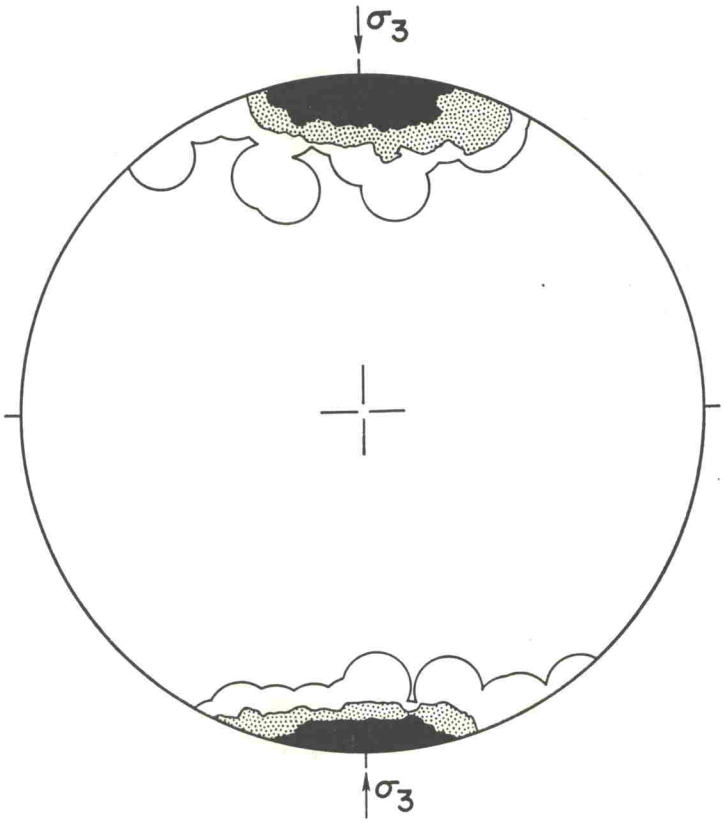

FIG. 7.—Specimen 911. Diagram of normals to 143 fracture sets in 129 detrital grains, of which 100 are quartz. Contours: 0.7, 3.5, and 10 per cent per 1 per cent area; 40 per cent maximum per 1 per cent area.

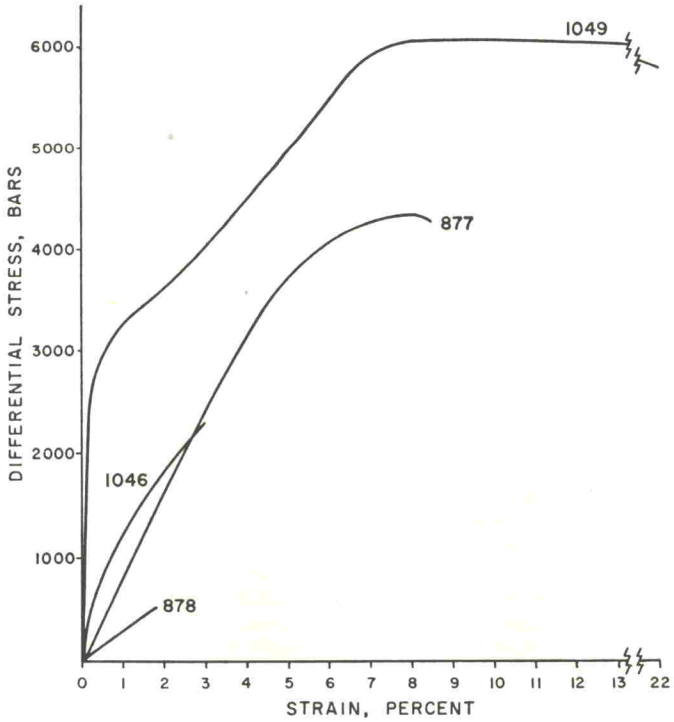

FIG. 8.—Stress-strain curves for specimens 878, 1046, 877, and 1049

orientation of the load axis with respect to the calcite crystal in the two specimens.

