have been formed within the body of the crystal may be explained by assuming the existence of some micro-cracks parallel to the octahedral faces, penetrating inside the body of the crystal. Now when the crystal is subjected to dissolution in nature, the etchant, liquid or gaseous, might have been percolated in the body of the crystal through the micro-crack, thus etching the two octahedral faces on the two sides of the crack and thus producing the triangular patterns observed.

That this might have actually happened is supported by the following observations :

(1) Etching through the crack would extend only as deep

as the crack and not throughout the whole cross--section of the crystal. This is what is observed in figures 51 (a) and 51 (b), in which it is clearly revealed that a part of the crystal is etched, whilst in the remaining portion there are the usual cleavage lines.

(2) As a result of etching along parts of the octahedral planes, a weakness might have been produced along these planes, and when the crystal was cleaved along another plane it is likely that it may have parted along this weakness due to the shock of the blow.

(3) The opposite orientations of the triangular etch patterns on the matched faces indicate that the matched faces have been subjected to dissolution.

(4) If the matched faces have been etched in nature, the etching would have produced correspondence in the number and position of etch pits on the matched faces. At a first sight such correspondence can not be established in figure 51 (a) and 51 (b). But a closer examination of this pattern, at a little higher magnification, reveals that a correlation exists between the etch pits on the matched faces, which is shown in figures 53 (a) (X 500) and 53 (b)

(X 500).

5.4 Orientation of the triangular pattern

The fact that the triangular depressions described above have trigon orientation was established by etching one of the faces in a solution of KNO_3 at 560° C. Thus figure 54 (X 400) represents the surface before etching and figure 55 (X 400) represents the same region after etching for 2 hrs. The triangular pits have become truncated, suggesting thereby that the original depressions were of trigon orientation. Some new pits oriented opposite to the original depressions are also seen.

5.5 The microstructures on the dodecahedral faces of the Crystal

In order to discover whether the crystal was really etched in nature, investigations were made on the microstructures on the rounded dodecahedral faces. Thus figures 56 (X 175), 57 (X 175) and 58 (X 350) represent typical microstructures observed on these faces. The crossed net work pattern, as seen in figures 56 and 57, and elevated triangular pattern seen in figure 58, are the most common features on these faces. Emara and Tolansky (1956) have shown that, by etching rounded dodecahedral faces, a crossed net work pattern is produced, while as shown in Chapter XI, if etching is carried out under certain conditions, triangular etch hillocks are produced. Thus the microstructures on the dodecahedral faces of this crystal indicate that the crystal has undergone dissolution in nature.

5.6 Discussion

That the triangular depressions observed on the cleavage faces have exactly the same characteristics as trigons suggests that they represent the usual trigons observed on natural octahedral faces of diamond. It has been shown beyond doubt in this work that the triangular depressions have been formed by etching and not due to growth. The author is therefore of the opinion that some trigons on the natural octahedral faces of diamond might have been formed due to a dissolution process in nature.

The crystal under study was a rounded dodecahedron. As has been shown, there is conclusive evidence that the crystal had undergone dissolution in nature. Normally, the crystal would grow with flat faces and sharp edges and corners. The rounded nature of the diamond crystal therefore may be due to dissolution of the crystal in nature and not due to growth, as some investigators maintain.