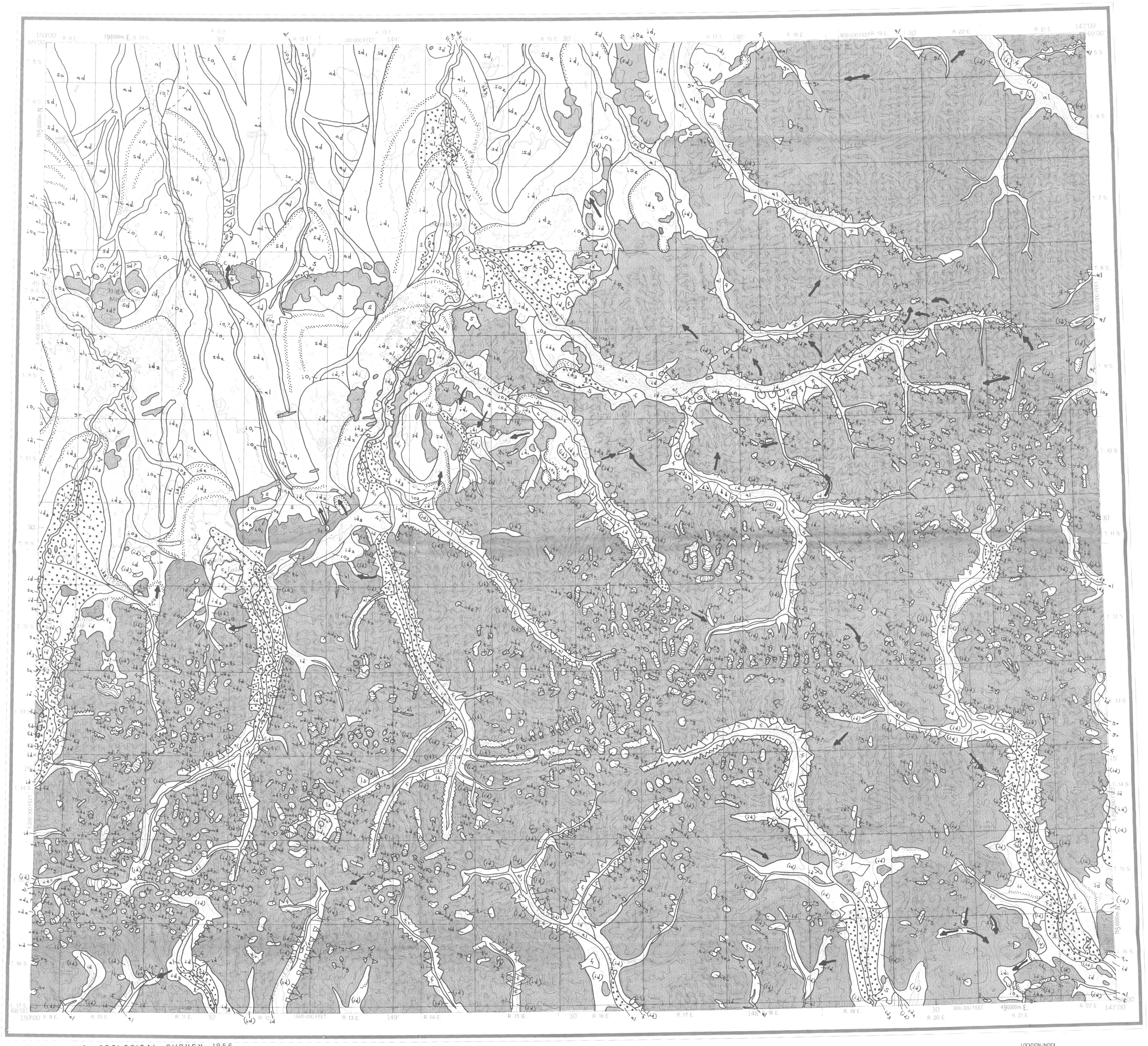
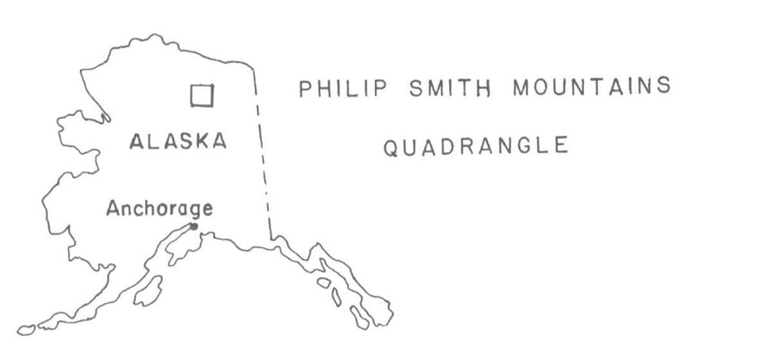
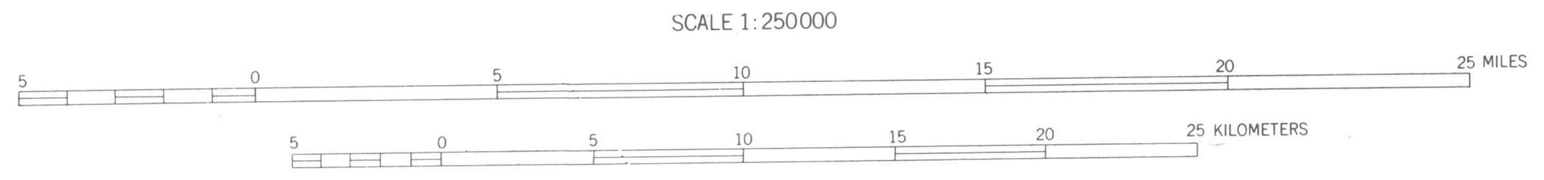


