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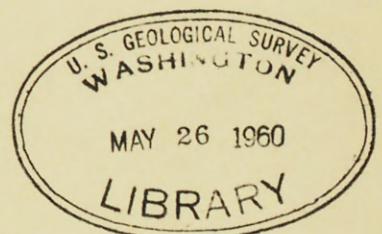
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Geological Investigations

Naval Petroleum Reserve No. 4

Alaska



Special Report No. 30

REVIEW AND PHOTOGEOLOGIC EVALUATION

OF SELECTED ANTICLINES

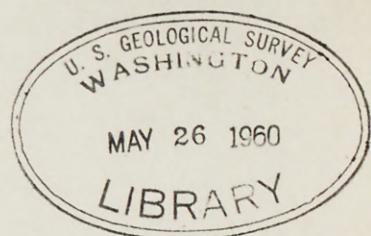
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By

W. A. Fischer

June 1951

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# REVIEW AND PHOTOGEOLOGIC EVALUATION OF SELECTED ANTICLINES

By

W. A. Fischer

## INTRODUCTION

This report is intended to serve as a catalogue of anticlinal structures in the Arctic Foothills province of northern Alaska that might be suitable for testing rocks of the Nanushuk and Colville groups for possible oil accumulation.

Only those anticlines lying between 150° and 162° W. long. in the foothills area are covered in this report. Structures that are presently included in the 1951 drilling program are listed but not discussed.

The structural data presented are for rocks of the Colville and Nanushuk groups only. No reference is made nor inference intended as to the structural attitudes of the underlying sediments.

Where definite geologic information is not available we have presented our "best guess" as to the structural and stratigraphic conditions that exist. We have endeavored to properly evaluate the data and to clearly distinguish the "best guesses" from the more firmly substantiated interpretations so that no confusion and no misinterpretation of the validity of the information in this report will occur.

Anticlines are listed in alphabetical order in Appendix A. In the body of the report the anticlines are divided into 11 groups on the basis of a combination of geographic position, structural and stratigraphic similarity, and relation to "lines of folding." No attempt has been made to group the structures on the basis of logistic interaccessibility. It is believed, in general, that the conditions of folding and sedimentation are similar for the structures within each group. Therefore, if one structure within a given group were to prove productive the other structures within its group might be considered good prospects.

Some of the anticlines in groups 9, 10, and 11 fall within the areas of 1:250,000 quadrangle maps 32, 33, and 34. These maps have not been completed and are not included with this report. The structures discussed are shown on 1:96,000-scale maps which are available to interested parties.

## GROUP I--UMIAT GROUP

Anticlines included:

Umiat  
East Umiat--Kuparuk  
Gubik  
East Gubik  
Square Lake



logical place to explore would be in the areas between the major streams. There is very poor evidence of a fault parallel to and lying between the axes of the Umiat-Kuparuk and Gubik anticlines. It is further possible that the axis is cut by transverse faults which are now occupied by the valleys of the major streams. Further surface exploration would not add to our present limited knowledge; all future work would have to be of geo-physical nature.

#### Square Lake anticline

quadrangle H-13, 1:96,000.

Quadrangle 23R, 1:250,000.

Stratigraphy.--Zone H, overlain in large part by Gubik sediments, is probably present over the axis of the Square Lake anticline.

Structure.--The structure of the Square Lake anticline was interpreted from rubble traces that are believed to be the Gubik formation. The Gubik formation may not properly reflect the underlying structure although experience in other areas indicates that normally the structure is correctly reflected in location, extent, and strike direction, but that the amplitude of the structure is minimized. If the structural interpretation of the Square Lake anticline is valid, it seems that one structural high would occur along the axis directly south of Square Lake.

#### GROUP II--TITALUK GROUP

Anticlines included:

Titaluk (East Titaluk, Maybe Creek Dome)

Wolverine

Willow

Wolf Creek

Weasel Creek

Shultz

Cache Ridge

#### Titaluk anticline

(East Titaluk and Maybe Creek Dome)

Quadrangles I-13 and I-14, 1:96,000.

Quadrangles 23R and 24, 1:250,000.

In part included in this year's drilling program.

