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PRELIMINARY REPORT ON STRATIGRAPHY AND STRUCTURE
OF THE UMIAT ANTICLINE

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INTRODUCTION

During the summer of 1946 the United States Geological Survey, as part of its program of stratigraphic and structural investigations in the Naval Petroleum Reserve No. 4, had one field party investigating the Umiat area.

The stratigraphy of the area was already fairly well known from earlier investigations. The main object of this investigation was to delineate, in as much detail as possible, the Umiat anticline in the area of Umiat Test No. 1.

Outcrops in the Umiat area are few. Direct compass readings for strikes and dips of bedding cannot be trusted since cross-bedding, slumping, and frost-heaving are the rule rather than the exception. Structural data was obtained by use of a plane table and alidade by the three-point method. On the accompanying geologic map many of the strikes and dips shown were obtained by solving three-point problems. Additional structural data was obtained by mapping structural traces.*

* Term used to cover rubble horizons, breaks in topography, changes in vegetation, etc., all expressions of the structure.

STRATIGRAPHY

The best outcrops in the Umiat area are in a few bluffs along the Colville River, where the formations exposed are, with the exception of those in Umiat Mountain, stratigraphically higher than the section drilled in Umiat Test No. 1.

Rocks of Upper Cretaceous age, from Formations F, G, and H are exposed in the area (see geologic map and chart of stratigraphic sections, in pocket). The youngest Formation, H, is well exposed in a bluff about 3 miles down river from Umiat Mountain. It is largely a sandstone, siltstone, and shale section, with interbeds of bentonite, and with a few tuffaceous beds. The "Umiat" sandstone (W. T. Foran), which forms a prominent ridge on the north limb of the anticline, was traced eastward into this bluff. This sandstone is tentatively considered to be the basal member of Formation H.

Formation G is poorly exposed. In the bluff 3 miles down river from Umiat Mountain the rocks stratigraphically below the "Umiat" sandstone are considered as the top of Formation G. A section about 120 feet thick is exposed here. It is primarily a cross-bedded sandstone section, somewhat bentonitic, and containing thin lenses of conglomerate and ironstone. The section below this, down to the top of Formation F is as yet relatively unknown.

The 1945 studies of the United States Geological Survey indicated that Formation G in this area should be about 400 feet thick. Based on structural data obtained during the summer of 1946, it is tentatively calculated that Formation G may be about 1,500 feet thick.

With the exception of the 120-foot section below the "Umiat" sandstone, little is known of the lithology of Formation G. The cuttings from the drilling done by the seismograph party at Umiat should furnish additional information on the lithology of Formation G.

The upper part of Formation F is well exposed in Umiat Mountain. This section is predominantly bentonitic shale and siltstone, with interbeds of sandstone, especially near the top.

STRUCTURE

Although rock exposures are few in the Umiat area, five horizons crop out persistently enough to give a fairly comprehensive picture of the distribution of the formations.

"Horizon 1" is a friable salt and pepper sandstone, stratigraphically 375 feet below the base of Horizon 2. Lithologically it is correlative with the sandstone at 920 feet in Umiat Test No. 1. This horizon is not exposed in Umiat Mountain, but is well exposed in the vicinity of Bearpaw Creek.

"Horizon 2" is a black "paper" shale, 200 feet thick. This is the most easily traceable lithologic horizon in the Umiat area.

"Horizon 3" is a fine-grained, calcareous sandstone unit about 125 feet thick. The base of this horizon is stratigraphically 150 feet above the top of Horizon 2.

Horizons 1, 2, and 3 are all in Formation F.

"Horizon 4" is a rather persistent coal bed in Formation G. It was seen only in isolated outcrops, but enough structural data was obtained

to calculate its stratigraphic position to the other key horizons. It lies approximately 725 feet above the top of Horizon 2.

"Horizon 5" is the base of the "Umiat" sandstone, here considered to be the basal member of Formation H. It is calculated to be 2,200 feet stratigraphically higher than the top of Horizon 2.

Knowing the stratigraphic intervals between these horizons it is possible to construct a structure-contour map of the Umiat anticline. It should be emphasized that the data -- both structural and stratigraphic -- are none too abundant, and therefore the map, in places, is generalized. The map is believed to depict, however, the structural picture of the Umiat anticline.

Structurally, the stratigraphically highest beds (Formation H) appear to form a symmetrical, or nearly symmetrical anticline. The south flank of the anticline, however, is poorly exposed. The dips observed are low, 6 to 7 degrees. On the north flank of the structure the dips observed on these beds steepen from 3 degrees in the western part of the area to a maximum dip of 9 degrees northeast of Umiat Mountain.

The north limb of the anticline is modified by a steep monoclinial flexure that is near and approximately parallel to the crest of the anticline. The amplitude of this flexure, near Umiat Test No. 1, at least near the surface, is believed to be no more than a few hundred feet. This monoclinial flexure is marked by a ridge that extends from a point northwest of Umiat Test No. 1 east to Umiat Mountain. This ridge consists of the fine-grained, calcareous sandstone of "Horizon 3." Along the ridge this

sandstone dips as much as 85 degrees north. North of this sandstone ridge (i.e., stratigraphically higher) the dip of the beds decreases gradually northward.

A short distance south of the sandstone ridge Horizon 2 ("paper" shale) is found to strike approximately east-west and dip 60 to 65 degrees north. Farther south Horizon 2 dips southward at a low angle; but considerable crinkling of the shale persists even at some distance from the ridge. Horizon 2 was not seen north of this ridge. This absence of Horizon 2 north of the ridge apparently cannot be explained by faulting (normal fault with the north side downthrown). A fault of a magnitude great enough to displace Horizon 2 to such a depth that the horizon does not crop out north of the ridge should leave some surface indications, but evidences of only minor movements were found. The very steep north dip of Horizons 2 and 3 on the north limb of the fold, and the gradual decrease of dips further to the north, are a very strong indication that the north limb of the anticline is a monoclinial flexure.

The axis of the structure lies just south of the ridge formed by Horizon 3, and trends approximately east-west. Near Umat Mountain the axis apparently swings a few degrees south of east.

The preliminary structure map (in pocket) is drawn on top of Horizon 2. In general, it shows that the Umat anticline has a closure of at least 500 feet, and probably several hundred feet greater. The high part of the structure is nearer the east end, apparently a short distance west of Bearpaw Creek. The plunge at the west end probably does not exceed

2 degrees. At the east end the plunge is somewhat steeper. West of Umiat Test No. 1, the major structure appears to change its trend from approximately east-west to about N. 70°W.

An accurate topographic base map of the Umiat area will be compiled this winter by J. H. Langhofer, from photo-control data obtained by him during the summer of 1946. In conjunction with this some additional structural data will be obtained, since many continuous lithologic units and structure traces were located on aerial photographs of the area, and can be plotted directly and accurately on the proposed map. Replotting on this new map of the data already accumulated will be necessary, but should not change radically the picture of the structure of the Umiat anticline as outlined above.