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PHOTOINTERPRETIVE MAPS OF MORPHOLOGICAL FLOOD-PLAIN DEPOSITS AND MATERIALS RESOURCES, MIDDLE KUSKOKWIM RIVER FROM SLEETMUTE TO KALSKAG, ALASKA

By

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PHOTOINTERPRETIVE MAPS OF MORPHOLOGICAL FLOOD-PLAIN DEPOSITS AND MATERIALS RESOURCES, MIDDLE KUSKOKWIM RIVER FROM SLEETMUTE TO KALSKAG, ALASKA

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REGIONAL GEOLOGIC SETTING

The Kuskokwim Mountains consist of 60,000 ft of Paleozoic and early Mesozoic sedimentary rocks and middle Mesozoic and Cenozoic volcanic rocks. These rocks were uplifted and folded during middle Mesozoic and Cenozoic time. Since late Cenozoic time, erosion has reduced the mountains to several rolling, denuded surfaces. These surfaces are called the Sleetmute and Georgetown uplands. Bounded by these uplands, the Kuskokwim River flows through a narrow valley from Sleetmute to Napaimiut and across a broad flood plain from Napaimiut to Kalskag.

SCOPE OF INVESTIGATION

Photogeologic maps (pl. 1-5) of the Kuskokwim River flood plain between Sleetmute and Kalskag are based on photogeologic interpretation and 5 days of field work. Color-infrared photographs (1:31,680 scale) were used for mapping landforms and their surface lithologies.

BASIS FOR MAP-UNIT INTERPRETATION

Flood-plain morphological features were examined and classified according to interpretive fluvial processes. The Kuskokwim River flood plain is depositionally active and flooded to some extent every year or two. Sediment textures are indicative of distinct depositional and erosional environments. Surface-sediment thickness and texture are reflected by vegetation type and distribution. Deciduous vegetation is dense and mixed with less coniferous forest when growing in well-drained gravelly, sandy, and silty sediments. Thick, silty sediments are primarily vegetated by coniferous forests. Flood-basin bogs develop in poorly drained, low-lying silt and clay. Sediments that have been recently deposited or that are frequently flood and ice scoured are unvegetated.

Fluvial deposits of the Kuskokwim River between Sleetmute and Kalskag fall into three groups (Reineck and Singh, 1980):

1. Channel deposits---Sediments deposited from river-channel activity; includes bar-accretion deposits (BA).

2. Bank deposits---Sediments deposited on river banks during high-water or flood periods; includes bankfull deposits (B).

3. Flood-basin deposits---Sediments deposited during heavy floods when the river flows over its banks into the flood basin; includes overbank flood deposits (OF) and slackwater flood-basin and flood-channel deposits (SBC).

Flood-plain deposits between Sleetmute and Kalskag consist primarily of well-stratified bar-accretion deposits of bed-load sand, gravel, and silt that are rarely exposed except in channel banks. Bar deposits examined in the field displayed moderate grain-size range. Unvegetated channel and point bars adjacent to the active river channel indicate that the river is either actively aggrading, migrating, or both. Sand and gravel eroded from banks by a migrating channel are redeposited nearby as channel bars or downriver point bars. Most point-bar deposits of the Kuskokwim River flood plain have been truncated by channel migration. When deposited, point bars have well-defined bar-and-swale topography, but subsequent fine sediment deposited during high water and flooding modifies and masks the original ridge-and-swale topography.

Erosional surfaces that border the main river channels are composed of silt and fine sand. Suspended silt and bed-load fine sand are deposited during high water or bankfull flow. Clay and silt are deposited as a veneer during recurrent flooding or overbank flows. These sediments generally overlay bar-accretion deposits. Mean grain size of overbank sediments decreases with increasing distance from the river channel. Silt thickness near Aniak measured from limited bore-hole data ranges from 1 to 6 m. Bankfull deposits and overbank flood deposits are similar to natural-levee and crevasse-splay deposits; however, these more conventionally named deposits were not well developed or easily differentiated in the study area.

Flood-basins are poorly drained, flat, and rather featureless except for abandoned channels. Some channels act as distributary flood channels during overbank flows; others have become slowly alluviated from suspended sediment introduced during overbank flows. The slowly alluviating flood channels contain silt, clay, and organic material. The distributary channels also contribute these sediments to low-lying areas of the flood plain (slack-water flood basins).

