DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES, DIVISION OF GEOLOGICAL
AND GEOPHYSICAL SURVEYS AND DIVISION OF OIL AND GAS

MISCELLANEOUS FIELD STUDIES
MAP MF- 928V

ALBERT—LANDSAT MOSAICS

DISCUSSION

These two uncontrolled Landsat mosaics, constructed with bands 5 (sheet 2) and 7 (sheet 3), along with a map showing one of many possible interpretations, are intended to augment other data regarding the eastern North Slope petroleum province, Alaska. To the best of my knowledge, no snow-free 1:500,000-scale Landsat mosaics of this area have been previously available to the public. 1/ Because of the synoptic perspective of the Landsat imagery, lineaments and arcuate, elliptical, and circular features visible on these images can supply unique information regarding local and regional geologic, structural and tectonic phenomena.

Sheet 1 represents one of many kinds of interpretations that can be derived from the study of mosaics of this type. Although many other lineaments can be seen (particularly in the stippled area), those drawn seem to be more significant because of their lengths (the shortest is more than 25 km long) and, for the most part, the boldness of their expression.

The major lineament (A) identified on the mosaics seems to be a major fracture or structural break. It can be traced from Camden Bay to the northeast-trending segment of the Colville River and out of the study area. On other Landsat imagery, the lineament seems to split just north of the White Hills, with the northern segment (C) terminating near Flaxman Island and the southern one (A) near Camden Bay. To the southwest, the lineament can be traced to the western tip of Seward Peninsula, a distance of over 1,000 km, where it parallels the northwest coastline and seems to mark the northwest edge of the mountains in that area.

Although only faintly visible on these mosaics, the northwest-trending major lineament (B) identified on other Landsat imagery also seems to be a major fracture or structural break. It extends more than 1,200 km from about lat 62°30'N., long 139°45'W. in Yukon Territory, Canada, at least as far as Barrow, Alaska, and coincides with gravimetric and magnetic contours along much of its length (Albert and Steele, 1976b).

Oil and gas locations outside of the Prudhoe Bay area (see Map B) are shown on sheet 1: Umiat, East Umiat, Gubik, Kemik, and Kavik. The Gubik gasfield, occurring along a mapped anticline (Brosgé and Whittington, 1966), is located near the intersection of three lineaments, including the two discussed above. The Umiat oilfield, also occurring along a mapped anticline (Brosgé and Whittington, 1966), is located near lineament A. The Kavik gasfield occurs on an east-trending lineament (near an intersecting north-trending lineament) that seems to be an extension of a thrust fault along the north front of the Sadlerochit Mountains (I. L. Tailleur, unpub. data, 1976). This thrust fault is thought to be associated with an overturned anticline in the Sadlerochit Mountains (H. N. Reiser, oral commun., 1977) that may also extend westward.

1/ Contact prints of these mosaics at 1:500,000 scale are available at nominal cost from the U.S. Geological Survey, Alaskan Technical Data Unit, 345 Middlefield Road, Menlo Park, CA 94025.

Because the major lineaments may be fractures or structural breaks and because oil and gas commonly are trapped in anticlines, the intersections of these two features may be favorable for accumulations of oil and gas. Although some of the other significant, but less extensive, lineaments may have been caused by glacial processes, many are probably local structural breaks or fractures and, where they intersect anticlines, could also favor the development of oil and gas concentrations. Oil and gas that accumulated in an anticline at its intersection with a lineament may have moved up-plunge towards the nearest closure on the anticline. Up-plunge migration of fluids could explain why some areas, such as the gasfield at East Umiat, are productive, while other wells drilled very near the intersections of anticlines and lineaments, such as Susie and West Kadleroshilik, are dry.

Most of the east-trending lineaments probably are related to the numerous east-trending fold axes that make up the characteristic structural grain of the Brooks Range visible in the southeastern part of the study area (stippled area) (I. L. Tailleur, unpub. data, 1976). Additionally, east-trending elliptical features (2 and 3) observed on the mosaics seem to be related to mapped anticlines and synclines (I. L. Tailleur, unpub. data, 1976).

The significance of the observed circular features is unclear. The large set of concentric circular features (1) is more than 90 km in diameter and is centered on a gravity low (Barnes, 1976). Previous studies in other areas have indicated that circular features commonly related to igneous phenomena (Albert and Steele, 1976a), but because there is no evidence for igneous activity in this part of the North Slope province these features more likely are related to some sort of basinal structure.

The observations discussed above are intended to demonstrate the kinds of data discernible from these Landsat mosaics. More detailed examination of the mosaics, in conjunction with geophysical, geochemical, geologic, and well data, should contribute significantly to regional oil and gas investigations by providing unique information regarding structural features that are commonly not recognizable in the field.

EXPLANATION

- A ?? B — MAJOR LINEAMENT IDENTIFIED ON MOSAIC. QUERIED WHERE UNCERTAIN
- B — MAJOR LINEAMENT IDENTIFIED ON OTHER LANDSAT IMAGERY
- — — OTHER SIGNIFICANT LINEAMENT IDENTIFIED ON MOSAIC. DASHED WHERE UNCERTAIN
- 1 — CIRCULAR OR ARCUATE FEATURE IDENTIFIED ON MOSAIC
- UMIAT — OIL AND GAS LOCATIONS OUTSIDE OF THE PRUDHOE BAY AREA
- BROOKS RANGE – AREA OF PROMINENT "STRUCTURAL GRAIN"

Scale 1:500,000
1 inch equals approximately 8 miles

10 0 10 20 30 40 MILES
10 0 10 20 30 40 50 KILOMETRES

Base from Harrison Bay, Beechey Point, Flaxman Island, 1955, Umiat, Sagavanirktok and Mount Michelson, 1956, 1:250,000 U.S. Geological Survey

MAP OF EASTERN NORTH SLOPE PETROLEUM PROVINCE SHOWING FEATURES INTERPRETED FROM LANDSAT MOSAICS

LANDSAT MOSAICS OF EASTERN NORTH SLOPE PETROLEUM PROVINCE, ALASKA, WITH PRELIMINARY INTERPRETATION OF OBSERVED FEATURES

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