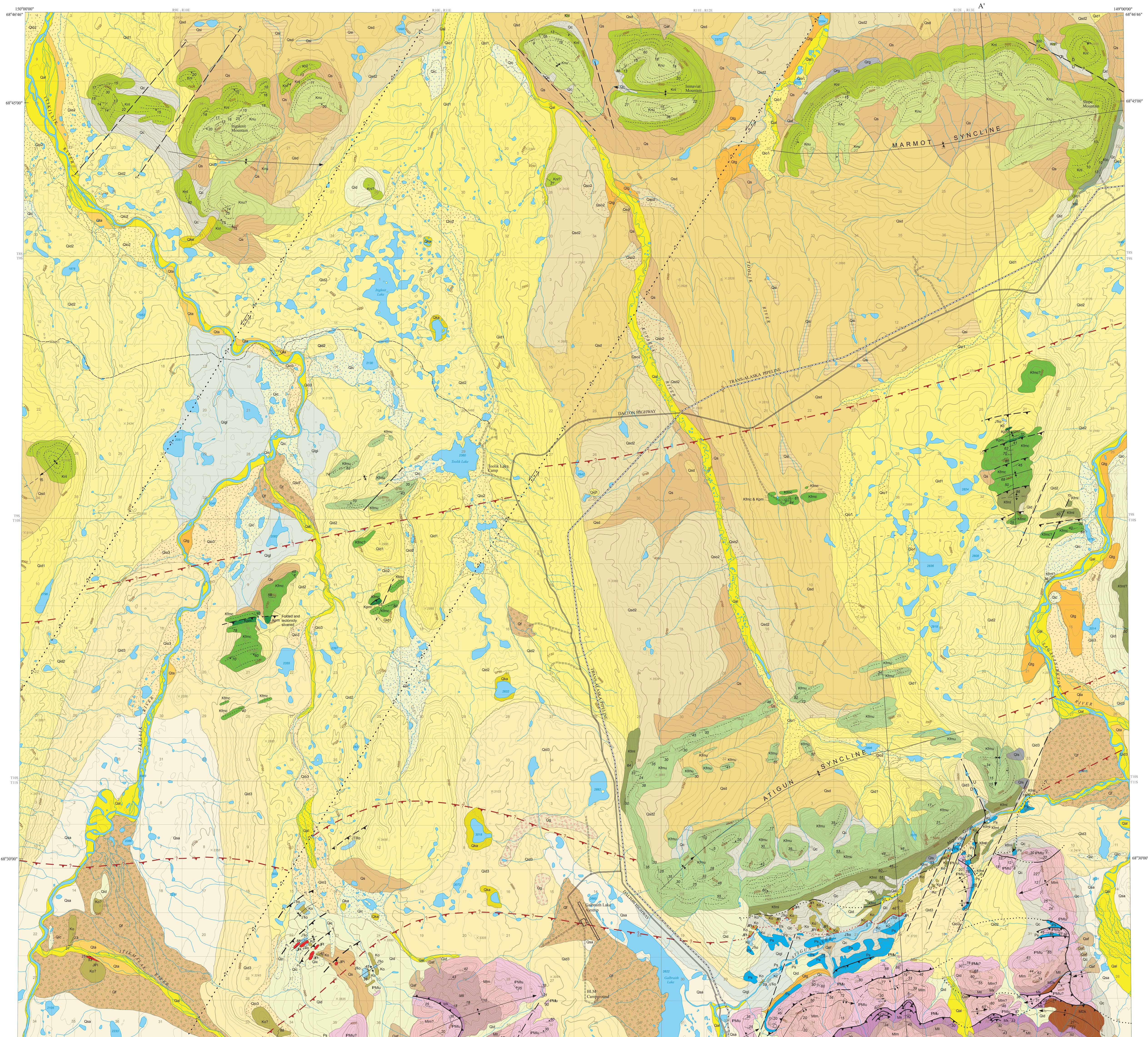
ALASKA DIVISION OF GEOLOGICAL
& GEOPHYSICAL SURVEYS

PRELIMINARY INTERPRETIVE REPORT 2002-2
HARRIS AND OTHERS (2002)