Stratigraphy.--Rocks ranging from the upper part of zone E to the lower part of zone G are present along the axis of this anticline. The presence of good faunal horizons in zone F and nearly continuous bedding traces makes these stratigraphic positions reliable. The effect of the postulated zone E-zone F unconformity on the thickness of zone E is not known. It is believed that approximately 10 miles to the south at the Weasel Creek anticline the entire thickness (approximately 1,800 feet) of zone E is present. Isopach maps of this structure indicate that the

sandstone beds tend to thicken toward the axis, but some are cut out in the immediate vicinity of the axis.

Structure.--Three separate and isolated structural highs are known to be present along the anticlinal axis. The western high on the Titaluk anticline is included in this year's drilling program. The central high, known as the East Titaluk high, has closure probably in excess of 80 feet. The eastern high known as the Maybe Creek Dome is a very small structure both in closure (approximately 25 feet) and in areal extent. No faults are known along the crest of the Titaluk anticline.

#### Wolverine anticline

Quadrangles H-15 and H-16, 1:96,000.

Quadrangle 24, 1:250,000.

Stratigraphy.--Little factual stratigraphic information is available, although it is probable that rocks of zone E persist for the entire length of the axis.

Structure.--Structural data are rare and generally unreliable. This axis may actually be a continuation of the Willow anticline that has been mapped by seismic studies east of the Ikpikpuk River. Inconclusive evidence suggests that a structural high may be present between the Titaluk and Ikpikpuk Rivers.

#### Willow anticline

Quadrangle I-14, 1:96,000.

Quadrangle 24, 1:250,000.

Stratigraphy.--In the vicinity of the axis of this anticline the surface is completely covered by the Gubik formation. A study of the seismic profiles indicates that the upper part of zone E probably is present immediately below the Gubik formation.

Structure.--Little surface structural data are present. The one seismic profile across the axis of the structure indicates that in cross section the anticline is similar to the Titaluk anticline and probably of the same general magnitude. No information as to possible areas of closure is available. All further exploratory work would have to be of subsurface nature.

#### Wolf Creek anticline

Quadrangles I-13 and I-14, 1:96,000.

Quadrangle 23R, 1:250,000.

Stratigraphy.--Fairly reliable stratigraphic evidence places zone F along the axis at the presumed structural high. Zone F crops out along the crest for approximately 10 miles to the northwest. Eastward from the structural high the structure plunges rapidly and zones G and H are believed present over the axis. The effect of the postulated zone E-zone F

unconformity on the thickness of zone E beneath this anticline is not known.

Structure.--Approximately 1,000 feet of east plunge is reasonably well established. West plunge in considerable amount is indicated, although only about 20 feet is proved. The structure is asymmetric with dips on the north flank in excess of  $10^{\circ}$  as compared to the  $2^{\circ}$  to  $3^{\circ}$  dips common on the south flank. Wolverine, Willow, and Wolf Creek anticlines fall in the same general line of folding. It is possible but not probable that they are actually part of one anticlinal structure.

#### Weasel Creek anticline

Quadrangle J-13, 1:96,000.

Quadrangle 23R, 1:250,000.

Included in this year's drilling program.

#### Shultz anticline

Quadrangle I-15, 1:96,000.

Quadrangle 24, 1:250,000.

Stratigraphy.--No definite stratigraphic information as to the age or character of the rock overlying this structure is available. It is probable that rock of either lower zone E or upper zone D is at the surface at the structural high.

Structure.--Shultz anticline has not been visited in the field and exposures are too poor to permit a good evaluation of the structure from aerial photographs. Probably only one small area of closure is present along the axis of this anticline. The amount of closure is not known, but judging from the relatively small size of the anticline it probably is not more than a few hundred feet. The axes of the Shultz anticline and Cache Ridge anticline almost merge at the western end of the Shultz anticline.

#### Cache Ridge anticline

Quadrangles I-15 and I-16, 1:96,000.

Quadrangle 24, 1:250,000.

Stratigraphy.--No definite stratigraphic information is available but it is likely that zone D is present along the axis of this structure.

Structure.--As seen on aerial photographs, the structure of the Cache Ridge anticline is quite complex. Dips in the vicinity of the axis are steep and in places nearly vertical. From long.  $156^{\circ} 30' W.$  to the vicinity of the Shultz anticline a consistent east plunge is apparent. No direct evidence of west plunge is visible. Closure may be affected, however, by a fault that appears to intersect the axis near its western end. It is further possible that the axis of this anticline merges into the flank of the Titaluk anticline. If this is so, there is almost

certainly a small area of closure near the point of bifurcation. Additional field work on this structure would probably be justified.

