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Two flow charts of orthoscopic U-stage techniques

MANY textbooks contain instructions for orthoscopic U-stage techniques. In some books the instructions are written out in detail in several long paragraphs, which may even be in small print. In other books the instructions are listed in a series of numbered sentences. These accounts are not very satisfactory aids to learning U-stage techniques. The more detail is given, the more difficult it becomes to comprehend and follow the prose account. If the operations are set out in note form then the more detailed and usable the account, the more its application becomes limited to a given type of mineral in a given orientation. If working details are omitted in order to simplify the account then the result for a learner will be an inaccurate or even totally false positioning of the mineral.

The failure of this narrative type of description of U-stage techniques is due to the fact that different types of minerals in different orientations require different treatments. There are only a limited number of adjustments to be applied to the U-stage but they are not applied in a set sequence or even in a series of set sequences. Instead, during the fixing of a mineral the next adjustment to the U-stage is determined by the response of the mineral to the previous adjustment considered in conjunction with responses to earlier adjustments.

The most efficient method of describing a complex set of operations of this type is by means of a flow chart. U-stage techniques are so well suited to this method that some years ago, without prior consideration, I found myself using it during a lecture on the subject. This approach was so successful that afterwards I constructed two complete flow charts, which I used thereafter for U-stage instruction. These first charts were modified as a result of experience of teaching with them and of students' comments, until they attained the forms shown in figs. 1 and 2.

The flow charts are not a substitute for an understanding of the theory on which the method is based. They are not even a substitute for the textbook accounts mentioned above. They provide a key to those accounts enabling students to work from the start with some confidence and little difficulty. They learn very quickly to find their way around the chart, to take short cuts and then, having mastered the technique much more quickly than they otherwise would have done, to abandon the chart altogether. When students get incorrect results or get stuck the chart enables the teacher to find their error very quickly and easily. For both teacher and student the charts are of great assistance.

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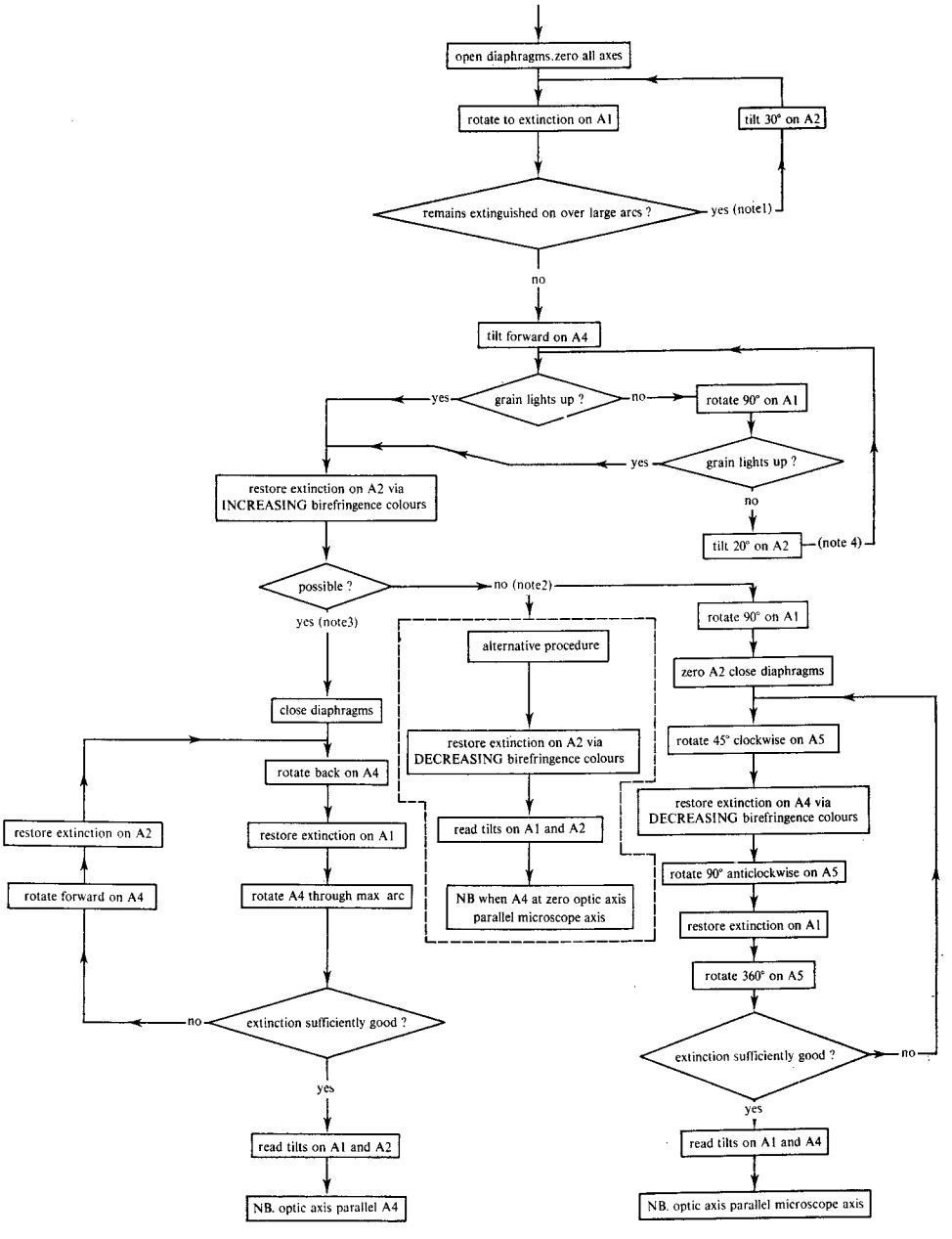

