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Preliminary Report 43

STRATIGRAPHY AND STRUCTURE OF PART OF BIG BEND ANTICLINE, ALASKA

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INTRODUCTION

Big Bend anticline is the northernmost of the three structures studied by U. S. Geological Survey Navy Oil Unit party 2 during the 1952 field season. 1/ The structure is 50 to 55 miles long and is approximately 15 miles south of Umiat and 10 miles north of Grandstand anticline. As there was insufficient time during the field season to study the complete structure, most of the time was spent on the east end, from the Chandler to Anaktuvuk Rivers, as that part of the structure was least complicated by faulting. A structure-contour map of the east end of the anticline has been prepared (pl. 1) since the November 1952 meeting of the Operating Committee.

STRATIGRAPHY

Big Bend anticline is a major structure involving complexly folded and faulted Nanushuk group (zones C, D, and E) and Colville group (zone F) sedimentary rocks. The rocks exposed in the anticline represent the northern facies of zones C, D, and E, and in general are more marine than in the type locality near Tuktu Bluff. The columnar sections for Big Bend anticline are included in Preliminary Report 41 (pl. 3, columns 5 and 7) 2/.

Zone C.--Approximately 400 feet of zone C is exposed at the axis of Big Bend anticline where the structure is breached by the Chandler River and Trouble Creek; it is a marine section similar in appearance to zone B at Tuktu Bluff. Siltstone and mudstone comprise about 60 percent of the total thickness. They are dark gray, micaceous, carbonaceous, and show a ropy flow structure. The sandstone is thin- to medium-bedded, dirty, calcareous, dark gray to greenish brown, weathering brown, and fine-grained. Ironstone nodules and marcasite concretions are moderately abundant throughout the section. A megafossil assemblage, including Laevidentalium sp., Pecten sp., and Inoceramus sp., was found in the sandy part of the sequence.

1/ Detterman, R. L., and Bickel, R. S., Stratigraphy and structure of the Grandstand and Hawk anticlines and vicinity, Alaska: U. S. Geol. Survey Navy Oil Unit Prelim. Rept. 41, November 1952.

2/ Detterman, R. L., and Bickel, R. S., op. cit., p. 1.

Zone D.--The massive white quartz conglomerate arbitrarily used as the contact between zones C and D to the south is absent at Big Bend anticline. The contact is gradational and is arbitrarily placed 1,700 to 1,800 feet below the base of zone E (horizon 10,000, pl. 1). The composition of the basal part of zone D (horizon 8,685 to the zone C-D contact) is very similar to that of zone C and consists of a series of interbedded sandstone, siltstone, silt shale, and mudstone, with some ironstone nodules and layers. The sandstone is thin- to medium-bedded, fine-grained, silty, and dark neutral to greenish in color. Megafossils, including Panope sp., Tancredia cf., T. stelcki McLearn, Inoceramus cf. I. tenuis Mantell, and Pleuromya sp., are found in the sandstone units. Above horizon 8,685, the zone D sandstone is heavier-bedded and fine- to medium-grained, with some coarse-grained salt and pepper sands near the top. One of the coarse-grained salt and pepper sandstone beds (horizon 9,700) has a sparse megafossil assemblage including Inoceramus sp., Corbula sp., Pecten sp., and Arctica dowlingi McLearn. Siltstone and silt shale comprise the bulk of the sequence between the sandstone horizons. Near the top, above horizon 9,700, coal and carbonaceous shale are interbedded with the siltstone-silt shale section.

Zone E.--Sedimentary rocks, correlated as zone E, are exposed on both flanks of the anticline. However, the contact with zone D cannot be placed exactly, as the key fossil horizon (Inoceramus athabaskensis McLearn) for basal zone E is missing. At one locality south of the axis along the Chandler River, a few fragments of Inoceramus sp. were found; however, this has been correlated as horizon 10,300. The contact between the two zones on Big Bend anticline is lithologically rather than faunally controlled, and is placed at the first appearance of a thin-bedded, fine-grained, yellow-brown, calcareous sandstone. A medium-bedded, medium-grained salt and pepper sandstone is approximately 30 feet below this and the two beds can be traced around the structure. This change in lithologic appearance from a predominantly medium-grained salt and pepper sandstone section to one composed primarily of fine-grained, calcareous, yellow-brown sandstone, is interpreted as the break between the zones. It must be emphasized that the contact on Big Bend anticline may differ somewhat from the contact to the south. The thickness of zone E in this area ranges from about 400 to 700 feet, and consists of interbedded sandstone, siltstone, silt and clay shale, and limestone. The sandstone is thin-bedded, fine-grained, dirty, calcareous, and usually yellow brown to greenish. The limestone is a minor constituent of the section, but notable for its tendency to cleave into thin sheets, and also, for the presence of a few fossils at the one locality south of the axis. These include Arctica sp., Volsella cf. V. silentinsis, and fragments of Inoceramus sp.