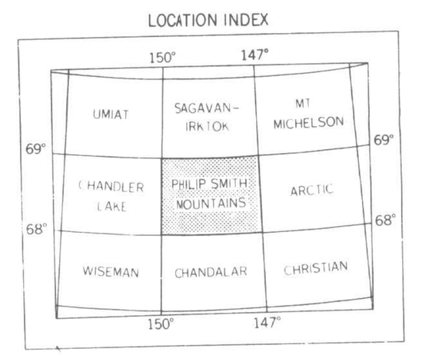
BASE FROM U.S. GEOLOGICAL SURVEY, 1956



QUADRANGLE LOCATION



CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL



GEOLOGY BY R.L. DETTERMAN, 1951; O.J. FERRIANS, JR., 1969-70; R.D. REGER AND RAY KREIG, 1971-74; AND T.D. HAMILTON, 1969-76.

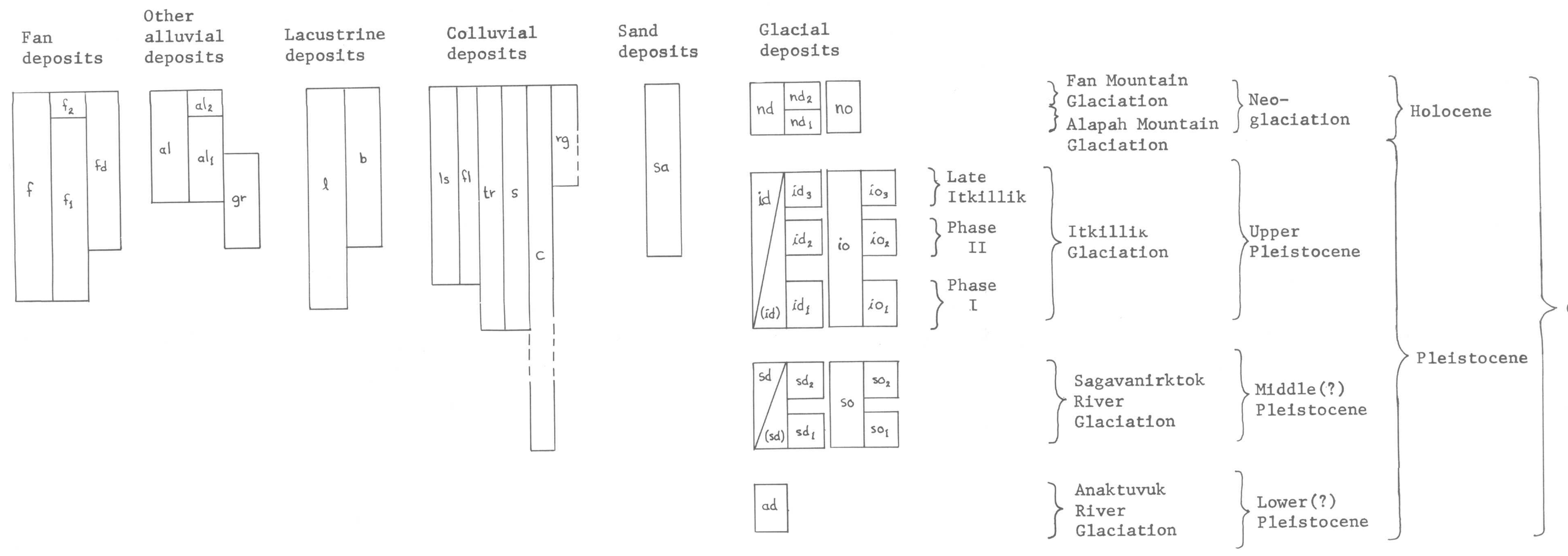
SURFICIAL GEOLOGIC MAP OF THE PHILIP SMITH MOUNTAINS QUADRANGLE, ALASKA

BY

THOMAS D. HAMILTON

1978

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

FAN DEPOSITS

f FAN DEPOSITS, UNDIFFERENTIATED--Range from coarse, poorly sorted, weakly stratified, angular to subangular silty rubble near heads of mountain valleys to moderately well stratified sandy fine gravel at mouths of large streams near north margin of Brooks Range. Fans within mountain valleys subject to icings during winter (see Sloan and others, 1976), slushflows during spring snowmelt period (see Washburn, 1973, p. 164-169), and mudflows during summer

f_2 ACTIVE FAN DEPOSITS--Moderately well stratified, subangular to subrounded, silty to sandy gravel, usually unvegetated. Commonly subject to icings (see Sloan and others, 1976). Differentiated only on largest fans in Sagavanirktok, Atigun, and Ribdon Valleys

f_1 INACTIVE FAN DEPOSITS--Silty to sandy gravel, as described above, generally with thin (less than 0.5 m) cap of silt, sand, or peat; partly to entirely vegetated. Differentiated only on largest fans in Sagavanirktok, Atigun, and Ribdon Valleys

fd FAN-DELTA DEPOSITS--Range from poorly sorted, weakly stratified, subangular gravel near valley walls to well-sorted, well-stratified, silt, sand, and fine gravel near valley centers. Represent alluvial fan deposits grading into lacustrine sediments in moraine-dammed lake basins

OTHER ALLUVIAL DEPOSITS

al ALLUVIUM, UNDIFFERENTIATED--Ranges from poorly sorted, moderately well stratified, subangular coarse gravel near heads of mountain valleys to well-sorted, sandy fine gravel along slow-flowing stretches of some streams north of Brooks Range. Includes, fan, flood-plain, and low terrace deposits too small to be designated separately

