ALASKA DIVISION OF GEOLOGICAL &
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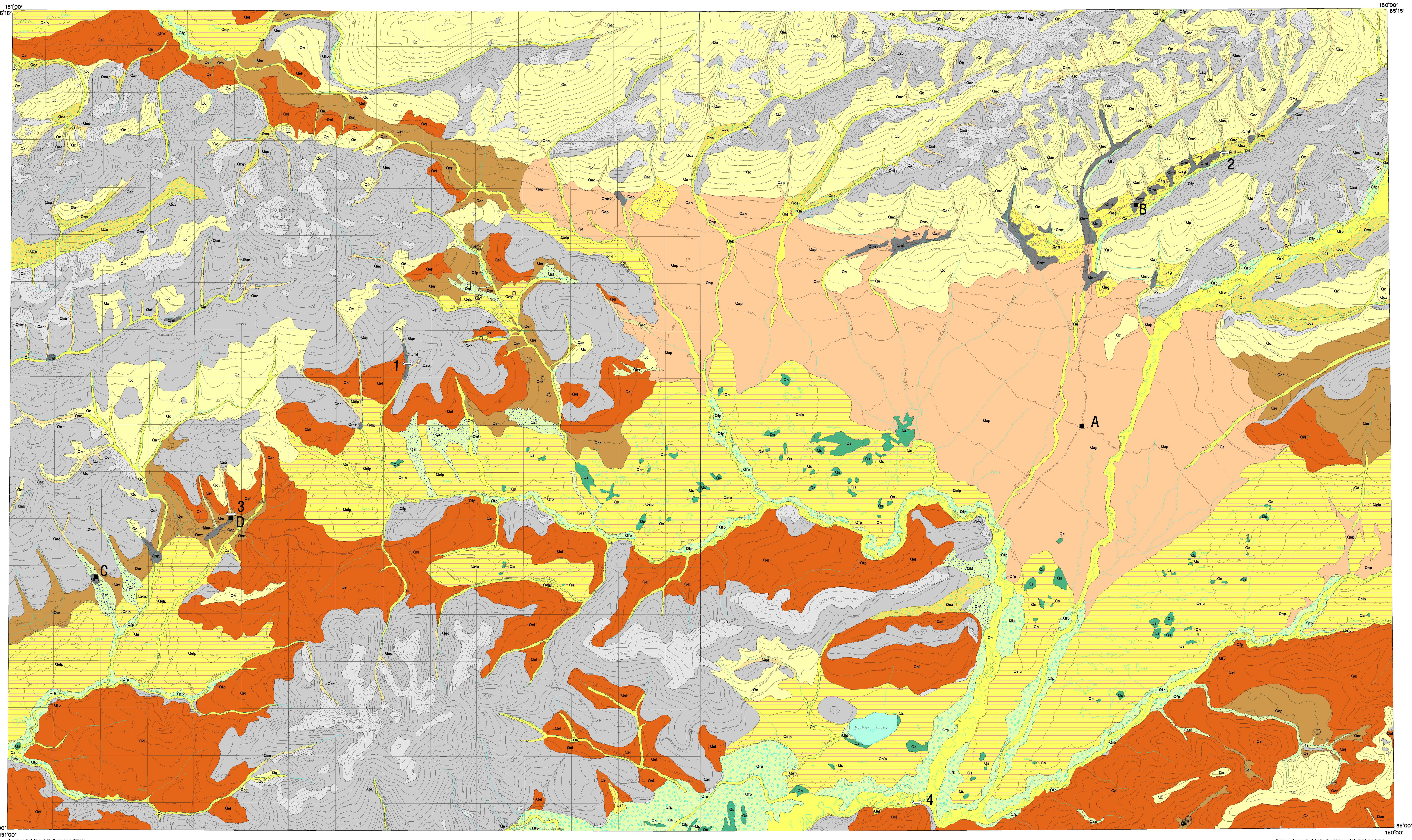
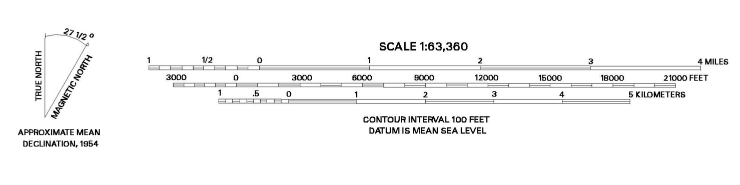
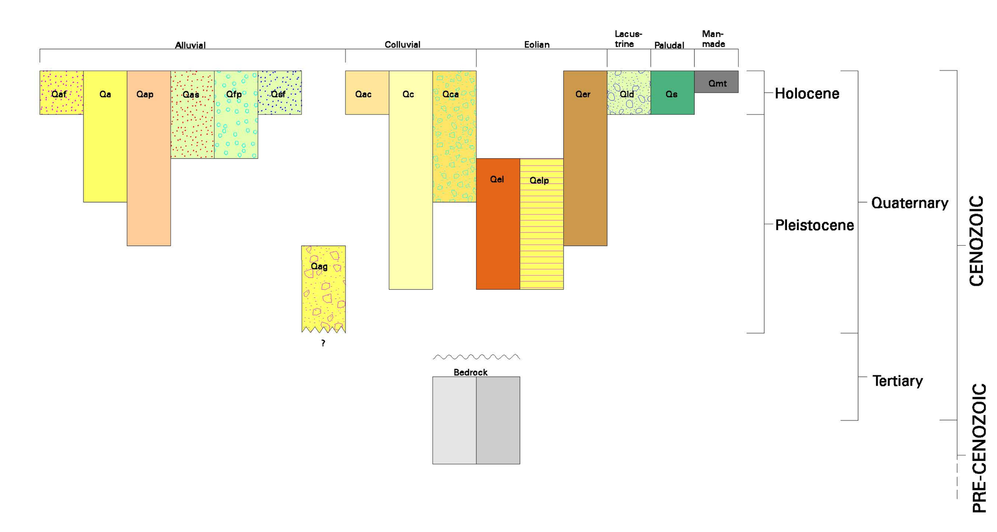