Zone F.--An unknown thickness of zone F occurs in the graben just west of the Chandler River. The unit is not exposed but the bentonitic clay shale forms "blisters" or "boils" on the surface. This is a common weathering feature of zone F, and it occurs more often than do good exposures. On both flanks of the anticline zone F unconformably overlies zone E.

STRUCTURE

Big Bend anticline has closure of 400 to 500 feet, with possibly an additional 400 feet south of the fault at the bend in the Chandler River. The structural picture south of the fault and west of the river is not clear, as exposures are very poor. Closure on the main part of the anticline can be definitely proved, with reversal in plunge indicated approximately where Trouble Creek breaches the structure. The contoured surface has an elevation of approximately 2,400 feet at Trouble Creek; at the east end of the anticline it is at about 1,900 feet, and at about 2,800 feet west of the Chandler River. Using the thicknesses of measured sections to the south and of those at Big Bend anticline, the contoured horizon would be 3,800 to 4,000 feet above the base of zone B. A test well located just south of the axis and about 2 miles west of Trouble Creek would start about 2,300 to 2,400 feet above the base of zone B. At Trouble Creek the structure is breached to approximately 1,950 to 2,000 feet above the base of zone B. The sections of zones B-C encountered at Grandstand Test Well No. 1 are predominantly siltstone and shale with minor amounts of dirty sandstone. Inasmuch as a test well on Big Bend anticline would be located about 10 miles north of Grandstand, the section drilled probably would be even siltier than at Grandstand. All the medium- to heavy-bedded salt and pepper sandstones of zone D are breached at Trouble Creek, which exposes about 400 feet of the siltstone, silt shale, and dirty, thin-bedded sandstone section at the base of zone D in this area.

The horizons used in structure-contouring Big Bend anticline cannot be correlated with identical horizons on the Grandstand structure, but the over-all correlation is reliable 3/. The surface expression of the horizons is commonly nothing more than a vegetation rubble trace, so it is possible that slightly different traces have been correlated as one horizon.

East of Trouble Creek Big Bend anticline is a relatively simple, slightly asymmetric structure. Two small transverse faults offset a few of the traces on the north flank of the structure approximately 3 miles west of the Tuluga River. The faults are about ¼ mile in length, and offset the traces a maximum of 200 feet. West of Trouble Creek the structure is considerably more complex, with the axis of the anticline being offset by a reverse fault. North of the reverse fault is a major normal fault. A graben is formed by the two faults with a rapid westward increase in displacement. This displacement increases from about 200 feet, at the east end, to over 1,000 feet 4 miles farther west. This results in zone F being exposed in a tributary valley west of the Chandler River, with zone D exposed on the hills bounding the valley. At least one small reverse fault, and numerous small drag folds probably were formed contemporaneously with the formation of the graben.

3/ Detterman, R. L., and Bickel, R. S., op. cit., p. 1.

In general the photogeologic structure-contour map prepared in the Washington office in the spring of 1952, compares favorably with the one resulting from field investigation 4/. The structure is a little more complex than is shown on the photogeologic map, but the over-all closure is about the same.

Planimetry for the structure-contour map of Big Bend anticline was taken from uncontrolled aerial photomosaics, and it must be emphasized that the position of the contours may change somewhat when transferred to a controlled planimetric base. The area was mapped at a scale of 1:20,000 on vertical aerial photographs. As there was insufficient time at the close of the season, the area was not included in the triangulation net of Hawk and Grandstand anticlines, and all points of altitude were determined by altimeter traverse.

4/ Brosgé, W. P., and Reiser, H. N., Progress report on photogeologic studies in the Chandler River area: U. S. Geol. Survey Navy Oil Unit Special Rept. 32, April 1952.