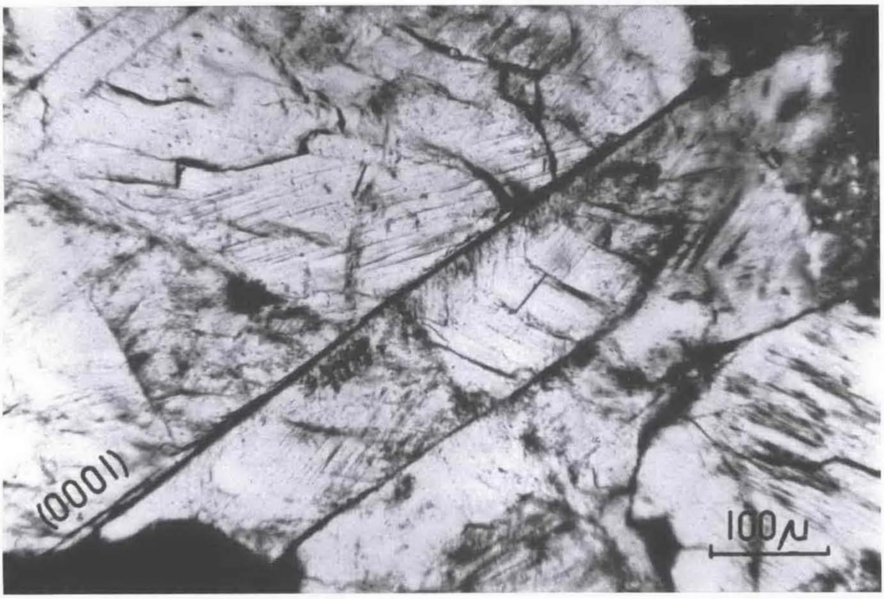

Fig. 7. Planar fracture parallel to {0001} and planar elements parallel to {10$\bar{1}$3}, formed later therefore terminating at the fracture. Quartz from sample S 350

are not open fissures. Regardless of their nature, smooth planar elements are discontinuity planes and zones of weakness. It has been demonstrated that quartz from a breccia of West Clearwater Lake, Canada, containing many planar elements of the non-decorated type breaks preferentially parallel to these features (ENGELHARDT, HÖRZ, STÖFFLER, BERTSCH, 1968). The same holds true for quartz from the Ries. An example is shown in Fig. 8. Under natural or artificial stress, quartz with non-decorated planar elements can break into platelets parallel to the planes of these elements. But fractures of this nature are always formed later than the planar elements, unlike the type of planar fractures mentioned above.

Since the multiple sets of smooth planar elements resemble strikingly cleavage patterns and additionally quartz containing such elements has the tendency to break along these planes, the non-decorated planar deformation structures from the Ries and Lake Mien, Sweden, have initially been reported as "cleavages" (ENGELHARDT and STÖFFLER, 1965). We now recommend to avoid the term "cleavage" in this connection. Cleavage means a perfect straight fracture producible potentially along all planes parallel to a certain rational plane of the undisturbed lattice. However, partition along non-decorated planar elements as observed in quartz from the Ries and other craters is due to a weakening of cohesion of the grains in these planes, produced under extraordinary stress conditions.

3.2. Crystallographic Orientation

The orientations of all five types of planar structures as defined in the last sections and their angular relation to the optic axes were measured with standard universal

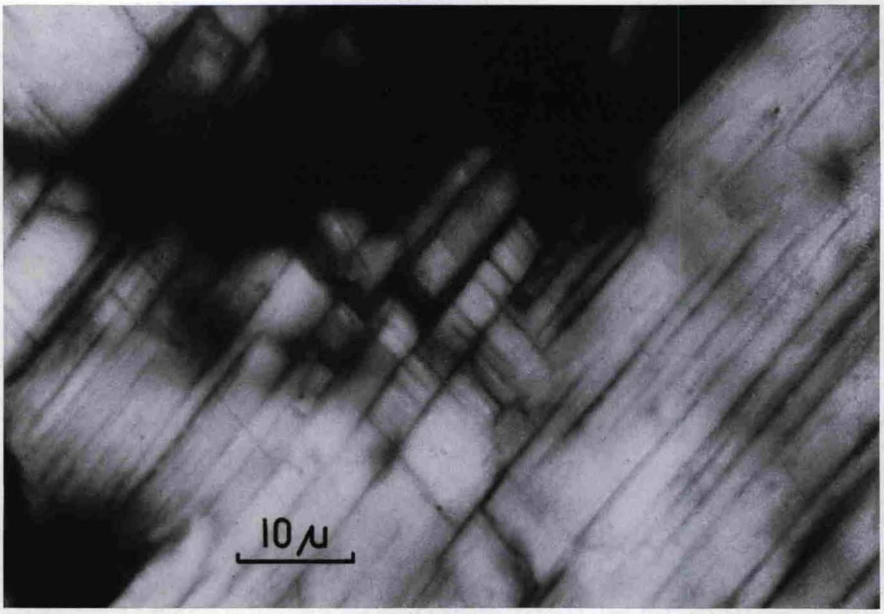

Fig. 8. Fracturing, caused during thin section preparation, following planar elements parallel to $\{10\bar{1}3\}$. Quartz from sample B 51. Crossed nicols

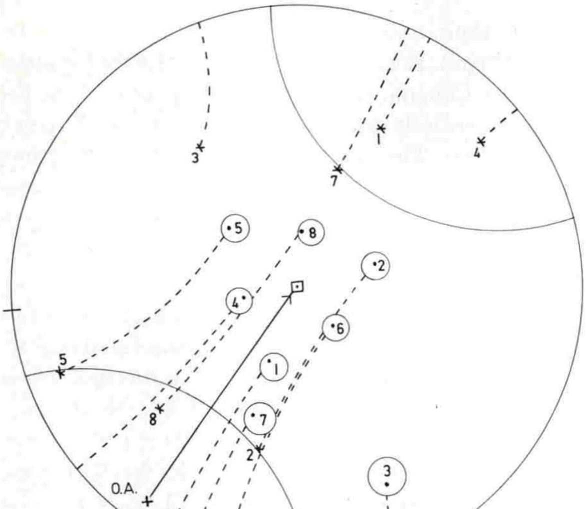

Fig. 9. Determination of the crystallographic orientation of planar structures. Stereographic projection. *Crosses*: Poles of planar elements (actual measurements on the U-stage). *OA*: Optic axis (actual measurements on the U-stage). The small circles represent the "blind" circle after rotation. *Points*: Poles of planar elements after transformation of the optic axis into the center of projection. 4, 6, 8: $\{10\bar{1}3\}$ or $\{01\bar{1}3\}$; 1, 2, 5: $\{01\bar{1}2\}$ or $\{10\bar{1}2\}$; 3: $\{21\bar{3}1\}$; 7: $\{10\bar{1}1\}$

stage techniques using thin sections. Per each grain the position of the optic axis and the poles of all measurable planar structures were plotted in individual stereo plots. An example is shown in Fig. 9. This particular grain displayed eight different sets of planar structures. The "blind circle" encloses the area not accessible to observation using an universal stage. The crosses indicate the actual measurements