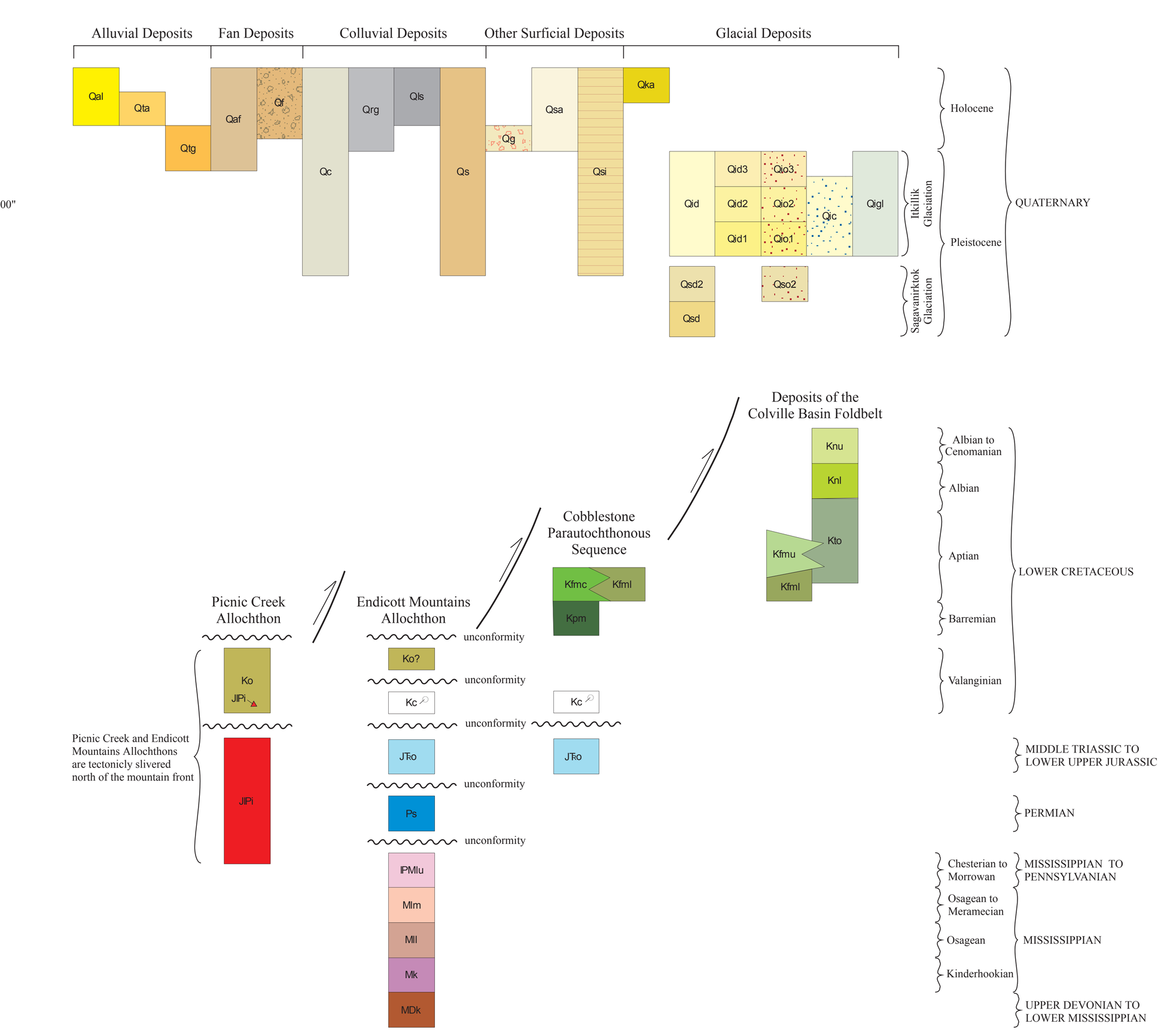
Base from U.S. Geological Survey
Philip Smith Mountains B-4, B-5, C-4, C-5, D-4, and D-5 quadrangles (1971, photorevised 1975).
Universal Transverse Mercator projection, zone 6.
1927 North American Datum

