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# Description and Interpretation of Geologic Materials from Shotholes Drilled for the Trans-Alaska Crustal Transect Project, Copper River Basin, Alaska, May 1985

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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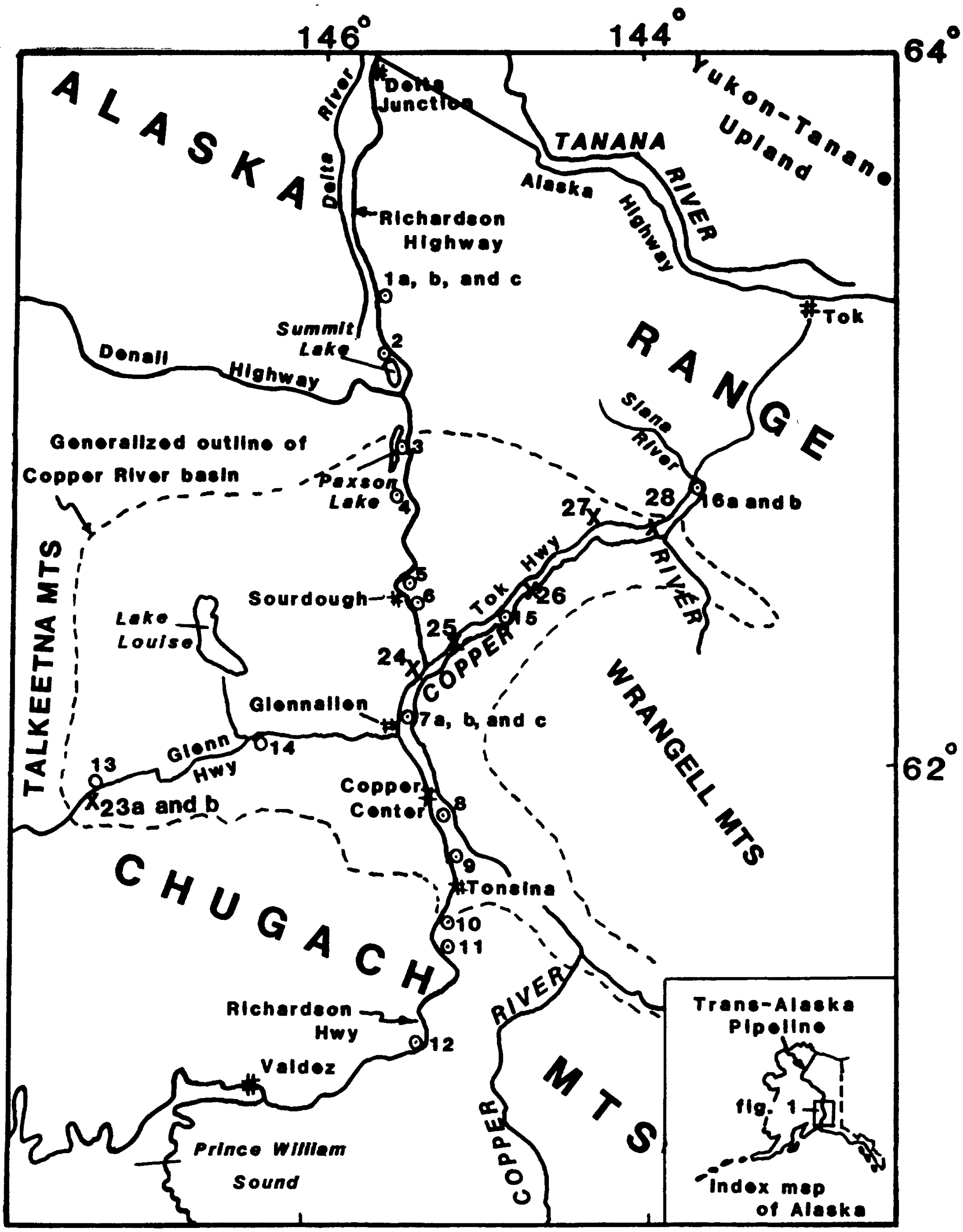
## INTRODUCTION