FIG. 1. Flow chart for determination of the orientation of the optic axis of a uniaxial mineral. *Note* 1. Optic axis approximately normal to section. *Note* 2. Optic axis too steeply inclined to section to be brought parallel to A4. It therefore has to be brought parallel to the microscope axes. With low birefringence minerals such as quartz this cannot be done very accurately. In this case the quicker 'alternative procedure' probably produces as accurate a result as the longer normal procedure. *Note* 3. Optic axis parallel A4. *Note* 4. Optic axis in plane of section.

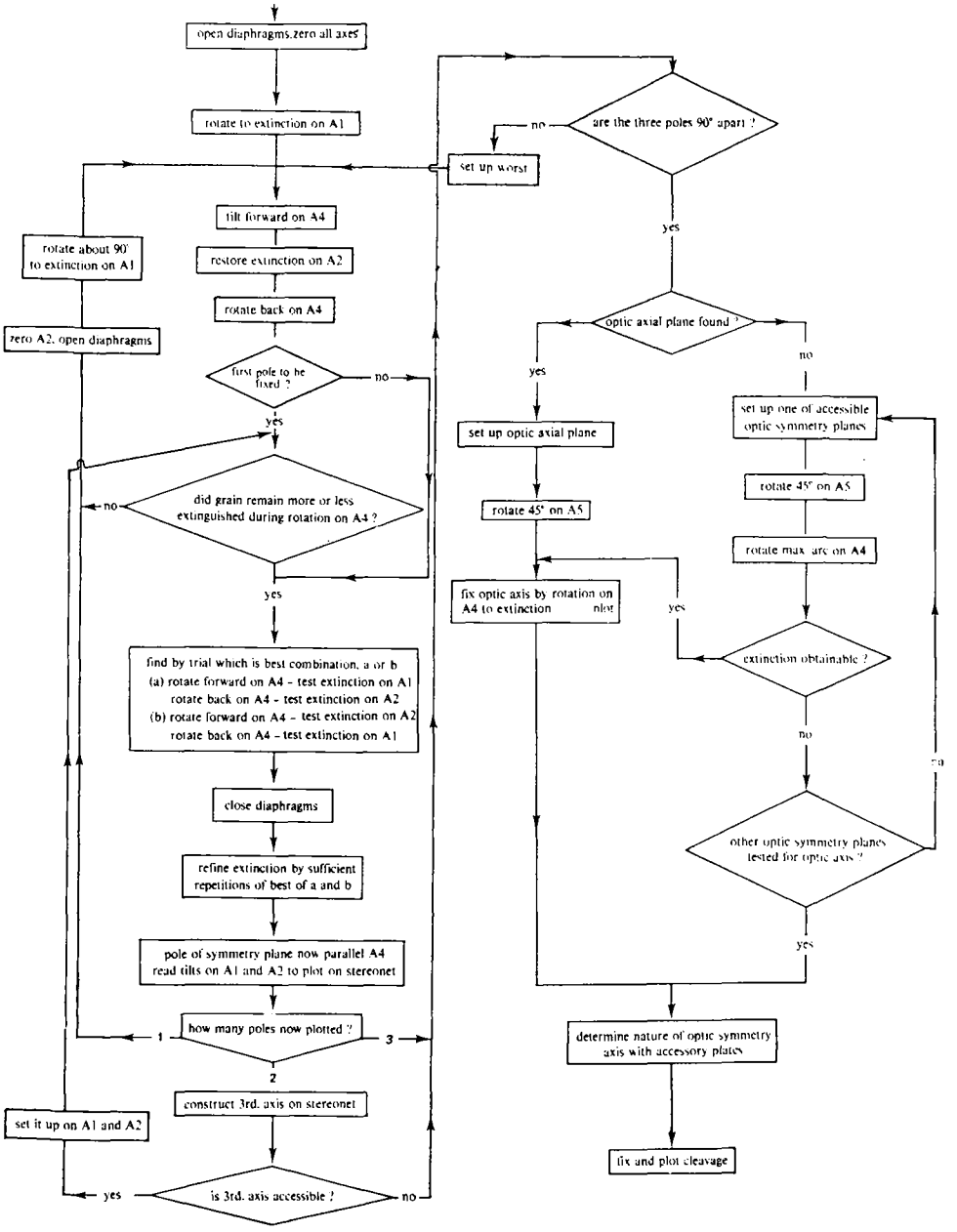

FIG. 2. Flow chart for the determination of the attitude of the biaxial indicatrix and of 2 V.