Dynamic Interpretation of Twin Lamellae in Calcite and Dolomite. Although in principle it is possible to make dynamic inferences from any known gliding system, in nature only a few common rock-forming minerals show the diagnostic features required in practice. Twinning in calcite and dolomite has received most attention in the laboratory and in the field. Knowledge of the deformation mechanisms in calcite has evolved from Brewster's observations(101) of mechanical twins in 1826 to the comprehensive experimental studies of deformed calcite single crystals and marbles, together with their petrofabric analyses.* As a result, gliding flow in calcite can be adequately accounted for by three gliding systems (Fig. 24):

(1) Twin gliding parallel to $e\{01\bar{1}2\}$ with $[e_1:r_2]$ as the gliding direction, and with a positive sense of shear,** effective throughout the temperature range of 20° to 800°C.

(2) Translation gliding on $r\{10\bar{1}1\}$ with $[r_1:f_2]$ as the gliding direction, sense of shear negative, effective over the temperature range 20° to 800°C.***

(3) Translation gliding on $f\{02\bar{2}1\}$ with $[f_1:r_3]$ as the glide direction, sense of shear negative, effective at 20°C and at 500° to 800°C, where it predominates over r translation.

Turner(111) has developed a technique for dynamic interpretations of twin lamellae in naturally deformed rocks by locating the mutually perpendicular directions of compression and extension that most favored development of the observed twin lamellae. The geometry of these relationships was initially set forth by Handin and Griggs (Ref. 105, pp. 866-869). If a maximum S_o value (0.5) for twinning is assumed,

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*See Refs. 43, 95, and 102-110.

**Arbitrarily, relative displacement of the upper layers of the lattice upward toward the optic axis (or c axis, or c_v as used here) is called gliding in the positive sense; relative displacement of the upper layers downward from the upper end of the c_v is called gliding in the negative sense.

***Direct visual evidence of translation (e.g., slip lines) is rare. Accordingly, translation gliding systems will not be utilized here, but will be discussed in the section on intragranular rotation phenomena.

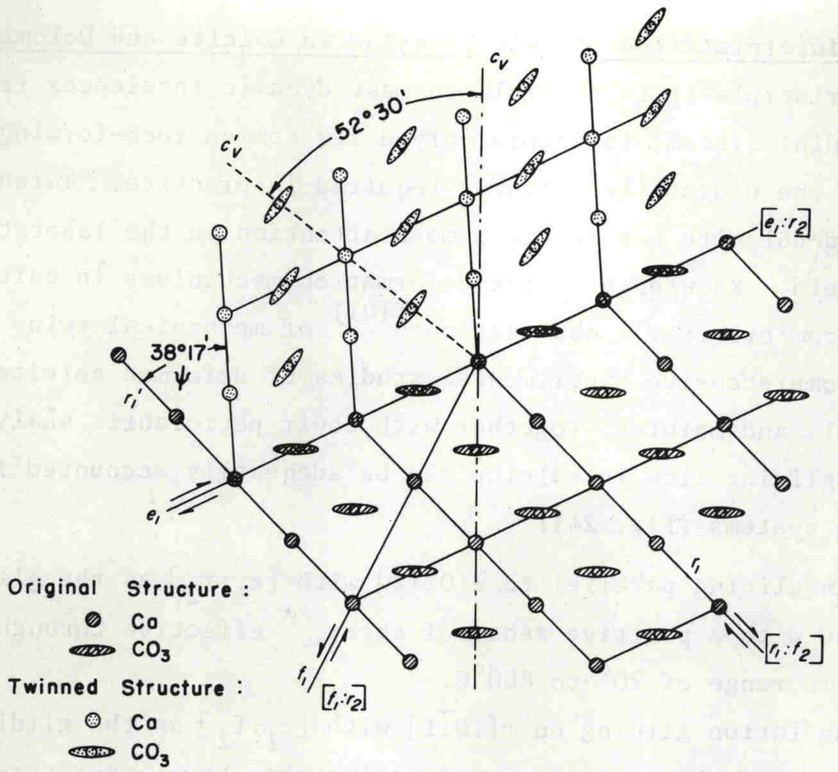

Fig. 24—Diagrammatic representation of the calcite structure. Section is drawn normal to the a_2 axis. The structure is twinned on e_1, with the gliding direction and sense of shear for the twin gliding indicated. Translation gliding systems along r_1 and f_1 are also shown.

the position of the load axis can be uniquely defined, because χ_0 and λ_0 must be 45 degrees (Fig. 19). Accordingly, σ_1' and σ_3' are fixed for twin gliding when $S_o = 0.5$ (Fig. 25(a)).* The compression axis σ_1' is inclined 45 degrees to e_1 or to the normal to e_1, and 71 degrees to c_v (the c axis).** The extension axis σ_3' is inclined 45 degrees to e_1 or the normal to e_1, and 19 degrees to c_v. For any calcite grain,

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* Primes are used to denote principal stress axes derived from any one crystal.

** By convention, the three twin planes in each calcite crystal are designated as e_1, e_2, and e_3; e_1 is identified as the plane along which the twin lamellae are best developed, i.e., most densely spaced or widest, and e_3 is identified as the plane along which they are the most poorly developed. In a calcite crystal in which at least one set of twin lamellae is developed (e_1), the positions of the other potential sets can be determined from the crystallography of calcite.