The TACT (Trans-Alaska Crustal Transect) project is a geological and geophysical study of the structure and evolution of the crust and upper mantle of Alaska along a north-south corridor crossing the middle of the State and adjacent continental margins. Begun in 1984, the U.S. Geological Survey TACT project is a major element of the TALI (Trans-Alaska Lithosphere Investigation), under which scientists from many institutions--State governments, universities, and industry--are cooperatively investigating the Alaskan lithosphere along a north-south corridor paralleling the Trans-Alaska oil pipeline (Page and others, 1986). Studies in 1984 concentrated on the Chugach and composite Peninsular/Wrangellia terrains, the Border Ranges fault system, and the underlying lower crust and upper mantle beneath the northern Chugach Mountains and Copper River basin. Seismic refraction and potential-field geophysical techniques were used to investigate deep structure, and to extend to depth, geological knowledge obtained at the surface. Preliminary results from these initial studies have been presented (Plafker and others, 1985; Fuis and others, 1985; Campbell and Barnes, 1985; Page and others, 1986). Most of the seismic refraction shots were detonated in drill holes ranging in depth from 100 to 180 ft. Yehle and others (1985) reported on the description and interpretation of the depositional environment of the geologic materials encountered during the drilling of shotholes at 16 sites in the Copper River basin and adjacent regions during May and June 1984.

In 1985, the geologic, seismic refraction, and potential-field geophysical studies were extended southward to investigate the Prince William terrain and the contact fault separating the Prince William and Chugach terrains, and also northward to investigate the northern margin of the Wrangellia (R. A. Page, written commun., 1985). Several new shallow shotholes were drilled. In this report, we present a similar description and interpretation for the geologic materials recovered from seven shotholes (CRB 85-23a and b through 28, fig. 1) drilled in the Copper River basin, Alaska, in May 1985. The holes were generally located along a 115-mi-long southwest-northeast-trending auxiliary profile crossing the main transect corridor originally established in 1984 using shotholes CRB 84-13 through 16a and b (fig. 1).

## DRILLING OPERATIONS AND SAMPLING

Seven holes were drilled and cased at six new sites while previously drilled sites CRB 84-7, 8, 11, 12, 14, 15, and 16 were reoccupied or redrilled during 1985. At all reoccupied sites, except CRB 84-7, where one of the previously drilled and cased holes was reused, new shotholes were drilled as




⊙ Drill holes described in Yehle and others (1985)

X Drill holes this report

Figure 1.--Location map showing the U.S. Geological Survey shotholes CRB 85-23a and b through 28, indicated by an "X", with respect to the 1984 shothole sites CRB 1a, b, and c through CRB 84-16 a and b, Copper River basin and vicinity, south-central Alaska. Scale approximately 1:2,000,000.

near as possible to the previous holes. In this report, descriptions and interpretations for materials are given only for the holes at the six new sites. No temperature measurements are known to have been attempted in the new holes. Loading of the holes with explosives took place soon after completion of drilling; detonation and geophysical measurements were accomplished during the middle of June 1985.

The drill, a modified Ingersoll-Rand TH 60 Cyclone, was operated by M-W Drilling, Inc., Anchorage, Alaska. Shothole CRB 85-27, in bedrock, was rotary-percussion drilled with a button bit using air as the drilling medium. The other shotholes were drilled in unconsolidated materials using a conventional rotary technique. Ground water from the hole was was used as the drilling medium when there was an adequate quantity. In no instance was ground-water flow so great that a hole was made unuseable as a shothole.

Where ground-water was inadequate, water was supplied from a truck-mounted, closed tank filled from a variety of sources that included stagnant ponds and glacial streams. Occasionally a foaming agent, Quik Foam, was added to the water used in drilling. Casing, of a nominal 8-in. interior diameter was added by the welding of 20-ft segments. An air hammer was used to advance casing after each 5-ft increment of drilling.

