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A GNOMONIC PROJECTOR

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Gnomonic projections obtained from Laue photographs can provide a ready means for the location of the axes of a randomly set crystal, and for the subsequent precise orientation of the crystal on a goniometer head. Such projections can be indexed by inspection when obtained from the crystal in correct alignment, and furnish an abundance of information concerning space group extinctions, interaxial angles and axial ratios.

Unfortunately however the labor involved in the measurement and plotting of the Laue data is a severe test of the crystallographer's patience when the pattern contains many spots, and it has become customary in recent years to disregard Laue photographs almost entirely,

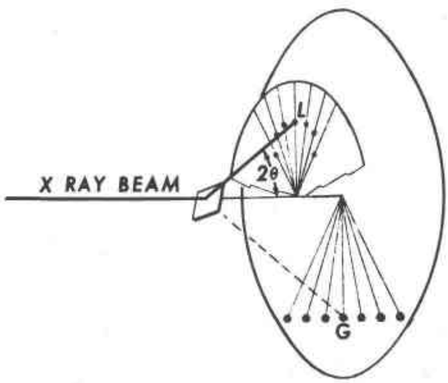

FIG. 1. Laue and gnomonic projections.

and to use other methods, often more complicated, for the alignment of crystals and for the determination of the basic axial ratios and interaxial angles.

The traditional geometrical basis for obtaining gnomonic projections from Laue photographs is illustrated in Fig. 1. for the usual flat plate, normal beam geometry.

It is seen that any Laue spot L, produced by reflection of the primary beam from a set of lattice planes, is located a distance $r \tan 2\theta$ from the film center, where r is the perpendicular distance from the crystal to the film plane. The corresponding gnomonic point G, produced by the intersection of the normal to these planes with a projection plane parallel to the film plane, is seen to be a distance $p \cot \theta$ from the center, where p is the gnomon length or distance from the crystal to the gnomonic plane. The gnomonic point, Laue point, and x-ray beam are seen to be in a plane perpendicular to the gnomonic and film planes.

Construction of a gnomonic projection from a Laue photograph thus consists essentially of two operations, the correlation of the functions

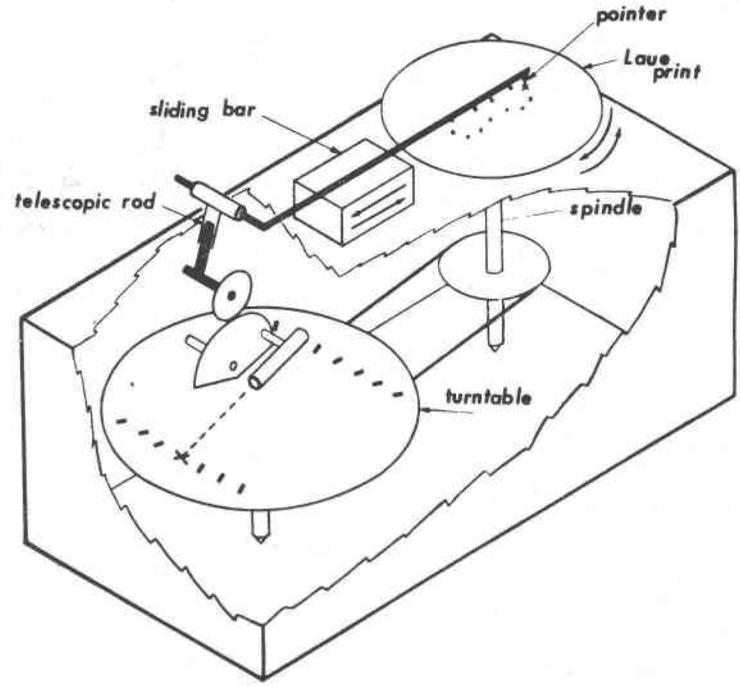

FIG. 2. Gnomonic projector.

$\tan 2\theta$ and $\cot \theta$, and the plotting of the function $\cot \theta$ along a diameter of a cirlce on the opposite side of the center to the Laue spot.

A simple mechanical device which performs these steps is illustrated in Fig. 2.

In operation a positive print of a Laue photograph is attached to the main spindle so that the spindle axis passes through the primary beam intercept. The pointer is set over a Laue spot by moving the sliding bar assembly (to which it is attached) and by rotating the spindle.

