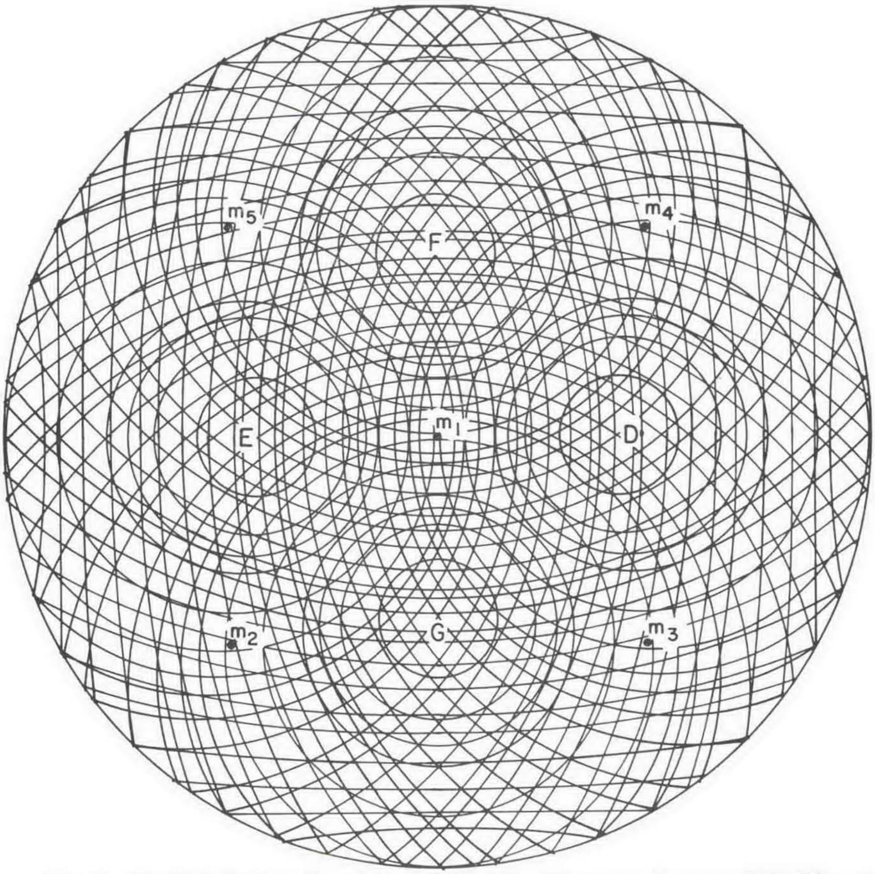

Fig. 4. Small-circle (equal angle) net for calcite. The net makes use of 17 different reflecting planes with ϕ-angles ranging from 13 to 90 degrees. Each set of 17 is concentric about the normals to four inclined rock sections dipping 45° to the section containing the primitive circle (plane of the paper). Letters D, E, F, and G correspond to sections of figure 2A, B.

Consider, for example, point m_1, figure 4. Here four circles (those corresponding to the "r" planes of calcite) intersect at the center of the net, one from each of the sections D, E, F, and G (see fig. 2A, B). If there were a point maximum located here at the very center of the net, the intensities of all four of these planes would be very strong. But note also that two of the four circles intersect at points m_2, m_3, m_4, and m_5. However, other small circles pass through, or very close to, these four points but not through m_1. If the point maximum were very perfect, the calcite r planes would yield very strong intensities, whereas the others would probably not even be recorded on the diffraction chart. Consequently, the average intensity value for m_2, m_3, m_4, and m_5 would be very much reduced compared to the average for m_1, but not to zero intensity as would be expected for a perfect point maximum or single crystal. This phenomena is characteristic of most areas of the net.

That these potential weaker false maxima do not seriously affect the resulting diagrams is shown by the corresponding optical diagrams of plates 1, 2, and 3. In the event that a false maximum is suspected in the diagram, a simple inspection of the intensity data is usually sufficient to determine whether it is real or not. As an example we take the x-ray petrofabric diagram for the Yule Marble, diagram D, plate 2. The moderately strong maximum just to the left and below the center of the diagram does not appear in the optic diagram, C, plate 2, and therefore might not be real. The net used to construct the x-ray diagram is that of figure 4. Circles 9 to 15 of sets F and G in general have high intensity values because of the locality of the main point maximum. These circles also pass through the weaker maximum in question and thus contribute to high values of intensity averages in this area. If this maximum were real, then some or all of circles 2 to 6, set G, and circles 11 to 14, set D, should have stronger than normal intensities. None of these circles lie in the region of the net containing the main point maximum and therefore are appropriate for the test. Finally, examination of the intensities assigned to these circles shows that only one has an intensity greater than the random (powder) value, and hence it may be concluded that this weaker maximum is false or at least considerably exaggerated.

Although such tests as the above are simple and quick to perform, a search should be made for a correction or an improvement for the technique that would eliminate this uncertainty. It has been suggested that multiplication of intensities at intersections of small circles rather than summation would eliminate such false maxima. This possibility is presently under consideration.

There are several methods for speeding up the summation process, the most promising of which has been the use of high-speed computing systems. Mr. W. E. Sharp of this institution has designed a data handling program for the IBM 7090 which is now in use, and Mr. W. L. Reuter (South Dakota School of Mines and Technology) has modified this program to fit the IBM 1620.

ABSORPTION

It is well known that the absorption of x-rays by powder spread thinly on a surface is a function of the Bragg angle and bulk density. For those of "infinite" thickness, however, absorption of x-rays is independent of Bragg-angle (Cullity, 1956, p. 189), providing that the sample is larger than the area irradiated by the beam at low angles. Provided that the sample areas and bulk densities are identical for all rock slices and that the irradiated area for rock slice and powder mount is the same, the absorption due to non-"infinite" thickness is quite irrelevant to the problem, inasmuch as the final data are expressed as rock-slice intensity to powder intensity ratios for each hkl.

Another source of error due to absorption is found in the difference in bulk densities between rock slice and powder mount. At the rock surface the grains are tightly packed or cemented, and pore space is nil; conversely, even in packed "well" samples, the pore space of the powder is considerable. The amount of error involved from this source is unknown, although it is expected that the increased penetration into the powder would at least in part offset the weaker reflection from the fewer grains in the immediate surface layer.