Procedures for collection of samples were not uniform because samples are ejected onto the ground behind the drill rig from a nozzle about 10 ft long and 0.5 ft in diameter at velocities varing from slow to very fast. As drilling progressed, the nozzle height above the ground surface varied from an initial maximum of about 22 ft after a new 20-ft segment of casing was welded on to it, to a final minimum of about 1.5 ft. Depending upon the height of the nozzle that emitted the ejecta plume and the velocity of the plume, there was commonly, a sorting of material by grain size within the drop zone behind the drill rig. This drop zone varied from about 100 to 3 ft behind the drill rig. Additional factors affecting the size of the drop zone and the sorting of materials were material type and amount of water in the plume. For instance, the relatively smaller, drier, and less cohesive particles were ejected the farthest, and relatively coarser and wetter materials were ejected intermediate distances. With relatively lower velocity of the ejecta, all materials, especially more cohesive ones, were found close to the drill rig. During each 5-ft increment of drilling, ejected samples were collected in large wash tubs located at two points within the ejecta-plume drop zone. Observed and inferred contaminants in the samples, in likely decreasing order of abundance, may include the following: (1) bits of material from previously collected samples that were not cleaned from wash tubs; (2) foam or other agents used to thicken the drilling medium; (3) particles, such as scum, insect and plant fragments, introduced from water collected for drilling and subsequently stored in the closed water tank; (4) other particles in the drilling water associated with the drilling operation itself, such as hydraulic oil, grease, rust, paint, paper, and miscellaneous metallic fragments; and (5) air-fall particles from nearby vegetation that blew onto the sample before collecting or packaging could be completed.

Geologic materials larger than medium-sized pebbles, about 1/2 in., present in situ, became broken during drilling, and thus, the ejected sample does not fully represent a true grain-size distribution. Hand-sized samples of cohesive, fine-grained materials were sometimes sheared from the drill-hole wall and ejected during casing advancement. These samples, which were less disturbed and contaminated, were also collected.

## INTERPRETATION OF MATERIALS

The type of geologic materials encountered in the drill holes, as deduced by visual examination and interpretation, are presented in the next section. Shotholes CRB 85-23a and b, 24 through 26, and 28 contain chiefly unconsolidated materials and are described in greater detail while shothole CRB 85-27, drilled in bedrock, is considered in a general way.

Grain-size descriptions are presented in the order of estimated decreasing abundance and follow the classification scheme of Wentworth (1922). The largest clasts not broken during the drilling process were less than 1/2 in. The broken coarser clasts resulting from conventional rotary drilling makes characterization of unconsolidated deposits difficult. Where in-situ clasts larger than 1/2 in. are abundant, descriptions relate largely to broken fragments. In some holes, there is great uniformity in the materials, especially those considered to be glacial lake deposits. Also noted, where readily apparent, are differences in clast lithology.

Permafrost conditions exist in most parts of the Copper River basin and the presence of permafrost has been widely reported in literature. However, during drilling operations of this type, direct evidence for the actual presence of permafrost at a particular site is sketchy. Small pieces of clear and milky ice were recovered from cuttings at shotholes CRB 85-24, 25, 26, and 28. During the drilling of the upper sections of CRB 85-23a and b, where evidence might have existed, permafrost was not directly observed.

We suggest possible depositional environments and age of unconsolidated deposits as interpreted from materials recovered from the holes and referenced to regional geology. All unconsolidated deposits are of Quaternary age. Most deposits are related directly or indirectly to the extensive former glacial Lake Atna (Mendenhall, 1905, p. 70; Ferrians and Schmoll, 1957); Nichols, 1965; Ferrians, 1971; Williams and Johnson, 1980. Lake Atna and other ancestral lakes covered much of the Copper River basin during long periods of the Quaternary. Other deposits commonly observed are thought to be alluvial sequences; some may be related to nonglacial intervals or the advance and retreat of glaciers. A few of the deposits penetrated are interpreted with certainty as diamictons of primary glacial origin (till). This supports the idea that the central part of the Copper River basin was dominated by a lacustrine rather than a glacier-ice depositional environment. Figure 2 is a sketch map depicting the interpreted relationship of shotholes CRB 85-24 through 28, to the generalized Copper River basin stratigraphy.

## DESCRIPTION OF DRILL SITES AND GEOLOGIC MATERIALS FROM DRILL HOLES

### CRB 85-23a and b

The numbering of drill holes is sequential and increases from holes numbered in 1984 reported by Yehle and others (1985). Numbers 17 through 22 were assigned to water shotpoints.