al_2 MODERN ALLUVIUM--Sand and gravel, as described above; generally unvegetated and commonly subject to icings (see Sloan and others, 1976). Differentiated only along major valleys

al_1 LOW ALLUVIAL TERRACE DEPOSITS--Sand and gravel, as described above; generally mantled with up to 0.5 m of silt, sand, or peat; and generally vegetated

gr GRAVEL DEPOSITS, UNDIFFERENTIATED--Include (1) gravel and sandy gravel in terrace remnants of uncertain origin along Itkillik River, along Sagavanirktok River, and east of Saviukviayak River and (2) lag deposits of coarse gravel associated with springs along south fork of Ribdon River

LACUSTRINE DEPOSITS

ℓ LACUSTRINE DEPOSITS, UNDIFFERENTIATED--Well-stratified clay, silt, and sand, grading into generally well stratified sandy fine gravel near former shorelines, especially near former stream mouths. Extensive thick deposits occur behind Itkillik-age moraines along floors of most major valleys. Partly buried beneath alluvium, solifluction and fan deposits, and sand sheets (see stippled map pattern). Include beach deposits too small to designate separately

b BEACH DEPOSITS--Nonstratified to well-stratified sand and well-sorted fine gravel. Differentiated only along west shore of Galbraith Lake and east of Itkillik Lake

COLLUVIAL DEPOSITS

ls LANDSLIDE DEPOSITS--Unsorted nonstratified coarse angular rubble forming lobes at bases of high, steep rock walls near heads of mountain valleys. Most common on Hunt Fork Shale and underlying brown shales (Brosgé and others, in press); also present locally on limestone and conglomerate. Subject to episodes of rapid downslope motion and long periods of relative stability

fl FLOW-SLIDE DEPOSITS--Unsorted nonstratified angular rubble in water-saturated, fine-grained matrix; subject to slow and probably continuous downslope motion. Form lobes at base of high till bluffs along Sagavanirktok River

tr TALUS RUBBLE--Angular unsorted nonstratified rock debris in cones and aprons more than 2 m thick along walls of mountain valleys and along flanks of bedrock ridges in foothills north of Brooks Range. Also forms thin (less than 1-2 m) and discontinuous sheets over many areas mapped as "bedrock"

