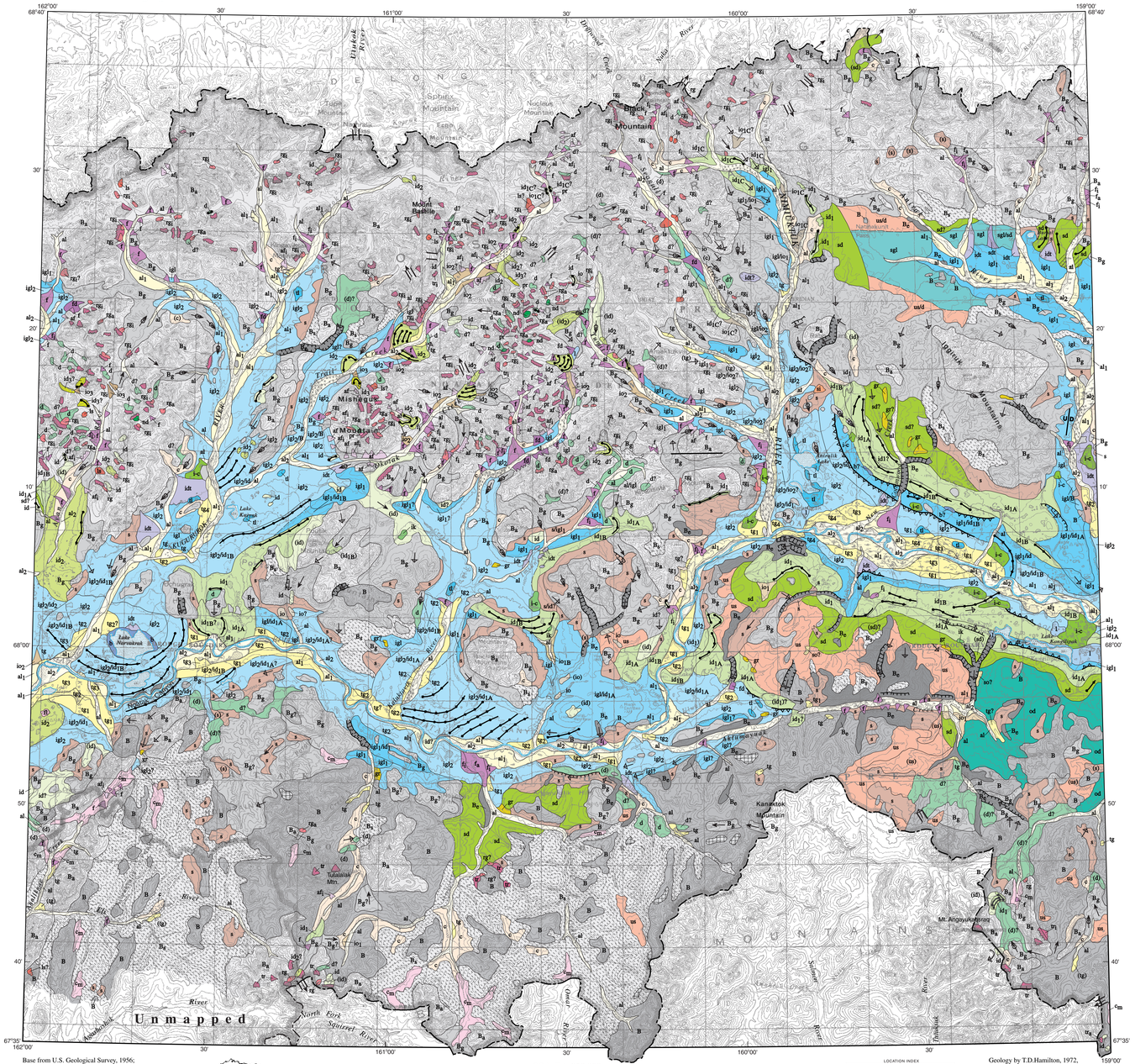
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 03-367
Version 1.0
Surficial geologic map of parts of the Misheguk Mountain and Baird Mountains quadrangles, Noatak National Preserve, Alaska
Pamphlet accompanies map



Base from U.S. Geological Survey, 1956; limited revisions, 1982, 1983
Universal Transverse Mercator, zone 4

