and the subsequent formation of K-felspar augens in augen-gneiss. Shear movement was continuing even after the formation of augens since augens themselves are found to have been sheared out in places. Augen-gneiss perhaps represents a mixture of pegmatitic melt and Manda coarse biotite granodiorite in variable proportions.

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THE RHOMBOID PROTRACTOR AND ITS APPLICATION IN THE CONSTRUCTION OF ISOMETRIC GEOLOGICAL PANEL DIAGRAMS

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Introduction: An isometric geological panel diagram consists of cross sections drawn on an isometric base. It represents an excellent method of geological illustration which enables a clearer understanding of complicated geological structures in three dimensions. An isometric section is actually a normal vertical section that has been rotated around 30°.

In normal vertical geological sections, the amount of dip of planar traces is usually plotted with the help of a rectangular protractor. However, in the case of isometric sections, wherein there is an introduction of fixed distortion of + or – 30°, the rectangular protractor cannot be used for plotting the amount of dip of planar traces. In order to overcome this difficulty, the authors have designed a rhomboid protractor with the help of which the amount of 'distorted dip' can be directly plotted. In this paper, the design of the rhomboid protractor and the procedure for drawing the isometric geological panel diagrams are discussed.

Rhomboid protractor: The rhomboid protractor is simple in design and is actually the isometric representative of a rectangular protractor.

A standard rectangular protractor is a parallelogram which is divided into two equal halves each having 90 degrees. When it is rotated around 30° its angular measurements are accordingly modified and it becomes a rhombus. The 90° on one half of the protractor is reduced to 60° and on another half is increased to 120°. This forms the rhomboid protractor. The 60° and 120° angles on either halves of the rhomboid protractor which are actually the isometric equivalents of 90° are proportionately divided into 90 equal sectors (Fig. 1a). Similarly, on the reverse side of the protractor, the two angles are divided into 90 equal sectors (Fig. 1b). The various sectors on either halves of the two sides of the protractor are respectively designated as 0 to 90 degrees so as to enable a direct plotting of the amount of dip of planar traces in an isometric section. This completes the construction of a rhomboid protractor.

Method of construction of isometric panel diagram: The method of construction of isometric panel diagram actually involves the construction of two sets of isometric cross sections the method of which is only a slight variation from that generally adopted for drawing vertical cross sections and described in various standard text books (Lahee, 1961; Badgley, 1965). Normally the method of construction of vertical cross sections consists of two parts: (i) to draw profile and (ii) to plot structural data. This holds good for isometric section as well. However, as the purpose of drawing the isometric panel diagram is to understand the structure of a particular area in three dimensions, it is necessary to select a minimum of one set of two section lines intersecting at right angle to each other on a geological map. For

1a.

1b.

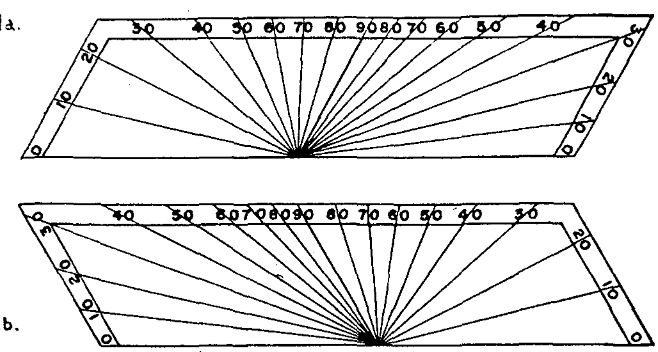

Figure 1a. Rhomboid protractor,
1b. the reverse side of the same protractor.

large structurally complicated maps, it is desirable to have a grid pattern of section lines so as to cover the entire area of the map. While drawing section lines particular attention may be paid to have them as close to perpendicular and parallel to the strike direction as possible. These lines may be variously designated as a–a′, b–b′, c–c′, and d–d′ respectively (Fig. 2). Next, the straight edge of a strip of paper is laid along each section line and the points of intersection of the topographic contour and the section line along with the values of corresponding contours are marked. For a correct presentation it is advisable to draw cross sections to the same scale as the map i.e., to the natural scale (Lahee, 1961).