s SOLIFLUCTION DEPOSITS--Unsorted nonstratified to weakly stratified silty rock debris and stony organic silt in sheets and aprons more than 1-2 m thick on lower flanks of bedrock ridges and valley walls. Commonly associated with outcrops of shale at and beyond north flank of Brooks Range (see Brosgé and others, in press). Also form thin (less than 1-2 m) secondary slope deposits over many areas mapped as "drift"

c COLLUVIUM, UNDIFFERENTIATED--Mixed talus rubble and solifluction deposits (as described above) in aprons more than 1-2 m thick on till and bedrock slopes, usually beyond the outer limits of last major (Itkillik) glaciation

rg ROCK-GLACIER DEPOSITS--Unsorted, nonstratified coarse angular rock debris with interstitial ice. Form lobate deposits at bases of talus cones along valley walls and tongue-shaped deposits within cirques (see White, 1976). Subject to slow downslope motion

SAND DEPOSITS

sa SAND--Moderately sorted to well-sorted fine to medium sand and silty fine sand, horizontally bedded to slightly crossbedded. Deposited initially by slow-moving streams within basins partly dammed by end moraines in Itkillik, Atigun, and Sagavanirktok River Valleys. Upper 0.5 to 5 m commonly later reworked by wind into sand sheets and dunes

GLACIAL DEPOSITS

Neoglaciation

nd NEOGLACIAL DRIFT, UNDIFFERENTIATED--Unsorted, nonstratified, coarse to fine angular rubble within and near cirques at heads of mountain valleys. Designates (1) remnants of eroded Neoglacial drift unassignable to either the Alapah Mountain or the Fan Mountain Glaciation and (2) composite drift bodies too small for subdivision

nd_2 DRIFT OF LATE NEOGLACIAL AGE--Unsorted, nonstratified, coarse to fine angular rubble, generally ice-cored, forming unstable and unvegetated arcuate end moraines and tonguelike lobes. Restricted to cirques and valley heads, generally within 1.5 km of fronts of modern glaciers. Form double moraine systems in some valleys

nd_1 DRIFT OF INFERRED EARLY NEOGLACIAL AGE--Unsorted, nonstratified, coarse to fine angular rubble, generally without ice cores, forming partly to wholly vegetated end moraines and tonguelike lobes. Deposits commonly extend 3-8 km from cirque headwalls and commonly terminate near mouths of short and steep cirque-headed tributary valleys

no NEOGLACIAL OUTWASH, UNDIFFERENTIATED--Moderately well sorted and stratified sandy coarse gravel forming modern flood plains and low (1-3 m) vegetated terraces in short and steep cirque-headed mountain valleys. Extend downvalley from modern glaciers and from Neoglacial end moraines

Itkillik Glaciation

id ITKILLIK DRIFT, UNDIFFERENTIATED--Poorly sorted nonstratified till, ranging in composition from silty sandy bouldery gravel to clayey stony silt, with local stratified ice-contact deposits consisting of moderately well sorted sand and gravel. Designates thick (greater than 3 m) drift deposits, usually within moutain valleys, that cannot be assigned to a specific Itkillik moraine system

Subunit *(id)* designates thin (0.5 to 3 m) and generally discontinuous deposits above bedrock within mountain valleys

id_3 DRIFT OF LATE ITKILLIK AGE--Till and stratified ice-contact deposits, as described above, forming arcuate, nested end moraines and irregular ground moraine with prominent kames, kettles, and kame terraces. Loess cover generally absent, and exposed cobbles and boulders very slightly weathered. Formed during stillstands or readvances of glaciers sometime between about 13,000 and 11,000 ^{14}C yrs B.P. (Hamilton and Porter, 1975)

id_2 DRIFT OF PHASE II--Till and stratified ice-contact deposits, as described above, with ice-contact deposits more abundant than till in most valleys. Forms broad drift lobes with prominent knob and kettle morphology associated with extensive, conspicuously channeled outwash trains (Hamilton and Porter, 1975). Crests and upper slopes lack loess and solifluction cover, and exposed boulders and cobbles exhibit slight to moderate weathering. Most swales lack solifluction deposits, and abandoned meltwater channels commonly are floored with lichen-covered coarse gravel

id_1 DRIFT OF PHASE I--Till and stratified ice-contact deposits, as described above, with till predominating in most valleys. Forms closely spaced concentric end moraines with flanking slopes up to 20-25° and subdued knob and kettle topography; associated with discontinuous outwash trains partly obscured by solifluction (Hamilton and Porter, 1975). Moraine crests generally bare of loess, but upper slopes blanketed by 0.5 to 2 m of stony organic silt (loess and colluvium). Exposed cobbles and boulders moderately to heavily weathered. Swales partly filled with 1-3 m of ice-rich, organic, silty solifluction deposits