SCALE 1: 250 000

5 0 5 10 15 20 25 MILES
5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
1987 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES WEST TO EAST FROM 19° 30' TO 22°

Geology by T.D.Hamilton, 1972, 1992-1993, 1999-2000, and 2003
Digital representation by K.A. Labay, SAIC contractor, 2002-2003

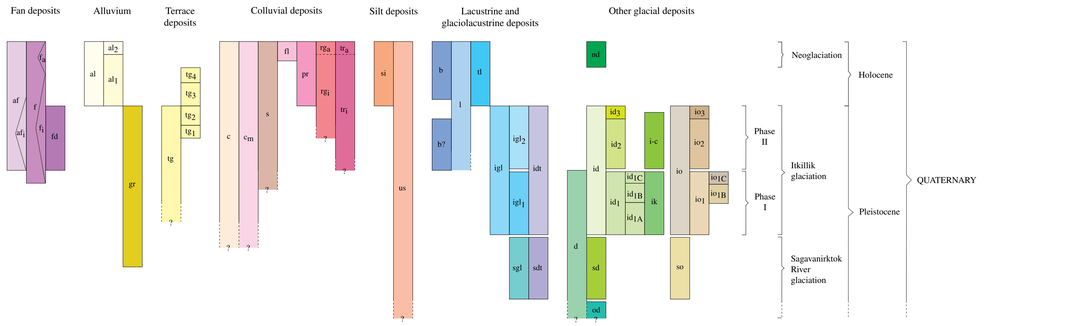
SURFICIAL GEOLOGIC MAP OF PARTS OF THE MISHEGUK MOUNTAIN AND BAIRD MOUNTAINS QUADRANGLES, NOATAK NATIONAL PRESERVE, ALASKA

By

Thomas D. Hamilton

2003

CORRELATION OF MAP UNITS



LIST OF MAP UNITS

[Map units shown in parentheses, such as **(id)**, indicate thin and generally discontinuous deposits over near-surface bedrock. Map units shown with slashes, such as **us/d**, indicate deposits of the first unit over known or inferred deposits of the second unit. Units of either type are described below only where additional explanation is necessary. Units queried where uncertain.]

BEDROCK SURFACE FORMS

B — **Bedrock, undifferentiated**—Bedrock intermediate in character between alpine and silt-covered. Moderate relief, with most crests exposing bare rock and most lower slopes vegetated. Talus rare to absent, and generally inactive where present

B_a — **Bedrock, alpine**—Generally unweathered bedrock, forming steep-sided, sharp-crested ridges. Dissected by avalanche chutes and (at higher altitudes) by cirques and nivation basins. Lower flanks commonly mantled with talus and with debris fans at bases of avalanche chutes. Commonly includes stream deposits, talus rubble, and other colluvial deposits too small to designate separately

B_e — **Bedrock exposed by erosion**—Unweathered to slightly weathered rock, forming generally steep slopes along flanks of meltwater drainage channels or recently incised stream systems. Most common along Noatak River and its lower tributaries

B_g — **Bedrock, glaciated**—Bedrock smoothed and abraded by overriding glacier ice. May exhibit faceted ridge spurs, ice-marginal drainage channels, stoss-and-lee topography, U-shaped divide crossings, and other features characteristic of glacial erosion. Generally well-exposed rock surfaces; commonly streamlined in direction of ice flow and channeled by meltwater (arrows show flow directions of ice and meltwater)

B_s — **Bedrock, silt-covered**—Bedrock of moderate relief, with silt cover generally present over all but the highest and steepest slopes. Most common near Pleistocene lake beds and other sources of airborne silt (loess), but also locally present where silt is generated by weathering of shale or other fine-grained readily disaggregated rock

