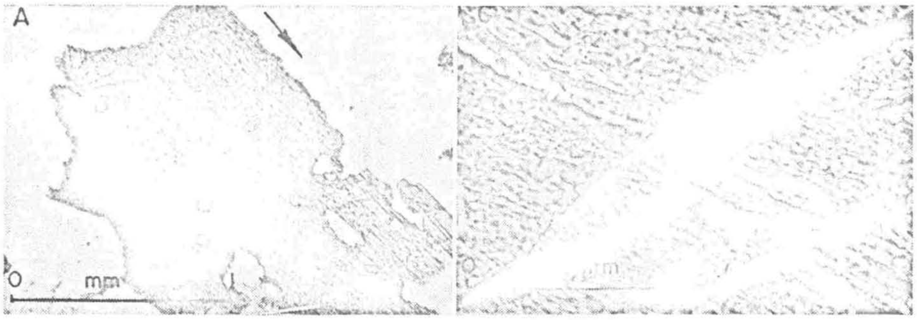
3 shows the greatest concen- kink-bands with their long al to the direction of shock- agation. The second greatest ons of kink-bands are sym- disposed at angles of 50° to the shock-wave direction. ientation of kink-bands to e stress is illuminated by ex- al work. Griggs, Turner, and 2) showed that the long axis ands in biotite in an experi- deformed granite tended to ormal to the axis of compres- erson and Weiss (3), in experi- udies of phyllite, found con- s of kink-bands symmetrically at 50° to the direction of in specimens compressed the foliation, but only one ped in specimens compressed nd 45° to the foliation. These studies suggest that orienta- h normal and at a moderate the axis of compression are as primary deformation fea- Ramsey (4) suggested that a der shear, resulting from a ment of the principal stress s, accounts for the develop- shear folds (similar to kink-



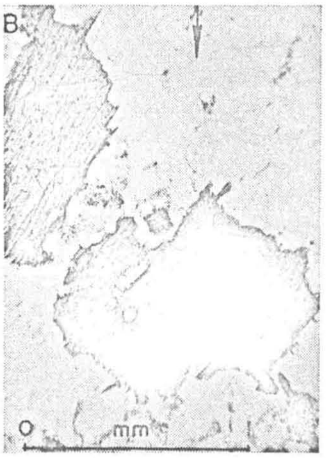
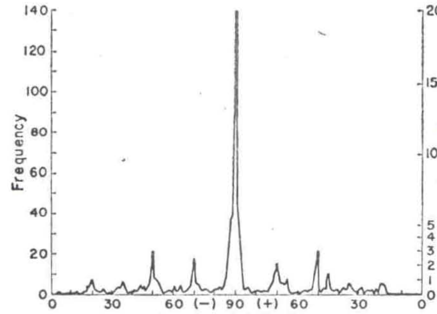


Fig. 2. Photomicrographs (plane polarized light) showing kink-bands in biotite. Arrows indicate stress direction (shock-wave propagation). Thin sections from core samples C_{10} and C_{11} used for photographs have known orientations with respect to the shot point. *A*, Kink-bands developed normal to stress direction. Crystallographic orientation of biotite with respect to the plane of the thin section is almost parallel to (001). The small black lines in the biotite almost parallel to direction of stress are inclusions. *B*, Kink-bands developed normal to stress direction (upper left and left center), at 50° (left center), and 70° (center). Other kink-bands are developed between 10° and 30° (center). Crystallographic orientation with respect to the plane of the thin section of both biotite grains is almost perpendicular to (001). Examination of thin sections prior to shot revealed no kink-bands and no apparent preferred orientation of biotite grains. *C*, Higher magnification photomicrograph of upper portion of *A* showing details of kink-bands.

e experiments (2, 3) might read- in the concentrations at 90° Neither experiment, however, the 70° concentrations. As d by Ramsey (4), it may be to explain the 70° concentra- second-order shear.

stry (5) and Moody and Hill bed the expected geometry of ion resulting from a compres- ss. If the direction of the com- tress (shock wave) is given with y shear angle, at 50°, and if cal angle" (6) is set to 20°, ntration at 70° may be ex- as resulting from second-order g. 4).

ed above, it is believed that k wave (and, therefore, the med the kink-bands. Although e of the shock wave is super- , and the development of der shears requires some time distribution of internal stresses, eless seems possible to argue e kink-bands resulted from a mary stress—the shock wave. 5 qualitatively shows the pas- e shock wave from the deto- oint, *0*, to the edge of the e (R_s). The history of kink- mation at a point may be related to the passage of the shock wave in time, distance, and peak compressive stress. The shock-wave front passes point *A* at time T_1, forming kink-bands normal to the direction of shock-wave propagation (90°) and primary shear sets (50°). The pressure behind the wave front does not return to ambient immediately after the passage of the front. For point *B* and time T_2, a similar argument can be proposed. At point *A* and time T_2, however, there is overpressure remaining which may be sufficient both in time



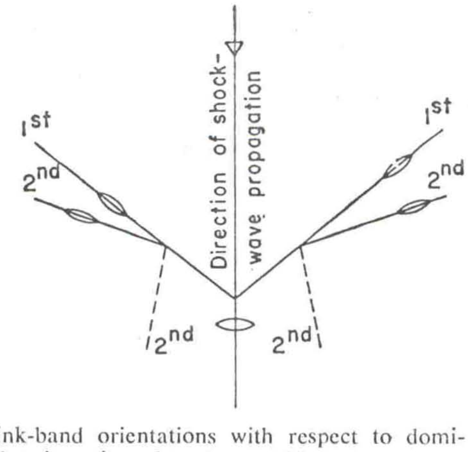


Fig. 3 (left). Frequency distribution of kink-band orientations with respect to dominant orientation. The dominant kink-band orientation, based on 110 measurements from oriented sections, is at 90° to the direction of shock-wave propagation. Kink-bands making angles in a counterclockwise direction with respect to the dominant orientation are plotted as (+); those making angles in a clockwise direction with respect to the dominant orientation are plotted as (−). Fig. 4 (right). Theoretical directions of first- and second-order shears with respect to the direction of stress (shock-wave propagation) (6). Dominant set of kink-bands is formed normal to the direction of shock-wave propagation. Observed concentrations of kink-band orientations interpreted as shear are indicated by solid lines. Although four directions of second-order shearing are possible, only two are present. Dashed lines indicate undeveloped shear directions. Kink-band orientations with respect to direction of shock-wave propagation and shear directions are indicated by shape of lens.