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The Relationship of the Mississippian Charles formation to the Structure of the Nesson Anticline of North Dakota

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1. Structure contour map drawn on base of last salt of Charles Formation.

2. Isopach map of Charles Formation.

ABSTRACT

An isopach map superposed upon a structure contour map of the Charles formation shows a definite thinning of the Charles over the structurally high areas of the Nesson Anticline of North Dakota. It is here suggested that this fact be used to help exploration for oil in the area.

INTRODUCTION

The Nesson Anticline is located in northeastern North Dakota in Williams and McKenzie Counties. Oil was first discovered in the area April 4, 1951, in the Clarence Iverson No. 1 well located in Section 6, Township 155 North, Range 95 West (Laird & Folsom, 1956, p. 2). There are now approximately 720 producing oil wells in the area, with new producers being reported weekly. With prospects for the future looking favorable, new methods of exploration are eagerly sought after by the oil companies.

ACKNOWLEDGEMENTS

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PURPOSE OF REPORT

The purpose of this report is to provide data that may lead to another useful tool for oil exploration. It is a well known fact that over structurally high areas, sediments sometimes thin. It was thought by the author that if the Charles formation thinned over the structurally higher areas, it might be shown on a structure contour map superposed on an isopach map. The structure contour map being drawn on the base of the Charles formation and the isopach map showing its thickness. These maps have been prepared and can be found in the packet on the inside of the back cover.

METHOD OF STUDY

A base map of the area showing well locations was first prepared. Then by use of well logs, the top and base of the Charles formation was picked. The elevation of the kelly bushing of the oil rig was used as a datum in preparing the structure map. The top of the Charles was picked at the top of the first salt member, which is also the base of the Kibbey formation. It was indicated on the microlog by a zero reading as the gypsum base drilling mud used caused the salt to cave, therefore making the mud a low resistance electrolyte. The electrodes did not touch the formation walls, so the current flowed only in the drilling mud causing a reading approaching zero.

On the gamma ray log the top of the Charles is well shown by a distinctly smaller natural radioactivity count than shown for the upper and lower beds.

The formational top is shown by a high resistivity on the laterolog. The salt is very dense and as the laterolog is a focus device, it reads the true resistivity of the bed.

The base of the Charles was picked between two very high natural radioactivity curves. There is some doubt as to the true base of the Charles, but the major oil companies pick it here as it is a characteristic curve found on logs from every well in the area.

CHARLES FORMATION

The Charles formation was first named by O. A. Seager (1942) from the Arro Oil and California Company's Charles No. 4 well, S. E., N. E. Section 21, Township 15 North, Range 30 East, Garfied County, Montana. Seager described the formation as a sequence of limestone, anhydrite, brown to red shales and siltstones, and dolomite lying between the Mississippian Kibbey and Mission Canyon formations. In the Nesson Anticline, the Charles consists of gray and white salt with cavities; red

shaly siltstone; and some white and pink, fine to coarse grained sand-3 stone; and gray, dense cavernous limestone (Laird, 1946, p. 14). Characteristic of the Charles in the anticline, is the presence of five to six separate salt beds. These can easily be recognized on either the microlog or laterolog and may be a valuable source of commercial salt. The Charles lies conformably on the Mission Canyon and is overlain unconformably by the Triassic "Spearfish" formation (Anderson, 1956).

DISCUSSION OF MAPS

Very close correlation between structural highs and the thinning of the salt is observed in the upper half of the maps. Townships 157 and 158 North, including the Ranges 94, 95 and 96 West show a thinning of the Charles over structural highs. The maps show that in Section 18, Township 158 North, Range 94 West, a definite high area is characterized by a thinning of the Charles by approximately 30 feet. Section 7, Township 159 North, Range 95 West, shows a very close correlation between a closed 5560 foot structure contour and a closed 670 foot isopach contour.

Other examples of close correspondence between structurally high areas and thinning of the salt in the upper part of the maps can be seen by examining the area around Section 12, Township 158 North, Range 95 West; Section 6, Township 157 North, Range 94 West; and Section 2, Township 157 North, Range 94 West.

An interesting area is Section 22, Township 158 North, Range 94 West. Here a structural nose seems to approximate a very sudden thinning of the Charles.

In the lower half of the maps, a few areas do not seem to correspond very well, but in general the trend seems to that of the upper part.

Some areas that show close correspondence are Section 6, Township 155 North, Range 95 West; Section 2, Township 155 North, Range 95 West; and Sections 21 and 23, Township 154 North, Range 95 West.

CONCLUSION

An examination of the maps reveals the close correspondence between structural highs and the thinning of the Charles formation. As oil is often found on structural highs, it is hoped that the thinning of the Charles may be used as a guide to future oil exploration. It is also hoped that further work be done on this problem; it may prove a valuable aid in the finding of faults.

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FIG. I STRUCTURE CONTOUR MAP DRAWN ON BASE
OF LAST SALT OF CHARLES FORMATION