These two 180-ft-deep holes are located in the Anchorage D-1 quadrangle, SE1/4SW1/4 sec. 6, T. 20 N., R. 12 E., of the Seward Meridian, at an altitude of about 2,950 ft. Access to the site is via a gravel road joining the Glenn Highway at about mileage point 118.5 from Anchorage (fig. 1). The drill holes are located about 0.08 mi west of a culvert draining nearby Trail Creek. The site is on slightly hummocky to flat terrain consisting of flood plain and

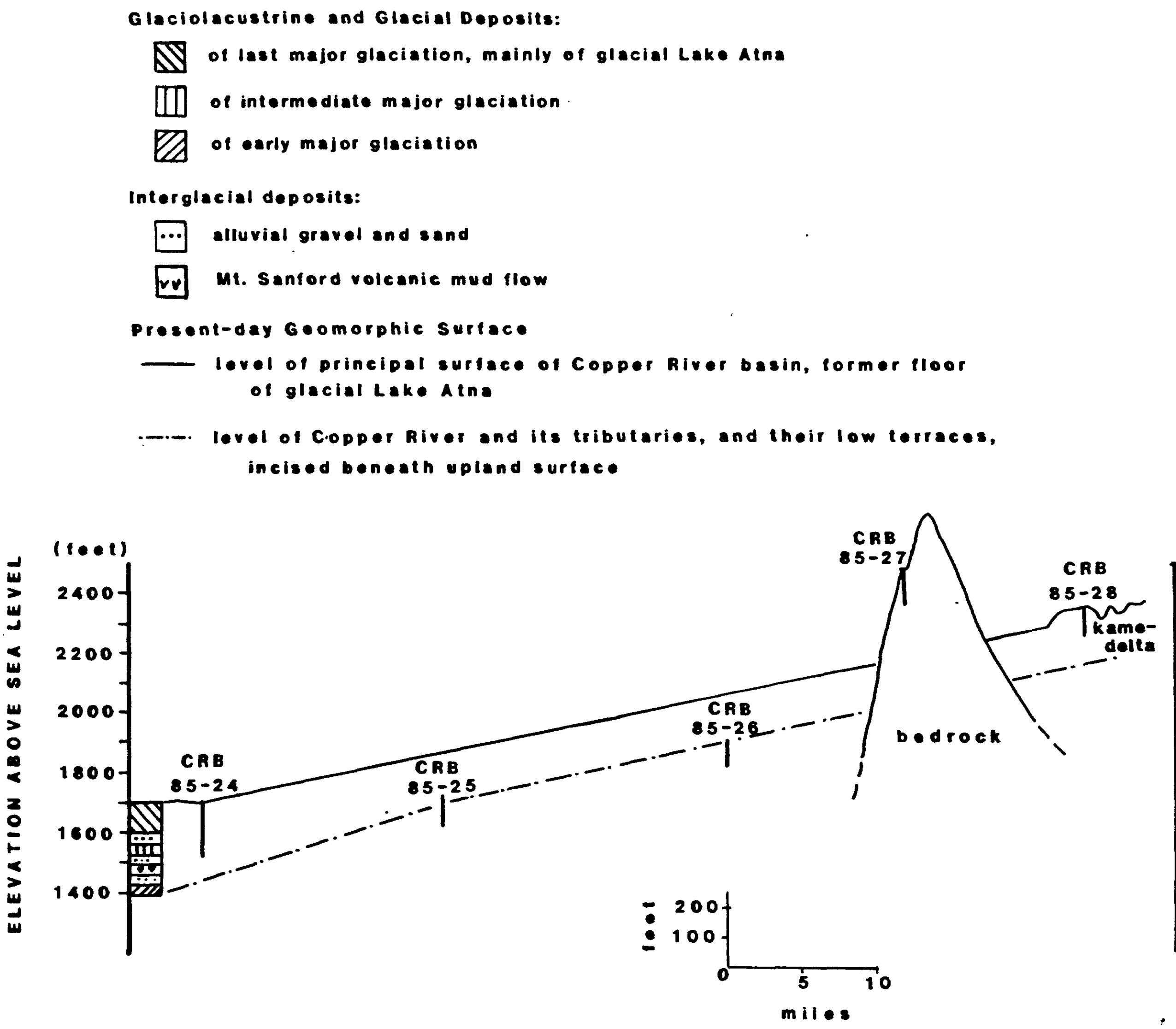



Figure 2.--Diagram showing the relationship of shotholes CRB 85-24 through 28, to generalized Copper River basin stratigraphy as exposed in river bluffs, to present-day geomorphic surfaces. (Modified from Ferrians and others, 1983).

