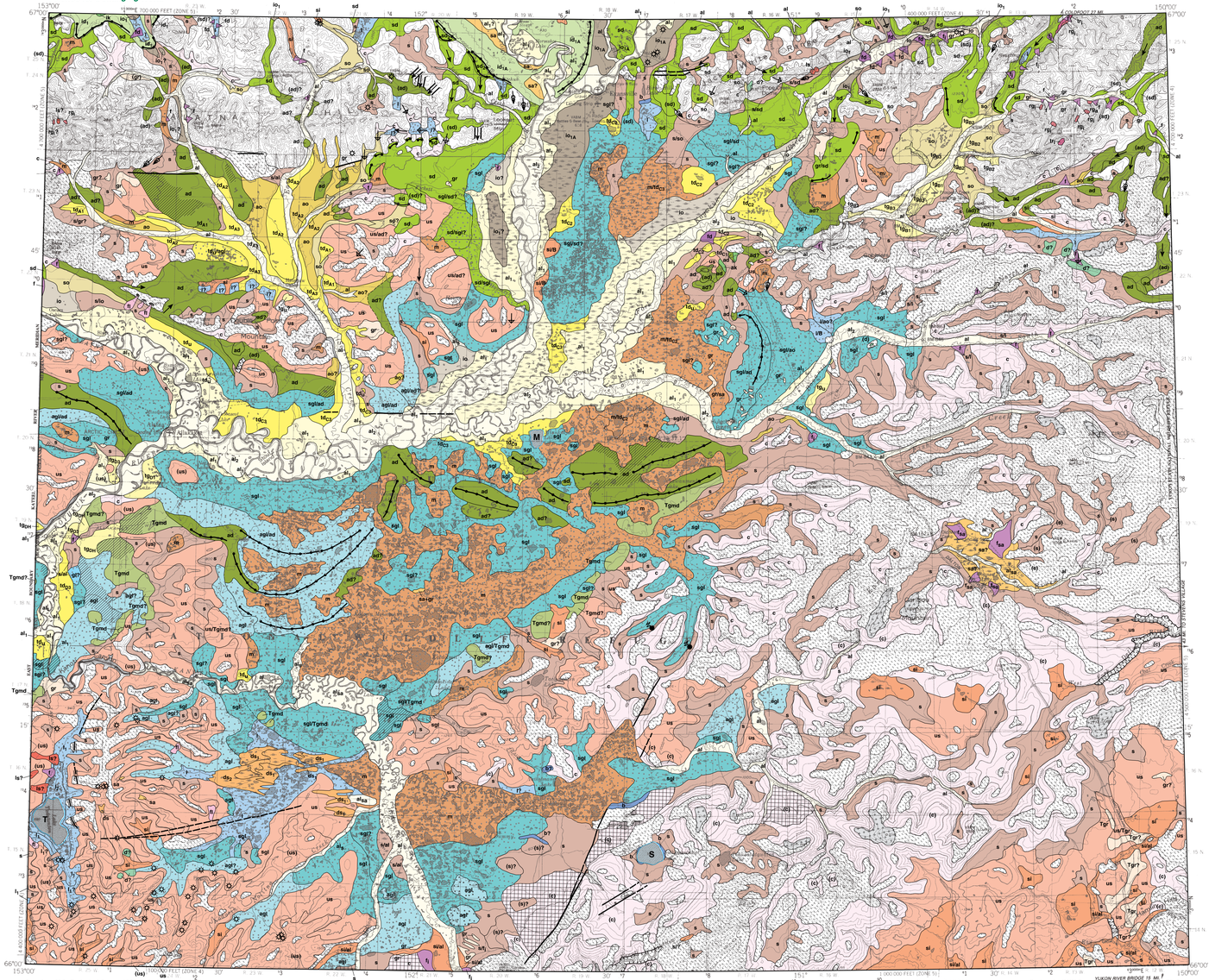
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES MAP MF–2409
Version 1.0

Surficial geologic map of the Bettles quadrangle, Alaska

Pamphlet accompanies map



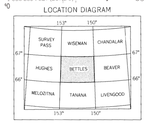
Base from U.S. Geological Survey, 1956; limited revisions, 1984
Universal Transverse Mercator, zone 5

