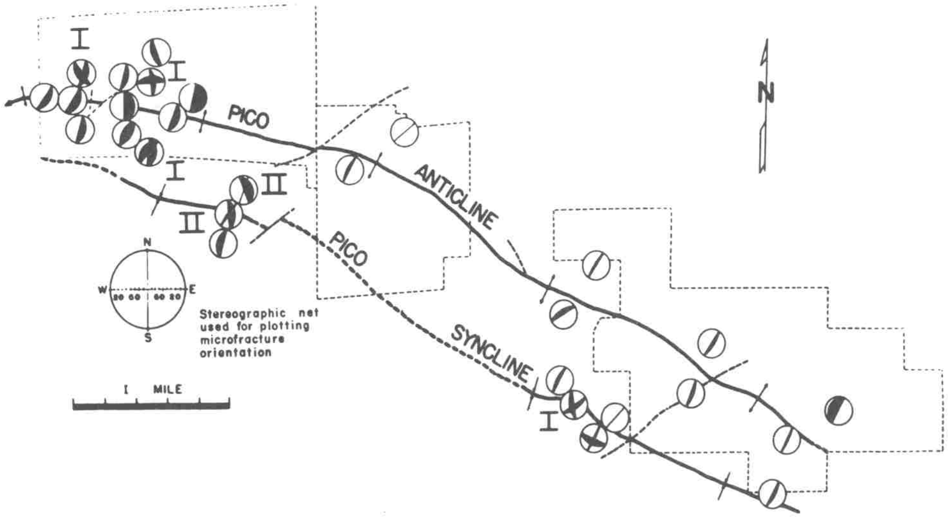

Fig. 14—Stereograms showing the orientation of major sets of microfractures associated with the Pico structure (from Bonham, Ref. 79, Fig. 7). The reference plane of each stereogram is horizontal.

that most are vertical and lie in the ac plane of the fold. Bonham points out that those near the western end of the structure reflect the westward plunge of the fold about the B$'$-axis.

Bonham does draw a dynamic inference from the ac fractures. He attributes them to tension parallel to the fold axis during deformation. Further inferences are possible from examination of the microfracture subfabrics. Consider first the diagram illustrating two concentrations (Fig. 12(b)). These define planes which intersect at about 75 degrees along a line nearly normal to the bedding plane. This configuration suggests that the fabric maxima define two sets of conjugate shear fractures (θ = 38 degrees) for which σ_1 is parallel to the bedding plane and normal to the fold axis, σ_2 is normal to the bedding plane, and σ_3 is in the bedding plane and parallel to the fold axis. In Fig. 14, there are four stereograms (marked "I") that contain two sets of planar features intersecting at 50 to 80 degrees. By correlating the line of intersection of the two sets with the probable dip of the beds (see fold axes), one concludes that at each station, sets comprise a pair of conjugate shear fractures that intersect in a line normal to bedding. In each case the orientations of the derived stresses are as stated above. Next, consider the many stereograms in

Fig. 14 that contain a single set of features oriented in the ac plane of the fold. These not only parallel the ac macrofractures, but also tend to bisect the acute angle between the conjugate shear fractures at nearby stations. By reference to the basic configuration (Fig. 8(a)), the ac features are recognized as extension fractures. Finally, at two stations (marked "II" in Fig. 14), it appears as though one set of ac microfractures and one set of shear fractures occur in the grains of the rock. That is, the lines of intersection are at high angles to bedding, the shear fractures nearly parallel those at other stations, and the small dihedral angle between the ac set and the shear fracture set is in each case about 20 degrees.

Thus, Bonham has mapped microfractures and macrofractures that (1) exhibit consistent orientations throughout the fold, (2) are geometrically related to the fold in a meaningful way, and (3) can be interpreted as genetically related to the same state of stress. These principal stresses appear to be uniformly oriented with respect to the bedding planes and to be independent of the dip of the beds. Unfolding brings principal stresses mapped at each station throughout the structure into congruency. Accordingly, one can conclude that the fractures occurred either throughout the folding process or early in the history of folding in response to a horizontal greatest principal stress oriented roughly N-25°-E, a vertical intermediate principal stress, and a horizontal least principal stress trending roughly N-65°-W. The first alternative requires that σ_1 remain nearly parallel to the bedding throughout folding.

Field Examples--Macrofractures and Faults. The literature is replete with purely geometric descriptions of macrofractures and faults. In most cases, the authors have referred to these features as joints (10^{-1} to 10^{3} m in observed length) and related them to larger-scale folds and faults. Some workers have attempted to associate the joints genetically with the regional state of stress, but few have had an adequate understanding of the problem. Good examples of enlightened investigations are available, however. Several of these are reviewed by De Sitter (Ref. 80, pp. 122-142), and Schmidt (Ref. 81, pp. 10-17) gives a comprehensive review of the literature. Additional significant