terraces, and Trail Creek, which flows approximately 30 ft below the level of the highest terrace. This outwash plain forms most of the floor of the area at the westernmost part of the Copper River basin (fig. 1). Geologic materials described below are a composite of direct observations, examination of nearby streamcuts, and interpretations of the driller's log. These drill holes were dry.

**CRB 85-23a and b**

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ material thought to be different, so indicated) | Partial description, (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| | | Composite of two drill holes, all materials not directly observed | | |
| 0-30 | 30 | Sandy to clayey gravel; in situ: includes cobbles to 12.5 cm-diameter? | Tan to medium brown, dry to moist; clasts include volcanics, milky quartz, and shale (Matanuska Formation). | Alluvial, deltaic, and outwash; Pleistocene (Williams, 1985). |
| 30-60 | 30 | Silty gravel---------- | Brown------------ | Alluvial or glaciofluvial; Pleistocene. |
| 80-142 | 62 | ---do----------------- | Gray------------- | Do. |
| 142-145 | 3 | Silty clay------------ | Gray, soft; organic residue in water(?). | Do. |
| 45-180 | 35 | Clayey to silty shale. | Dark gray to black; shale (Matanuska Formation). | Offshore marine(?); Cretaceous (Grantz, 1951). |

**CRB 85-24**

This 180-ft-deep hole is located in the Gulkana B-3 quadrangle, SW1/4SE1/4 sec. 20, T. 6 N., R. 1 W., of the Copper River Meridian, at an altitude of about 1,700 ft. This site is accessed by a Trans-Alaska pipeline maintenance road, which joins the Richardson Highway at a mileage point about 126.4 north of Valdez (fig. 1). The drill hole is located in the right-hand side of a borrow pit, 200 ft west of the road culvert draining Bear Creek, approximately 1.6 mi from the Richardson Highway. The hillslope is cobble laden with volcanic rocks (fine-grained, black- and-white speckled, and brick red clasts) a few pieces of milky quartz. Static-water level in this hole was

41 ft from the surface at the time it was loaded for shooting, which was about two weeks after drilling.

The deposits penetrated in this hole can be correlated with the generalized stratigraphic section of Pleistocene deposits in the east-central part of the Copper River basin (Ferrians and others, 1983, p. 151). They include primarily, silt and clay of the last major glaciation, and underlying alluvium, representing prior nonglacial conditions. Fine sand and silt deposits between 137-140 ft may be remnant glaciolacustrine deposits of the intermediate glaciation.

**CRB 85-24**

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ materials thought to be different, so indicated) | Partial description, remarks | Inferred environment of deposition and age |
|---|---|---|---|---|
| 0-5 | 5 | Sandy cobble gravel; increasingly more sandy with depth. | Light tan, dry-- | Road material overlying late-phase glaciolacustrine, deposits; Pleistocene. |
| 5-10 | 5 | Medium sandy gravel, (in situ: includes cobbles). | Tan, moist------ | Glaciolacustrine; Pleistocene. |
| 10-16 | 6 | Gravelly coarse to medium sand. | ---do----------- | Do. |
| 16-20 | 4 | Silty to clayey medium to fine sand, a few pebbles, ice pieces. | Light gray; wet, cold. | Do. |
| 20-25 | 5 | Clayey silt, with a small percentage of medium to fine sand. | Olive gray, moist to damp, drier than above; compact. | Do. |
| 25-27 | 2 | Silt and clay, with a few coarse sand grains; decreasing in grain size with depth. | Medium gray, moist to dry. | Do. |
| 27-35 | 8 | Silty clay, with a few sand grains; mottled with organic(?) flecks. | Dark gray with brown flecks. | Do. |

