

## DESCRIPTION OF SURFICIAL MAP UNITS

### ALLUVIAL DEPOSITS

**al** - ALLUVIUM, UNDIFFERENTIATED—Ranges from poorly sorted, moderately well stratified, subangular, coarse gravel near heads of mountain valleys to moderately well sorted, gravelly sand and sandy, fine gravel along moraine-dammed and slow-flowing stretches of major rivers. Flanked by vegetated floodplain deposits consisting of weakly stratified sand and silt beneath silty peat and sod.

**al-auf** - AUFEIS FACIES—Alluvium subject to extensive winter aufeis formation. Marked by ice accumulations up to several meters thick in early summer and by broad, highly braided, unvegetated, unstable channel reaches in late summer and early fall. Smaller aufeis zones are common along other drainage systems, but are not mapped individually.

**al-sa** - SAND FACIES—Alluvium that consists almost entirely of sand. Occurs where Itkillik and Atigun rivers transverse sandy basin-filling deposits (unit sa).

**al-sp** - SILT AND PEAT FACIES—Thick and continuous floodplain deposits of silt, organic silt, and ice-rich silt; with numerous thaw ponds. Overlie channel deposits that commonly contain lag boulders. Mapped only along upper Kuparuk River.

**al2** - MODERN ALLUVIUM—Channel and floodplain deposits, as described above, along modern courses of Itkillik and Sagavanirktok rivers.

**al1** - LOW ALLUVIAL TERRACE DEPOSITS—Channel and floodplain deposits of Itkillik and Sagavanirktok rivers, as described above, mantled with up to 2 m of silt, sand, or peat; and generally vegetated. Generally stand 1–2 m above modern floodplains.

**tg** - TERRACE GRAVEL—Fluvial sand and gravel forming discontinuous surfaces 6–10 m above modern level of Sagavanirktok River and at various levels above Toolik River. Locally covered by eolian silt 0.5–1.0 m thick.

**tg2 and tg1** - TERRACE GRAVEL—tg1 and tg2 are older and younger, respectively, sets of terrace remnants near Toolik River.

### FAN DEPOSITS

**af** - DEPOSITS OF STEEP ALPINE FANS—Coarse, very poorly sorted, nonstratified to weakly stratified, subangular to subrounded silty sandy gravel at mouths of avalanche chutes and canyons along steep valley walls and mountain fronts. Upper segments generally channeled, with levees of angular to subangular coarse debris. Subject to snow avalanches during winter, slush flows during

spring snowmelt season, and debris flows during summer. Surface gradients (generally 12° to 25°) are intermediate between those of alluvial fans and talus cones.

**f** - FAN DEPOSITS, UNDIFFERENTIATED—Range from very poorly sorted, weakly stratified, subangular, silty, sandy, coarse gravel at mouths of steep canyons to moderately sorted and stratified subrounded to rounded sandy gravel at mouths of large tributary valleys with relatively gentle gradients. Locally subject to icings during winter.

**f-i** - INWASH FACIES—Fanlike deposit banked up against flank of former Itkillik II glacier 5.5 km south-southeast of Toolik Lake.

**fa** - FAN DEPOSITS, ACTIVE—Moderately sorted and stratified sandy gravel. Locally bears thin cover of sand or silty sand that is capped by sod. Mapped only near mouth of Itikmalak River.

**fi** - FAN DEPOSITS, INACTIVE—Sandy gravel, as described above, beneath thicker and more continuous cover of vegetated sand and silt. Mapped near mouths of Itikmalak and Atigun Rivers and unnamed eastern tributary to Itkillik River.

**fiB and fiA** - INACTIVE FAN SEGMENTS—fiA and fiB are older and younger inactive fan segments, respectively. Mapped only near mouth of Atigun River, where the older deposits stand about 5 m above the younger fan deposits and may be capped by eolian silt beneath thick and continuous sod cover.