FAN DEPOSITS

af — **Deposits of steep alpine fans**—Coarse, very poorly sorted, subangular to subrounded silty sandy gravel at mouths of avalanche chutes and steep canyons. Upper segments generally channeled, with levees of angular to subangular coarse debris. Subject to snow avalanches during winter, shallows during spring snowmelt, and debris flows during summer. Surface gradients generally 12° to 25°, intermediate between those of alluvial fans and talus cones

af_i — **Inactive alpine fan deposits**—As described in unit **af**. Generally weathered and covered with sod and vegetation

f — **Fan deposits**—Range from poorly sorted, weakly stratified, subangular, silty, sandy coarse gravel at mouths of mountain valleys to gravelly sand and silt within lowlands

f_a — **Active fan deposits**—As described in unit **f**. Employed only on compound fans to distinguish active from inactive elements

f_i — **Inactive fan deposits**—As described in unit **f**. Generally weathered and covered with sod and vegetation

fd — **Fan-delta deposits**—Alluvial-fan deposits (as described in unit **f**) that grade downslope into deltaic and lacustrine facies (well sorted and generally well stratified sand and silt, with some fine gravel locally present

ALLUVIUM

al — **Alluvium, undivided**—Varies from moderately sorted, stratified, coarse gravel in upper valleys to muddy fine gravel and gravelly mud along lower river courses. Along smaller streams, unit includes fan, flood-plain, and low terrace deposits that are too small to be designated separately

al_2 — **Modern alluvium**—Gravel to gravelly mud, as described in unit **al**, generally unvegetated and subject to annual flooding. Differentiated only along principal streams

al_1 — **Low alluvial-terrace deposits**—Gravel to gravelly mud, as described in unit **al**, mantled with 0.3-1 m of silt, sand, turf, and peat, and generally vegetated. Forms terraces generally within 3-4 m of modern stream levels. Differentiated only along principal streams

gr — **Gravel deposits, undifferentiated**—Isolated, gravelly erosion remnants of uncertain composition and origin

TERRACE DEPOSITS

tg — **Terrace gravel**—Alluvial gravel and sandy gravel, generally capped by flood-plain deposits of silt, sand, or peat up to 1-2 m thick. May locally have thicker mantle of eolian silt or thaw-lake deposits

tg_4 — **Terrace gravel, lowest-level**—Alluvial gravel, as described in unit **tg**. Forms broad alluvial surfaces 8-12 m above river level along Noatak River near New Cottonwood Creek and along lower Kugururok River. Thaw lakes common

tg_3 — **Terrace gravel, low-level**—Alluvial gravel, as described in unit **tg**, with thicker silt and peat cover. Forms surfaces about 15 m above Noatak River and lower Kaluktavik River. Thaw lakes common

tg_2 — **Terrace gravel, intermediate-level**—Alluvial gravel, as described in unit **tg**, with thicker silt and muskeg cover. Forms surfaces 25-35 m above Noatak River and lower courses of some tributaries. Some kettle lakes present

tg_1 — **Terrace gravel, highest-level**—Alluvial gravel, as described in unit **tg**, generally with thick (up to 3-5m?) silt and muskeg cap. Forms surfaces about 50 m above modern level of Noatak River. Kettle lakes common on surface

COLLUVIAL DEPOSITS

c — **Colluvium, undivided**—Mixed solifluction deposits and talus rubble, as described individually (see **s** and **tr**), in sheets and aprons more than about 0.5 m thick. Common on upper slopes below exposed or near-surface bedrock

c_m — **Colluvium-filled mountain valley**—Colluvial deposits mixed with some alluvium. Mapped in narrow mountain valleys, where individual deposits are too small to be shown separately. Talus on steep upper slopes; solifluction, fan, and debris-fan deposits on lower slopes. Colluvium interfingers with alluvium toward valley center

s — **Solifluction deposits**—Very poorly sorted, nonstratified to weakly stratified, stony silt and organic silt in smoothly graded, gently to moderately sloping sheets and aprons more than 0.5 m thick

fl — **Flow deposits**—Very poorly sorted stones in abundant muddy matrix. Associated with slumps on walls of active kettle on moraine of Avan (Itkillik II) age south of Noatak River opposite mouth of Avan River

ls — **Landslide deposits**—Unsorted, unstratified, coarse to fine, angular rubble, commonly with matrix of finer debris, forming lobes below detachment scars and slide tracks on steep rock walls. Subject to rapid downslope movement and long periods of relative stability. Most common in upper mountain valleys near north margin of map area

pr — **Protalus rampart deposits**—Unsorted, nonstratified, coarse angular rock debris forming arcuate low ridges. Associated with persistent snowbanks in shaded sites, commonly at bases of cirque headwalls. Subject to rockfalls during spring thaw