The rotation of the spindle carrying the Laue diagram is coupled by a chain drive to a turntable on which is fastened a sheet of photographic paper. The translation of the sliding bar is transmitted through a

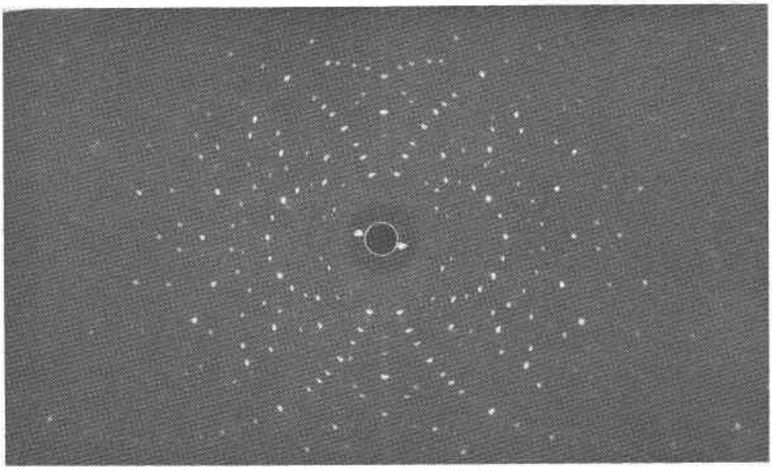

FIG. 3. Laue diagram of α-$SnI_4 \cdot 2S_8$ (*Fdd2*) projected down *b* axis.

telescopic rod to a 2-for-1 reduction gear train: the smaller of the gears thus provides a measure of 2θ, the larger gear of θ. A small electric light and optical collimator attached to the larger gear is thus positioned automatically by the pointer, and upon being switched on, this exposes a

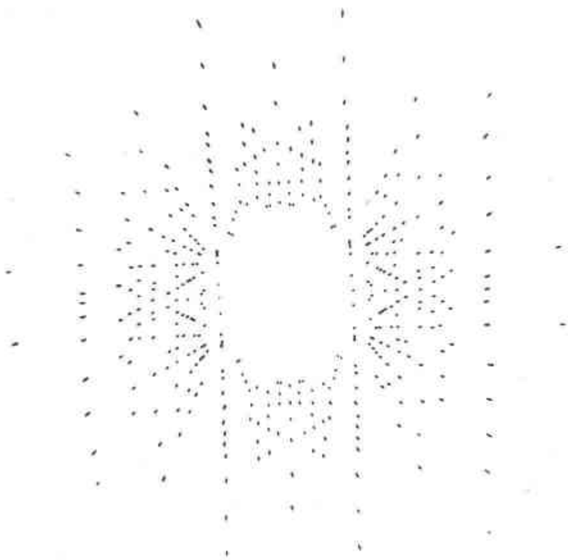

FIG. 4. Gnomonic projection.

spot on the photographic paper at a distance proportional to *cot* θ from the turntable axis.

The constants r and p in the gnomonic relationship are represented by the length of the telescopic rod at the $\theta=0°$ position, and the distance between the photographic paper and the axis of the larger gear, respectively. The latter may be varied to any convenient value by raising or lowering the turntable, but the value set for r must correspond to the film-to-crystal distance for the Laue photograph in question. In practice it has been found convenient to use values of $r=3$ cm, $p=1$ cm to record the maximum number of points on a paper of convenient size.

A Laue photograph of a complex orthorhombic crystal and its gnomonic projection produced in this manner are shown in Figs. 3 and 4.

The gnomonic projector has the advantages of improved accuracy and speed compared to manual plotting, and can be readily assembled from materials readily available from broken clocks and phonographs. The requirements for accuracy in the construction of the projector are few, and precision assembly is unnecessary except for the following points:

a) The sliding bar and pointer must be arranged so that the pointer moves in a straight line radially outward from the spindle axis.
b) The telescopic rod must be set vertical at the $\theta=0°$ position, and the light beam must be set to be parallel with the plane of the turntable at this position.
c) The axis of the turntable should intercept the axis of the larger gear, and be perpendicular to it, so that the light beam moves radially outward from the turntable axis.

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PARAGONITE FROM TÄSCH VALLEY NEAR ZERMATT, SWITZERLAND[1]

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INTRODUCTION

During a field trip in the upper Täsch valley near Zermatt, Switzerland, Zen and Bearth collected a specimen of a peculiar-looking white mica in a quartz-kyanite vein. This mica proved to consist of paragonite and little else. Because single-phase paragonite suitable for chemical analysis is extremely rare, the sample was investigated in detail; this note reports the mineralogical results.

The upper Täsch valley is in the Mesozoic ophiolite zone that tectonically overlies the Monte Rosa nappe and underlies the Dent Blanche

[1] Publication authorized by the Director, U. S. Geological Survey.