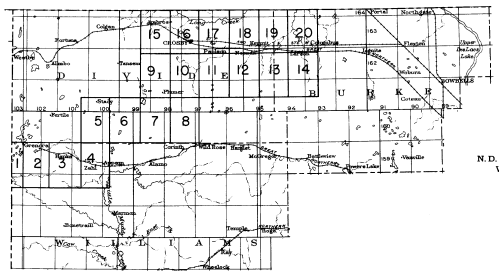

INDEX MAP

Location index of mapped area consisting of the individual 7½ minute U. S. Geological Survey topographic maps listed below.

1. Brush Lake
2. Grenora
3. Hanks
4. Zahl
5. Stady
6. Smoky Butte
7. Brightwater Lake
8. Alamo NE
9. Crosby SW
10. Crosby SE
11. Noonan SW
12. Noonan SE
13. Columbus SW
14. Columbus SE
15. Ambrose
16. Crosby
17. Paulson
18. Noonan
19. Atcoal
20. Columbus

SELECTED WELLS

N. D. Geol. Survey Well No.

NORTH DAKOTA

548 Pure Oil Company, Ole Gunderson No. 1
SW NW Sec. 11, T 160N, R 98W, Divide County

898 Texota Oil Company, Edward L. Ely No. 1
SE NE Sec. 32, T 163N, R 93W, Burke County

1024 Phillips Petroleum, Ballard-Brathen No. 1
NE NW Sec. 29, T 162N, R 95W, Divide County

1286 Skelly Oil Company, O. M. Olsen No. 1
SE NE Sec. 33, T 162N, R 100W, Divide County

1443 Dakamont Exploration Corporation, H. E. Jacobson No. 1
SW NE Sec. 6, T 162N, R 96W, Divide County

1546 Kery-McGee, Arlot Johnson No. 1
NE SW Sec. 34, T 162N, R 101W, Divide County

1900 Signal Drilling Company, Knute A. Unhjem No. 1
NW SW Sec. 5, T 162N, R 98W, Divide County

MONTANA

Mobil Producing Company Mueller F44-20-P
SIE SE Sec. 20, T 32N, R 59E, Sheridan County

Regional Gravity Map of Northwestern North Dakota

By
MILLER HANSEN

GRAND FORKS, NORTH DAKOTA
1960

INTRODUCTION

This gravity map is another of the research projects carried on by the North Dakota Geological Survey to learn more about the geology of the State. This map will be useful to those interested in the geologic structure of this area.

Observations were made during the 1959 field season using elevations from the U. S. Geological Survey 7½ minute topographic maps listed below the index map in the upper left hand corner of this sheet. Since the topographic maps were published, there has been a good deal of road building in the area and as a result many of the elevations given on the maps are no longer valid. Along some roads the difference in elevation between the old and the new grade were estimated to be as much as 10 feet.

Accurate elevations are an important part of the final computation of gravity data, and it was necessary to re-determine the elevations at section corners chosen for gravity meter stations along re-graded roads. Corrections were made by selecting a point estimated to be at the same elevation as the surface of the old road and measuring the vertical distance to the surface of the new grade with a hand level. Elevations determined in this manner are not accurate enough for detailed work, but they proved to be sufficiently accurate for a regional map such as this one.

INSTRUMENT DATA

Observations were made with a Carter Type "Y" gravity meter, a null-type instrument so constructed that it is not affected by changes in barometric pressure. The type "Y" meter is provided with self-contained heating and temperature control systems. Energy for the heating coil is provided by an ordinary 6-volt automobile battery. Only the latitude adjustment was required in order to prepare the meter for use in North Dakota.

Calibration of the meter was determined to be .71 gravity units per dial division. Occasional checks by taking a rider reading showed no appreciable change in sensitivity during the course of the survey.

FIELD PROCEDURE AND COMPUTATION

For field operation of the meter it was necessary to adapt a vehicle to carry the meter safely on both long and short hauls and to provide means to set the meter up rapidly for making observations from inside the car.

Lines of observations were planned to be no more than three miles apart, with readings taken at each section corner along the line. It was not always possible to maintain this station density as can be seen from the map. In certain small areas where additional readings were deemed necessary the lines were run one mile apart. Instrumental drift was determined by taking a second reading at the base station and distributing the difference linearly with time among all the stations read between the two base station readings. Instrumental drift was generally low, often measurable in tenths of a gravity unit over a three hour run. Differences of one to two gravity units were not uncommon, but a difference of five gravity units in a four hour run was regarded as being due to operating conditions rather than to the instrument.

After the first base station was established in Section 32, T 163N, R 94W and assigned an arbitrary value of 500 gravity units, no station was used as a base unless it had been tied into the survey from at least two directions and the successive readings found to check closely. In most instances these readings checked within a fraction of a gravity unit, and the maximum variation was less than three gravity units.

All computations were made according to the method of Nettleton (1940). The free air and Bouger corrections were combined into one correction. The latitude correction for the area mapped is 12.9 gravity units per mile. No terrain corrections were made since the area in which the survey was conducted is of low relief.

DISCUSSION

The final corrected values in gravity units were plotted on the map and gravity contours were drawn at intervals of 10 gravity units or 1 milligal. The resulting map shows a gravity high north of Columbus and a steep gradient west to the low in the vicinity of Crosby. To the south of the Crosby low an increase in gravity is noted with another fairly steep gradient west and southwest to the lowest gravity reading of the survey south of Grenora in the southwestern corner of the map.

Many of the elevations used in computing final gravities are known to be inexact as noted previously due to road building after the elevations were determined. In spite of this there are only a few stations on the map that appear erratic. Station values along most of the lines of observations increase or decrease in a generally regular manner.

This regional gravity map adjoins at the international boundary the Regional Gravity Map of South Saskatchewan published by the Department of Mineral Resources, Province of Saskatchewan. Both maps reflect the gravity high near Columbus at 102° 50' and the low in the vicinity of Crosby at 103° 20' west longitude.

Most of the oil drilling activity in northwestern North Dakota has been concentrated in the Noonan-Columbus area with nineteen test wells outside the field boundaries. West of the Noonan field only three tests have been drilled within the limits of the gravity map.

Recently interest has been sparked by the Mobil Producing Company Mueller well in Sheridan County, Montana, just west of the mapped area. With the shows in older Divide County, North Dakota, test wells such as the Jacobsen (No. 1443),[1] the Gunderson (No. 548) and the Johnson (No. 1546) this whole area may experience a new period of exploration.

[1] Numbers used are North Dakota Geological Survey well file numbers and are so designated on this map.

REFERENCES

Nettleton, L. L., 1940, "Geophysical Prospecting for Oil", 1st edition, pp 51-62.

Sawatzky, H. B. (compiler), 1959, Department of Mineral Resources, Province of Saskatchewan, "Regional Gravity Map of South Saskatchewan".

Gravity Map
NW N. Dak.