Brief Notes on Field Methods Used in Geological Work of Mid-Continent Oil Fields.

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In writing this article the writer is not attempting to make an elaborate discussion of the various methods nor is he attempting to suggest new methods of doing field work, but instead is endeavoring to bring together in a compact form, various methods commonly used, for the benefit of the young geologist who has not had an opportunity to learn them by actual experience.

No doubt many will take issue with me in regard to the value of some of these methods. However the writer has found them quite satisfactory under certain conditions and within certain limitations.

The geological work as conducted by the different oil companies of the mid-continent field is based upon one fundamental principle, namely, the location of structure favorable to the production of oil. The favorable structure as all know is the anticline. Therefore the geologist is continually searching for the anticline.

The geologist meets with many and varied difficulties in this work. He must follow the outcrops of the various rock strata and obtain elevations at intervals of at least one quarter mile and oftener if necessary. He must also measure the vertical interval between the different strata whenever the two horizons outcrop close together, thus presenting an opportunity to make such measurement. This vertical interval should be measured frequently in order to catch any variation in the interval. These elevations and intervals are used as a basis for drawing the structural contours, thus enabling the geologist to select the most favorable locations for drilling.

The following methods are used to obtain the elevation of outcrops.

1. Plane Table and Stadia Traverse, Using Telescopic Alidade.
2. Setting Bench Marks with Plane Table and Stadia. Geologist Using Aneroid Barometer.
3. Using Aneroid Barometer with Stationary Barograph.

4. Setting Bench Marks with Aneroid Barometer.

5. Reconnaissance (Scouting) Using Aneroid Barometer and Hand Level.

Method No 1.

For close detail work the plane table and stadia traverse is by far the most accurate method and no doubt favored by all geologists.

With this method the party consists of a geologist in charge and an instrument man. The geologist carries the stadia and follows the outcrop, giving stadia readings for location and elevation as frequently as he deems necessary. Between stations the instrument man sketches the drainage, roads and any and other features necessary to make a complete geological map.

At intervals of an hour or an hour and a half the geologist should return to the plane table and sketch the various outcrops on the map and record the vertical interval between the different strata he has mapped.

At night the day's work is inked in and that portion of the map is complete with exception of the structural contours.

This method is favored for open country and areas free from timber growth, and is fairly rapid.

The small telescopic alidade used by the United States Geological Survey is commonly used. The size of plane table depends upon horizontal scale used, varying from 15 inches to 24 inches square.

Method No. 2.

The second method used is not as accurate as first but is much more rapid for use in timber-covered areas.

With this method an instrument man with plane table, stadia and a rodman are sent into the particular area to be mapped. They run a stadia traverse along the roads, establishing bench marks at the corners and other conspicuous places, at least every one-half mile. If the roads are few the bench marks should be established at the end of spurs that extend toward the main stream between tributary valleys. A key system being used to mark the bench marks, the rodman paints the bench marks according to the key used. The elevation and number or key is recorded on the map for use of the geologist.

The geologist now takes the level sheet from the instrument man and by use of the aneroid barometer carries the elevation along the outcrop of rock strata. For the results obtained with the barometer to be of any value care should be taken that the barometer is checked frequently.

The method ordinarily used is to set the aneroid barometer at same elevation as bench mark from which start is made also noting time barometer was set, which is essential. Whenever an elevation reading is made on the outcrop the time of reading should be noted. The barometer must be checked at a known elevation every forty or forty-five minutes and should not be more than an hour between checks for accurate results. The barometer must not be changed after being set at first station in the morning.

At night, plot a curve showing amount of variation of barometer from normal during day. By means of the curve correct all readings for elevations made during the day by adding or subtracting the difference from normal, to the reading to be corrected.

Example: Suppose correction curve shows aneroid barometer was reading 22 feet high at 10:15 and elevation reading on outcrop was 953 feet at same time. To get correct elevation of that point subtract 22 feet from 953 feet which gives 931 feet, the correct elevation. If aneroid barometer was reading low at 10:15 the 22 feet should be added to give correct elevation which would be 975 feet, etc.