Base modified from U.S. Geological Survey Tanana A-1 and A-2 Quadrangle, Alaska (1952). Universal Transverse Mercator projection, 1927 North American datum.

Sources of geologic data: field mapping and photointerpretation by D.S. Pinney (1997); 1:250,000-scale mapping of Tanana Quadrangle by Chapman and others (1982); unpublished geology by D.M. Hopkins and B. Taber, (1962). This work carried out in cooperation with the U.S. Geological Survey, Agreement # 1434-HQ-97-AG-1785, June 1996-May 1997. Electronic cartography by A.G. Sturmann and D.S. Pinney.



## CORRELATION OF MAP UNITS




## DISCUSSION

The Tanana A-1 and A-2 quadrangles are located in the western part of the Yukon-Tanana upland between Yukon and Tanana rivers. The generally subdued landscape is dominated by three pluton-cored highlands: Roughtop Mountain and Manley Hot Springs Dome on the west and Eureka Dome in the far northeast corner. The principle drainage is Baker Creek, which flows from the highlands around Eureka across a broad, gently sloping basin and thence into Tanana River. The largest settlement in the area is Manley Hot Springs, which was established at the site of natural hot springs around the turn of the century in response to mining activity.

Stream valleys in this part of the Yukon-Tanana upland are spectacularly asymmetrical (Hopkins and Taber, 1962). North and east-facing slopes are consistently steep, while south and west-facing slopes are consistently gentle. The gentle slopes are ancient slip-off slopes, and their bedrock surfaces consist of a series of multiple strath terraces and discontinuous channels largely buried beneath aprons of redeposited loess and fans of colluvial debris (see stratigraphic sections B and C). Many of the terraces and channels have been stripped and mined for gold and, in the Tofty district, tin. Mining efforts target the gravel-bedrock contact, where gold and cassiterite (tin ore) have been concentrated by ancient streamflow. Detailed discussions of the genesis of gold in the map area can be found in Newberry and Clautice (1997) and Reifenstuhl and others (1997; 1998).