**CRB 85-24--Continued**

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ materials thought to be different, so indicated. | Partial description, remarks | Inferred environment of deposition and age |
|---|---|---|---|---|
| 35-40 | 5 | Silty clay, with some fine sand and granules. | Dark gray; no brown flecks, forms sticky stiff ribbons, faint bedding(?). | Do. |
| 40-58 | 18 | Silty to sandy clay, with one 2.5-cm-diameter pebble. | Medium gray, moist to damp; very stiff ribbons tears irregularly). | Do. |
| 58-60 | 2 | Silty to sandy clay. | Medium gray, moist to damp; very stiff ribbons tears irregularly); softer. | Do. |
| 60-75 | 15 | Clay and silt, with a few small pebbles. | Medium gray, moist; drills easily but is compact; cuttings dime size rather than ribbons. | Do. |
| 75-80 | 5 | Clay, with some silt and fine sand; less silty than above with a few angular pebbles. | Dark gray, moist, clay is greasy to feel, faint bedding. | Do. |
| 80-85 | 5 | Clay, with some silt and fine sand; a few angular pebbles; large cobble at 84 ft. | Dark gray, moist; clay is greasy to feel, faint bedding. | Glaciolacustrine; Pleistocene. |
| 85-100 | 15 | Silty clay, with occasional pebbles. | Dark gray, moist very compact. | Do. |
| 100-102 | 2 | Silty clay, with more broken angular pieces of clasts than the above unit (in situ: diamicton?). | ---do----------- | Glacial or glaciolacustrine; Pleistocene. |

CRB 85-24--Continued

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ material thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 102-115 | 13 | Coarse to medium sand, with high percentage of pebbles (in situ: probably includes cobbles?). | Gray----------- | Alluvial; Pleistocene. |
| 115-120 | 5 | Coarse sandy pebble gravel, subrounded to rounded. | Gray, clasts are mainly volcanic (fine grained to aphanitic); drills easily, casing drops readily into hole. | Do. |
| 120-130 | 10 | Pebble gravel with minor sand (in situ: contains cobbles?). | ---do--------- | Do. |
| 130-137 | 7 | Pebble medium sand-- | ---do--------- | Do. |
| 137-140 | 3 | Silty fine sand, 2.54- to 1.25-cm-sized compact silt pieces in situ: silt with fine sand?). | Medium gray, silt pieces moist. | Alluvial or glaciolacustrine; Pleistocene. |
| 140-147 | 7 | Medium sand with pebble gravel. | Gray, wet-------- | Alluvial; Pleistocene. |
| 147-160 | 13 | Sandy pebble gravel, subrounded to rounded (in situ: includes cobbles?). | Gray, hole produces water at rate of approximately 50 gpm. | Do. |
| 160-180 | 20 | Pebble and some cobble gravel. | Gray, difficult to drive casing. | Do. |

## CRB 85-25

This 100-ft-deep hole is located in the Gulkana B-3 quadrangle NE1/4SE1/4 sec. 9, T. 7 N., R. 2 E., of the Copper River Meridian, at an altitude of about 1,725 ft. To the north about 0.5 mi is Tok Highway mileage point about 15.0 northeast from its junction with the Richardson Highway (fig. 1). The hole is situated on the floor of a large borrow pit developed in a low alluvial terrace along the north side of the Copper River. This terrace appears slightly lower and smoother than a similar level terrace on the south side of the river. Static water level in this hole was 85 ft when it was loaded for shooting less than 2 weeks after drilling.

The Mt. Sanford volcanic mudflow deposit crops out in a river bluff about 1 mi east, at an elevation approximately level with the top of the drill hole described in this report. Therefore, it is believed that the Pleistocene glaciolacustrine deposits encountered in the hole probably represent the early major glaciation of Ferrians and others (1983, p. 151).