Specimen 1049 exhibits an incipient shear zone 0.1 inch wide that is inclined at 35° to σ_1. The zone is marked by a deformation mosaic in the calcite. Detrital grains are highly fractured within the zone but not more so that outside. Little if any shearing movement has taken place along the zone, as is evident from the lack of offset at the cylinder boundaries. In addition, the specimen exhibits a clockwise external rotation of 10°–15° caused by constraint of the steel end cups. The detrital grains are highly fractured throughout the specimens (fracture index is 300). The microfractures are parallel to σ_1, (fig. 9, *b*). The microfractures reflect the external rotation of the cylinder and therefore formed prior to the kinking.

The calcite crystal in specimen 1049 exhibits twin lamellae (index is 153), undulatory extinction, a few $r\{10\bar{1}1\}$ planes, and some extension fractures. In areas of the specimen outside the incipient shear zone, the calcite is characterized as follows:

1. Twin lamellae are best developed adjacent to fractured detrital grains and die out into the centers of the interstices.

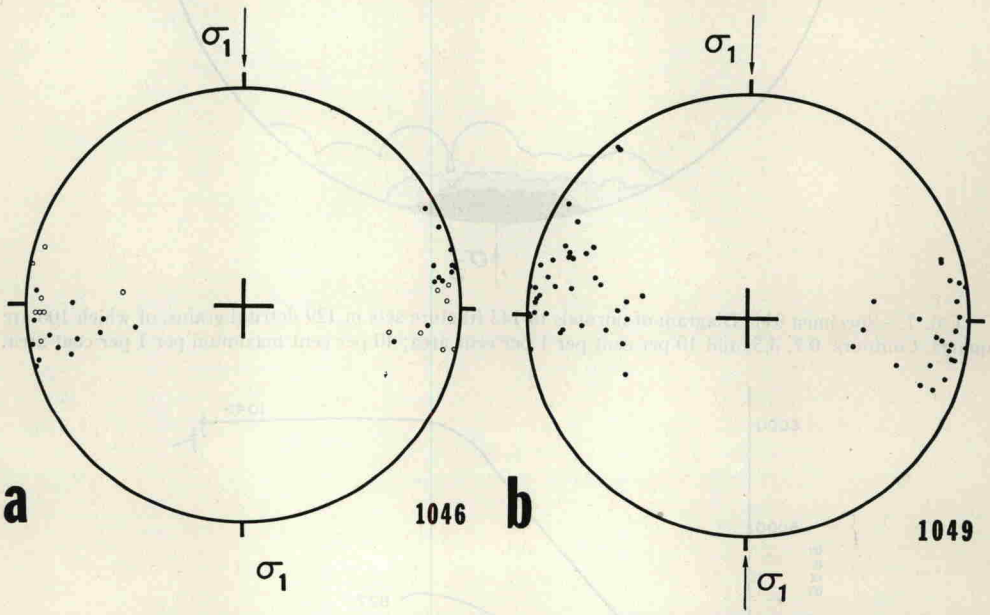

FIG. 9.—Diagrams illustrating orientation of microfractures with respect to load axes for specimens 1046 and 1049. Plane of each diagram is parallal to long axis of deformed cylinder. *a*, specimen 1046. Solid circles represent normals to 23 sets of microfractures in calcite crystal. Open circles represent normals to 15 sets of microfractures in the detrital grains. *b*, specimen 1049. Solid circles are normals to 57 sets of microfractures in 50 detrital grains.

PLATE 3

A, Photomicrograph of extension fractures in calcite crystal and in detrital grains of specimen 1046. The fractures are oriented with respect to the principal stress axes as shown. Crossed nicols.

B, Photomicrographs showing details in specimen 725 (pl. 4). *a*, Photomicrograph shows microfractures in the detrital grains and the through-going shear zone. It is oriented such that σ_1 is N.-S. and σ_3 is E.–W. Crossed nicols. *b* and *c*, Photomicrographs illustrate twin lamellae in deformed calcite cement, located at the center of each field of view. Photomicrographs were taken with the thin section mounted on the universal stage so that the twin lamellae at the center of *c* are tilted on edge. One nicol.