Gold-bearing placer deposits occur on buried benches in the Tofty district, and on elevated benches and in stream channels in the Eureka district. Measurements on imbricate clasts establish that paleocurrent directions at the head of Dalton Gulch in the Tanana A-2 Quadrangle are southerly from the headwaters of present-day Dalton Gulch. Imbrication on a bench in a mine pit indicates westerly flow from the head of Cache Creek valley or possibly even from the Baker Creek flats. Yeend (1990) argues for an ancient trunk drainage whose head is represented by the bench placers in the Eureka mining district and whose lower course is recorded by the buried placers of the Tofty mining district. This late Tertiary or early Pleistocene ancestral drainage system would have joined the Tanana far west of its confluence with modern Baker Creek. Deposition on slipoff slopes by southward-migrating streams is undoubtedly another important factor in the development of the placer gravels. Although the cause of valley asymmetry is not well understood, the successive benches that develop as the stream migrates laterally during downcutting may play a role in concentrating disseminated fine gold from more local bedrock sources, and may be the controlling factor in the low-grade placers of upper Boulder Creek.

Lower slopes and broad valley bottoms are extensively blanketed with permafrost-rich silt, especially in the Tofty district, and most early mining was carried out by sinking deep shafts through the fine-grained, frozen overburden into the pay gravels below. Some of these shafts were as much as 30 m deep in the Cache Creek area (Eakin, 1912; 1913). Recent mining operations at Dalton Gulch have exposed a thick sequence of frozen organic silt containing abundant plant and animal remains (see stratigraphic section D and faunal listing). The Dalton Gulch site has yielded one of the few *in situ* late Wisconsin faunas documented in Alaska. An AMS date obtained from tissue attached to *in situ* bones of a ground squirrel (97DP030-F24) near the base of the bone-bearing zone provides a reliable minimum limiting age for the assemblage of 33,260±670 yr B.P. (GX-23475).

The central part of the map area is dominated by an extensive alluvial plain composed of gravels shed principally from the highlands around Eureka. Numerous shallow streams in rapidly changing channels have incised the thick silt deposits that fill Baker Creek basin and deposited gravel well into Holocene time (see stratigraphic section A).

## REFERENCES CITED

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Yeend, Warren, 1989, Gold placers, geomorphology, and paleo-drainage of Eureka Creek and Tofty areas, Alaska: U.S. Geological Survey Bulletin 1946, p. 107-109.

## MAP SYMBOLS

- Contact
- Pingo, intact
- Pingo, collapsed
- Location of Quaternary stratigraphic section
- Location of vertebrate fossil site

Fossil fauna recovered from Tanana A-1 and A-2 quadrangles, central Alaska *[Rodent fossils were identified by G. H. Jarrell and C.J. Conroy of the University of Alaska Museum. Cervalces identified by P. Matheus of the Alaska Quaternary Center. Other large-mammal fossils were identified by R.A. Gangloff and K. May of the University of Alaska Museum.]*