While geologist is walking the outcrop, he should sketch the drainage, roads, trend of outcrop of rock strata and other features necessary to make a complete geological map.

After making correction of barometer readings the day's work should be inked as finished, so that the work will not be lost by erasure during work the next day. The inking should be up to date at all times.

The aneroid barometer most commonly used is 2½ inches in diameter graduated to record elevation of 3,000 feet with 10 feet divisions. Frequently larger instruments are used, some as much as 6 inches in diameter. The larger aneroids are the more accurate.

Method No. 3.

The third method is not as accurate as either of the first two, but much more rapid, and can be carried on with less expense, as the plane table and operator are eliminated. With care accurate results can be accomplished with this method.

If a geologist is sent into a field to do a rapid piece of work and time available for doing the work or character of the work would not pay to employ the use of plane table and stadia this method is the most satisfactory one to use. The reader must keep in mind that the element of time is important to the oil geologist. He must finish his work and get report to the chief geologist to pass upon, before another company has an opportunity to obtain lease on valuable acreage that he is likely to report favorable.

In this method a barograph can be used to an advantage in connection with the ordinary aneroid barometer. Set the barograph at some place near center of area to be worked and proceed with aneroid barometer as in Method No. 2, noting time all readings are made. At night, instead of plotting curve as before, use curve of barograph and proceed in same way to make correction for elevations.

If a barograph is not available use two aneroid barometers, one to be stationary and the other carried by geologist. In case two aneroids are used the one stationary should be read every 15 or 20 minutes throughout the day and a curve plotted from these readings. Proceed as before in making corrections for elevations.

Method No. 4.

The fourth method can be used in case it is desirable to detail a small area and neither a plane table, barograph or extra aneroid barometer is available and time is short for completing the work.

The geologist uses his aneroid to establish his own bench marks. An elevation at a certain point may be assumed. Set aneroid at this assumed elevation, noting the time. Drive in a circle making readings at points where bench marks are desired, noting time of readings. Return to starting point within 45 minutes or an hour from time of start. Repeat circuit, checking previous readings. Now these points can be used as bench marks, making circuits from these points establishing

bench marks farther out, checking and rechecking the points to be used as bench marks. Continue this until bench marks have been established over area to be detailed. Plot curve and make corrections for elevations of points to be used for bench marks. After the bench marks have been established the method of procedure is same as in Method No. 2 in all respects.

This method is very good and quite accurate for obtaining quick results.

Method No. 5.

The fifth method is simply reconnaissance work, or scouting, as it is frequently called.

With this method the geologist drives over the country observing the dip of the rock strata by use of the hand level, aneroid barometer or eye.

Wherever an exposure of rock is observed the hand level is used to determine the approximate amount of dip in any distance. The direction of dip may be obtained by use of the compass. The geologist must always know the height of his eye from the ground.

Example: Suppose strata is dipping west and in a distance of one-quarter mile the geologist finds the dip to be five times the height of his eye which is 5 feet 6 inches, therefore the rock would be dipping 27 feet 6 inches in one quarter mile, etc.

The aneroid barometer may be used in scouting to determine approximate amount of dip for short distances. Read elevation of outcrop, then follow strata for distance exposed, with occasional readings, noting amount of variation from first reading. This gives the amount of dip.

Example: If aneroid reads 700 feet at a given point and outcrop is followed east one-quarter mile and then reads 670 feet, showing strata dips east 30 feet in one quarter mile. Supposing second reading was 732 feet then strata dips west 32 feet in one quarter mile, etc.

An experienced geologist should be assigned to scouting work. The greatest value of this method is that it permits a large territory to be covered rapidly and a great part eliminated. An experienced man will be able to find most of the structure. Later, if deemed advisable, the various structures reported by the scout can be worked in detail by either of the first two methods.