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GRAPHICAL CONSTRUCTION FOR THE EPICENTRE OF AN EARTHQUAKE.

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GRAPHICAL CONSTRUCTION FOR THE EPICENTRE OF AN EARTHQUAKE.

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When the distance of an epicentre from three stations is known, the epicentre is uniquely determined by the intersection of the three small circles having the respective stations as centres.

The stereographic projection of the earth's surface on the plane of the equator possesses the simple property that any circle on the sphere projects into a circle on the plane. Dr O. Klotz (*Journal Roy. Astron. Soc. of Canada*, 1911) has shown in this way how to construct the epicentre, and has given tables which facilitate the process.

A Galitzin installation at a single station gives, not only the distance of the epicentre, but also the azimuth, that is the angle between the meridian of the station and the great circle which passes through both station and epicentre. "Every great circle passing through the station projects into a circle on the projection, and all their centres lie on a fixed straight line." Hence remembering that, since the transformation is conformal, angles remain unaltered, a very simple graphical construction for the particular azimuth follows.

Let the co-ordinates of the station be

$$\text{Latitude } \phi_s \qquad \text{Longitude } \lambda_s,$$

and let the co-ordinates of the epicentre as given by the seismogram be Δ in degrees along the arc of the great circle and α the azimuth of that great circle passing through S, the station.

Starting with a circle divided in degrees, we take it to represent the stereographic projection of the equator, using the South Pole as the origin of projection. The centre of this circle is the projection of the North Pole. We may take the line joining 0° to N as the projection of the meridian of the station. Draw the line AN at right angles to TN. Mark off the arc $TS' = \phi_s$, join AS', to cut TN in S. Then S is the projection of the station.

All great circles passing through the station project into circles which pass through S and have their centres on a straight line at right angles to TNU, and at a distance $\tan \phi_s$ from N, taking the radius of the equator as unit.

We may construct this line as follows:—Mark off the arc $AB = \phi_s$, draw AC perpendicular to AN to meet NB in C. Draw CD parallel to AN.

Wt. 31050/641—6—6—625—5/12—N. & Co., Ltd. Gp. XV.

Mark off the arc $UF = 90° - a$, join NF and draw SG parallel to NF to meet CD in G. G is the centre of the circle passing through S on which the projection of the epicentre lies.

The projection of the small circle of angular radius Δ of the sphere with station as centre may also be constructed on the diagram.

Mark off the arcs S'J and $S'K = \Delta$ in degrees, join A to J and K, to cut TNU in L and M. Bisect LM in O. The circle centre O and radius OL is the projection, and therefore passes through the projection of the epicentre.

Hence E, the intersection of the circles LEM and SE, is the projection of the epicentre. The longitude relative to the station is read off directly on the divided circle, while the latitude can also be read off by reversing the process used for constructing S.

With a sheet prepared with divided circle and the fundamental lines for the station marked off, the operation takes far less time to do than to describe. It is also quicker than the calculation by spherical trigonometry and quite accurate.

The diagram shown was prepared by Mr Southerns, scientific assistant in the observatory, and refers to the great Turkestan earthquake of 3rd January 1911.

The seismogram gave

$$\Delta = 5850 \text{ kms} \equiv 52° \ 37' \qquad a = 69° \ 49' \text{ E. of N.}$$

For the epicentre Mr Southerns obtained

$$\phi_E = TQ = 41° \ 0' \text{ N.} \qquad \lambda_E = RT - 3° \ 12' = 77° \ 28' \text{ E.}$$

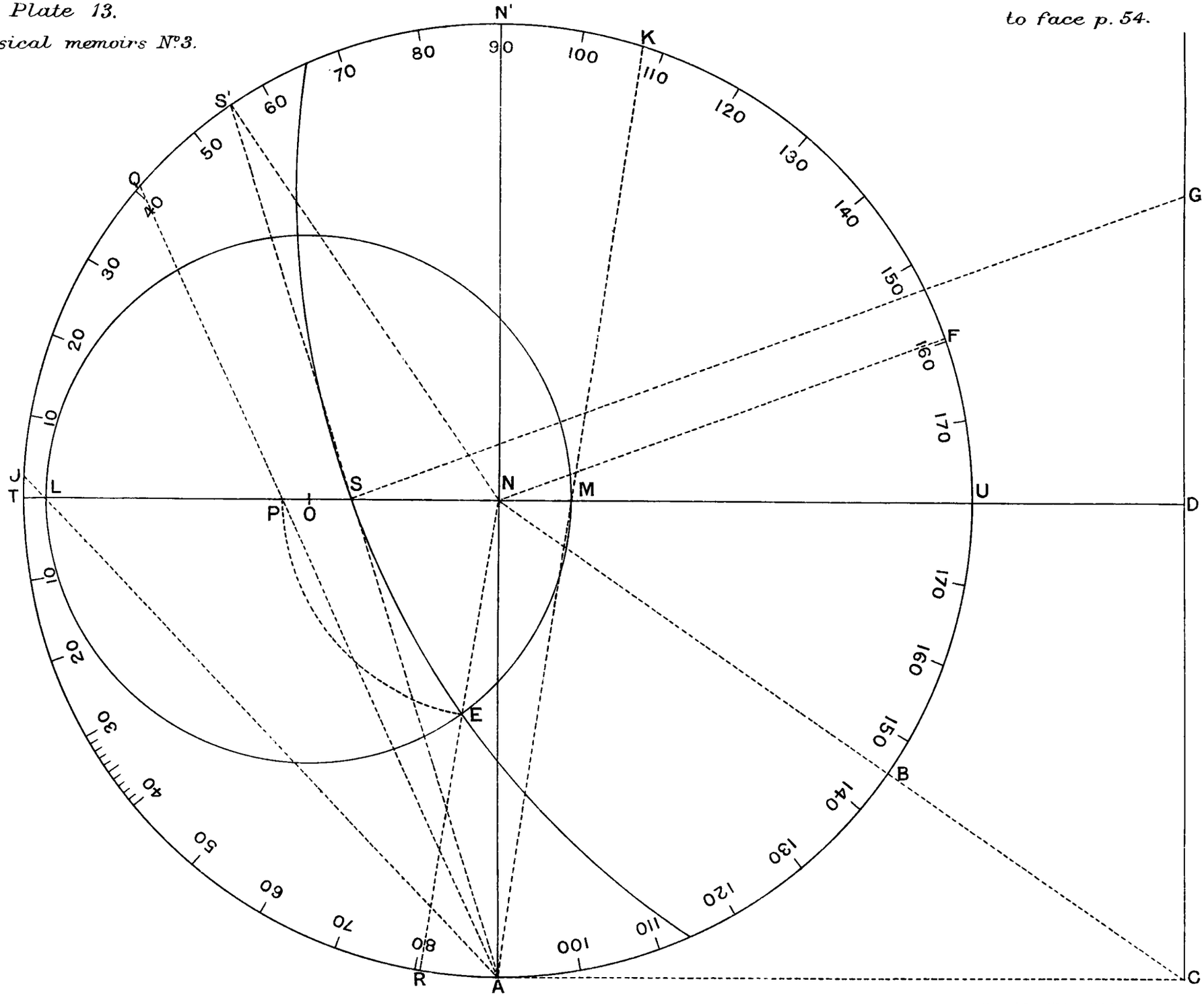
while the result obtained by calculation was

$$\phi_E = 41° \ 4' \text{ N.} \qquad \lambda_E = 77° \ 12' \text{ E.}$$

ESKDALEMUIR,
December, 1911.

Note.—The above construction was suggested by the results "Forsyth, Theory of Functions, p. 499."

to face p. 54.



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