$$P = \sum_{x=x'}^{x=\infty} \frac{e^{-Np} Np^{x}}{x!} ,$$

where P is the probability, N is the total number of points in the sample, p is the probability that 1 point will occur in a given 1 per cent area (here, 0.01), and x equals the number of points per 1 per cent area. When Np = 1, the probabilities of finding at least x points in any 1 per cent area are as follows: 0 points, 1.00; 1 point, 0.63; 2 points, 0.26; 3 points, 0.08; 4 points, 0.02; 5 points, 0.004; 6 points, 0.0006; and 7 points, 0.0001. Thus in a sample of 100 points (Np = 1), the chances of obtaining a 6-point (6 per cent) concentration from a random distribution are 6 in 10,000, and a 7-point (7 per cent) concentration, 1 in 10,000.

Statistical tools should be used prudently--only to guide interpretations, not to dictate them. For example, none of the tests known to the author takes into account the locations (specific orientations) of the points on the diagram whose orientations are analyzed collectively. For instance, an orientation pattern may be characterized by points distributed within a band (girdle) along small or great circles. There is little doubt that this pattern would have geological significance, although statistical tests might show that the distribution was random. The role of statistics here should not be to dictate against reason that the pattern was random but rather to suggest that no significance should be attached to any concentrations within the girdle.

Deformation Mechanisms and Criteria for Dynamic Interpretations

Fracturing and Faulting

General. Many classifications of fracturing, faulting, and related phenomena are found in the engineering and metallurgical literature,[31] but none is generally applicable to geological problems. The types of failure pertinent here are extension fracturing and faulting (including shear fracturing).[32,33] Brace[34] has recently found that these types may be gradational under certain states of stress.

Fracturing is regarded as a process involving separation into two or more parts after total loss of cohesion and resistance to load, and release of stored elastic strain energy. Extension fracturing is separation of a body across a surface oriented normal to the least principal stress (σ_3).* There is no offset parallel to this surface. Macroscopically the least principal stress may either be negative (tensile) or positive (compressive). Tensile fracture (σ_3 negative) is regarded as a special case of extension fracture. Correlation between extension fractures (the feature) and the principal stresses follows from the criterion of no offset. The fracture surface is parallel to the plane of vanishing shear stress normal to σ_3, and contains σ_1 and σ_2 (Fig. 8(a)).

Faulting is defined as offset parallel to a more or less planar surface of nonvanishing shear stress. There is no restriction on the magnitude of offset. Faulting may or may not be accompanied by loss of cohesion and resistance to load, actual separation, or release of stored elastic strain energy. When these events do occur, it is proper to speak of shear fracturing. In the laboratory it is usually possible to distinguish between shear fracturing and faulting. In nature, however, it is rarely possible to observe the process and determine whether it is actually accompanied by a loss of cohesion, etc. Clearly, those features which have inherently maintained cohesion should be called faults. On the other hand, the fact that a feature exhibits no cohesion across its surface at present can not be used to infer that it formed as a result of shear fracturing. That is, the loss of cohesion may have occurred after the feature initially formed. Accordingly, there is a problem when dealing with naturally deformed rocks as to what to call the features that result from these processes. The usage adopted here is as follows: The term "shear fracture" will be used to designate features along which the shear displacement is less than an arbitrary amount (1 m), and the term "fault" will refer to features

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*By the convention often adopted in geology, compressive stresses are positive, tensile stresses are negative. The greatest principal compressive stress is designated σ_1, the intermediate principal stress is σ_2, and the least principal stress is σ_3.