SCALE 1:63,360

CONTOUR INTERVAL
50 FEET NORTH OF 68°30'
100 FEET SOUTH OF 68°30'
DATUM IS MEAN SEA LEVEL

Approximate Mean Declination, 1971

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Surficial units simplified from Hamilton, 2002

ALLUVIAL DEPOSITS

Qal — **Alluvium, undifferentiated** (Holocene)—Modern channel and floodplain deposits; ranges from poorly sorted to moderately well stratified sand and gravel and includes sand facies and silt and peat facies.

Qta — **Low Alluvial Terrace Deposits** (Holocene)—Channel and floodplain deposits as described above, mantled with up to 2 m of sand, silt, and peat; generally vegetated and stands 1–2 m above modern floodplains.

Qtg — **Terrace Gravel** (Holocene)—Fluvial sand and gravel forming discontinuous surfaces 6–10 m above modern river levels. May bear cover of eolian silt 0.5–1.0 m thick.

FAN DEPOSITS

Qaf — **Steep Alpine Fans** (Holocene)—Coarse, very poorly sorted, nonstratified to weakly stratified, subangular to subrounded, silty, sandy gravel at mouths of avalanche chutes and canyons.

Qf — **Fan Deposits, undifferentiated** (Holocene)—Active and inactive fan deposits of moderately sorted and stratified sandy gravel mapped at the mouths of rivers. Deposits mapped along the west side of Galbraith Lake are fan-delta deposits consisting of fan gravel near valley walls, grading into deltaic and lacustrine facies.

COLLUVIAL DEPOSITS

Qc — **Colluvium, undifferentiated** (Pleistocene to Holocene)—Mixed talus (angular bedrock debris) and solifluction deposits (as described below), in sheets or aprons on upper slopes.

Qrg — **Rock-Glacier Deposits** (Holocene)—Very poorly sorted, nonstratified, coarse, angular rock debris, commonly with matrix of silt and fine rubble. Where active, contains abundant interstitial ice.

Qls — **Landslide Deposits** (Holocene)—Unsorted rock debris forming lobes associated with detachment scars farther upslope.

Qs — **Solifluction Deposits** (Pleistocene to Holocene)—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.

OTHER DEPOSITS

Qg — **Gravel, undifferentiated** (Holocene)—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.

Qsa — **Sandy Basin-Filling Deposits** (Holocene)—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 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.

Qsi — **Ice-rich Silt Deposits** (Pleistocene to Holocene)—Silt up to several meters thick, derived from airfall 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.

GLACIAL DEPOSITS

Itkillik Glaciation

Qka — **Active Kettles** (Holocene)—Deposits of kettle depressions in drift of Itkillik age that appear to be actively enlarging. Depressions are marked by turbid water, deep-seated flows and slumps around margins, and highly unstable flanks that commonly steepen downward to water edge.

Qid — **Drift of Itkillik Age, undifferentiated** (Pleistocene)—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.

Qid3 — **Drift of Latest Itkillik Readvance** (Pleistocene)—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.

Qid2 — **Drift of Itkillik Phase II** (Pleistocene)—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.

Qid1 — **Drift of Itkillik I Age** (Pleistocene)—Till and meltwater deposits, as described above. Morphology irregular, but smoother than on features of Itkillik II age. Moraine crests 5–10 m wide.

