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An instrument for teaching clinometry

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Abstract—By combining a compass, counterweight and gimbal, an instrument for simultaneous measurement of dip, strike, pitch, plunge and trend data has been constructed. The instrument automatically locates the strike of the surface on which it is placed. It may serve as a useful teaching aid in the structural laboratory.

THE ABILITY to determine the geographic orientations of linear and planar features is one of the first skills which every student of structural geology must acquire. The clinometer, as described by Seymour (1816) may be used in a variety of ways to measure dip, strike, pitch, plunge and trend. However, most students find these operations confusing at first and, more importantly, fail to see clearly the relationships between the various measures of attitude. The instrument illustrated in Fig. 1 displays all the above angles simultaneously and allows the student to study their interrelationships. Although independently designed, it bears comparison with the apparatus described by Ingerson (1942) for the measurement of plunge and trend (Ingerson used the term pitch for plunge) and with other instruments used in borehole orientation.

The instrument consists of a compass mounted on the stage of a gimbal (i.e. a two-axis universal stage) which pivots between two perspex sheets. A weight attached to the underside of the stage ensures that the compass needle swings in the horizontal plane. It also serves as a pointer to the black scale of degrees simultaneously indicating the dip of the perspex sheets and the plunge of the poles which connect them (these being supplementary angles). The black scale is rigidly attached at right angles to the gimbal ring and at its corner, a brass weight serves to swing the scale piece into a vertical plane. This brass weight also serves as a pointer to a scale engraved on the bottom perspex sheet and indicates the pitch of the instrument's edge in the plane of the perspex.

In constructing the instrument, care should be taken to use non-magnetic materials throughout. The compass must be centrally balanced on the stage and aligned to read the trend of the stage's axis of rotation in the gimbal ring. Both stage and gimbal ring should be bevelled to avoid jamming. The stage may be made to pivot on jewels but stiff screws are adequate and more economic. The poles must be accurately machined so that they hold the perspex sheets rigidly yet do not apply pressure to the gimbal ring at its outer pivotal points. The weights attached to the stage and the scale piece should be variable as some trial and error may be necessary in order to get the instrument to swing into position when dips are low.

In Fig. 1 the instrument is shown placed on a bedding plane with its edge along a lineation. It is now possible, without touching the instrument, to read the dip and strike of bedding, the pitch of the lineation and the plunge and trend of the pole to bedding. When no planar feature is present the poles connecting the perspex sheets may be aligned with a linear feature in order to obtain its plunge and trend. The concepts of Euler angles are easily demonstrated by three successive movements of the instrument. Students respond enthusiastically to exercises using this instrument and spontaneously align their conventional clinometers with it in order to compare results.

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REFERENCES

Ingerson, E. 1942. Appartus for direct measurement of linear structure. *Am. Miner.* **17**, 721–725.

Seymour, Lord W. 1816. Description of a clinometer. *Trans. geol. Soc. Lond.* **3**, 385–391.

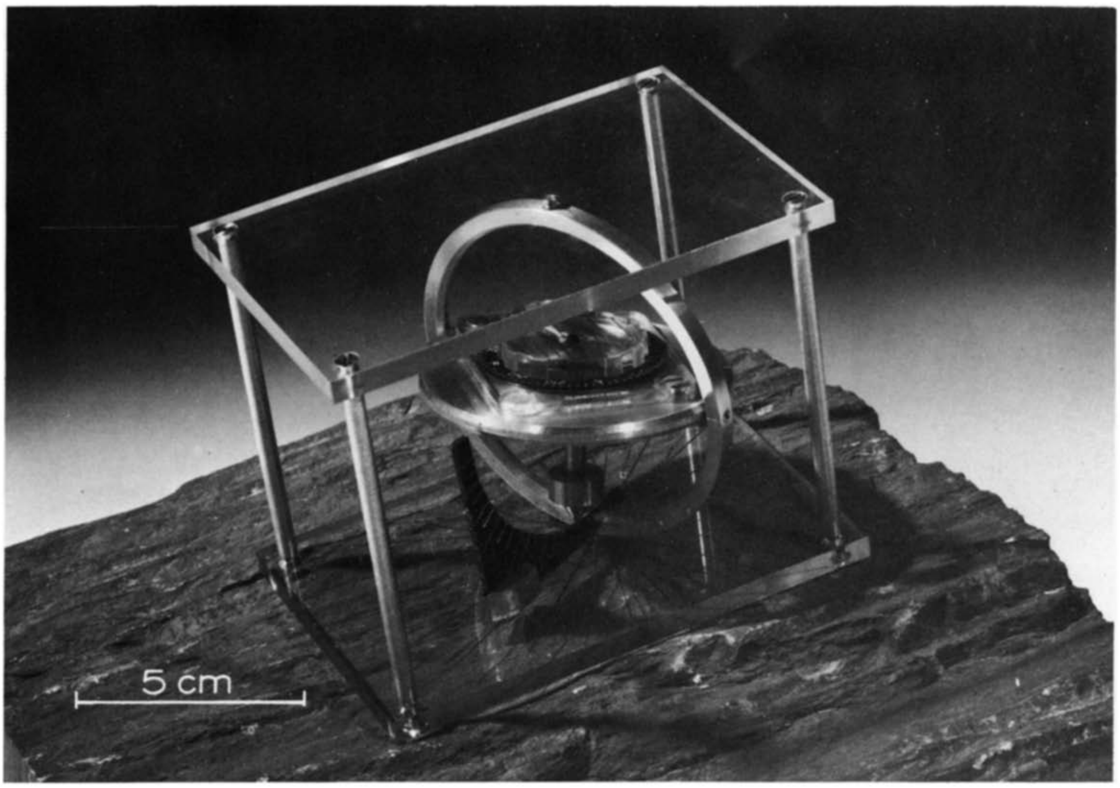

Fig. 1. An automatic clinometer for reading dips, strikes, pitches, plunges and trends (see text for details).