As a first step in preparing an isometric panel diagram, the section lines on the map are transferred on to a graph paper. These lines constitute the isometric base in which the two sets of section lines show intersection of 120° and 60° respectively (Fig. 3). While transferring the section lines on to the graph paper care should be taken to see that the two sets of lines intersect the vertical coordinate (i.e., the ordinate) of the graph paper at 60°/120° and 120°/60° respectively, i.e., the end lines of the section should be parallel to the ordinate, or the section lines should make 30° with the abscissa (see Fig. 3). The points of intersection of contours are now transferred from the strip of paper to the section lines (forming the isometric base). The lowest point crossed by the section lines (or the sea level) may be chosen as a base line. According to the values of the contours marked on the paper strip, dots are marked vertically above the point (i.e., parallel to the ordinate of the graph paper). These dots are connected by a curved line which forms the isometric profile of the

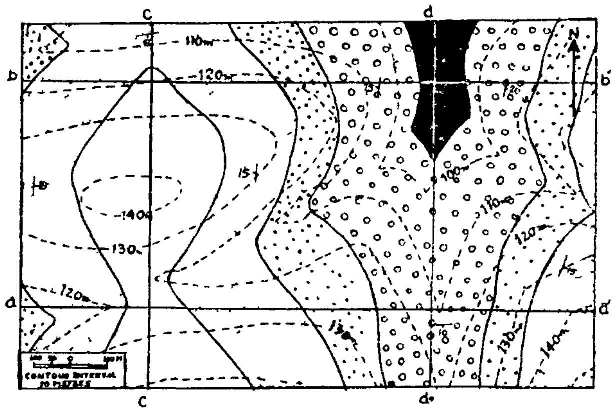

Figure 2. A geological map showing a grid of four section lines.

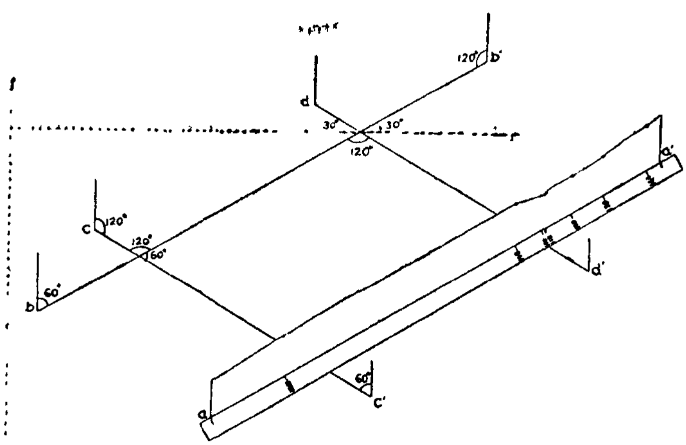

Figure 3. The isometric base for the panel diagram of the area shown in figure 2, showing the various angular relationship and the construction of profile line.

section (Fig. 3). The two sets of profile lines at the point of intersection have the same elevation value (Fig. 4). The concealed parts of the isometric cross sections in the panel are erased, and the base lines and end lines are thickened to provide a pronounced three dimensional picture to the panel diagram (Fig. 4).

The next stage comprises the transfer of geological data to the isometric profile sections. This can be accomplished by projecting the contact of rocks and dips of outcrops on corresponding section lines and then transfering the same on the base of the isometric sections. The position of the contact of rocks and also the dips of planar structures are marked on the profile line. Next, with the help of the rhomboid protractor, lines are drawn according to the angle of the planar structures (using apparent dip values along the section lines) at the points marked on the profile. Only one side of the protractor can be used for a particular set of isometric panel

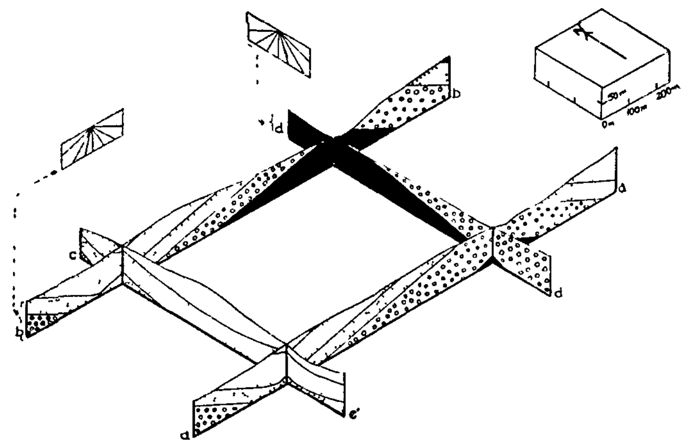

Figure 4. The isometric geological panel diagram of the area shown in Figure 2.

(Fig. 4). In an isometric panel diagram, there should be continuity in planar traces of the various structural elements when they meet along a vertical line of intersection of two isometric cross sections (see Fig. 4). When the geological data are plotted on all the cross sections, the isometric geological panel diagram presents the structure of the entire area in three dimensions.

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