in a significant proportion of the grains, and they are described and interpreted elsewhere (Christie, 1958).

The preferred orientations of [0001] axes in the analyzed specimens are shown in figure 21 (in pocket), diagrams D1–D5. There is a high degree of preferred orientation in all the specimens. In specimens M13, M14, M17, and M18 the patterns of preferred orientation are similar; the [0001] axes tend to form a single area of concentration, containing two distinct maxima, and there is some suggestion of a girdle in each instance. In specimen M15, however, the [0001] axes define a diffuse girdle which contains several maxima. These maxima do not lie in the periphery of the girdle but are inclined to it at small angles ("cleft-girdle" pattern). The degree of homogeneity of the [0001] axis orientation in the rocks (as indicated by the similarity of the component diagrams from the three sections) is variable but usually high.

The patterns of preferred orientation of [0001] resemble closely those of Alpine dolomites described by Ladurner (1953). Specimens M13, M14, M17, and M18 are similar, with regard to the orientation of [0001] axes, to the *S*-tectonites of Ladurner's classification (though they lack any texturally defined *s*-plane), and specimen M15 is similar to Ladurner's *B*-tectonites of Type III.

Diagram D6 in figure 21 (in pocket) is a synoptic diagram showing the main maxima (3, 4, and 5 per cent per 1 per cent area) in the patterns for each of the five specimens, geographically oriented. In general, the maxima lie in a girdle about the axis *B*, and the broken lines, which are drawn parallel to this girdle, pass through the main maxima for specimens M14 and M18. The axis *B* of the girdle is approximately parallel to the axes of medium-scale folds measured in the dolomite (fig. 16, *b*). Thus the fabric on a microscopic scale is consistent with that on the larger scales observable in the field, and this aspect of the fabric may be assumed to reflect the same movements.

The orientation of twinned $\{02\bar{2}1\}$ lamellae in specimens M14, M15, M17, and M18 is shown in diagrams D7, D8, D9, and D10, respectively. The poles of the lamellae are concentrated in a single maximum in specimens M14, M15, and M18, whereas in specimen M17 they tend to lie in a diffuse girdle which is diagonal in the diagram.

INTERPRETATION

The mechanisms of deformation of dolomite have been determined by experiments on dolomite rock (Turner *et al.*, 1954; Handin and Fairbairn, 1955) and single crystals (Higgs and Handin, 1959). These are (*a*) twin gliding on $\{02\bar{2}1\}$ planes, normal to the directions $[02\bar{2}1:0001]$, with negative sense, and (*b*) translation gliding or slip on the basal plane {0001} parallel to one of the *a*-axes. Twin lamellae are formed by the former mechanism and the latter is recorded by rotation through the crystals of preëxisting $\{02\bar{2}1\}$ lamellae to irrational orientations. The internally rotated lamellae have been designated L_9 (Turner *et al.*, 1954) and L_f^c (Higgs and Handin, 1959).

Turner (1953) plotted axes of compression (*C*) and tension (*T*), which would be ideally oriented to cause twinning on the prominent $\{10\bar{1}2\}$ twin lamellae in the calcite grains of several marbles. He found that these axes, *C* and *T*, show a

preferred orientation in the rocks, reflecting the stress that produced the twinning. By using the method devised by Turner, it is possible to determine the orientation of the stress that produced the twinning in a natural dolomite, assuming that the experimentally determined mechanism operated (Christie, 1958; Crampton, 1958). Similar deductions may be made from the orientations of internally rotated lamellae in grains (Christie, 1958). The experimental evidence indicates that slip on {0001} is a more important mechanism than twinning on $\{02\bar{2}1\}$ under most experimental conditions, but the deformation due to this mechanism can be recognized only if twin lamellae were present before slip began. Internally rotated (L_9) lamellae are present, but extremely rare, in specimens M15, M17, and M18; they are more common in specimen M14. It has been demonstrated that the stress deduced from rotation of lamellae due to basal slip in specimen M14 is the same as that deduced from the twinning (Christie, 1958). The axes *C* and *T* deduced from twinning $\{02\bar{2}1\}$ lamellae in specimens M14, M15, M17, and M18 are shown in figure 21 (in pocket), diagrams D11–D14.

From the orientation of the $\{02\bar{2}1\}$ planes in dolomite and the sense of twin gliding, it follows that the *C*-axes are inclined at a small angle (17.5°) to the [0001] axis, and the *T*-axes are similarly inclined to the base (0001). Thus in a dolomite rock so intensely deformed that twinning has taken place on all the $\{02\bar{2}1\}$ planes, the preferred orientation of the *C*- and *T*-axes deduced from the fabric would be controlled, not by the orientation of the applied stress, but by the preferred orientation of the lattices of the grains. For example, in a rock in which the [0001] axes define a single maximum, the *C*-axes inferred from the twin lamellae would form a maximum coincident with the concentration of [0001] axes, and the *T*-axes would be oriented in a diffuse girdle normal to the maximum of compression (*C*) axes; the preferred orientation of the inferred stress axes in such a rock will not necessarily give the orientation of the applied stress during deformation. In the specimens under consideration two features suggest that the stress axes inferred from the twinning do, in fact, represent the stress that produced the twinning: first, the orientation of the interpreted twin lamellae is rather highly restricted, and, second, the maxima of compression axes (*C*) do not coincide with the maxima of [0001] axes in any of the specimens.

If there is a strong point maximum of both *C*- and *T*-axes, the maxima probably indicate the orientation of the greatest and least principal stress axes, σ_1 and σ_3, respectively (compressive stress positive). In this instance the third principal stress was probably intermediate between σ_1 and σ_3, so that $\sigma_1 > \sigma_2 > \sigma_3$. If there is a point maximum of *C*-axes, and the *T*-axes are distributed in a great circle normal to it, two of the principal stresses (σ_2 and σ_3) were probably equal and less than the third (σ_1), which is parallel to the maximum of *C*-axes. The stress would then be axial ($\sigma_1 > \sigma_2 = \sigma_3$).* An axial stress would also be indicated by a point maximum of *T*-axes (σ_3) with a great circle of *C*-axes normal to it ($\sigma_1 = \sigma_2 > \sigma_3$). The least principal stress in the last instance might be either tensile or compressive, though it is unlikely that tensile stresses exist at depth in the earth's crust.

There are point concentrations of *C* and *T* in specimens M14 (D11) and M17

* The term "axial" is used to characterize the stress when two of the principal stresses are equal, because "uniaxial," as usually defined, implies that two of the principal stresses are zero.