United States

Department of the Interior

U.S. Geological Survey

Washington

Geological Investigations

Naval Petroleum Reserve No. 4

Alaska

Report No. 37

REVIEW OF THE STRATIGRAPHY AND STRUCTURE OF THE GUBIK ANTICLINE

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INTRODUCTION

At the direction of Ralph L. Miller, a special study was made of the part of the Gubik anticline east of the Colville River. The purpose of this study was twofold; first, to examine the field evidence bearing on east plunge, second, to attempt to establish the continuity of the anticlinal axis from the Colville River to the Anaktuvuk River. The results of this study and a summary of results of the study of part of the anticline west of the Colville River by Stefansson and Thurrell[1] are presented below.

STRATIGRAPHY

Within the area outcrops adjacent to the probable position of the axial trace of the Gubik anticline are limited to the part of the anticline west of the Colville River, the bluffs along the west bank of the Colville River, and the bluffs along the west bank of the Anaktuvuk River. The entire area between the Colville and Anaktuvuk Rivers in the vicinity of the axis of the Gubik anticline is overlain by deposits of stream gravel. These gravel deposits probably average 30 to 50 feet in thickness. At the Anaktuvuk River the bedrock has been largely obscured by the slump of these gravels. This factor coupled with the nonresistance of the bedrock largely limit the information and the reliability of the information obtainable from the Anaktuvuk bluffs.

At the Colville River the rock exposed near the axis of the Gubik anticline is zone I. The color of the bluffs is banded yellow, buff, light gray, yellow red, and pink. On the whole the section is poorly consolidated. It consists largely of clay, silt, and shale; the entire section is very bentonitic. Coal (bony) and tuff are very common. Sandstone beds are not numerous. They occur as either thin (as much as 5 feet thick) beds, usually fairly well consolidated, slabby, fine- to medium-grained, silty, and gray in color; or as thicker beds, loosely consolidated, light gray, fine- to medium-grained, and friable. Most of the thicker beds are bentonitic and some are cross-bedded. Ironstone lenses and nodules are common, especially in the sandstone beds. The exact position of the zone H-zone I contact shown on plate 1 was determined by Stefansson and Thurrell[2] on the basis of lithology, degree of consolidation, and color

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1/ Stefansson, Karl, and Thurrell, R. F., Stratigraphy and structure of the area of the Colville River north of Umiat, Alaska: U. S. Geol. Survey Navy Oil Unit Report No. 12, 1948.

2/ Stefansson, Karl, and Thurrell, R. F., Op. cit.

of the rock exposed in the Colville River bluffs. Faunal horizons limited the interval in which this contact could be placed to a few hundred feet. Although a marked lithologic break between zones H and I is mentioned in Report No. 12, in observing this part of the section the author did not note a sharp lithologic break; however, there were noticeable differences in gross lithologic appearance and make-up. The sandstone of zone H is harder, more massive, and displays a slightly different color. In this area zone H is marked by an almost complete absence of coal, particularly in the upper part of the section.

At the Anaktuvuk River the section is composed of sandstone, coal, bentonite, and shale. The character of the sandstones changes rapidly across the strike. On the flanks the sandstones are massive, fine-grained and cross-bedded. On the south flank old stream courses are evident in the bedding. Northward from this sandstone and downward in the section the sandstones that are exposed are more friable, contain coaly streaks and plant fossils. The amount of coal and bentonite increases rapidly toward the axis, and near the lowest stratigraphic point one 6-foot coal bed is present.

U. S. Geological Survey Report No. 1[3] indicated the presence of zone H macrofossils near the axis of this anticline. A search revealed no trace of this fossil horizon. A check of the records indicated that none of the genera listed in this collection may now be considered as diagnostic of zone H. The gross lithologic appearance of the exposed part of the section on the Anaktuvuk River is typical of zone I as exposed nearby on the Colville River. This observation is concurred in by George Gryc who has also studied both sections. Along the Colville River no coal was found in upper zone H or in the lowest 400 feet of zone I.[4] Coal is abundant near the axis in the lowest part of the section exposed at the Anaktuvuk River bluffs. In these same bluffs approximately 1 mile south of the axis, small shell fragments were found in a small 1-inch coquinalike layer. These were identified by George Gryc[5] as pelecypods of the genus Mytilus. While not considered diagnostic of zone I, similar fossils in a similar state of preservation and deposited in a similar lithologic medium were observed in 1947 by Stefansson and Thurrell and in 1949 by Gryc and Fischer in zone I on the Colville River. Six microfossil samples were collected from outcrops near the axis of the Gubik

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3/ Payne, T. G., and others, Stratigraphy and structure of the area of the Killik, Chandler, Anaktuvuk, and Colville Rivers, Alaska: U. S. Geol. Survey Navy Oil Unit Report No. 1, 1946.

4/ Payne, T. G., and others, Op. cit.

5/ Gryc, George: Personal communication, August 1950.

anticline on the Anaktuvuk River. These have been studied by Bergquist, who reports that the faunules do not contain diagnostic microfossils, but that they have closer affinities to the zone I fauna from the Sentinel Hill core test than to any zone H fauna.

It therefore is highly probable that no rock stratigraphically lower than zone I is exposed near the axis at the Anaktuvuk River. If this inference is correct the probability of closure is increased.

STRUCTURE

The structure contours shown on the west part of the Gubik anticline were drawn by Stefansson and Thurrell[6] on a persistent 15-foot conglomeratic sandstone. This conglomeratic sandstone is about 2,800 feet stratigraphically above the top of zone F and approximately 1,500 feet below the collar of the Sentinel Hill core test. The anticline plunges west. Plunge of at least 40 feet is established, but it is probably much greater. This west plunge was substantiated by recent geophysical studies.[7] In the area between the Colville and Anaktuvuk Rivers no structural information is available. There is no definite assurance that the anticlinal axes observed at the Colville and Anaktuvuk Rivers are in reality expressions of the same anticlinal trend; however, judging from regional trends and the similarity of lithologic units it is highly probable that only one anticline is represented.

At the Anaktuvuk River such surface data as are available indicate a plunge of the anticline to the east. The loosely consolidated character of the rock, the possibility of slump, and the presence of complex cross bedding make the strikes depicted on plate 1 questionable. If slump were a factor in these readings it would introduce an easterly component of dip. It should be noted, however, that only where the bedrock appears to be in place were the strikes and dips recorded. The generally constant readings obtained, together with the east dip components evident on the north flank make the presence of eastward plunge a strong probability.

Judging from topographic features and to some extent from the attitudes of the gravel terraces, it is the opinion of the writers that the Gubik anticline is similar in east-west configuration to the Umiat anticline. The structural high should be located between the Chandler and Anaktuvuk Rivers and is probably closer to the Anaktuvuk.

6/ Stefansson, Karl, and Thurrell, R. F., Op. cit.
7/ United Geophysical reports of Party 144, 1950.