STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Tony Knowles, *Governor*

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Milton A. Wiltse, *Director and State Geologist*

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Reconnaissance engineering-geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope Alaska
by
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RECONNAISSANCE ENGINEERING-GEOLOGIC MAP OF THE SAGAVANIRKTOK B-1 QUADRANGLE, EASTERN NORTH SLOPE ALASKA

by
DeAnne S. Pinney[1]

DISCUSSION

This map illustrates potential near-surface sources of various geologic materials that may be useful for construction. Field observations indicate that each geologic unit (for example, stream alluvium) has a definite composition or range of composition. Therefore, the probable presence of materials is interpreted from the distribution of geologic units on the geologic map of these quadrangles. This map is generalized and is not intended to show exact locations of specific materials. The purpose is to indicate general areas that deserve consideration for certain materials and to eliminate other general areas from consideration for these materials. Local variations are common, especially near unit boundaries.

Potential uses of map units are qualitatively summarized in tables 1 and 2, which show potential availability of various construction materials in each engineering-geologic unit. Precise economic evaluations of specific deposits as sources of construction materials will require detailed examination of each deposit, including areal extent, volume, grain-size variation, thickness of overburden, thermal state of the ground (ground temperature), and depth to water table as well as logistical factors, demand, and land ownership.

This map also addresses some of the principal hazards and engineering considerations that may be associated with mapped geologic units based on their general physical properties, conditions that are characteristic of their depositional environment, and topography. Potential geologic hazards directly relate to surficial-geologic units because (1) the processes that formed the deposits may be hazardous where still active, (2) postdepositional conditions (like ground ice) may present additional hazards, and (3) materials characteristically present in the deposits are known to be susceptible to certain hazards (like liquefaction). In general, natural hazards in lowlands are related to a lack of bearing strength (such as saturated, organic-rich swamp deposits and thawing of ice-rich permafrost) and to seasonal flooding. In highlands, mass movements may be a serious local concern. Local, unevaluated factors affecting mass movement (rock avalanches, landslides, and debris flows) include sediment textures, bedrock structures, and water content. This map is intended only as a general guide to some common hazards that may be present, depending on other factors like topography and water content, and does not preclude the presence of other unevaluated or site-specific hazards.

This map was derived electronically from the geologic map of the area (Reifenstuhl and others, 2000) using Geographic Information System (GIS) software. It is only locally verified by ground observations during brief field visits. The results should be considered reconnaissance in nature.

DESCRIPTION OF MATERIALS UNITS

UNCONSOLIDATED MATERIALS

GS Fluvial and glaciofluvial gravel, sand, and silt. Chiefly (estimated >80 percent) clean sand and gravel. Grain size, sorting and degree of stratification are variable. Permafrost may be present, especially in older deposits. Older deposits may contain highly weathered clasts and thus may not be suitable as construction materials. Rare oversized materials may include boulders. Includes primarily GP and GW of the Unified Soil Classification (Wagner, 1957).

GM Poorly- to moderately well-sorted clay, silt, sand, gravel, and diamicton of colluvial, fluvial and glacial origins. Includes angular, unsorted talus debris and chaotically deformed colluvium derived from landslides. Engineering applications vary widely due to large range of grain size and sorting properties. Commonly frozen. Estimated 20-80 percent coarse, granular deposits with considerable oversized material. Includes primarily GC and GM of the Unified Soil Classification (Wagner, 1957).

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Table 1. *Generalized engineering properties of unconsolidated units*