### GROUP III--MEADE GROUP

Anticlines included:

West Titaluk  
Gregg  
Shaningarok  
Meade River

#### West Titaluk anticline

Quadrangles H-16 and H-17, 1:96,000.

Quadrangles 24 and 25, 1:250,000.

Stratigraphy.--Regional trends indicate that zone D is present at the axis in the vicinity of the structural high. No estimate of the amount of zone D remaining can be made. Because there is evidence that zone B is largely shale a few miles to the north of this anticline, it is doubtful whether over 2,000 feet of possibly favorable section is present beneath this anticline.

Structure.--This anticline is large, with a considerable amount of east plunge. West closure is probably affected by two faults that cross the axis at approximately long.  $157^{\circ}$  W.

#### Gregg anticline

Quadrangles H-16 and H-17, 1:96,000.

Quadrangles 24 and 25, 1:250,000.

Stratigraphy.--East of the Meade River rocks as old as zone B are exposed at the surface. To the west of the river the age of the rock is not known but probably is zone C or older.

Structure.--From a point about 4 miles east of the Meade River plunge is strong and pronounced to the east. The character of the anticline west of this point is not known. A small closed high may exist just east of the Meade River, but in all probability the major regional high is west of the river. This anticline lies in the belt of the so-called Meade River Arch and is in a general area of complex faults. Exposures are too few and poor to evaluate the effect of the faults on this anticline. No field work has been done on this structure.

#### Shaningarok anticline

Quadrangles H-17 and H-18, 1:96,000.

Quadrangle 25, 1:250,000.

Stratigraphy.--Little stratigraphic information is available west of the Meade River and north of Shaningarok Creek, but zone D probably persists along this axis for most of its extent.

Structure.--Available evidence suggests high-angle reverse faults near and parallel to the axis of this anticline. Outcrops and other structural data are rare, and quite possibly this structure is further complicated by transverse faults. No definite position of a structural high can be established but one local high may be present approximately 10 miles west of the Meade River, and other local highs may occur elsewhere along the structure.

#### Meade River anticline

Quadrangles H-17 and H-18, 1:96,000.

Quadrangle 25, 1:250,000.

Stratigraphy.--Sedimentary rocks overlying the axis of the Meade River anticline range from zone B to zone D. Zone C is believed to be absent at the surface, zone B rocks having been exposed by faulting. A large gas seep on the south flank of the anticline is questionably located in zone B.

Structure.--In general the anticline is highly faulted. Both transverse and longitudinal high-angle reverse faults are present. Effective closure is probably obtained by plunge to the east and transverse faulting to the west. Gas was obtained from shot holes drilled over this structure, and as the gas seep has a large rate of flow, a gas reservoir of considerable size may be present in this area. The gas seems to be escaping along a fault plane. The complexity of the structure prevents any reliable analysis of structural closure.

#### GROUP IV--KNIFEBLADE RIDGE GROUP

Anticlines included:

Knifeblade Ridge

Kigalik

Sugar

#### Knifeblade Ridge anticline

Quadrangles J-13 and J-14, 1:96,000.

Quadrangles 23R and 24, 1:250,000.

In part included in this year's drilling program.

Stratigraphy.--Rocks ranging from zone E to zone D are present along the axis of this structure. Faults are prevalent, particularly in the vicinity of the axis. Generally the older rock is exposed on the south flank of the anticline and the younger on the downthrown block on the north side of the structure. Field studies indicate a slight increase in porosity and permeability from east to west within a given horizon.

Structure.--A longitudinal fault in the vicinity of the axis is present in the western two thirds of the anticline. This fault may continue eastward but is not evident at the surface. One major transverse fault is present. It is quite probable that at least four areas of closure exist along this axis. A transverse fault divides the major area of closure into approximately equal parts. No seep of either oil or gas is known in the vicinity of this anticline.

### Kigalik anticline

Quadrangles I-15, I-16, and I-17, 1:96,000.

Quadrangles 24 and 25, 1:250,000.

Stratigraphy.--Cretaceous rocks ranging in age from zone B to zones D and E undifferentiated are present near the axis of the Kigalik anticline. A high-angle reverse fault parallel to the axis is upthrown on the south side so the older rocks are in general confined to the south flank.