Several low alluvial terraces that are delineated by abrupt scarps border the flood plain. Colluvial and landslide debris consisting of heterogeneous soil and rock are deposited on lower slopes of valley walls adjacent to the flood plain. These deposits accumulate because of gravity, slope wash, slope failure, and creep. Tributary streams flowing into the Kuskokwim River or onto its flood plain deposit alluvial fans that consist of gravel, sand, and silt.

MATERIALS RESOURCES AND EXCAVATION-SITE HAZARDS

The mapping project was initiated in response to local concern generated by sand-and-gravel extraction from the active Kuskokwim River channel between Aniak and Kalskag by federal and state agencies and private contractors. On the basis of U.S. Army Corps of Engineers permit applications, the Alaska Department of Transportation and Public Facilities (DOTPF) is the largest user of gravel in the area. Local residents feel the excavations are causing accelerated bank erosion. Sand and gravel is usually excavated close to community projects because of transportation considerations and costs.

Point- and channel-bar gravel deposits are the best source for economical gravel excavation. During the past 10 yr, about 500,000 m^3 of

sand and gravel have been excavated from 'Birch Tree Crossing,' a point-bar excavation site between Kalskag and Aniak (sample E, pl. 5). Sand and gravel is barged from there to Bethel and other downriver locations. The active channel of the Kuskokwim River flows around an extremely sharp bend at Birch Tree Crossing. The outside channel bank at the crossing is very steep and the center of the channel is 15 m deep. Bed-load sand and gravel is continually being deposited along the point bar at the crossing because of channel configuration. Sequential air photos and field evidence indicate that excavations are quickly replenished at the crossing. Field observation did not reveal any accelerated cutbank erosion opposite the point bar.

In the lower and central Kuskokwim River region, the Corps of Engineers is looking for bedrock that could be used as riprap for stabilizing and reducing erosion along the Kuskokwim River at Bethel. The river is cutting metabasalt at Birch Tree Crossing. A metabasalt sample was submitted to DOTPF materials lab for testing of mechanical abrasion, chemical loss, specific gravity, adsorption, and unit weight. Sample analyses indicate that the rock is mechanically and chemically durable. The metabasalt has large areal extent (pl. 5) and may be suitable as a material source for river-bank stabilization at Bethel. The rock could also be crushed and used by DOTPF for airport and road construction.

Curves of semilogarithmic cumulative grain-size distribution were plotted for samples collected at four existing and three potential sand-and-gravel excavation sites between Aniak and Kalskag (samples A-D, pl. 4 and samples E-H, pl. 5). Grain-size classifications for these sample sites are based on a modified Wentworth scale from Lambe and Whitman (1979). Sample A is from the upriver end of the channel bar opposite Aniak. Sample B is from overbank silt deposits that cap the channel bar. Sample C is from the downriver end of the channel bar. Curves of cumulative grain-size distribution and classifications are similar for the samples collected at both ends of the channel bar, which indicates that the channel bar could be a source for gravel.

In 1982, the City of Aniak and DOTPF were considering excavating gravel from the closest bank of the channel-bar island opposite the city waterfront. Excavation of gravel from that side of the channel bar could result in local channel erosion, disequilibrium, and accelerated bank erosion along Aniak's waterfront. Sample D is from a nearly depleted gravel-excavation site north of the Aniak airport. This site contains about 45 percent gravel and cobbles and 55 percent sand by weight. Sample E is from 'Birch Tree Crossing,' where there is an abundance of aggregate. The percentages of gravel, cobbles, and sand here are similar to percentages for Sample D. Sample F is from an alluvial fan about 10 km upriver from Upper Kalskag. The fan contains at least 100,000 m^3 of sand, gravel, and cobble-boulder gravel, and it has potential as an upland sand-and-gravel excavation site. The base of the fan is exposed along a cutbank of the Kuskokwim River. Sample G was collected from the Kalskag airport material-excavation site near Upper Kalskag. The point-bar site has a high ratio of cobbles and gravel to sand. The cutbank between Lower Kalskag and Upper Kalskag is actively eroding. Sample H was collected from the point-bar excavation site across the river from Upper Kalskag. The gravel-to-sand ratio for this site is similar to that of site G. Excavation

of large quantities of sand and gravel along a point bar may cause accelerated cutbank erosion across the river. Sand and gravel should not be excavated from point bars in areas where opposite cutbank erosion is desired to be kept at a minimum.

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