| Locality | Name | Genus | Field number | Description | Provenance |
|---|---|---|---|---|---|
| 1 | Order Artiodactyla: | | | | |
| | Bison | *Bison sp.* | 97DP019-F1 | Partial metatarsal | Surface collection |
| | Unknown | *Unknown* | 97DP019-F2 | Bone fragment | Surface collection |
| | | *Unknown* | 97DP019-F3 | Bone fragment | Surface collection |
| 2 | Unknown | *Unknown* | 97DP020-F1 | Long bone fragment | Slopewash |
| | | *Unknown* | 97DP020-F2 | Skull (?) fragment | Slopewash |
| | Order Artiodactyla: | | | | |
| | Bison | *Bison priscus* | 97DP020-F3 | Left metatarsal, female (?) | Slopewash |
| 3 | Order Rodentia: | | | | |
| | Ground Squirrel | *Spermophilus sp.* | 97DP030-F13 | Skull | Slopewash |
| | | *Spermophilus sp.* | 97DP030-F24 | Anterior part of carcass | *In situ* |
| | | *Spermophilus sp. ?* | 97DP030-F16 | Humerus | Slopewash |
| | Collared Lemming | *Dicrostonyx sp.* | 97DP030-F17 | Partial maxillae | *In situ* |
| | Order Proboscidea: | | | | |
| | Mammoth | *Mammuthus primigenius* | 97DP030-F27 | Right lower M3 | *In situ* |
| | | *Mammuthus cf. M. primigenius* | 97DP030-F1 | DP3 maxillary tooth | *In situ* |
| | | *Mammuthus cf. M. primigenius* | 97DP030-F14 | Partial lower M3 | Drainage channel |
| | | *Mammuthus sp.* | 97DP030-F6 | Molar fragment | *In situ* |
| | | *Mammuthus sp.* | 97DP030-F20 | Cervical vertebra | *In situ* |
| | Order Artiodactyla: | | | | |
| | Giant elk (elk-moose) | *Cervalces* | 97DP030-F26 | Partial occiput | *In situ* |
| | Caribou | *Rangifer sp.* | 97DP030-F3 | Partial antler | *In situ* |
| | | *Rangifer sp.* | 97DP030-F12 | Distal end of left (?) metacarpal | Slopewash |
| | | *Rangifer sp.* | 97DP030-F21 | Right metacarpal | *In situ* |
| | | *Rangifer sp.* | 97DP030-F25 | Right metacarpal | *In situ* |
| | Bison | *Bison priscus* | 97DP030-F2 | Left radius | Slopewash |
| | | *Bison priscus* | 97DP030-F18 | Right lower M3 | *In situ* |
| | | *Bison priscus* | 97DP030-F19 | Right upper M2 | *In situ* |
| | | *Bison priscus* | 97DP030-F22 | Left metacarpal | *In situ* |
| | | *Bison priscus* | 97DP030-F23 | Right metacarpal | Slopewash |
| | | *Bison sp.* | 97DP030-F4 | Right femur | Drainage channel |
| | | *Bison sp.* | 97DP030-F8 | Cervical vertebra | *In situ* |
| | | *Bison sp.* | 97DP030-F9 | Cervical vertebra | *In situ* |
| | | *Bison sp.* | 97DP030-F10 | Cervical vertebra | *In situ* |
| | | *Bison sp.* | 97DP030-F11 | Prethoracic vertebra | *In situ* |
| | | *Bison sp.* | 97DP030-F15 | Juvenile metacarpal | Slopewash |
| 4 | Order Artiodactyla: | | | | |
| | Musk Ox | *Symbos cf. S. cavifrons* | 97DP051-F1 | Partial skull | Surface collection |

## DESCRIPTION OF MAP UNITS

### Alluvial Deposits

**Qaf** Alluvial fan deposits—Fan-shaped, heterogeneous mixtures of gravel with some sand and silt and few to numerous, subangular to rounded boulders, especially in proximal areas; clasts locally derived; may include debris-flow deposits; thick to thin bedded; surface smooth, except for numerous shallow, interconnected channels; locally covered by reworked silt

**Qa** Alluvium in modern stream channels—Elongate deposits of stratified gravel and sand with few to numerous boulders underlying active streams, floodplains, and associated low terraces; well sorted and medium to thick bedded, locally crossbedded; shows fining-upward cycles

**Qap** Alluvial plain deposits—Irregular blankets and low-angle fans of stratified gravel and sand with silt interbeds and few to numerous boulders underlying much of Baker Creek flats; well sorted and medium to thick bedded, locally crossbedded; surface flat to gently sloping with numerous shallow, interconnected channels; wood collected from an exposure in a gravel pit (map locality A) yielded a minimum limiting date of 2,565 ± 75 yr B.P., or 2,996 (2,734; 2,721) 2,211 calibrated yr B.P. at the 2 sigma level

