

## GEOGRAPHICAL POSITIONS WITH A SEXTANT.

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W. A. COGSHALL, Indiana University.

The determination of geographical positions by sextant observations is made by observation of the altitude above the horizon of the sun or other heavenly body, the time of some standard meridian being known. From each observation of altitude we may lay down a line on a map, the direction of the line being at right angles to the direction of the sun at the moment of observation. The observer is at some point on this line but one observation does not tell just what point.

If such a line is derived from an observation in the forenoon, and another in the afternoon when the direction to the sun has changed considerably, the two will intersect and this intersection will be the position of the observer and may be read from the scale of the chart.

If now we make several more observations and plot a line for each, the intersections will increase very rapidly as each new line intersects many of those already on the map.

I have taken observations of students for several terms and combined them into two maps, one having about 1,200 intersections and the other about 700. No selection was made other than to exclude those that fell so far outside the limits of the map as to show either faulty observations or mistakes in reduction.

The center of gravity of the intersections on each map should be the most probable latitude and longitude of the point of observation. The observations were all made at the Kirkwood Observatory on the Indiana University campus, by students in the course in Practical Astronomy, with a chronometer which at best was corrected only every other day and sometimes at longer intervals.

The centers of gravity of the two maps do not vary more than about 200 feet from each other, and the latitude and longitude from the two combined lies about 600 feet north of the observatory. The probability of any pair of observations giving a point as near as this is, of course, very small, no matter what care is taken in making the observations or in knowing the time with high accuracy. An uncertainty in the position of about a mile is expected although many are much closer than that. With a large number of observers and a large number of intersections the accidental errors are largely eliminated and a result attained which agrees with the latitude and longitude of the Bloomington Quadrangle within a few feet.

After finding this result I was interested to know what might be expected with a smaller number of observations and greater care. I accordingly plotted nine lines from my own observations in which I had taken particular care to know the time exactly and to have observing conditions good. These nine lines give 25 intersections, scattered over

much the same territory as the larger number but whose center of gravity is only about 50 feet from the Observatory.

It seems rather remarkable to me that one's position on the Earth can be determined so well with no other equipment than a good watch and a small instrument that can almost be carried in an overcoat pocket.