Structure.--The axis of the Kigalik anticline persists for over 70 miles in an east-west direction. Both to the east and west the axis dies out within north-northeast-trending zones of disturbance. A high-angle reverse fault, south side upthrown, is parallel to the axis along the entire length of the anticline. The displacement along this fault is not known but in places must exceed 1,500 feet. Near the central part of the anticline, the axis of the anticline and the trace of the fault follow the same line at the surface; west of this area, at about long.  $156^{\circ}30'$  W., the fault crosses to the north flank, the axis appears to be disrupted, and additional high-angle faults are present on the north flank. This area of disturbance lies within one of the north-northeast-trending zones. West of it the anticline is normal in configuration, with the fault just south of the axis. The anticline is asymmetric, and, contrary to the normal pattern in the foothills region, the south flank is the steeper with dips in excess of  $20^{\circ}$  as compared to the  $3^{\circ}$  to  $5^{\circ}$  dips common on the north flank. The Kigalik anticline is a westward continuation of the Knifeblade Ridge line of folding.

### Sugar anticline

(Approximately lat.  $69^{\circ}17'$  N., long.  $157^{\circ}30'$  W.)

Quadrangles I-16, I-17, and I-18, 1:96,000.

Quadrangles 24 and 25, 1:250,000.

Stratigraphy.--Zone B is present along the south flank of the anticline. Zones B and C are present along the north flank.

Structure.--The Sugar anticline is actually a series of disrupted anticlines that follow the same general line of folding. High-angle reverse faults near the eastern and western parts of the anticline appear to be upthrown on the south side. The eastern fault is the larger but probably is displaced less than 1,000 feet. This anticline terminates along the same zones of disturbance as the Kigalik anticline and is disturbed in much the same fashion as the Kigalik anticline. Closure seems to be effected at approximately long.  $157^{\circ}$  W. and long.  $158^{\circ}15'$  W. by differential movement of the longitudinal faults.

GROUP V--KETIK GROUP

Anticlines included:

Ketik

Wix

Elusive Creek

Anticline at  $69^{\circ}35' N.$ ,  $160^{\circ}15' W.$

Anticline at  $69^{\circ}32' N.$ ,  $160^{\circ}45' W.$

West Carbon Creek

Ketik anticline

Quadrangle I-19, 1:96,000.

Quadrangles 25 and 26, 1:250,000.

Stratigraphy.--Rocks of zones C, D, and E are believed present over the axis of the Ketik anticline. As there is probably a very rapid northward rise in the top of the shale section in this area, it is doubtful if more than a thousand feet of possibly favorable sandy section is present beneath the crest.

Structure.--Closure on this anticline could not be proved by field studies. A study of the vague traces on the photographs, however, suggests approximately 300 feet of closure. No estimate of the magnitude of throw on faults on the south side of the anticline can be made. Although the evidence of faulting is easily discernible the displacement does not seem to be large.

Wix anticline

Quadrangle I-18, 1:96,000.

Quadrangle 25, 1:250,000.

Stratigraphy.--No reliable stratigraphic information is available in the immediate vicinity of Wix anticline, but rocks ranging from zone C through lower zone D are probably present in the area.

Structure.--Wix anticline may be a western continuation of the Sugar anticline, which is included in the Knifeblade Ridge group. It may also continue westward and be continuous with the anticlinal axis that abuts against the fault on the south flank of the Ketik anticline. The lateral gap between these two axes crosses a line of general disturbance and it is probable that a structural low exists at this point.

Elusive Creek anticline

Quadrangle H-19, 1:96,000.

Quadrangles 25 and 26, 1:250,000.

Stratigraphy.--Rocks of lower zone D are believed to be present at the surface in the vicinity of the axis of this anticline. Presumably

the very rapid northward shalling out of sands of zones B and C would limit the favorable sands beneath this anticline to approximately 1,500 feet. The rock at the surface is believed to be stratigraphically lower than the oil sands of zones D and E undifferentiated on the Kokolik River.

Structure.--The Elusive Creek anticline is approximately 15 miles long, and judging from the steep dips on its flanks, it is a fold of relatively large magnitude. The anticline is asymmetric with the north flank the steeper. A fault zone parallels the axis near the eastern end of the structure. This fault zone lies in the same position as one local structural high. The eastern end of the anticline is terminated in a general zone of disturbance.

Anticline at  $69^{\circ}35' N.$ ,  $160^{\circ}15' W.$

Quadrangle H-20, 1:96,000.  
Quadrangle 26, 1:250,000.