**Qas** Silty alluvium in modern stream channels—Irregular, elongate deposits of stratified silt beneath modern channels and floodplains of streams draining loess-mantled slopes; may include fine-grained debris-flow deposits, especially in the upper reaches; moderately to well sorted and medium to thin bedded, locally crossbedded

**Qfp** Floodplain alluvium bordering modern streams—Elongate deposits of stratified pebble-cobble gravel and medium sand with few to numerous boulders forming modern floodplains and associated low (<3m) terraces; typically mantled by thin layer of silty overbank deposits; lower surfaces may be flooded during periods of maximum stream discharge; surface smooth to hummocky with local low scarps and bogs; commonly frozen

**Qsf** Silt fan deposits Fan—shaped deposits of dark brown to gray silt with some sand and angular to subrounded pebbles in proximal areas; may include fine-grained debris-flow deposits, especially in the upper reaches; thick to thin bedded; surface smooth, except for numerous shallow, interconnected channels; organic material recovered from underlying colluvium (map locality C) yielded a minimum limiting date of 3,140 ± 130 yr B.P., or 3,976 (3,375; 3,372; 3,357) 2,744 calibrated yr B.P. at the 2 sigma level (GX-23480)

**Qag** Old, high-level alluvial gravels—Irregular residual deposits of gold-bearing, pebble-cobble gravel with well rounded quartzite boulders up to 3 m diameter preserved on high interfluves in the Eureka Creek area; up to 4 m thick, but generally much thinner; locally extensively reworked by mining activity; organic material recovered from successive benches exposed in a placer cut in Doric Creek (map locality B) yielded minimum limiting dates of >36,130 yr B.P. (GX-23477), 36,650 + 3,490/-2,430 yr B.P. (GX-23478), and >42,770 yr B.P. (GX-23479)

### Colluvial Deposits

**Qac** Undifferentiated alluvial and colluvial valley-fill deposits—Fan-shaped and elongate heterogeneous mixtures of subangular rock fragments and gravel with some silt and sand deposited in upper stream courses primarily by brief, intense summer stream flow, debris flows, and gelifluction; surface smooth, except for local low scarps and shallow, steep-sided channels

**Qc** Undifferentiated colluvium—Irregular, heterogeneous blankets, aprons, and fans of angular to subrounded rock fragments, gravel, sand, and silt that are left on slopes, slope bases, or high-level surfaces by residual weathering and complex mass-movement processes, including rolling, sliding, flowing, gelifluction, and frost creep; probably perennially frozen; locally washed by meltwater and slope runoff; surface generally reflects configuration of underlying bedrock surface

**Qca** Colluvial apron and fan deposits—Apron- and fan-shaped, heterogeneous mixtures of angular rock fragments with trace to some gravel, sand, and silt deposited at the bases of steep walls of modern stream valleys; may include or be capped by a considerable amount of redeposited eolian silt; locally washed by meltwater and slope runoff; surface steep to gently sloping

### Eolian Deposits

**Qel** Loess-Homogeneous blankets of well—sorted, mottled, light grayish-brown silt deposited by eolian processes; generally structureless, but with broadly horizontal bedding and some laminations, wavy bedding, and small-scale crossbedding; contains scattered small charcoal fragments and root casts; local cryoturbation structures; weathered deposits are light yellowish brown to orange; thicknesses in exposures range from 1 m to greater than 5 m, and may exceed tens of meters in valley bottoms; forms vertical scarps many meters high; generally perennially frozen; surface smooth to deeply gullied