Qio3 — **Outwash of Latest Itkillik Readvance** (Pleistocene)—Moderately well sorted, sandy gravel. Generally lacks loess or peat cover. Occurs in front of or marginal to drift lobes of latest Itkillik II readvance. Forms conspicuous terraces along Itkillik and Sagavanirktok Rivers.

Qio2 — **Outwash of Itkillik Phase II** (Pleistocene)—Sandy gravel, as described above. Forms extensive aprons and valley trains in front of or along flanks of Phase II moraines.

Qio1 — **Outwash of Itkillik Phase I** (Pleistocene)—Sandy gravel, as described above, generally with thin to moderate (0.3–2.5 m) loess and solifluction cover. Forms discontinuous, low terraces along Toolik River near north margin of map.

Qic — **Ice-Contact Deposits** (Pleistocene)—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 terracelike 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 meltwater streams flowing beneath glacier; steep, bouldery ice-contact faces present where deposition was against glacier flank.

Qigl — **Glacial-Lake Deposits** (Pleistocene)—Possible fine-grained lacustrine sediments deposited as veneers over glacial drift of Itkillik II age in Itkillik River valley and over drift of Itkillik II readvance near Galbraith Lake. Probably thicken toward valley centers and thin in upslope direction.

Sagavanirktok River Glaciation

Qsd2 — **Drift of Sagavanirktok River Age; late advance** (Pleistocene)—Poorly sorted, nonstratified, bouldery till, probably with local patches of moderately well sorted gravel (meltwater deposits). Forms subdued morainal topography intermediate in character between that of Itkillik drift and that of older Sagavanirktok River age.

Qsd — **Drift of Sagavanirktok River Age, undifferentiated** (Pleistocene)—Till and meltwater 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 morainal ridges 50–100 m high, with crests 150–300 m wide.

Qso2 — **Outwash of Late Sagavanirktok River Advance** (Pleistocene)—Moderately well sorted and stratified, oxidized, sandy gravel. Associated with morainal deposits and meltwater channels of Qsd2 age in upper Kuparuk valley.

BEDROCK UNITS

DEPOSITS OF THE COLVILLE BASIN FOLDBELT

Knu — **Nanushuk Formation, upper part** (revised nomenclature, Mull and others, 2002b) (Albian to Cenomanian)—Dominantly nonmarine, gray to light gray sandstone (lithic and chert arenite) and quartz- and chert-pebble conglomerate interbedded with poorly exposed, dark gray, carbonaceous shale and coal. Top of unit not exposed in map area.

Knl — **Nanushuk Formation, lower part** (revised nomenclature, Mull and others, 2002b) (Albian)—Dominantly marine, gray to greenish-gray, very fine- to fine-grained sandstone (lithic arenite), and minor conglomerate. Top of unit intertongues with upper Nanushuk.

Kto — **Torok Formation** (Aptian–Albian)—Dark gray to black silty shale, mudstone, and clay shale, with interbedded thin-bedded siltstone and very-fine-grained sandstone in upper part. Top of unit gradational and intertongues with lower Nanushuk; base not exposed.

Kfmu — **Fortress Mountain Formation, upper part** (Aptian)—Gray to gray-green conglomerate and lithic sandstone, in massive units up to 18 m thick, and dark gray to black siltstone form the resistant ridges and cuestas of Atigun Syncline. Conglomerate is dominated by chert clasts with lesser amounts of mafic igneous and sandstone or quartzite clasts, and occasional limestone and shale clasts. Individual units thin and become finer grained rapidly to the north or northeast. Top of unit is a Holocene erosion surface but regionally intertongues with and is in part correlative with the lower part of the Torok Formation.

Kfml — **Fortress Mountain Formation, lower part** (Aptian)—Predominantly dark gray to black siltstone and lesser thin beds of very fine-grained lithic sandstones. Unit characterized by laterally continuous beds often defined by calcareous siltstone nodules in lower part; becomes progressively coarser grained and gradational with the upper Fortress Mountain Formation. Top of unit mapped at the bottom of the lowest cliff-forming, coarse-grained sandstone and conglomerate bed. In Atigun Gorge the basal contact is probably an angular unconformity overlying the structurally complicated Okpikruak Formation of the Picnic Creek allochthon, and possible backthrust relationships over the rocks of the Endicott Mountains allochthon.