Stratigraphy.--Rocks of zones D and E undifferentiated are present in this area. The Kokolik River oil sands may be present beneath the surface. A total thickness of 3,000 feet of favorable Cretaceous sedimentary rocks may underlie the anticline.

Structure.--This anticline was located from a study of aerial photographs. All structural criteria are extremely vague. The anticline is small both in length and amplitude but does appear to have closure.

Anticline at  $69^{\circ}32' N.$ ,  $160^{\circ}45' W.$

Quadrangle H-20, 1:96,000.  
Quadrangle 26, 1:250,000.

Stratigraphy.--The anticline is largely covered by the Gubik formation. Rocks of zones D and E undifferentiated are believed to underlie the Gubik. The Kokolik River oil sands probably have been removed by erosion along the crest of this anticline.

Structure.--Only the eastern end of the anticline is visible on aerial photographs. The axis probably persists westward and is a part of the anticlinal axis mapped in the field on the Kokolik River. No information as to structural highs is available; however, evidence of east plunge, probably in excess of 1,000 feet, is very good.

West Carbon Creek anticline

Quadrangles I-20 and I-21, 1:96,000.  
Quadrangle 26, 1:250,000.

Stratigraphy.--Rocks of zones D and E undifferentiated are present along the axis west of long.  $160^{\circ}43' W.$  East of this longitude zones B and C undifferentiated were mapped. Possibly rocks of zones D and E are the facies equivalent but not the time equivalent of zones B-C. If this is so probably only a thin veneer of favorable sands overlies the shale along the axis of this anticline.

Structure.--This anticline appears to be a westward continuation of the Carbon Creek line of folding. It is apparently disconnected from the main Carbon Creek anticlinal axis by minor faults within a zone of disturbance. No structural highs are evident along this western part of the anticline.

#### GROUP VI--WARD GROUP

Anticlines included:

Ward

##### Ward anticline

Quadrangle I-20, 1:96,000.

Quadrangle 26, 1:250,000.

Stratigraphy.--Rocks of upper zones D and E undifferentiated are probably present along the axis of this anticline, which is one of the two known anticlines in this area beneath which the Kokolik River oil sands are probably present. A total of approximately 3,500 to 4,000 feet of favorable sandy section is probably present beneath this anticline.

Structure.--The Ward anticline is unique in that it lies within the trough of one of the major synclines of the western part of the Reserve. It is not large in either amplitude or areal extent but possesses definite closure of approximately 300 feet. The parts of the Lookout Ridge syncline that are north and south of the anticline are made up of massive Nanushuk group rocks and rests on shale of the underlying Torok formation.

#### GROUP VII--AUPUK GROUP

Anticlines included:

Aupuk

Killik Bend

##### Aupuk anticline

Quadrangles J-14 and J-15, 1:96,000.

Quadrangles 23R and 24, 1:250,000.

Stratigraphy.--Zone D is present along the axis of the Aupuk anticline. Time equivalents but not facies equivalents of zone E rocks may also be present near the axis. Field examination of zones B and C along the Kurupa River south of the anticline indicated that the sands were generally dirty, impermeable, and of low porosity, but because the character of the sands may change quite rapidly from south to north, the unfavorable sands exposed approximately 10 miles south of the axis may have become cleaner and more favorable beneath the Aupuk anticline.

Structure.--The axis of the Aupuk anticline approximately follows the course of the Colville River for a distance of over 30 miles. The western end of the anticline merges with a fault zone which is a part of a north-northeast-trending zone of disturbance; the eastern end plunges

rapidly in the area just north of Killik Bend. Two structural highs are present along the axis. The western high centers at approximately long.  $155^{\circ}15'$  W.; plunge to the east is present in significant amount, closure to the west is probably effected by a fault zone. The eastern, and more significant, structural high, centering at approximately long.  $154^{\circ}30'$  W., probably has closure in excess of 1,000 feet. A longitudinal fault occurs on the north flank of the anticline near the east structural high. Two gas seeps are present along the trace of this fault.

#### Killik Bend anticline

Quadrangles J-12, J-13, J-14, K-13, K-14, 1:96,000.  
Quadrangle 23R, 1:250,000.

Stratigraphy.--Rocks of zones C, D, and E are present over the axis of this anticline, which is approximately 10 miles south of the Aupuk anticline. The rocks of zones B and C probably are here less favorable than they are at the Aupuk anticline. Zone C is present over the axis at the structural high.