rg — **Rock-glacier deposits, undifferentiated**—Coarse angular rock debris, as described in unit **rg_a**, with activity undetermined or with active and inactive components too small to be mapped separately

rg_a — **Rock-glacier deposits, active**—Very poorly sorted, nonstratified, coarse angular rock debris with matrix of silt and fine rubble; contains abundant interstitial ice. Upper surfaces generally unvegetated, unweathered to moderately weathered, and with lichen cover sparse. Frontal slopes barren, steep, and highly unstable, meeting upper surfaces at abrupt angle. Form lobate deposits at base of talus cones within cirques or along valley walls

rg_i — **Rock-glacier deposits, inactive**—Coarse angular rock debris, as described for unit **rg_a**, but lacking interstitial ice. Upper surfaces and frontal slopes weathered, covered by lichens, and commonly partly covered by sod and vegetation. Frontal slopes grade into upper surfaces without abrupt angles

tr — **Talus rubble**—Angular, unsorted rock debris, as described in unit **tr_a**, with activity undetermined or with active and inactive components too small to be mapped separately

Talus rubble, active—See Map Symbols

tr_i — **Talus rubble, inactive**—Angular rock debris, as described in unit **tr_a**, generally weathered and lichen covered, and with partial sod cover

SILT DEPOSITS

si — **Ice-rich silt deposits**—Silt deposits, commonly with ice-wedge polygon networks, more than 1-2 m thick in swales and other depressions. Mapped only east of Niminuktuk River opposite mouth of Kukukpiktak Creek

us — **Upland silt deposits**—Poorly to moderately sorted, generally unstratified, silt, organic silt, and slightly stony silt draped over uplands of low to moderate relief. Represents loess mixed by frost action with local organic matter and weathering products. Commonly grades downslope into thick, massive, organic-rich silt or into solifluction deposits

LACUSTRINE AND GLACIOLACUSTRINE DEPOSITS

b — **Beach deposits**—Moderately well sorted, coarse to medium sand, commonly mixed or interbedded with platy fine gravel. Locally forms ridges of poorly sorted, gravelly sand to sandy coarse gravel where mixed by ice shove. Mapped along modern shore of Lake Narvakrak. Possible ancient beach deposits (unit **b?**) occur at edge of glacial-lake deposits (unit **$ig1_2$**) north of Noatak River near New Cottonwood Creek

dt — **Deltaic deposits**—Generally well stratified sand and sandy fine gravel deposited by streams at lake margins. Commonly build outward into lake, and overlie fine-grained lacustrine deposits. Mapped only at southeast corner of Lake Kangilipuk

l — **Lacustrine deposits**—Clayey silt, silt, and sand, commonly well stratified, grading into sand and gravelly sand near former shorelines and sandy fine gravel near former river mouths. Mapped primarily along receding lake margins or beds of lakes that have recently drained. Commonly include beach deposits too small to be designated separately

tl — **Thaw-lake deposits**—Weakly stratified to nonstratified silt, organic silt, and clayey to sandy silt; generally contains abundant ice as lenses, wedges, and interstitial grains. Fill thaw basins in glacial-lake deposits on floors of Noatak, Kugururok, and Niminuktuk valleys

igl — **Glacial-lake deposits of Itkillik age**—Stratified silt, clayey silt, and silty fine sand, commonly with dispersed dropstones. Grades into gravelly sand to sandy fine gravel near former stream mouths. Mapped as compound unit (for example, **igl/B**, **igl/id_1**, **igl/io_1**) where drapes or overlies bedrock or other glacial deposits

igl_2 — **Glacial-lake deposits of Avan (Itkillik Phase II) age**—Glacial-lake deposits, as described in unit **igl**, that formed behind moraine dam at mouth of Avan River. Form extensive deposits at altitudes up to 300-320 m (1000-1050 ft) along Noatak River and lower to middle parts of its tributary valleys. Mapped as compound unit (for example, **igl_2/B**, **igl_2/sd**, **igl_2/od_1**) where it drapes or overlies bedrock or other glacial deposits. Arcuate symbols designate end moraines of preceding glacial advances that later were draped by lake deposits. Upper limits are locally marked by wave-cut scarps

