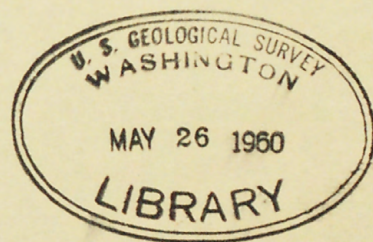


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Special Report 36  
A NEW INTERPRETATION OF THE DRIFTWOOD ANTICLINE

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## ILLUSTRATIONS

- Plate 1. Generalized structure-contour map of parts of  
the East and West Driftwood anticlines . . . . (Separate)
2. Geologic map showing structural setting of  
the Driftwood anticlinal area . . . . . (Separate)



# A NEW INTERPRETATION OF THE DRIFTWOOD ANTICLINE

By

Edward G. Sable

## INTRODUCTION

Continued work in the Driftwood anticlinal area has prompted further studies of the structure, including a more careful analysis of aerial photographic evidence and its relation to geological surface data. As a result of these studies, a structural concept somewhat different from that which was reported in 1950 <sup>1/</sup> is presented here. The previous interpretation was that the Driftwood anticline was essentially a single large complex fold; the writer now believes that the western part of the structure consists of two roughly parallel anticlines that trend N. 70° E., with the southeasterly anticline (East Driftwood) "rolled" and faulted in part against the northwesterly fold (West Driftwood). The Torok formation upper siltstone-shale unit is exposed in the "cores" of both anticlines. The eastward extent of these anticlines is uncertain, and the surface interpretation east of the Utukok River has not been appreciably altered by further photogeologic work.

Reasons for the change in interpretation are ascribed to increased experience in the use of photogeology as a tool to augment field work, to a better understanding of regional and local structure in similar areas to the south and east, and to examination of alternate interpretations proposed by other workers.

## RECENT FIELD STUDIES

A short surface reconnaissance of part of the Driftwood area was made in the summer of 1952 by Messrs. Ruby, Mohr, Milak, and Myers. Reflection and refraction seismic operations were also undertaken during the 1952 summer season <sup>2/</sup>. Alternate interpretations of the structure, in part a result of these studies, are 1) that the structure consists of several en echelon-type folds; 2) that the inferred axis east of the Utukok River represents a major fault; and 3) that the surface structure is an expression of thrust faulting and may not reflect similar structure at depth.

It has not been possible to satisfactorily relate the surface structures of the Driftwood area to results of the seismic work. No good evidence of the multiple overthrusting in the Driftwood area suggested by the Seismograph Survey report is shown by surface data.

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- 1/ Sable, E. G., and Mangus, M. D., Stratigraphy and structure of the Driftwood anticline: U. S. Geol. Survey Navy Oil Unit Rept. 44, May 1951.
  - 2/ Donohue, G. E., Seismograph Survey Report of the Kaolak to Carbon Creek, Utukok River and Driftwood areas, United Geophysical Co. Inc., 1952.

## DISCUSSION OF STRUCTURE-CONTOUR MAP

In 1950 it was not thought advisable to draw a structure-contour map with the scant data and uncertain interpretation in parts of the Driftwood area. A generalized structure-contour map (pl. 1) at 1:20,000 horizontal scale is included with this report; contours are drawn at 100- and 300-foot intervals. It is emphasized that for the most part the map is highly interpretive and the contours are approximate, particularly in the faulted area between the two anticlines where exposures are scarce. The correlation of datum horizons on the two anticlines may be subject to considerable error.

Methods used in structure contouring include:

1. The lowest observed sandy bed which continues around the west nose of West Driftwood anticline (trace 1) was traced along the north and south flanks of the structure. Along this datum horizon altitudes obtained from the topographic contour map made during the 1950 field season were used to delineate the flanks of the structure. A second sandy zone exists near the axis of West Driftwood anticline and its upper beds are approximately 1,000 to 1,300 feet below trace 1. In East Driftwood anticline, a similar relationship is present. There, a resistant trace (trace 2) approximately 1,200 feet above an axial sandy zone was used as the datum horizon, and the datums in the two anticlines were considered approximately equivalent. It should be realized that this is an uncertain correlation and even though the general sandy zones may be equivalent, the correlation of trace 1 and trace 2 may be in error as much as 300 stratigraphic feet.