Structure.--Only one structural high is apparent along the anticlinal axis. This is within 4 miles of the western end of the anticline and lies in part within the boundary of NPR-4. Plunge to the west is probably more than 500 feet. A consistent plunge to the east for more than 20 miles probably results in a total east plunge in excess of 3,000 feet.

#### GROUP VIII--FOSSIL CREEK GROUP

Anticlines included:

Fossil Creek  
Little Twist  
Big Bend  
Schrader

#### Fossil Creek anticline

Quadrangles I-12, I-13, J-11, J-12, 1:96,000.  
Quadrangles 22 and 23R, 1:250,000.

Stratigraphy.--Zone C is present along the axis at the highest structural point. West of the Colville River rocks of zone G are present over the axis. Some favorable sands may be present within the remaining part of zone C but it is extremely doubtful that the total sandy section beneath the anticline exceeds 750 feet.

Structure.--The Fossil Creek anticline is a large structure and is an eastern continuation of the Titaluk line of folding. The axes of the Titaluk and the Fossil Creek anticlines may actually join. Fossils collected along the east bank of the Colville River indicate the presence of zone C near the axis of this structure. East of the Colville River zone G and possibly zone H are believed to be present over the axis. If the fossils are correctly identified and zone C is present east of the Colville, either a west plunge

of over 4,000 feet or a fault of significant displacement is present beneath the channel of the Colville River. Plunge to the east is not proved but is probably present in significant amount.

#### Little Twist anticline

Quadrangles J-12 and J-13, 1:96,000.

Quadrangle 23R, 1:250,000.

Stratigraphy.--Rocks of zone E crop out along the axis. The remaining part of zone E and possibly the upper part of zone D are probably of favorable facies beneath the surface. The maximum total thickness of the sand section probably does not exceed 2,500 feet.

Structure.--The Little Twist anticline is relatively small. The structure is complicated by a longitudinal fault that crosses from the south flank to the north flank near the middle of the anticline and displaces the axis. At the Colville River the displacement on this fault is not more than 100 feet. No areas of closure are known.

#### Big Bend anticline

Quadrangles J-11, J-12, and J-13, 1:96,000.

Quadrangles 22 and 23R, 1:250,000.

Stratigraphy.--Rocks of zone D are present in the vicinity of the structural highs. At the structural lows rocks of zone E crop out across the axis of the anticline. The upper part of zone D should be sandy in this area, so at least 1,000 feet of sandy section should be present beneath the crest.

Structure.--The Big Bend anticline is large in both linear extent and amplitude and has two local areas of closure along the axis east of the Chandler River. Closure on both these highs is approximately 500 feet. Near the Chandler River the axis is crossed by a zone of disturbance and is bent and complicated by longitudinal faults on the north flank. Other areas of closure are probably present west of the Chandler River but have not been mapped.

#### Schrader anticline

Quadrangle J-11, 1:96,000.

Quadrangle 22, 1:250,000.

Stratigraphy.--Rocks of zones F and G are present over the axis of this anticline. Its stratigraphic position and geographic position would seem highly favorable for testing zones D and E. The sandy section can reasonably be expected to persist downward for approximately 3,500 feet.

Structure.--Structural data, other than in the valley of the Chandler River, are very sparse. No structural highs have been recognized. There is evidence of east plunges in the vicinity of the Anaktuvuk River. On the east side of the Anaktuvuk River the south flank of the anticline is complicated

by a zone of very steeply dipping strata that crop out at Schrader Bluff. As this zone of steep dips is not visible on the west side of the river, a fault may be implied beneath the present channel of the Anaktuvuk River.

#### GROUP IX--KURUPA GROUP

Anticlines included:

Kurupa

##### Kurupa anticline

Quadrangles K-13, K-14, K-15, and J-15, 1:96,000.

Quadrangles 24, 32\* and 33\*, 1:250,000.

Stratigraphy.--Rocks ranging from zones B to D crop out over the axis of this anticline. In general the geographic position of this anticline is such that the rocks preserved along the crest at the structural highs are not apt to be in favorable facies. Rocks of zone B crop out at the main structural highs. It is doubtful if over 500 feet of sandy section is present beneath the axis at these points.

Structure.--The Kurupa anticline is one of the major structures of the northern foothills belt. Its axis persists for over 70 miles, extending from the Chandler River on the east to the vicinity of the junction of the Colville and Etivluk Rivers. At both ends the axis terminates within a north-trending zone of disturbance. No significant faults have been located along the axis of this anticline.