Map unit	Drainage	Permafrost (observations based on soil pits and natural exposures)	Frost susceptibility	Slope stability	Bearing strength	Potential primary products	Potential engineering considerations	Component geologic units[a]
GS	Good in recently deposited alluvium above stream level, fair to poor in older alluvium where permafrost has developed and where covered by silty colluvium and peat. Good in younger permafrost-free terrace deposits without significant cover of organic silt. Drainage may be inhibited on older, inactive surfaces mantled by appreciable thicknesses of silt and organic materials.	Generally absent in younger alluvial deposits; locally present in older deposits mantled by silt and peat. May be present discontinuously in older terrace deposits; may be ice rich in organic silt or where silt has infiltrated into gravels by percolating ground water. Sporadic where accumulations of peat and organic silt promote development of segregated ice. Ice is typically limited to fine-grained overburden. May be present on older, inactive surfaces mantled by appreciable thicknesses of silt and organic materials.	Minimal in well-drained modern alluvium; may be moderate to intense in active layer silt and peat. Terrace gravels generally not susceptible to heave; heave may occur in organic silt that caps older alluvium.	Generally stable, except for ice-rich permafrost-bearing deposits subject to thaw instability and areas adjacent to cutbanks or free faces, where sudden, rapid collapse may occur due to stream erosion or surface loading. Fill terraces may be subject to slumping and rapid erosion.	Variable, but generally good to fair, especially below peat and silt overburden.	Crushed aggregates and miscellaneous clean fill.	Older deposits that contain permafrost and have significant cover of eolian, organic, or colluvial sediments are generally undesirable as materials sources. Very short, steep tributaries may have high potential for debris flows or snow avalanches. Cutbanks along active streams may fail, thus may not be suitable for structure sites. High flooding and icing potential along margins of streams.	Qa, Qac, Qat, Qfdi, Qfp, Qoe, Qofe
GM	Variable, depending on proportion of silt- and clay-sized material and stage of permafrost development. Deposits on or at the base of steep slopes may be subject to snow avalanches and torrential flooding during periods of snowmelt or heavy precipitation.	Common on north-facing slopes, especially in older deposits. Segregated-ice content may be high where silt and organic materials are prevalent.	High in deposits that contain large proportions of silt or organic silt and in deposits with poor drainage. Fans are frost stable, except for silt and organic zones on old fan surfaces, especially where shallow permafrost inhibits drainage.	Thaw unstable where perennially frozen or where deposit contains excess ice. Deposits of predominantly silty material are susceptible to creep, especially where saturated by near-surface ground water, such as springs along faults. Steep colluvial deposits, such as talus aprons at or near the angle of repose, are generally unstable and may be subject to snow avalanches, debris flows, and rock falls. Fans are generally stable, except where overburden is susceptible to frost heaving.	Variable but generally fair to poor.	Unclassified fills, although some local pods or lenses may be a source of small quantities of moderately sorted, gravel-rich fluvial sand.	Fan surfaces may be subject to snow avalanches, debris flows, subsidence, and local liquefaction. Therefore, caution should be exercised during excavation and construction activities. Saturated or over-steepened deposits may be subject to slope failure, and local thaw subsidence may occur in areas of permafrost.	Qaf, Qc, Qca, Qcr, Qde, Qdf, Qdir, Qdmc, Qdmi, Qdms, Qds, Qh
SM	Highly variable depending on stage of permafrost development. Very poor in frozen deposits.	Common in silt deposits. Interstitial ice, segregated ice, and massive ground ice may be present, especially in deposits with appreciable organic content or in areas of limited drainage.	High in deposits with high proportion of silt or organic silt and in areas of poor drainage. Thaw unstable following surface disturbance where deposit contains ice-rich permafrost.	Silt deposits are thaw unstable where perennially frozen or where containing excess ice; subject to slumping and earthflows, especially if organic content is high.	Generally poor.	Silt deposits are generally unsuitable as materials sources.	Silt deposits may be subject to slump, slough, subsidence, liquefaction, mudflows, and thaw subsidence.	Qas, Qsr, Qsu, Qts
OR	Very poor, often with standing water.	Generally frozen except near stream cuts.	Very high. Thaw unstable following surface disturbance.	Thaw unstable; subject to failure due to saturation.	Generally poor, especially where thawed	May be suitable for horticultural or energy applications.	Surface subject to inundation, extreme frost heaving, and thaw subsidence in saturated soils. Generally unsuitable as structure sites unless structures are pile supported.	Qs

[a]Source of geologic units: Reifenstuhl, R.R., Pinney, D.S., Mull, C.G., Harris, E.E., LePain, D.L., Pinney, D.S., and Wallace, W.K., 2000, Geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigations 2000-1a.

Table 2. *Engineering properties of bedrock units*

Map unit	Principal rock characteristics	Potential primary products	Component geologic units[a]
BC	Medium-jointed, fine- to coarse-grained sedimentary carbonate rocks.	• Dimension stone • Ornamental stone • Crushed rock • Cement	PMlu, PMlm, Trs
BM	Medium-jointed, fine- to medium-grained quartzose sedimentary rocks.	• Riprap and drain rock • Crushed rock • Unclassified fills	Kkb, Kkm
BO	Other lithologies.	• Unclassified fills • Serpentinite may be suitable as an ornamental stone	KJk, Kphu, Kc, Mkt, Mky, Mll, Pe, pM, TKp, Tri, Trik, Tru,

[a]Source of geologic units: Reifenstuhl, R.R., Pinney, D.S., Mull, C.G., Harris, E.E., LePain, D.L., Pinney, D.S., and Wallace, W.K., 2000, Geologic map of the Sagavanirktok B-1 Quadrangle, eastern North Slope, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigations 2000-1a.

SM Silt deposited primarily by wind and reworked by fluvial and colluvial processes. May be organic rich. Commonly frozen and ice-rich, especially on north-facing slopes. Chiefly fine materials. Estimated >80 percent silt, sand, and clay. Includes primarily ML, MH, and SM of the Unified Soil Classification (Wagner, 1957).

OR Organic-rich silt and peat in bogs and thaw lake basins. Commonly frozen and ice-rich due to the excellent insulating properties of peat. Generally water-saturated. Chiefly organic materials. Estimated >50 percent peat, organic sand, or organic silt. Includes Pt of the Unified Soil Classification (Wagner, 1957).

BEDROCK MATERIALS

BC Medium-jointed, fine- to coarse-grained sedimentary carbonate rocks. Includes limestone, and dolostone.

BM Medium-jointed, fine- to medium-grained quartzose sedimentary rocks. Includes quartzose sandstone and conglomerate, quartzite, and chert.

BO Rocks of mixed lithology and very fine-grained sedimentary lithologies that are generally poorly suited for use as construction materials. Includes shale, siltstone, graywacke and argillite.

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