

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

To Accompany

PRELIMINARY ENGINEERING GEOLOGIC MAPS OF THE  
PROPOSED NATURAL GAS PIPELINE ROUTE IN THE  
TANANA RIVER VALLEY, ALASKA

By

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This report is preliminary and  
has not been edited or reviewed  
for conformity with Geological Survey  
standards and nomenclature.

## INTRODUCTION AND ACKNOWLEDGMENTS

The maps in this preliminary report were compiled primarily from published geologic maps as designated on sheets 1 and 2. Field studies carried out by the compilers in 1976, 1977, and 1978, however, resulted in redefining the position of certain contacts, particularly in the Big Delta quadrangle (map B). Additionally, certain map unit designations of the previously published maps have been changed in order to maintain uniformity throughout the area covered by the present maps. Age assignments of moraines are given informally as "older" or "younger" and differ in some cases on map D from those used on published maps. These differences reflect the opinions of the compilers. Quantitative data pertaining to the ages of moraines in this area have not yet been obtained.

Because the area covered by the maps is extensive, descriptions of the map units in the tabular text are necessarily general. The maps and text are not designed to replace the detailed studies necessary prior to the beginning of any kind of construction effort, but may be useful in the planning of those studies.

Access to unpublished reports, field data and geologic mapping was generously allowed by R. D. Reger of the Alaska Division of Geological and Geophysical Surveys, and by T. L. Péwé, F. R. Weber, J. R. Williams, and T. D. Hamilton. Discussions with the above named people were helpful in studying the distribution and characteristics of the unconsolidated deposits. H. L. Foster provided advice on the description and distribution of the rock units shown on the maps. Information on the type and characteristics of the rock at Paradise Hill, map E,

and general geologic information along parts of the Alaska Highway was provided by W. H. Slater, Hal Livingston, and Gary Brazo of the Alaska Department of Transportation and Public Facilities. M. P. Springer assisted in the field in 1977. The report benefited from reviews by O. J. Ferrians, Jr., and J. R. Williams.

#### QUATERNARY FAULTING AND SEISMICITY

The Tanana Valley near Fairbanks is a seismically active area that has undergone several moderate to severe earthquakes in the past 50 years. In 1937, an earthquake of magnitude 7.3 was centered near Salcha Bluff (map B) and severe shaking caused rockfalls on the Richardson Highway (Bramhall, 1938). In 1947 a magnitude 7 shock with its epicenter 90 km west of Salcha Bluff near Nenana was felt over a wide area (St. Amand, 1948). A 1967 earthquake swarm had magnitudes of as much as 5.6, and epicenters were only a few miles east of Fairbanks (Jordan and others, 1969). Seismic activity east of Fairbanks has persisted since 1967, and in February and March of 1977 an earthquake swarm occurred that consisted of several thousand earthquakes, the largest of which was magnitude 4.1 (Estes and others, 1977); at least 17 of these shocks were felt by residents.

An analysis of the distribution of epicenters of the 1977 earthquake swarm (Estes and others, 1977) shows that they are concentrated in a linear trend that extends from the west side of the Hopper Creek-Steele Creek divide southward to a point at least a mile south of the Chena River (map A), where a large cluster of epicenters is plotted. The cluster centers on the route of the proposed gas pipeline. This

area has undergone severe shaking, and mud and sand boils were noted in the alluvium in earlier earthquakes. Plots of hypocenters of the 1977 earthquakes led Estes and others (1977) to speculate that the seismic events occurred along the intersection of two faults, one trending NE-SW and the other trending NW-SE.

In spite of this historic record of seismic activity, faults displacing unconsolidated deposits have not yet been recognized in the mapped area west of the Delta River. This is perhaps because dense vegetation and inaccessibility of the terrain combine to make fault recognition difficult, even in on-site investigations. In the Salcha River valley (map B), however, several linear features of uncertain origin, but possibly caused by faulting, have been mapped. These consist of aligned drainage systems and a linear ridge in the undifferentiated silt (Qsu). A pingo along the southernmost and longest of these features suggests the presence of a ground water barrier. Because the epicenter of the 1937 earthquake of magnitude 7.3 was located near Salcha Bluff, only 20 km west of these features, there is a strong possibility that these features are fault-controlled.

In the Big Delta area (map B) another linear feature has been noted that consists of treeless areas that are aligned with an escarpment that follows the south shore of Clearwater Lakes. Although a fault origin of this linear feature was suggested by Weber (1971), field investigations failed to reveal a topographic discontinuity nor any offset of stratigraphic units (J. R. Williams, personal communication, 1976). The linear feature is not, therefore, mapped as a fault because its fault origin cannot yet be demonstrated.

Seismic events such as those described for the Fairbanks-Salcha River vicinity have not been recorded in the remainder of the mapped area, and only one fault cutting unconsolidated deposits has been recognized (near Yerrick Creek, map D). However, this should not be construed as evidence that this region will not be subjected to severe seismic shaking or to faulting of unconsolidated deposits. Parts of the valley east of the Delta River are within 15 km of faults bounding the north flank of the Alaska Range that have been active within the past 20,000 years (Hudson and Weber, 1977), and within 40 to 70 km of the active strike-slip Denali and Totschunda fault systems that pass through the range. The results of an examination of the average rate of late Cenozoic displacement along the Denali and Totschunda fault systems suggests that a major earthquake could be overdue in eastern Alaska (Plafker and others, 1977). Earthquakes with magnitudes of as much as 8 can be expected along these faults with attendant seismic shaking and liquefaction in adjacent parts of the Tanana Valley.

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