#### GROUP X--GRANDSTAND GROUP

Anticlines included:

Grandstand

Hawk

Anticline at lat.  $68^{\circ}47'$  N., long.  $151^{\circ}31'$  W.

##### Grandstand anticline

Quadrangles K-11 and K-12, 1:96,000.

Quadrangles 33\* and 34\*, 1:250,000.

Stratigraphy.--Rocks of zones C, D, and E are present over the axis. Local structural highs are approximately coextensive with the outcrop areas of zone C. The highs occur in the valleys of the Chandler and Anaktuvuk Rivers. Over-all closure on the anticline is probably well in excess of 1,000 feet. Local highs probably have closure greater than 500 feet. The uneroded part of zone C and of zone B may be in a favorable sand facies beneath this anticline. The total sand section beneath this anticline probably does not exceed 1,500 feet.

\* 1:250,000 quadrangle map not finished.

Structure.--Just to the east of the Anaktuvuk River the axis of the Grandstand anticline terminates within a general north-trending zone of disturbance. Probably east plunge of over 1,000 feet is present at this point. At the Chandler River the axis is sharply bent along another zone of disturbance. Approximately 20 miles west of the Chandler River the axis intersects another zone of disturbance, is bent sharply to the south, and dies out. West plunge at this point is probably in excess of 1,000 feet. No significant faults have been recognized in the vicinity of this axis.

#### Hawk anticline

Quadrangle K-12, 1:96,000.

Quadrangle 33\*, 1:250,000.

Stratigraphy.--Rocks of zones D and E are present over the axis. Zone D is here sedimentary rock of continental origin, but the underlying zones B and C may well be within a favorable sandy facies beneath this structure.

Structure.--The Hawk anticline is relatively small and uncomplicated. The south limb of the structure is steeper than the north, but no dips exceed 15°. Plunge to the east and west is evident. The amount of closure is not known but probably is more than 300 feet.

#### Anticline at lat. 68°47' N., long. 151°30' W.

Quadrangle K-11, 1:96,000.

Quadrangle 34\*, 1:250,000.

Stratigraphy.--Rocks as old as upper zone C are present along the axis of this anticline near its structural high. Approximately 2,000 feet of sandy section should underlie this structure. Rocks of zones B and C beneath it should be in a favorable marine facies.

Structure.--This anticline is a relatively small structure. One small area of closure is evident along the axis. Westward the axis merges into the uniformly north-dipping south flank of the Ayiyak Mesa syncline. Closure probably does not exceed 150 feet.

#### GROUP XI--SHALE WALL GROUP

Anticlines included:

Shale Wall  
Lemming  
Rocktop Ridge  
Kayak Mountain

#### Shale Wall anticline

Quadrangle J-10, 1:96,000.

Quadrangle 22, 1:250,000.

\* 1:250,000 quadrangle map not finished.

Stratigraphy.--Stratigraphic information is very unreliable, but it is probable that rocks ranging from zone C to zone E are present along the axis of this anticline.

Structure.--Outcrops are rare in the axial area between the Nanushuk and Itkillik Rivers. There is no evidence of faults in the immediate vicinity of the axis. The anticline terminates to the west within a general north-trending zone of disturbance. Outcrops and rubble traces are too sparse to permit the identification of structural highs. Further structural work would have to be of subsurface nature.

#### Lemming anticline

Quadrangle K-10, 1:96,000.

Quadrangle 34\*, 1:250,000.

Stratigraphy.--A fault upthrown on the south side parallels the axis of this anticline. South of the fault zones D and E are present; on the north side zones F, G, and H are believed present. The north limb of this anticline would be a very favorable facies position for testing sands of the Nanushuk group which probably persist to a depth of over 3,000 feet.

Structure.--A longitudinal high-angle fault upthrown on the south side is parallel to and just north of the axis. Displacement along this fault must exceed 500 feet. The western end of the anticline is cut by a transverse fault upthrown to the southwest. No estimate of its displacement can be made. Outcrop data are too few to permit locating structural highs.

#### Rooftop Ridge anticline

Quadrangles K-10 and K-11, 1:96,000.

Quadrangle 34\*, 1:250,000.

Stratigraphy.--Rocks of zones B, C, D, and E are present near the axis of this anticline. Nanushuk group rocks below the crest of this anticline may well be sandy and of facies favorable for exploration.