**Qelp** Pitted loess—Homogeneous blankets of mottled, light grayish-brown silt and organic silt deposited by eolian processes and subsequently modified by melting of ice-rich permafrost; generally massive to locally bedded; contains scattered small charcoal fragments and root casts; measured thicknesses exceed 8 m in natural exposures and tens of meters in drift shafts; forms vertical scarps many meters high; surface pitted and hummocky with abundant small lakes and boggy areas

**Qer** Reworked upland silt—Heterogeneous blankets of silt and organic silt originally laid down by eolian processes and subsequently minorly to extensively reworked by fluvial and colluvial processes; includes silt-rich debris-flow deposits; may contain angular clasts of local origin; massive to thinly bedded, with some wavy bedding and crossbedding; commonly perennially frozen and ice rich; locally contains abundant Pleistocene faunal remains; surface steep to gently sloping with numerous shallow, interconnected channels and local low scarps; organic material recovered from a placer cut in Dalton Gulch (map locality D) yielded conventional radiocarbon minimum limiting dates of 35,070 +2,800-2,080 yr B.P. (GX-23481) and 37,760+4,470/2,860 yr B.P. (GX-23482), and an AMS minimum limiting date of 33,260 ± 670 yr B.P. (GX-23475)

### Lacustrine Deposits

**Qld** Delta deposits—Fan-shaped, heterogeneous mixture of well sorted silt, sand, and gravel; thick to thin bedded; shows crossbedding and fining upward cycles; surface smooth, except for numerous shallow, interconnected channels

### Paludal Deposits

**Qs** Swamp deposits—Semicircular to irregular deposits of silt and peat in poorly-drained areas; saturated and locally frozen below a depth of about 1 m, locally ice rich; surface flat and smooth, may have standing water

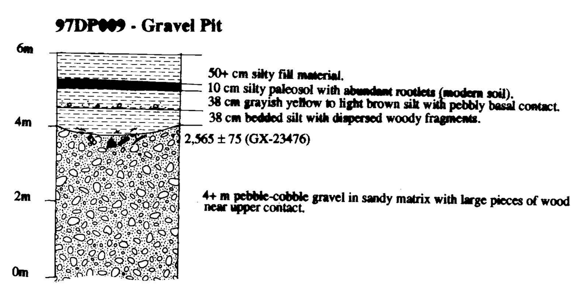
### Manmade Deposits

**Qmt** Mine tailings—Water-washed pebble-cobble gravel with trace to some sand reworked by placer mining operations; typically well sorted; surface irregular or forming symmetrical ridges and cones