igl_1 — **Glacial-lake deposits of Aniuk (Itkillik Phase IB) age**—Glacial-lake deposits, as described in unit **igl** that formed beyond Aniuk moraine or during ice recession from Aniuk moraine. Locally present at altitudes up to 400 m (1300 ft) beyond limits of unit **igl_2**. Widely present on floor of Aniuk River valley and along both flanks of Noatak River valley east of Niminuktuk River, where wave-cut scarps separate it from unit **igl_2**. Mapped as compound unit (for example, **igl_1/id_1**, **igl_1/io_1**) where it drapes or overlies other glacial deposits

sgl — **Glacial-lake deposits of Cutler (Sagavanirktok River) age**—Glacial-lake deposits, as described in unit **igl**, that formed beyond moraines of probable Cutler age in Aniuk River valley. Present to altitudes up to about 460 m (1500 ft) beyond limits of unit **igl**. Mapped as compound unit (**sgl/sd**) where it overlaps end moraines of Sagavanirktok River age

idt — **Deltaic deposits of Itkillik age**—Generally well stratified sand and sandy fine gravel, as described in unit **dt**. Formed near mouths of streams that flowed into glacial lakes of Itkillik age, and typically overlie and interfinger with fine-grained deposits of those lakes

sdt — **Deltaic deposits of Cutler (Sagavanirktok River) age**—Deltaic deposits, as described in units **dt** and **idt**. Mapped only along north side of Aniuk River valley between Picnic and Setting Sun creeks

OTHER GLACIAL DEPOSITS

d — **Drift, undifferentiated**—Glacial deposits, as described in unit **id**, of uncertain age

Late Holocene glaciation (Neoglaciation)

nd — **Drift of neoglacial age**—Unsorted nonstratified angular rubble forming lobes and arcuate ridges with steep and commonly unstable slopes. Clasts unweathered to slightly weathered; generally unvegetated except by lichens. Restricted to cirques in rugged highlands between Trail and Tumit Creeks and between Avan and Kugururok Rivers

Itkillik glaciation

id — **Drift of Itkillik age, undifferentiated**—Unsorted to poorly sorted, generally nonstratified, compact till ranging in composition from muddy sandy gravel to gravelly muddy sand, with local stratified ice-contact deposits consisting of moderately sorted sand and sandy gravel. Contains faceted and striated stones up to large boulder size

id_3 — **Drift of late Avan (late Itkillik Phase II) readvance**—Glacial deposits, as described in unit **id**, with irregular morphology and narrow-crested moraines. Mapped at north flank of Misheguk Mountain. Also possibly present within unnamed southern tributary to Trail Creek 22 km farther to the northeast

id_2 — **Drift of Avan (Itkillik Phase II) age**—Glacial deposits, as described in unit **id**. Form extensive deposits along lower course of Avan River and on south side of Noatak River opposite Avan River mouth. Overlapped by glacial-lake deposits to about 180 m (600 ft) altitude, and wave-eroded to altitudes locally as great as 320 m (1060 ft). Also forms closely nested sets of 2-4 arcuate, steep-sided, narrow-crested moraines in upper mountain valleys close to rugged highlands in northcentral part of map area

id_1 — **Drift of Itkillik Phase I, undivided**—Glacial deposits, as described in unit **id**. Morphology rugged to subdued, depending on relations to ice-dammed glacial lakes. Common in lower parts of Kugururok and Kaluktavik River valleys and along Noatak River valley upstream from Aklumayauk Creek

id_1C — **Drift of late Aniuk (Itkillik Phase IC) age**—Glacial deposits, as described in unit **id**. Formed by late stillstand or readvance of residual glaciers near head of Niminuktuk River valley and within upper valley of Seagull Creek

id_1B — **Drift of Aniuk (Itkillik Phase IB) age**—Glacial deposits, as described in unit **id**, that extend into Aniuk moraine, a prominent end moraine at mouth of Aniuk River near east margin of map area. Overlapped by glacial-lake deposits (units **igl_2** and **igl_1**) to altitudes of about 400 m (1300 ft). Differentiated from unit **id_1A** primarily along Noatak River upvalley from Aklumayauk Creek confluence

id_1A — **Drift of Makpik (Itkillik Phase IA) age**—Glacial deposits, as described in unit **id**, that extend east up Noatak River valley into Makpik moraine, a prominent end moraine at mouth of Makpik River beyond east margin of map area