Structure.--The Rooftop Ridge anticline is a large structure. It is terminated on the west within a general north-trending zone of disturbance that approximately coincides with the present course of the Anaktuvuk River. East of the Nanushuk River all outcrops are obliterated by thick deposits of terrace gravels. A high-angle reverse fault parallels the axis of this anticline. No estimate of throw can be made. No local structural highs have been mapped, but one may center at approximately long.  $150^{\circ}20'$  W., lat.  $68^{\circ}53'$  N.

#### Kayak Mountain anticline

Quadrangle K-10, 1:96,000.

Quadrangle 34\*, 1:250,000.

\* 1:250,000 quadrangle map not finished.







Name	Approximate location	1:96,000 quadrangle	1:250,000 quadrangle	Group	Significant faults	Relative length 1/	Altitude of flanks 2/	Age of rock at surface	Minimum total depth of sandy section (approx.) (in feet)	Maximum possible closure (approx.) (in feet)
Lemming	68°57' N. 150°30' W.	K-10	34*	11	Strike fault, north flank	M	M-L	D-E, F, G, H	3,000	?
Little Twist	69°07' N. 153°00' W.	J-12 J-13	23R	8	Strike fault	M	S	E	2,500	?
Maybe Creek Dome	69°20' N. 153°45' W.	I-13	23R	2	--	S	L	G	?	25
Meade River	69°35' N. 158°00' W.	H-17 H-18	25	3	Transverse and reverse	L	M-S	B, D	700 - 2,500	?
Rooftop Ridge	68°53' N. 150°40' W.	K-10 K-11	34*	11	High-angle reverse, south flank	L	S	B, C, D, E	1,000 ?	?
Schrader	69°10' N. 151°15' W.	J-11	22	11	Transverse ?	L	M	F, G	3,500	?
Schultz	69°20' N. 155°15' W.	I-15	24	2	--	S	L	D ?	3,000 ?	200 ?
Shale Wall	69°05' N. 150°30' N.	J-10	22	11	--	M	S	C, D, E	2,000 ?	-
Shaningerok	69°40' N. 158°00' W.	H-17 H-18	25	3	High-angle reverse?	L	M	D ?	2,000	?
Square Lake	69°35' N. 153°15' W.	H-13	23R	1	--	M	L-M	H	2,500 ?	?
Sugar	69°20' N. 158°00' W.	I-16 I-17 I-18	24 25	4	High-angle reverse	L	M-S	B-C	1,500 ?	500 ?
Titaluk	69°20' N. 154°30' W.	I-14	24	2	--	L	L	E ?	?	300+
Uniat	69°22' N. 152°15' W.	I-11 I-12	22 23R	1	Thrust, south flank ?	L	M	E ?	1,000 - 2,500	600+

Name	Approximate Location	1:96,000 quadrangle	1:250,000 quadrangle	Group	Significant faults	Relative length 1/	Attitude of flanks 2/	Age of rock at surface	Minimum total depth of sandy section (approx.) (in feet)	Maximum possible
Ward	69° 22' N. 150° 30' W.	I-20	26	6	—	S	L	D-E	4,000	300
Weasel Creek	69° 10' N. 153° 45' W.	J-13	23R	2	—	M	M-S	E	4,500	200
West Carbon Creek	69° 25' N. 161° 00' W.	I-20	26	5	—	—	—	D-E	750 ?	?
West Titaluk	69° 35' N. 157° 00' W.	H-16	24	3	High-angle reverse	L	L	D, E ?	2,000 ?	500
Willow	69° 35' N. 154° 40' W.	I-14	24	2	—	L ?	L	E ?	?	?
Wix	69° 22' N. 158° 30' W.	I-18	25	5	Strike fault	S	S	C-D ?	1,500 ?	?
Wolf Creek	69° 30' N. 154° 00' W.	I-13	23R	2	—	L	M	F	?	300
Wolverine	69° 35' N. 155° 30' W.	H-15	24	2	—	L ?	L	E ?	?	?

1/ Relative length: (S) small, less than 10 miles long.

(M) medium, axis 10 to 20 miles in length.

(L) large, over 20 miles long.

2/ Attitude of flanks: (L) low, 0° to 5° dips.

(M) medium, 5° to 10° dips.

(S) steep, over 10° dips.

\* Map not finished.