COBBLESTONE PARAUTOCHTHONOUS SEQUENCE

Kfmc — **Cobblestone Member of Fortress Mountain Formation** (revised nomenclature, Mull and others, 2002a) (Aptian)—Dark, greenish-gray lithic sandstone and pebble to cobble conglomerate often with conspicuous light- to cream-weathering leached chert or tuff grains that give a light-colored appearance to the otherwise dark colored lithic sandstone. Medium- to thick-bedded in amalgamated turbidite units characterized by debris-flow deposition; carbonaceous plant debris abundant in some beds contains flakes of tasmanite. The Cobblestone Member is apparently older than and stratigraphically underlies the main complex of the Fortress Mountain Formation as mapped in the Colville Basin foldbelt. Top of unit not exposed in map area but to the west is overlain by Torok Formation at a relatively sharp contact; has relatively sharp basal contact with underlying unnamed phosphatic-manganiferous shale.

Kfml — **Fortress Mountain Formation, lower part** (Aptian)—Dark gray to black siltstone and lesser thin beds of very fine-grained lithic sandstones with interbedded calcareous siltstone nodules. Poorly exposed in the eastern side of map area in thrust-repeated section of Cobblestone sandstone. Extensive covered intervals and imbricate thrust faulting make relationships between the lower Fortress Mountain, Cobblestone sandstone, and Torok shales difficult to distinguish, but it appears that the lower Fortress Mountain is transitional with Torok shales to the north and west.

Kpm — **Unnamed phosphatic-manganiferous shale** (Barremian)—Hard, bioturbated shale with conspicuous reddish-brown, manganiferous weathering sheen.

Kc — **Buchia limestone coquina** (Valanginian)—Distinctive reddish-brown weathering, thin-bedded limestone, with thin interbeds and partings of dark gray to black, fissile shale, composed entirely of the pelecypod *Buchia sublaevis*. One exposure in rubble bank overlying the Otuk Formation in obscure, small gully north of Cobblestone ridges, west of the Sagavanirktok River.

JTRo — **Otuk Formation** (Middle Triassic to lower Upper Jurassic) (Oxfordian)—Thinly interbedded, organic-rich, fossiliferous limestone and shale; obscure rubble exposure in small gully north of Cobblestone ridges, west of the Sagavanirktok River. Triassic part of formation contains abundant flat Upper Triassic pelecypods *Monotis* sp. and *Halobia* sp. Organic-rich black marl and fissile paper shale dug from bank is probable Blankenship Member.

PICNIC CREEK ALLOCHTHON

Ko / JIPi — **Okpikruak Formation melange** (Valanginian)—Greenish-gray to medium-dark gray, thin- to thick-bedded graywacke, very finely micaceous, with rhythmically interbedded dark gray to black mudstone and shale; formation generally sheared and contorted; pelecypods from this unit have been identified as *Buchia sublaevis*. Unit contains scattered exotic, large, angular blocks and rounded boulders of Imnaitchiak Chert.

JIPi — **Imnaitchiak Chert** (Pennsylvanian to Jurassic)—Yellowish-orange weathering, gray to greenish- and bluish-gray and occasional maroon thin-bedded chert and silicified mudstone, with interbedded siliceous shale. Unit commonly contorted and associated with Okpikruak graywackes as angular blocks up to 40 m long and 5 m high. One exposure (13 km west of Galbraith Lake, T11S, R10E, southeast corner of sec. 22) closely associated with the Imnaitchiak cherts is a 12-m-thick section of interbedded micritic limestone and black chert with sooty shale partings, which resembles rocks of the structurally higher Ipnavik River allochthon exposed in the Killik River area 185 km west of the map area (Mull and others, 1994).