| Depth (ft) | Thickness (ft) | Recovered material (if in situ material thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 0-10.0 | 10 | Sandy pebble gravel, decreasing grain size with depth. | Light tan, moist becoming wet. | Alluvial; Holocene. |
| 10.0-10.5 | 0.5 | Silty clay, sharp contact with unit above. | Dark gray, hard. | Do. |
| 10.5-15.0 | 4.5 | Gravelly coarse to medium sand. | Light gray----- | Do. |
| 15.0-20.0 | 5 | Coarse to medium sand, few subrounded pebbles. | Light gray, wet; less than 5 percent of pebbles are red volcanics. | Do. |
| 20.0-28.0 | 8 | Sandy pebble gravel. | ---do---------- | Do. |
| 28.0-37.0 | 9 | Very silty clay, sharp contact with unit above. | Medium dark gray, moist; sticky, stiff, 1.25- x 2.54- x 0.67-cm-sized pieces. | Glaciolacustrine; Pleistocene. |
| 37.0-42.0 | 5 | Silt and very fine sand. | Gray, soft; slurry, drills easily. | Do. |

**CRB 85-25--Continued**

| Depth (ft) | Thick-ness (ft) | Recovered material (if in situ material thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 42.0-50.0 | 8 | Silty to sandy clay, with a few small pebbles. | Medium dark gray, moist; tacky-stiff ribbons. | Do. |
| 50.0-60.0 | 10 | Silty clay, (in situ: may contain interbedded silt layers). | Medium dark gray, stiff; longer ribbons than above, faint indication of bedding. | Do. |
| 60.0-100.0 | 40 | Silty clay, 2.54-cm-diameter piece of milky ice from approximately 85 ft. | Medium dark gray, moist; stiff. | Do. |

## CRB 85-26

This 102-ft-deep hole is located in the Gulkana C-2 quadrangle, NE1/4SE1/4 sec. 34, T. 10 N., R. 4 E., of the Copper River Meridian, at an altitude of 1,910 ft. To the northwest about 0.15 mi is the Tok Highway mileage point about 35.8 northeast of its junction with the Richardson Highway (fig. 1). The hole is situated approximatly 0.1 mi east of the Chistochina River on the floor of a borrow pit developed extensively in the 1950's. The area is forested and underlain by gravelly flood-plain alluvium of the Chistochina River. Collar elevation is approximately 1.5 ft above river level, and surrounding depressions are filled with water. As in hole CRB 85-25, the Pleistocene deposits in this hole probably represent one or more early glaciations comparable to that of Ferrians and others (1983).

| Depth (ft) | Thickness (ft) | Recovered material (if in situ material thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 0-10 | 10 | Sandy pebble gravel, (in situ: includes coarser clasts?). | Tan, wet------- | Alluvial; Holocene. |
| 10-15 | 5 | Sandy pebble gravel, percent of cobbles increasing. | ---do---------- | Do. |
| 15-18 | 3 | Sandy gravel----------- | ---do----------- | Do. |
| 18-20 | 2 | Sand, silt and clay. | Light gray, slurry. | Large glacial lake; Pleistocene. |
| 20-34 | 14 | Silt with sand, very fine, few gravel pieces. | ---do----------- | Do. |
| 34-37 | 3 | Pebbly silt with a few clay pieces. | Light gray------ | Do. |
| 37-55 | 18 | Sandy silty clayey pebble gravel; large cobble on top of unit (in situ: diamicton?). | Medium to light gray, slow drilling, compact, cobbles large enough to stop rotation. | Glacial till(?); Pleistocene. |

**CRB 85-26--Continued**

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ material thought to be different, so indicated) | Partial description, remarks | Inferred environment of deposition and age |
|---|---|---|---|---|
| 55-60 | 5 | Sandy silty clayey pebble gravel; increasing large clast content. | Medium to light gray; ground water has slight fetid smell. | Do. |
| 60-65 | 5 | Sandy silty clayey pebble gravel, increasing sand content with depth. | ---do---------- | Do. |
| 65-80 | 15 | Cobbly coarse to medium sand, with some silt and clay (in situ: may contain silt and clay layers). | Light gray, drills easier. | Glaciofluvial or alluvial; Pleistocene. |
| 80-97 | 13 | Pebbly coarse to medium sand, with a small percent of clay. | Medium gray---- | Do. |
| 97-102 | 5 | Silty clay, with some coarse sand; clear to milky ice pieces. | Dark gray to dark olive gray, cold. | Large glacial lake; Pleistocene. |

## CRB 85-27

This 140-ft-deep hole is located in the Gulkana C-1 quadrangle, SW1/4SE1/4 sec. 20, T. 11 N., R. 6 E., of the Copper River Meridian, at an altitude of about 2,490 ft. To the south 0.2 mi is the Tok Highway mileage point about 48.9 northeast from its junction with the Richardson Highway (fig. 1). The hole is situated on the floor of an active rock quarry cut into a south-facing hillslope composed of dark-gray diorite (Moffit, 1954). Exposures in the quarry show three prominent joint planes approximately perpendicular to each other. The rock was pulverized by percussion drilling with a button bit. Static water level in this hole was 80 ft when it was loaded for shooting approximately two weeks after drilling.