**fd** FAN-DELTA DEPOSITS—Compound deposits consisting of fan gravel (as described above) near valley walls, grading into deltaic and lacustrine facies near valley centers. Mapped primarily along west side of Galbraith Lake basin, with possible additional occurrence in Itkillik valley near southwest corner of map.

**fd-gr and fd-sa** - UPPER (PROXIMAL) fd-gr AND LOWER (DISTAL) fd-sa FACIES—Mapped only on large fan deltas in Galbraith Lake basin. Proximal subunits are coarse gravel, relatively steep, and well drained, with abundant surface stones; distal subunits are sandy, gently sloping, and poorly drained, with surface stones nearly absent.

## **COLLUVIAL DEPOSITS**

**c** - COLLUVIUM, UNDIVIDED—Mixed talus rubble and solifluction deposits, as described individually below, in sheets and aprons on steep slopes or near their bases. Commonly mapped where talus on upper slopes interfingers with solifluction on lower slopes across broad transition zone.

**tr** - TALUS RUBBLE—Angular, unsorted, nonstratified rock debris forming cones and aprons along lower part of southeast face of Slope Mountain near northeast corner of map. Areas of active talus (unvegetated, unweathered to slightly weathered, with lichen cover sparse to absent) are interspersed with more extensive vegetated talus that may have become stabilized following last (Itkillik II) glaciation. Also forms thin (less than 1–2 m) and generally discontinuous sheets over many uplands mapped as “bedrock.”

**rg** - ROCK-GLACIER DEPOSITS—Very poorly sorted, nonstratified, coarse, angular rock debris,

commonly with matrix of silt and fine rubble. Where active, contains abundant interstitial ice; frontal slopes are barren, steep, and unstable, meeting upper surfaces at abrupt angle. Where inactive, upper and frontal surfaces are weathered, lichen covered, bear partial sod cover, and grade smoothly into each other. Inactive rock glaciers are recognized south of Atigun Gorge and along the north flank of Slope Mountain near its west end.

**ls** - LANDSLIDE DEPOSITS—Unsorted rock debris forming lobes at base of steep west wall of Sagavanirktok River valley at east end of Atigun Gorge. Associated with detachment scars farther upslope. Also includes a possible large slump block in Atigun Gorge.

**s** - SOLIFLUCTION DEPOSITS—Very poorly sorted, nonstratified to weakly stratified, stony, sandy silt to organic silt. Forms sheets and aprons that thicken down slopes and accumulate up to several meters deep along slope bases. Deposits widespread on gentle to moderate slopes beyond limits of Itkillik glaciation; locally present on Itkillik drift.

**fl** - FLOW DEPOSITS—Very poorly sorted rock debris in abundant muddy matrix. Associated with slumps on walls of kettle in glacial deposits of Itkillik II age 7.5 km south of Toolik Lake. Also mapped on southwest flank of Itigaknit Mountain. Common around margins of active kettles (see unit ika, below).

#### **OTHER NONGLACIAL DEPOSITS**

**b** - BEACH DEPOSITS—Low, slightly sinuous, sandy ridges with steep, ice-shoved outer faces, overwash fans on inner flanks, and spit-like terminations. Mapped only near north end of Galbraith Lake basin.

**ds** - DUNESAND DEPOSITS—Moderately well sorted, fine to medium sand. Most commonly forms either horseshoe-shaped parabolic ridges associated with unvegetated blowouts or shapeless mounds trapped by vegetation. Associated with sandy basin-filling deposits (unit sa). Mapped only on west shore of Galbraith Lake and west of Itkillik River in southwest corner of map area.

**gr** - GRAVEL, UNDIFFERENTIATED—Gravel deposits of uncertain origin near north end of Galbraith Lake basin. Probably formed during wastage of glacier ice as kame deposits against glacier front or as deltaic deposits in high-level lakes dammed by glacier.

