The fact that joints, fissures, cracks, etc., are either shear fractures or extension (tensile) fractures and that they form with a predicable geometric relationship to the principal stresses in the rocks at the time of fracturing (Figure 14) has proved to be a useful basis for relating fractures to structure (e.g., see DeSitter, 1956, p. 132; Stearns, 1964; and Friedman, 1964). Macrofractures sets in the rock mass are recognized as shear or extension features on the basis of this geometry and if possible by offset criteria. They are correlated geometrically with the local structure (fabric axes and planes, fold axes, faults) or genetically through consideration of the corresponding principal stress axes. For example, certain fracture patterns are now recognized to be ubiquitously associated with folds presumably because they are related to the bending stresses in the folded plates (Figure 15). This has been tested by mapping these fracture patterns in genetically different folds. Similarly, in and adjacent to fault zones macrofractures parallel and conjugate to the fault are invariably developed. It follows that macrofracture orientation patterns can be predicted from stress trajectory information obtained from theoretical analyses or from photomechanical model studies of rock mass problems.

The major limitation to this approach is that one cannot predict what combination of shear and extension fractures will form from a given orientation of the principal stress axes. For example, extension fractures alone might form, or one shear and an extension fracture, or both shears, or only one of the shear fractures etc. Accordingly, predictions of fracture orientation from one locality to another can only be stated ideally in terms of the total shear and extension fracture assemblage possible for a given state of stress.

Norris (1966) related the bedding, macrofractures, cleats, normal faults, reverse faults, and wrench faults to the kinematic axes for thrust