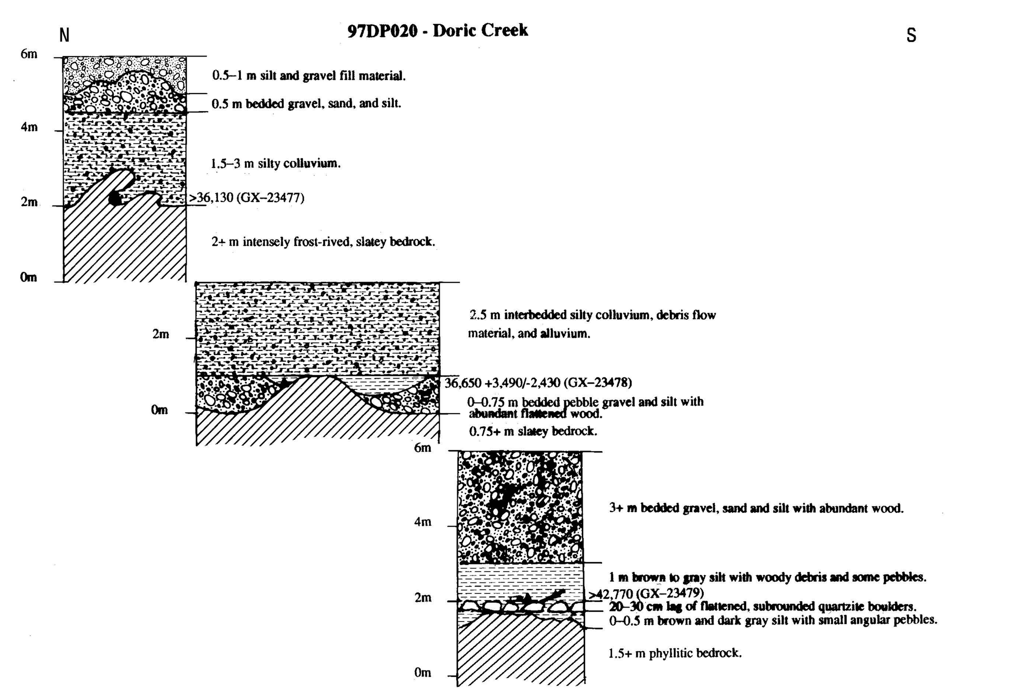
### Bedrock Deposits

Thinly covered bedrock—Bedrock covered by thin (generally less than 1 m thick) veneer of surficial debris

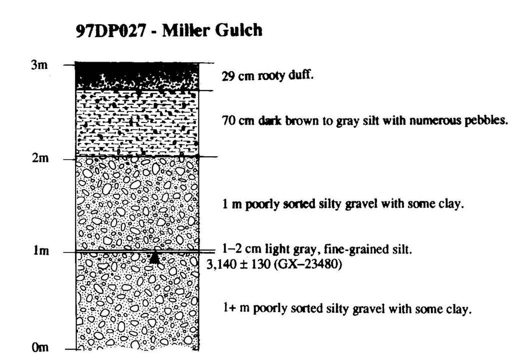
Exposed bedrock—Bedrock with essentially no cover



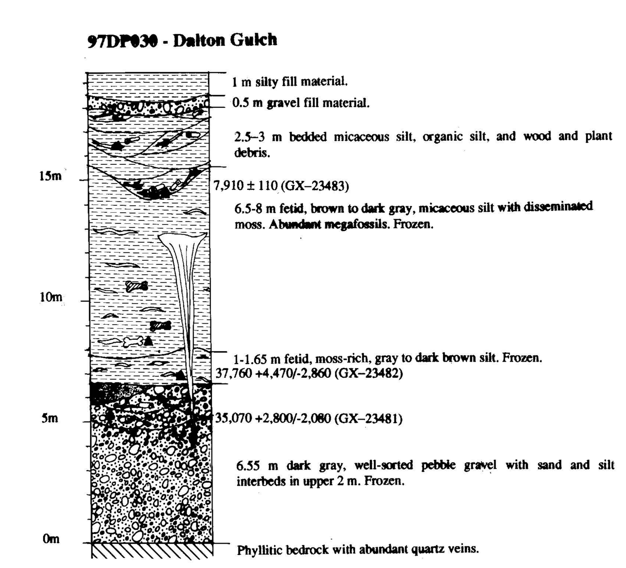

Stratigraphic section measured at locality A, gravel pit near Baker Creek, Tanana A-1 Quadrangle.




Series of stratigraphic sections measured on bench sequence at locality B, placer mine on Doric Creek, Tanana A-1 Quadrangle.




Stratigraphic section measured at locality C, placer mine on Miller Gulch, Tanana A-2 Quadrangle.




Stratigraphic section measured at locality D, placer mine on Dalton Gulch, Tanana A-2 Quadrangle.

The author is very grateful to David M. Hopkins (Alaska Quaternary Center) for generously sharing his vast knowledge of the area and Florence R. Weber (U.S. Geological Survey) for her thoughtful review of the map.

THIS MAP HAS NOT BEEN REVIEWED FOR TECHNICAL CONTENT (EXCEPT AS NOTED) OR FOR CONFORMITY TO THE EDITORIAL STANDARDS OF DGGS

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# PRELIMINARY SURFICIAL-GEOLOGIC MAP OF THE TANANA A-1 and A-2 QUADRANGLES, CENTRAL ALASKA

By

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1998

Date: 05/26/98