QUADRANGLE LOCATION

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
1984 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 25 TO 27 EAST



Geology by W.W. Patton, Jr. and T.P. Miller, 1966-70; R.A. Kreig and R.D. Reger, 1972-75; and T.D. Hamilton, 1962-66, 1970-74, and 1983-87
Digital representation by Earth Satellite Corporation, 1999; Greenhorne & O'Mara, 1999; K.A. Labay, Raytheon ITSS contractor, 2000-2002
Edited by Jane S. Ciener
Approved for publication September 30, 2002

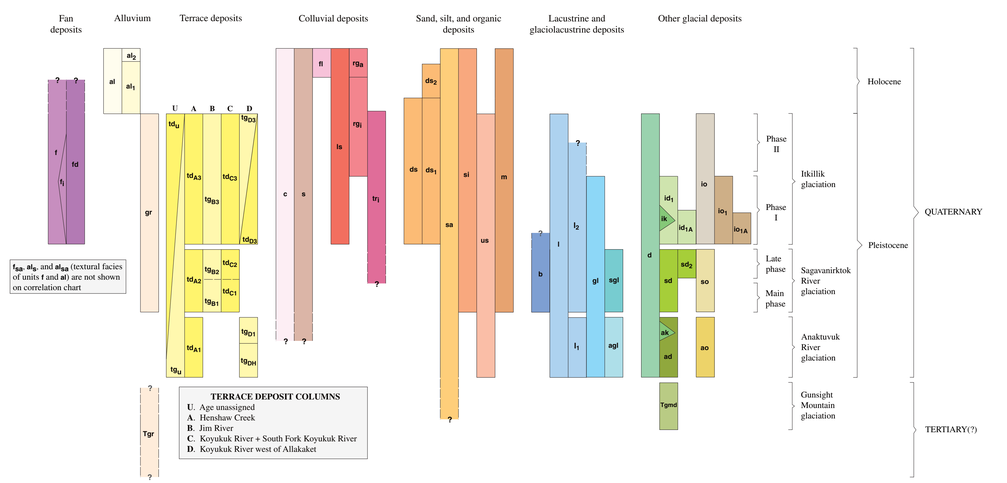
SURFICIAL GEOLOGIC MAP OF THE BETTLES QUADRANGLE, ALASKA

By

Thomas D. Hamilton

2002

CORRELATION OF MAP UNITS



f_{sa}, al_9, and al_{sa} (textural facies of units **f** and **al**) are not shown on correlation chart

TERRACE DEPOSIT COLUMNS
U. Age unassigned
A. Henshaw Creek
B. Jim River
C. Koyukuk River + South Fork Koyukuk River
D. Koyukuk River west of Allakaket

LIST OF MAP UNITS

[See pamphlet for detailed descriptions. Units queried where uncertain.]

FAN DEPOSITS

f — **Fan deposits**—Range from coarse gravel (mountain valleys) to gravelly sand and silt (Koyukuk basin)
f_i — **Inactive fan deposits**
f_{sa} — **Sandy fan deposits**—Dominantly sand- to granule-sized
fd — **Fan-delta deposits**—Alluvial-fan deposits that grade distally into lacustrine beds

ALLUVIUM

al — **Alluvium, undivided**—Coarse gravel to sandy fine gravel and gravelly sand. Locally includes fan and low terrace deposits too small to map separately
al_9 — **Fine-grained alluvium**—Along slow-moving streams
al_{sa} — **Sandy alluvium**—Along slow-moving streams
al_2 — **Modern alluvium**—Gravel and sandy gravel; generally unvegetated
al_1 — **Low alluvial terrace deposits**—Gravel and sandy gravel, mantled with thin silt, sand, turf, and peat
gr — **Gravel deposits, other**—Gravelly erosion remnants of obscure composition and origin
Tgr — **Quartzose gravel of inferred Tertiary age**—Rounded quartz pebbles and small cobbles in nearly pure quartz sand