io ITKILLIK OUTWASH, UNDIFFERENTIATED--Moderately well sorted and stratified sandy gravel, with largest stones decreasing in size from subangular cobbles and small boulders near moraine fronts to subrounded pebbles and cobbles farther downvalley. Forms aprons and valley trains in front of Itkillik moraines, and isolated terrace remnants farther downvalley

io_3 OUTWASH OF LATE ITKILLIK AGE--Sandy gravel, as described above, generally without loess or peat cover. Forms aprons and valley trains in front of late Itkillik moraines. Terraces are low (1-4 m), and generally continuous

io_2 OUTWASH OF PHASE II--Sandy gravel, as described above, generally without loess cover. Forms extensive aprons and valley trains in front of Itkillik II moraines. Terraces 5-15 m high and generally continuous

io_1 OUTWASH OF PHASE I--Sandy gravel, as described above, generally with thin (0.5 to 3 m) cover of loess and solifluction deposits. Forms aprons and valley trains in front of moraines of phase I. Terraces 15-25 m high and generally discontinuous. Commonly incised within drift of Sagavanirktok River Glaciation and dissected in turn by outwash of phase II

Sagavanirktok River Glaciation

sd SAGAVANIRKTOK RIVER DRIFT, UNDIFFERENTIATED--Poorly sorted nonstratified till, ranging in composition from silty sandy bouldery gravel to clayey stony silt, with local deposits of moderately well sorted gravel. Designates thick (greater than 3 m) isolated drift patches between Sagavanirktok River and Itkillik ice limits (Detterman and others, 1958) that cannot be related to a specific Sagavanirktok River moraine system

Subunit *(sd)* designates thin (0.5 to 3 m) and generally discontinuous drift above bedrock between (maximum limits of Sagavanirktok River and Itkillik ice

sd_2 YOUNGER DRIFT--Till and gravel, as described above, forming subdued end moraine and ground moraine with some ridge crests bare of loess and solifluction cover. Bare ridge crests expose weathered gravel consisting of subrounded pebbles, cobbles, and small boulders of resistant lithologies from which finer sediments have been removed by wind, frost action, solifluction, and possibly running water. Almost entirely overlapped by Itkillik I drift in Itkillik and Sagavanirktok Valleys

sd_1 OLDER DRIFT--Glacial deposits of unknown composition forming distinct but very subdued nested morainal ridges with flanking slopes up to 3.5° which stand as divides between major drainage systems north of the range front. Ridge crests and flanks bear thick (1-5 m) cover of organic silt (loess and solifluction deposits); swales and kettles filled to greater than 5 m thickness with ice-rich, organic, silty colluvial and lacustrine sediments

so SAGAVANIRKTOK RIVER OUTWASH, UNDIFFERENTIATED--Moderately well sorted, stratified sandy gravel, with largest stones probably decreasing in size from subangular cobbles and small boulders near moraine fronts to subrounded pebbles and cobbles farther downvalley. Overlain by 1-3 m of organic silt (loess and solifluction deposits). Commonly associated with underfit or abandoned stream courses. Includes valley trains that were active during both older and younger Sagavanirktok ice advances as well as fragmentary outwash remnants that cannot be related to a specific Sagavanirktok River moraine system

so_2 YOUNGER OUTWASH--Sandy gravel, as described above, forming outwash trains originating at outer limits of younger Sagavanirktok River moraines

so_1 OLDER OUTWASH--Sandy gravel, as described above, forming outwash trains originating at outer limits of older Sagavanirktok River moraines

Anaktuvuk River Glaciation

ad ANAKTUVUK RIVER DRIFT, UNDIFFERENTIATED--Glacial deposits of unknown composition. Overlain by continuous cover of organic silt (loess and solifluction deposits) more than 2-3 m thick. Form very subdued till plains and low broad morainal ridges with extremely gentle (1-2°) flanking slopes (Detterman and others, 1958). Former swales and kettle depressions filled with ice-rich, silty, organic colluvial and lacustrine deposits more than 5 m thick. Deeply and broadly dissected by minor as well as major stream systems. Overlapped by older drift of the Sagavanirktok River Glaciation and cut by meltwater channels originating at fronts of Sagavanirktok River moraines

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GEOLOGIC SYMBOLS

- Bedrock
- Glacier - Curved lines are concave in downvalley direction
- Surface and subsurface lacustrine deposits
- Morainal ridge
- Contact - Dashed where approximately located or inferred
- Pingo
- Spring
- Prominent kame or kame complex
- Direction of glacier flow across topographic divide - Double arrow indicates direction uncertain

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