2. Four restored cross sections (pl. 1), A-A' and B-B' on West Driftwood, C-C' and D-D' on East Driftwood, were bushed using field data. The datum horizons were projected over the structures, and positions of contours higher than those outlined by the altitude method were delineated from these.

3. The anticlines were assumed to be essentially simple surface folds. Small-scale structures are not represented by the contours. With the exception of the contorted beds along Pattern Creek, all readings on West Driftwood anticline indicate a simple surface fold. Minor deviations of field strikes from the over-all picture are believed due to variations of primary bedding or local warpings along the structure. East Driftwood anticline may be more complex; it is overturned at the Utukok River, has some dip reversals on the south flank, and a fault is believed to displace the inferred axis east of the Utukok.

## DISCUSSION OF STRUCTURES

### West Driftwood anticline

West Driftwood anticline is an elongate, narrow, slightly asymmetrical fold covering 10 square miles where exposed. West plunge affects a minimum of 1,500 and a possible maximum of 2,500 feet section. East plunge is indicated only by a slight curvature of traces and by the drainage pattern of Pattern Creek, west of the Utukok River. From the contours shown at the Utukok River, 600+ feet of closure may be inferred. The highest contour of the structure, 3,300 feet, encompasses the area between the Utukok River and Plunge Creek. With the exception of the contorted bedding north of the fault zone on Pattern Creek and the minor transverse fault 1 mile west of Plunge Creek, no complexity of structure was noted. The datum trace was picked as the lowermost traceable bed on the west nose. It was traced without difficulty around the south flank of the anticline, where it lies approximately 1,100 feet below the top of the section. On the north flank, the trace position was inferred. Here it passes into flats underlain by shale about 100 to 200 feet above the topmost sandy beds. The reconstructed cross section A-A' (pl. 1) showed no exaggerated section thickness on the south flank as was shown on plate 2 of Navy Oil Unit Report 44. The loss of 1,200 feet of sandy section from south to north is thought by the writer to be due to a rapid northward shaling which is characteristic of these rocks in other areas, or, less likely, to the presence of a fault on the north flank.

### East Driftwood anticline

East Driftwood anticline is a larger and in part more asymmetric field than West Driftwood. The surface axial exposures at the Utukok River show a northward-overtaken axial plane that dips 67° south. The "minor fold" 1 1/2 miles west of the Utukok River, previously interpreted in Report 44 as a large drag fold or a bifurcation of the main axis 3/, is now believed to be the west nose of the East Driftwood anticline. West plunge involves about 3,000 feet of section and the highest restored contour is 5,700 feet, 2,400 feet higher than West Driftwood. No east plunge can be proved. The previous supposition that the axis is coextensive with the long level ridge east of the Utukok River is still considered correct. Only a portion of the south flank can be contoured east of the Utukok; a slight northward swing of the 1,900-foot contour east of the river infers some closure, in part possibly against the fault which displaces the axis 3 miles east of the Utukok River. East of this fault, the contour parallels the ridge for 5 miles. A younger sandy section occurs on the south flank of the anticline along Driftwood Creek, but it apparently shales out westward toward Adventure Creek where predominantly shale sections are exposed. No observed evidence supports the possibility that the presence of this section is due to a third en echelon anticline.