ENDICOTT MOUNTAINS ALLOCHTHON

Ko? — **Okpikruak Formation** (Valanginian)—Greenish to medium-dark gray, thin- to thick-bedded, slightly micaceous graywacke with rhythmically interbedded mudstone and shale. Only remnants of this unit are present at the mountain front and whether it is part of the Picnic Creek or Endicott Mountains allochthons is uncertain; its close association, in places, with the Otuk Formation suggests that it may be present on the Endicott Mountains allochthon in this area.

Kc — **Buchia limestone coquina** (Valanginian)—Distinctive reddish-brown weathering, thin-bedded limestone, with thin interbeds and partings of dark gray to black, fissile shale, composed entirely of the pelecypod *Buchia sublaevis*. Well exposed in Atigun Gorge, commonly structurally infolded with upper part of the underlying Otuk Formation.

JTRo — **Otuk Formation** (Middle Triassic to lower Upper Jurassic)—Black, fossiliferous, organic-rich limestone, siliceous limestone, and organic-rich black, sooty shale, with abundant *Monotis* sp. and *Halobia* sp. pelecypods (Triassic); top of unit is the Blankenship Member (Lower to lower Upper Jurassic)—organic-rich black shale with rare small (½ cm diameter) pelecypod *Otapiria tailleuri*. Unit is commonly intensely deformed; disconformably overlies the Siksikpuk Formation.

Ps — **Siksikpuk formation** (Permian)—Upper part dominantly black, fissile, clay shale with scattered barite and siderite nodules and concretions; lower part is distinctive yellowish-brown weathering, greenish-gray calcareous siltstone. Base of the unit is exposed in Atigun Gorge and is disconformable with the underlying Lisburne Group; increasingly thrust-imbricated to intensely folded upsection.

IPMlu — **Lisburne Group, upper part** (Chesterian to Morrowan)—Dominantly cliff-forming, light-gray weathering, massive, skeletal wackestone with lesser thin lenses of skeletal packstone and grainstone; abundant nodules and stringers of dark gray to black chert.

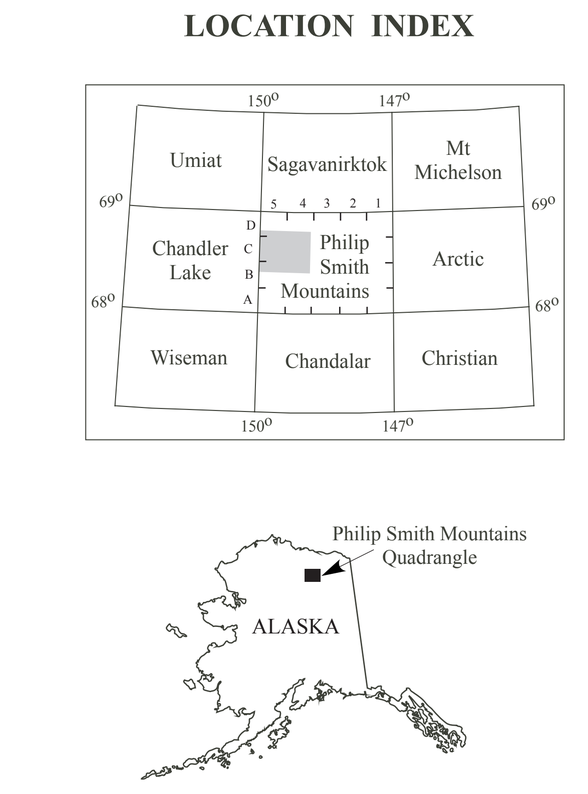
Mlm — **Lisburne Group, middle part** (Osagean to Meramecian)—Lower half of unit is ledge- and slope-forming, dark gray, massive skeletal packstone and thin-bedded argillaceous lime mudstone; chert nodules occur throughout. Middle part of unit is a cliff-forming, medium-brownish-gray, thick-bedded skeletal packstone. The top of this unit is slope-forming brownish gray to black, platy to medium-bedded skeletal packstone and wackestone, and lime mudstone. Overall this unit is better exposed than most of the lower part but is recessive relative to the upper part of the Lisburne Group.