## CRB 85-28

This 100-ft-deep hole is located in the Nabesna C-6 quadrangle, NW1/4NE1/4 sec. 20., T. 11 N., R. 8 E., of the Copper River Meridian, at an altitude of 2,350 ft (fig. 1). To the north about 250 ft is the Tok Highway mileage point about 61.6 east from its junction with the Richardson Highway. The drill hole is situated in the floor of a borrow pit probably developed extensively in the 1950's. The area is lightly forested and underlain by pitted outwash and (or) kame-delta deposits that probably formed marginal to Lake Atna and the glacial ice, which occupied the Slana valley just north of this site when the ice was largely stagnant. The thickness of gravel and sand in this hole suggests that more than one episode of glacier/lake interface conditions may be represented. This hole was dry.

| Depth (ft) | Thickness (ft) | Recovered material (if in situ material thought to be different so indicated) | Partial description, remarks | Inferred environment of deposition and age |
|---|---|---|---|---|
| 0-5 | 5 | Sandy pebbly gravel (in situ: includes coarser clasts?). | Light tan, dry; clasts consist of red scoria, aphanitics and medium-grained volcanics rocks. | Pitted outwash or kame-delta deposits; Pleistocene. |
| 5-7 | 2 | ---do------------- | Tan to brown, moist. | Do. |
| 7-13 | 6 | Sandy pebbly gravel, all clasts coated with gray sandy silt (in situ: includes coarser clasts?). | Gray, moist---- | Do. |
| 13-22 | 9 | Medium to fine sand, uniform; sharp contact with unit above. | ---do----------- | Do. |

CRB 85-28--Continued

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ materials thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 22-27 | 5 | Pebbly medium sand, clasts increase with depth. | Gray, wet------- | Pitted outwash or kame-delta deposit; Pleistocene. |
| 27-35 | 8 | Sandy pebbly gravel, milky to clear ice pieces. | ---do----------- | Do. |
| 35-40 | 5 | Cobbly pebbly sand, large cobble at 38 ft, ice pieces. | Gray, wet, cold- | Do. |
| 40-45 | 5 | Sandy pebble gravel, fewer cobbles than unit above. | ---do----------- | Do. |
| 45-53 | 8 | Silty coarse to medium sand, with some pebbles. | Gray, slurry---- | Do. |
| 53-58 | 5 | Silty pebble gravel, (in situ: includes some coarser clasts, diamicton?). | ---do----------- | Do. |
| 58-67 | 9 | Silty to somewhat sandy pebble gravel, rare clay, becomes less pebbly with depth. | Medium gray, wet. | Do. |
| 67-75 | 8 | Gravelly medium to fine sand. | Brownish gray, moist. | Do. |
| 75-82 | 7 | Coarse to medium sand with rounded pebble gravel. | Light gray, dry-- | Do. |
| 82-87 | 5 | Sandy pebble gravel-- | ---do----------- | Pitted outwash or kame-delta deposit; Pleistocene. |

**CRB 85-28--Continued**

| Depth (ft) | Thickness (ft) | Recovered materials (if in situ materials thought to be different, so indicated) | Partial description (remarks) | Inferred environment of deposition and age |
|---|---|---|---|---|
| 87-90 | 3 | Coarse to medium sand with pebbly gravel. | Light gray, dry dusty. | Do. |
| 90-95 | 5 | Coarse sandy pebble gravel. | ---do----------- | Do. |
| 95-98 | 3 | Coarse sand with some pebbles. | ---do----------- | Do. |
| 98-100 | 2 | Pebble gravel with coarse sand. | ---do----------- | Do. |

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