[0001] and the poles of lamellae in the grains of quartz-tectonites would suggest that the reverse relationship may be correct: that the deformation lamellae originate as a result of movements parallel to the [0001]-axes of the grains. There is a mechanism, demonstrated by experimental studies, by which gliding movement on one set of surfaces may give rise to subsidiary movement along a plane inclined at steep angles to the glide-surface, namely, the formation of "kink-bands" (Turner, et al., 1954, p. 896-897). These kink-bands are slightly irregular zones, bounded by sub-parallel planes, in which the lattice of the mineral has a different orientation from that of the parent grain; they are inclined at high angles to the active slip-plane in the crystal and may or may not be parallel to a rational crystallographic plane.

In all the reported cases of minerals or metals in which kink-bands are considered to develop, they do so in response to gliding on a rational crystallographic glide-plane. There is no evidence, either from petrographic studies or from a consideration of the crystal structure of quartz (Griggs and Bell, 1938; Fairbairn, 1939) that such planes exist in quartz. However, there is good evidence that there is a linear weakness parallel to [0001]: the most obvious and common indication of post-crystalline deformation in quartz is the appearance of undulose extinction in zones sub-parallel to [0001]; when the strain is slight, the variation in extinction is continuous over a grain, but when the strain is more intense the grain is divided into distinct zones bounded by sharp surfaces of discontinuity. These boundaries are not distinctly planar and their orientation cannot be measured with the U-stage, indicating that they are not rational crystallographic planes but rather curved or irregular surfaces. The available data on the experimental deformation of quartz at high temperature and pressures (Griggs and Bell, 1938) show that quartz exhibits a strong tendency to break into needles parallel to the [0001]-axis. Examination of the crystal structure of quartz shows that none of the prism planes have the characters necessary to act as glide-planes, but it has been suggested (Griggs and Bell, 1938; Fairbairn, 1939) that imperfections in the crystal lattice, known as lineage structures (Buerger, 1934), which are known to exist parallel to [0001] in quartz, may be important in controlling the deformation. Griggs and Bell (1938, p. 1740) demonstrated that the needles parallel to [0001] are irregular and not bounded by prism planes.

Differential movement along [0001] of irregular blocks or rods elongate parallel to [0001] is part of the "Frontwendung" hypothesis of Hietanen (1938) and similar gliding movement is postulated by Weiss (1954). But in both of these hypotheses the deformation lamellae are considered to be the first indication of strain, representing planes of limited translation-gliding parallel to the basal pinacoid or rhombohedral planes. This is not in agreement with the actual crystallographic orientation of the lamellae. The following mechanism, which we consider to be the simplest and most rational means of accounting for the crystallographic orientation of the lamellae and their orientation in the fabric, is proposed:

Certain grains in the rocks have deformed by gliding parallel to the [0001]-axis, and the lamellae represent kink-bands inclined at high angles to the glide-surface and glide-direction. The type of gliding envisaged is not normal translation-gliding on a rational crystallographic plane; it may be "*linear gliding*" involving differential movement of rods sub-parallel to the [0001]-axis (such as might be illustrated with a sheaf of pencils) or the gliding may take place on irregular surfaces of high resolved shear stress in the zone of [0001], involving differential movement of platy elements defined by these irregular surfaces.

In addition to explaining the restricted but non-rational orientation of the lamellae, this hypothesis accounts for most of the features observed in the patterns of preferred orientation of the fabric elements in the specimens. In a quartzite with random orientation of [0001]-axes, subjected to strong axial compression, gliding parallel to [0001] (or on non-rational surfaces in the zone [0001] ) will take place only in grains with an orientation such that there is high resolved shear stress suitable for gliding parallel to [0001]; the [0001]-axes of these grains define (in projection) a uniformly-covered small-circle girdle about the axis of compression. The stress in this instance is axial and the resulting strain will also be axial. However, if a rock with a strong preferred orientation of [0001]-axes is subjected to a similar axial compression, the grains oriented so that there is high resolved shear stress parallel to [0001] will again deform by gliding, but the pattern defined by the [0001]-axes of these grains will not be a complete and evenly-covered small-circle about the axis of compression: the pattern will be modified by the pre-existing preferred orientation. Although a small-circle may still be defined by the [0001]-axes of the deformed grains, it will contain maxima where the small-circle coincides with concentrations in the pre-existing pattern of [0001]-axes. (Although the stress in such a case is axial, the resulting strain, by this mechanism alone, would not be axial, but would have some lower symmetry controlled by the pre-existing anisotropy of the fabric.) An examination of figures 5a and 5c, for example, shows that the maxima of [0001]-axes in grains with deformation lamellae (fig. 5c) occur where the small-circle in this diagram crosses areas of high concentration in the pattern of preferred orientation of [0001] in the rock as a whole (fig. 5a). A similar relationship may be seen, though it is less evident, in specimens I (figs. 2a, 2c) and III (figs. 4a, 4c).

Kink-bands probably originate in response to some external influence which prevents unlimited deformation by gliding on a set of glide-planes with high resolved shear stress. In the case of deformed cylinders of calcite this influence is the constraint caused by clamping the ends of the cylinders, and thus preventing external rotation of the cylinder (Turner, et al., 1954). In the case of an aggregate of calcite or quartz grains, the constriction of any grain is probably imposed by the neighboring grains in the aggregate. This is illustrated for quartz in figure 7, assuming the mechanism postulated above, namely, gliding on non-rational surfaces of high resolved shear stress in the zone of [0001]. The development of kink-bands (represented by deformation lamellae and bands) in quartz may be explained as follows: When the aggregate of quartz grains (quartzite) is deformed by strong compression (fig. 7c) only grains which are suitably oriented for gliding parallel to [0001] (grains X and Y in fig. 7) will deform by gliding. As gliding proceeds these grains will become elongated and will rotate externally with respect to the axis of compression (figs. 7b, c). These processes are, however, impeded by the surrounding grains, which are not suitably oriented to deform by gliding. But