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THE BENFORD PLATE

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Mr. James Benford of Bausch and Lomb Incorporated, in cooperation with Dr. R. C. Emmons, Department of Geology, University of Wisconsin, has designed a substage mica plate to be used in conjunction with the conventional mica plate as an aid in the study of interference figures. The purpose is to eliminate the isogyres of a figure and to reduce the appearance of an optic axis to a dark spot of zero retardation. The color rings are unaffected.

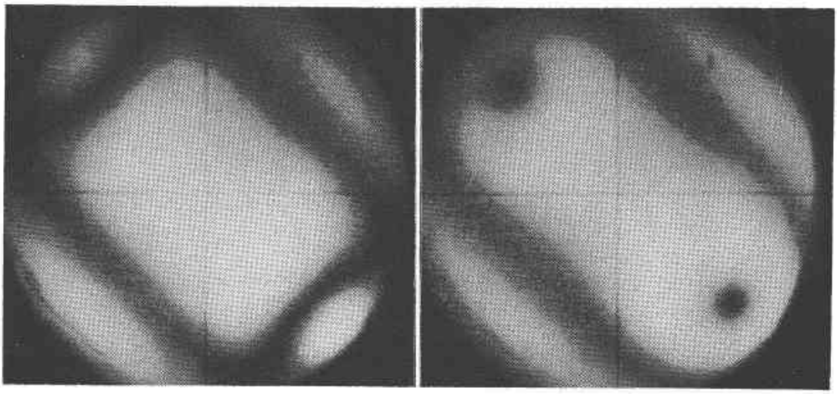

FIG. 1. Acute bisectrix figure of muscovite. (Left) Without Benford plate. (Right) With Benford plate and accessory mica plate inserted.

The lower mica plate is inserted at 90° to the upper mica plate, the two thereby cancelling each other. There can be no isogyres since they represent loci of extinction and such are destroyed by the lower plate. The color rings are shifted but are returned by the upper plate. The optic axes are spots in relation to the color rings rather than parts of isogyres. They represent points of zero retardation rather than part of an area of extinction.

In measuring 2V by the method of Horace Winchell (1939), which is outstandingly satisfactory, it is most convenient to measure 2D on the ocular scale. In measuring dispersion of an interference figure, the distribution of the color fringes is strikingly easily observed. The symmetry of the color ring distribution is also well revealed.

There is one precaution in application of the Benford plate which should be specified and checked at the time of purchase—it is that the two plates (the usual accessory mica plate of 155 mμ retardation and the substage Benford plate) have equal retardation. The manufacturer must allow himself some tolerance from the stated 155 mμ value of the plates but can select pairs of matched plates for use with this method of interference figure analysis. The tolerance does not ordinarily come to the attention of the operator in routine work but it is quite noticeable in the use of the two plates and leads to two sources of error:

1. If the two plates are of slightly different retardation 2D is of different value when measured in two positions which are 90° apart obtained by rotating the micrometer ocular. Neither value is correct. This provides the simplest method to test the equipment for matching plates, using a muscovite mount (2V=44°) on the stage and a 4 mm. N.A. 0.85 objective. The absolute retardation of the plates is of no concern, merely that they are selected to agree.

2. When one is observing dispersion, this effect can modify the distribution of the color fringes, leading to an incorrect determination of the crystal system and orientation. If, however, the plates are well matched, observations of dispersions in interference figures is both more sensitive and more precise than is possible by the conventional method.

This technique has been in satisfactory classroom use for several years at the University of Wisconsin.

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THE CHALCOKYANITE SERIES

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Some important earlier results on the chalcokyanite series were not reported in the paper of Pistorius (1960). These additional results are:

Chalcokyanite Kokkoros and Rentzeperis (1958)	$CuSO_4$	*Pmnb*	$Z=4$
		$a_0=6.69$ Å, $b_0=8.39$ Å, $c_0=4.83$ Å	
		$a:b:c=0.797:1:0.576$	
Zinkesite	$ZnSO_4$	*Pmnb*	$Z=4$
		$a_0=6.74$ Å, $b_0=8.60$ Å, $c_0=4.77$ Å	
		$a:b:c=0.784:1:0.555$	
Synthetic	$CoSO_4$	*Pmnb*	$Z=4$
		$a_0=6.72$ Å, $b_0=8.47$ Å, $c_0=4.66$ Å	
		$a:b:c=0.793:1:0.550$	

Full structure determinations for $CuSO_4$ and $ZnSO_4$ are given by Kokkoros and Rentzeperis (1958). The Cu, Zn and Co sulfates are