**mv** - DEPOSITS ON FLOORS OF MOUNTAIN VALLEYS—Include alluvium, talus rubble, colluvium, solifluction deposits, and glacial drift that form deposits too small to map individually. Mapped only in narrow mountain valleys near south margin of map.

**sa** - SANDY BASIN-FILLING DEPOSITS—Generally stratified; ranges from silty fine sand to coarse sand with granules and sparse small pebbles. Forms low (4–8 m) terraces bordering modern flood plains of sandy alluvium (al–sa) in sedimentary basins behind moraine dams in Itkillik and Atigun River valleys. Also forms gently sloping, poorly drained surfaces around Galbraith Lake. Commonly includes lacustrine, deltaic, fluvial, and (or) eolian deposits that are too small or inconspicuous to map separately.

**(sa)** - THIN SANDY BASIN-FILLING DEPOSITS—Sandy deposits, as described above, near north

end of sand basin in Itkillik River valley. Deposit west of river forms westward-tapering wedge above lateral moraine of latest Itkillik advance. Deposit east of river is draped over bedrock knob.

**si** - ICE-RICH SILT DEPOSITS—Silt up to several meters thick, derived from air fall loess mixed with solifluction deposits. Abundant ice present as disseminated grains and as lenses and wedges. Numerous small thaw lakes on surface. Occupies elongate basins along drainage swales. Form thick and extensive mappable units only on deposits of Sagavanirktok River age.

## **GLACIAL DEPOSITS**

Unit designations in parentheses indicate thin and discontinuous glacial deposits that overlie bedrock

### **Itkillik Glaciation**

**ika** - ACTIVE KETTLES—Kettle depressions in drift of Itkillik age that appear to be actively enlarging. Distinguished by turbid water, deep-seated flows and slumps around margins, and highly unstable flanks that commonly steepen downward to water edge.

**id** - DRIFT OF ITKILLIK AGE, UNDIFFERENTIATED—Unsorted to poorly sorted, generally nonstratified, compact bouldery till. Mixed sand-to-clay matrix, with silt generally dominant. Contains local meltwater-washed ice-contact deposits of moderately sorted sandy gravel.

**id3** - DRIFT OF LATEST ITKILLIK READVANCE—Till and ice-contact deposits, as described above. Forms arcuate to lobate deposits within Itkillik valley, north of Galbraith Lake, and at east end of Atigun canyon. Galbraith and Itkillik moraines have abundant fine-grained matrix, and they enclose extensive sandy basin-filling deposits (unit sa). Atigun glacier dammed similar basin fill in upper valley of Sagavanirktok River.

**id3B and id3A** - DRIFT SUBUNITS OF LATEST ITKILLIK READVANCE—Older and younger moraines, respectively, of latest Itkillik advance in Itkillik River valley and north of Galbraith Lake.

**id2** - DRIFT OF ITKILLIK PHASE II—Till and ice-contact deposits, as described above. Form narrow-crested (3–5 m) end moraines, prominent knob and kettle terrain, and conspicuously channeled outwash trains. Flanking slopes are as steep as 18°–23°. Crests and upper slopes lack loess and solifluction cover, and exposed stones are only slightly weathered. Most swales lack solifluction deposits.

**id2B and id2A** - SUBUNITS OF ITKILLIK PHASE II DRIFT—id2A and id2B are older and younger advances, respectively, of Itkillik II age, in Itkillik River valley, between Toolik and Galbraith lakes, and in Sagavanirktok River valley southeast of Slope Mountain. Younger drift sheet commonly is distinguished from older drift by steep moraine fronts and associated outwash trains in valley centers and by flanking melt-water channels along valley sides. Melt-water from glaciers of younger advance has locally eroded drift of older advance.

**id1** - DRIFT OF ITKILLIK I AGE—Till and melt-water deposits, as described above. Morphology irregular, but smoother than on features of Itkillik II age. Moraine crests 5–10 m wide; flanking slope angles as steep as 15°–21°, but lower slopes are smoothed by solifluction. Erratic boulders common, and topographic crests commonly have exposures of bare gravel.