ik — **Ice-stagnation (kame) deposits**—Thick and extensive water-washed sand and gravel deposited in contact with stagnating glaciers of Itkillik I age. Commonly forms conical to subdued mounds with well-drained surfaces. Mapped only near heads of Anaiak, Sisiak, and Aklumayauk creeks

i-c — **Ice-contact meltwater deposits**—Meltwater-washed sand and gravel, as described in unit ik, commonly associated with glaciolacustrine deposits. Probably formed by accelerated melting of debris-covered stagnant glacier ice where in contact with transgressing glacial lake. Most common on lateral and end moraines of Aniuk (unit **id_1B**) advance north and south of Noatak River near east margin of map area

io — **Outwash of Itkillik age, undivided**—Moderately well sorted and stratified sandy gravel forming aprons and valley trains in front of moraines of Itkillik age and terrace remnants farther downvalley. Largest stones decrease in size from subrounded cobbles and very small boulders near moraine fronts to rounded to subrounded pebbles and granules farther downvalley

io_3 — **Outwash of late Avan (late Itkillik Phase II) readvance**—Gravel aprons and valley trains, as described in unit **io**. Associated with or downvalley from end moraines assigned to late Avan readvance in Trail Creek valley. Also present near mouths of cirque-headed tributary valleys near head of Avan River

io_2 — **Outwash of Avan (Itkillik Phase II) age**—Sandy gravel, as described in unit **io**. Primarily associated with end moraines of Avan age (unit **id_2**) in mountain valleys close to rugged highlands in north-central part of map area

io_1 — **Outwash of Itkillik Phase I**—Sandy gravel, as described in unit **io**. Forms apron beyond end moraine of Itkillik I age near head of Little Cottonwood Creek and terrace remnants near head of Aklumayauk Creek

io_1C — **Outwash of late Aniuk (late Itkillik Phase IB) age**—Sandy gravel, as described in unit **io**, associated with end moraines of inferred late Aniuk age. Forms terrace remnants in valley of Seagull Creek and near head of Niminuktuk River

io_1B — **Outwash of Aniuk (Itkillik Phase IB) age**—Sandy gravel, as described in unit **io**, associated with end moraines of inferred late Aniuk age near head of Sisiak Creek

Sagavanirktok River glaciation

sd — **Drift of Cutler (Sagavanirktok River) age**—Poorly sorted nonstratified till, probably ranging in composition from silty sandy bouldery gravel to clayey stony silt, with local deposits of moderately well sorted and stratified gravel. Moraines relatively subdued and generally discontinuous. Generally covered by thick (>3 m) blanket of silt, stony silt, and organic silt (loess, solifluction, and muskeg deposits), but crests of some ridges and knolls expose weathered gravel and erratic boulders of resistant lithologies. Mapped mainly in eastern parts of map area

so — **Outwash of Cutler (Sagavanirktok River) age**—Moderately well sorted and stratified gravel to sandy gravel, commonly oxidized to several meters depth. Forms terrace remnants in front of end moraines of probable Cutler age (unit **sd**) near heads of Aklumayauk Creek and a northern tributary to that creek

Sagavanirktok River or older glaciation

od — **Older drift**—Till and gravel, as described above. Forms featureless deposits buried beneath thick mantle of fine-grained loess and colluvium. Commonly identifiable only by presence of erratic boulders in stream beds

MAP SYMBOLS

- **Boundary of Noatak National Preserve**
- **Contact**—Dashed where approximately located or inferred
- **Fault**—Expressed in Quaternary sediments or as unmodified offsets in bedrock. Sense of motion (D, down; U, up) shown where determinable
- **Drainage channel**—Abandoned or containing underfit stream
- **Crest of morainal ridge**
- **Erosional scarp**
- **Direction of glacier flow across topographic divide**
- **Direction of ice movement or meltwater drainage**
- **Former meltwater flow direction**
- **U-shaped pass**—Where glacier crossed topographic divide
- **Active talus rubble**—Jagged side faces upslope
- **Aufeis zone**
- **Altiplanation terrace**
- **Heavily eroded surficial unit**—Near northeast corner of map
- **Lake**

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