TERRACE DEPOSITS

td_U — **Terrace deposit**—Alluvial gravel; commonly intergrading or mantled with fluvial, deltaic, lacustrine, or organic deposits
tg_U — **Terrace gravel**—Alluvial gravel, sandy gravel, and floodplain deposits; commonly mantled by loess, muskeg, and thaw-lake sediments

A. Terrace deposits along Henshaw Creek

td_{A3} — **Terrace deposit, low-level (late Pleistocene)**—Alluvial gravel and sandy gravel, forming terraces 8-14 m high that decrease in height downstream
td_{A2} — **Terrace deposit, intermediate-level (middle Pleistocene)**—Gravel and finer sediments, forming terraces up to 35 m high that decrease in height downvalley
td_{A1} — **Terrace deposit, high-level (early Pleistocene)**—Gravel and finer sediments, forming terraces up to 75 m high that decrease in height downvalley

B. Terrace deposits along Jim River

tg_{B3} — **Terrace gravel, low-level (late Pleistocene)**—Gravel and sandy gravel, forming terrace remnant 2-3 m above river
tg_{B2} — **Terrace gravel, intermediate-level (late middle Pleistocene)**—Gravel and sandy gravel, forming terraces 25-30 m high
tg_{B1} — **Terrace gravel, high-level (early middle Pleistocene)**—Gravel and sandy gravel, with thick (5 m or more) silt cover, forming dissected terraces about 50 m high

C. Terrace deposits along Koyukuk River (upvalley from Allakaket) and South Fork Koyukuk River

td_{C3} — **Terrace deposit, low-level (late Pleistocene)**—Sandy gravel, with some finer-grained deposits; muskeg cover locally thick and continuous. Forms terraces 5-10 m high that decline in height downvalley
td_{C2} — **Terrace deposit, intermediate-level (late middle Pleistocene)**—Terrace deposits about 20-25 m high with muskeg cover locally thick and continuous
td_{C1} — **Terrace deposit, high-level (middle Pleistocene)**—Terrace deposits about 40 m high along South Fork

D. Terrace deposits along Koyukuk River below Allakaket

tg_{D3} — **Terrace gravel, low-level (late Pleistocene)**—Alluvial gravel and sandy gravel, forming terraces 8-10 m high
td_{D3} — **Terrace deposit, low-level (late Pleistocene)**—Sandy gravel, with some finer-grained deposits. Near mouth of Kanuti River
tg_{D1} — **Terrace gravel, high-level (early Pleistocene)**—Alluvial gravel with silt cover, forming terrace remnants 50-60 m high
tg_{DH} — **Terrace gravel, highest-level (early Pleistocene?)**—Oxidized gravel capped by thick loess. Forms terrace remnants up to 120 m above Koyukuk River

COLLUVIAL DEPOSITS

c — **Colluvium, undivided**—Mixed solifluction deposits and talus rubble
s — **Solifluction deposits**—Poorly sorted stony silt and organic silt
fl — **Flow deposits**—Lobes of angular rock rubble in abundant silty matrix
ls — **Landslide deposits**—Angular rubble below detachment scars and slide tracks
rg_a — **Rock-glacier deposits, active**—Lobes of coarse angular rock debris with matrix of ice-rich silt and fine rubble
rg_i — **Rock-glacier deposits, inactive**—Coarse angular rock debris lacking interstitial ice. Surfaces weathered and partly vegetated
tr — **Talus rubble, inactive**—Angular rock debris along lower walls of mountain valleys. Surfaces weathered and partly vegetated

SAND, SILT AND ORGANIC (MUSKEG) DEPOSITS

ds — **Dune sand**—Fine to medium sand, commonly forming parabolic ridges
ds_2 — **Dune sand, younger and older components**—Where partly reactivated by wind
sa — **Sand deposits**—Sand with granules and sparse small pebbles; in grus-filled basins
si — **Ice-rich silt deposits**—Silt, commonly with ice-wedge polygons, in depressions and along valley centers
us — **Upland silt deposits**—Silt, organic silt, and slightly stony silt; commonly grades downslope into solifluction deposits
m — **Muskeg**—Organic deposits more than 1-2 m thick where drainage restricted