**id1B and id1A** - SUBUNITS OF ITKILLIK I DRIFT—id1A and id1B are drift deposits of older and younger advances, respectively, of Itkillik I age, north of Toolik Lake and near head of Kuparuk River. Conspicuous melt-water channel system separates the older and younger drift components north of Toolik Lake.

**io3** - OUTWASH OF LATEST ITKILLIK READVANCE—Moderately well sorted sandy gravel. Generally lacks loess or peat cover, and oxidized to only 20–30 cm depth. Occurs in front of or marginal to drift lobes of latest Itkillik II advance. Forms conspicuous terraces along Itkillik and Sagavanirktok rivers.

**io2** - OUTWASH OF ITKILLIK PHASE II—Sandy gravel, as described above. Stones etched, fractured, and pitted to 30–40 cm below surface; matrix oxidized to 30–45 cm depth. Forms extensive aprons and valley trains in front of or along flanks of Phase II moraines.

**io2B and io2A** - SUBUNITS OF ITKILLIK PHASE II OUTWASH—io2A and io2B are outwash associated with older and younger moraines, respectively, of Itkillik II age. The younger outwash forms trains that originate at fronts of id2B moraines and are inset within drift of id2A age.

**io1** - OUTWASH OF ITKILLIK PHASE I—Sandy gravel, as described above, generally with thin to moderate (0.3 to 2.5 m) loess and solifluction cover. Upper 1–1.5 m oxidized, with silt illuviation and weathered stones. Forms discontinuous low terraces along Toolik River near north margin of map.

**io1A** - SUBUNIT OF ITKILLIK PHASE I OUTWASH—Outwash of older Itkillik Phase I advance. Mapped only near Kuparuk River near north margin of map.

**i-c** - ICE-CONTACT DEPOSITS—Moderately well sorted coarse gravel to sandy fine gravel, with sparse boulders and some inclusions of poorly sorted till; collapse structures common. Upper surfaces irregular to terrace-like with abundant kettles; becoming sinuous (esker-like) east of Itkillik River and on drift lobe at east end of Atigun canyon. Surface boulder litter common where deposited by melt-water streams flowing beneath glacier; steep, bouldery ice-contact facies present where deposition was against glacier flank.

**igl?** - GLACIAL-LAKE DEPOSITS—Fine-grained sediments possibly deposited in lakes as veneers over glacial drift of Itkillik II age in Itkillik River valley and over drift of Itkillik II advance near Galbraith Lake. Probably thicken toward valley centers and thin in upslope direction.

### **Sagavanirktok River Glaciation**

**sd** - DRIFT OF SAGAVANIRKTOK RIVER AGE, UNDIFFERENTIATED—Till and melt-water deposits, probably as described above; entirely covered by eolian silt (loess) on ridge crests and by stony silt and organic silt (solifluction deposits) on flanking slopes. Forms distinct but very subdued nested moraine ridges 50–100 m high, with crests 150–300 m wide and flanking slopes generally 2° to 4°. Large, erratic boulders sparsely scattered on moraine crests and upper slopes.

**sd 2** - DRIFT OF SAGAVANIRKTOK RIVER AGE; LATE ADVANCE—Poorly sorted, nonstratified bouldery till, probably with local patches of moderately well sorted gravel (melt-water

deposits). Forms subdued moraine topography intermediate in character between that of Itkillik drift and that of older Sagavanirktok River age. Some ridge crests lack loess and solifluction cover; they expose weathered residual gravel (resistant lithologies from which finer sediments have been eroded). Mapped along upper Kuparuk drainage and its west valley side. May also occur along Toolik River near north margin of map.

**so2** - OUTWASH OF LATE SAGAVANIRKTOK RIVER ADVANCE—Moderately well sorted and stratified oxidized sandy gravel. Associated with moraine deposits and melt-water channels of sd2 age in upper Kuparuk valley.