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3/ Sable, E. G., and Mangus, M. D., op. cit., p. 5

### Fault between anticlines

The location of the fault between West and East Driftwood anticlines is fairly well established west of the Utukok River. An intermittent N. 40°-70° E.-trending vegetation-covered trace along the north flank of East Driftwood parallels the fault and appears to truncate bedding of West Driftwood. One mile east of the Utukok, along Pattern Creek, a disturbed zone is present north of the fault. On the assumption that the datum traces of both anticlines are equivalent, it was found that the 2,700-3,000-foot contours of both anticlines nearly coincided at the fault, and that, therefore, the apparent displacement is small in the southwest part of the fault. Northeastward, the apparent displacement increases to 1,200-1,500 feet at the Utukok River. East of the Utukok, the position of the fault is questionable. A disturbed zone 2 miles east of the Utukok may be an expression of the fault. If so, the fault here is nearly parallel to the strike of both structures in contrast to its transverse character west of the river. It is also possible that the fault swings southward along the small drainage east of the Utukok and parallels the axis of East Driftwood anticline. Both possibilities are shown on plate 1. It appears that unequal compressive forces from the southeast have broken East Driftwood contemporaneous with folding and thrust it over the eastern part of West Driftwood. The inclination of the fault is not known; the relationship to topography indicates that it is probably steeply dipping. If it is low angle, the axis of West Driftwood may extend beneath the fault and continue in the subsurface north of East Driftwood. If it is high angle, and extends northeastward, eventual closure of West Driftwood against the fault is possible. However, nearly all surface beds examined north of East Driftwood are north dipping under the Mamashuk group at Meat Mountain and appear to reflect the anticlinal nature of East Driftwood.

There are some indications that an unconformity may be present within the thick shale unit underlying the Mamashuk group sandy units and overlying the Torok formation upper siltstone-shale unit. Photogeologic studies in the Utukok-Kukpowruk Rivers areas show that the basal sands of the Mamashuk group cross time lines eastward and northward, so some of the shale underlying the Mamashuk group at Meat Mountain is equivalent in time to Mamashuk sandy units further west  $\frac{4}{5}$ . An unconformity, if present, would therefore lie below the sandstone-shale contact in the lower part of the Mamashuk group. Evidence for such an unconformity within the shale unit is not positive, but consists of:

1. The pronounced differences in regional strike and degree of complexity between Mamashuk group or older units.
2. Apparent strikes within the shale unit discordant to strikes of lower Mamashuk Group sandy beds. Because of lack of exposures this cannot be clearly shown; an example is the south flank of Meat Mountain, where sandy traces within the shale unit  $\frac{3}{4}$  mile north of Seismo Creek strike approximately N. 80° E., in contrast to the east strike of sandy traces in the Mamashuk group.



## REINTERPRETATION OF STRUCTURAL SETTING

Further photogeologic studies were also made in the areas surrounding the Driftwood anticlinal area. A 1:96,000-scale map of the area (pl. 2) shows the structural setting of the area and bedding trace trends in the vicinity. Approximate locations of 1952 seismic reflection lines by United Geophysical Company party 146, are also shown.

From new photogeologic evidence, it has been possible to re-interpret the general structural setting of the Driftwood area. Bedding traces north of the anticlinal area show that the Meat Mountain syncline axis does not swing northwest across the Utukok River as shown on older maps, but generally parallels the trend of East Driftwood anticline. The major anticlinal nature of the Driftwood area is evidenced from 1 to 3 miles north, west, and south of the exposed "cores" of the structures. Other traces in the flats north and south of Driftwood are undecipherable and appear to be complexly folded.

An anticlinal trend is evident west of West Driftwood anticline. Bedding traces strike N. 45°-60° E. and it appears that the general trend of West Driftwood may continue southwest to the complex anticlinal area that exposes the Terek formation upper siltstone-shale unit shown in the southwest corner of plate 2.

On the Colville River, 20 miles east of the Utukok River, a major anticlinal trend exposing Terek formation upper siltstone-shale unit is believed coextensive with the Driftwood trend. Three miles north of this a major syncline represents the eastward extension of the syncline at Meat Mountain. Another major anticlinal area is defined 2 miles north of the Meat Mountain syncline, and can be traced roughly into the Brady anticlinal area, 40 miles east. From the regional stratigraphic and structural picture, the Driftwood anticlinal area appears to lie in a lower structural position than the Brady area.

Sandy beds seen within the shales may represent time breaks and the beginning of deposition of the Namashuk group.