LACUSTRINE AND GLACIOLACUSTRINE DEPOSITS

b — **Beach deposits**—Sand and platy fine gravel; locally shoved into ridges
l — **Lacustrine deposits**—Fine sediments, grading into sand and gravel near former shorelines and river mouths
l_2 — **Lacustrine deposits, low-level (late to middle Pleistocene)**—Stratified silt and related deposits. Overlain by muskeg with abundant lakes
l_1 — **Lacustrine deposits, high-level (early Pleistocene)**—Stratified silt and related deposits forming poorly drained surfaces above bluffs 30 m high
gl — **Glacial-lake deposits, undivided**—Stratified silty deposits of uncertain age
sgl — **Glacial-lake deposits of Sagavanirktok River age (middle Pleistocene)**—Fine sediments grading into sand to fine gravel near former stream mouths
agl — **Glacial-lake deposits of Anaktuvuk River age (early Pleistocene)**—Stratified stony silt, forming erosion remnants that generally bear thick cover of ice-rich silt with numerous thaw ponds

OTHER GLACIAL DEPOSITS

d — **Drift, undivided**—Glacial deposits of uncertain age

Itkillik glaciation (late Pleistocene)

id_1 — **Drift of Itkillik Phase I**—Compact bouldery till with local ice-contact sand and gravel
id_{1A} — **Drift of Itkillik Phase IA**—Outermost moraine and associated drift of Itkillik complex
ik — **Kame and kame-terrace deposits**—Unusually thick and extensive water-washed sand and gravel
io — **Outwash of Itkillik age, undivided**—Valley trains of sandy gravel
io_1 — **Outwash of Itkillik Phase I**—Sandy gravel associated with drift of Itkillik I age
io_{1A} — **Outwash of Itkillik Phase IA**—Outwash train that originates at moraine of Itkillik IA age

Sagavanirktok River glaciation (middle Pleistocene)

sd — **Drift of Sagavanirktok River age**—Bouldery till and ice-contact gravel, generally covered by thick loess, solifluction, and muskeg deposits. Weathered gravel and erratic boulders exposed on some ridges and knolls
sd_2 — **Drift of Sagavanirktok River late phase**—Till and ice-contact deposits
so — **Outwash of Sagavanirktok River age**—Sandy gravel associated with end moraines of Sagavanirktok River age

Anaktuvuk River glaciation (early Pleistocene)

ad — **Drift of Anaktuvuk River age**—Bouldery till, with some coarse gravel
ak — **Kame terrace(?)**—Linear gravel-rich deposit
ao — **Outwash of Anaktuvuk River age**—Gravel and sandy gravel, associated with moraines of Anaktuvuk River age

Gunsight Mountain glaciation (Tertiary?)

Tgmd — **Drift of Gunsight Mountain age**—Till and ice-contact deposits, forming isolated erosion remnants

MAP SYMBOLS

- **Contact**—Dashed where approximately located or inferred
- **Fault**—Expressed in Quaternary sediments. Dashed where approximately located or inferred. Arrows indicate direction of lateral motion
- **Drainage channel**—Abandoned or underfit
- **Crest of morainal ridge**
- **Headwall scarp of debris flow**
- **Direction of glacier flow across topographic divide**
- **Direction of ice movement or meltwater drainage**— Associated with ice-scoured bedrock
- **Former glacial-lake outlet or drainage diversion**
- **U-shaped pass**—Where glacier crossed topographic divide
- **Spring**
- **Pingo**
- **Bedrock, undifferentiated**
- **Bedrock**—Exposed along canyon walls or margin of river terrace
- **Near-surface bedrock**—Generally covered by 1-2 m of soil, peat, loess, solifluction deposits, and rock debris; usually completely vegetated
- **Pediments**—North and east of Sithylemenkat Lake. Bear thin colluvial cover
- **Altiplanation terrace**
- **Surface and subsurface lacustrine deposits**
- **Heavily eroded surficial unit**
- **Lake**—M, Minnkokut; S, Sithylemenkat; T, Todatonten

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