Mll — **Lisburne Group, lower part** (Osagean)—Predominantly slope-forming unit with the base being a cliff of light gray weathering, medium gray, thick-bedded to massive skeletal grainstone overlain by a darker weathering slope of poorly exposed platy- to thin-bedded, dark-brownish-gray skeletal wackestone and lime mudstone.

Mk — **Kayak Shale** (Kinderhookian)—Dark-gray to black, fissile, shale and dark gray bioturbated siltstones; near top of unit orange-brown weathering, thin, fossiliferous limestone beds of packstone and wackestone with interbedded shales. Forms subdued slopes and commonly acts as detachment surface for Lisburne thrust sheets. Unit transitional with overlying Lisburne Group.

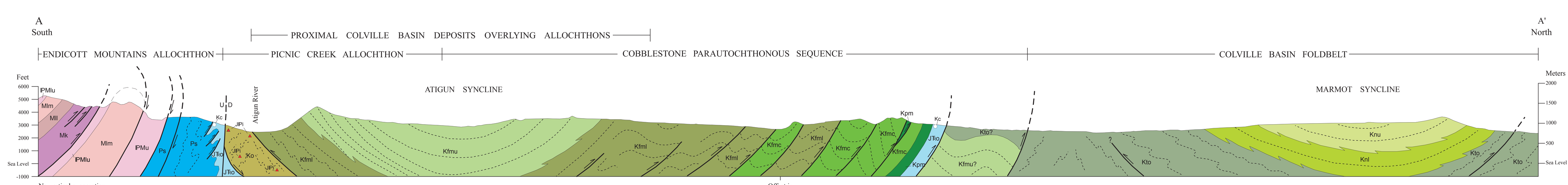
MDk — **Kanayut Conglomerate** (Upper Devonian to Lower Mississippian)—Interbedded black, dark gray, pale green, and minor maroon shale and slate with light tan quartzite, and medium gray and light tan granule–pebble conglomerate. This unit represents only the uppermost Kanayut Conglomerate (Stuver Member) and is transitional with the overlying Kayak Shale.

LOCATION INDEX



MAP SYMBOLS

- Contact—dashed where approximately located; dotted where concealed.
- Fault—dashed where inferred or approximately located; dotted where concealed; queried where uncertain; relative movement shown where known.
- Thrust fault—sawteeth on upper plate; dashed where inferred or approximately located; dotted where concealed; queried where uncertain. Overturned where indicated.
- Major thrust fault bounding structural provinces—sawteeth on upper plate; dashed where inferred or approximately located; dotted where concealed.
- Syncline showing trace of axial plane and direction of plunge; dashed where inferred.
- Anticline showing trace of axial plane and direction of plunge; dashed where inferred.
- Overturned anticline showing trace of axial plane and direction of plunge; dashed where inferred.
- Multiple minor folds showing trace of axial plane and direction of plunge.
- Traceable beds
- 60 Strike and dip of beds
- Vertical beds
- 30 Strike and dip of overturned beds
- Strike and dip of bed overturned 240°
- Approximate strike and direction of dip of beds
- 80 Strike and dip of cleavage
- 40 Direction of plunge of lineation
- Aufeis



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Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under assistance award number 01HQAG0054. The views contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

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GEOLOGIC MAP OF THE DALTON HIGHWAY (ATIGUN GORGE TO SLOPE MOUNTAIN) AREA, SOUTHERN ARCTIC FOOTHILLS, ALASKA

By
E.E. Harris, C.G. Mull, R.R. Reifenstuhl, and Simone Montayne

2002