DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

PUBLIC DATA FILE 89-8B
COMBELLICK, PLATE 4 OF 7

Base prepared photogrammetrically by Walker-Alaska Aerial Surveys, Inc. from aerial photography taken Sept. 30, 1988.

Geology mapped from 1:12,000-scale color aerial photography taken Sept. 30, 1988 by Walker-Alaska Aerial Surveys, Inc. Field data collected Aug. 15-27, 1988, by R.A. Combellick and M.A. Beloiwich. Bedrock data provided by D.N. Solie and R.R. Reifenstuhl. Cartography by B.E. Davidson.

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SCALE: 1:12,000

1000 0 1000 2000 3000 4000 5000 FEET

200 0 200 400 600 800 1000 1200 METERS

CONTOUR INTERVAL 20 AND 100 FEET

DATUM: MEAN LOWER LOW WATER

ALASKA

STUDY AREA

TRUE NORTH

22°

MAGNETIC N

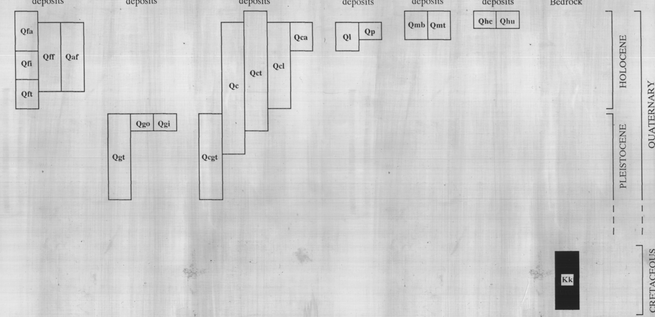
APPROXIMATE MEAN DECLINATION, 1987

RADIOCARBON-DATED SECTIONS

Radiocarbon-age determinations by Geochron Laboratories Division, Krueger Enterprises, Inc.

This report has not been reviewed for technical content (except as noted in text) or for conformity to the editorial standards of DGGS.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Surficial deposits and bedrock exposures were mapped by interpreting 1:12,000-scale stereo aerial photographs and incorporating field observations made during a two-week period in August, 1988. Most but not all deposit types were examined and described in the field (* indicates deposits that were not examined in the field). Deposits are grouped into categories based on primary mode of deposition: fluvial, glacial, colluvial, lacustrine, marine, and artificial. Road-base fill deposits were not mapped except where they coalesce with larger areas of fill (Qhc). Instead, geologic units were mapped across roads to indicate the materials that probably lie beneath the road fill.

A single bedrock unit, the Kodiak Formation, named and described by Moore (1969), underlies the entire area and was not subdivided. For a complete description of bedrock lithology and structure in the study area, see Solie and Reifenstuhl (1989). Geologic mapping by Moore (1967) shows regional structure and bedrock relationships. Brown (1989) summarizes bedrock geotechnical properties potentially affecting ground-water flow.

With exception of the youngest deposits (Qfa, Qct, Qmb, Qmt, Qhc, and Qhu), most surficial units are overlain nearly continuously by 1-26 in. of organic-rich silt, probably loess, which is in turn overlain by 1-18 in. of fine- to medium-grained (0.074-0.5 mm) volcanic ash. Source of the volcanic ash was the 1912 eruption of Novarupta, near Mt. Katmai (Griggs, 1922; Curtis, 1968). In basins, maximum observed thickness of ash is 36 in. At high elevations around Barometer and Erskine Mountains, volcanic ash discontinuously mantles bedrock and colluvial slopes, where wind and slope wash have concentrated the ash locally into depressions.

Several landslide deposits (Qcl) resulting from slumps and slides of till or bedrock were mapped in the study area. These slides appear inactive, and may have occurred shortly after retreat of glacial ice exposed the steep valley walls. A large slump deposit and numerous headwall scarps on the southeast side of Old Womens Mountain adjacent to the Coast Guard harbor are evidence of deep-seated landslide activity some time in the past. Although surface rock falls continue to occur along the road, there is no clear evidence of recent movement of the landslide deposit or adjacent rock mass below the scarps. A comprehensive account of effects of the great Alaska earthquake of 1964 (Kachadoorian and Plafker, 1967) contains a detailed summary of effects of coseparation, fissuring, and tsunami runup near the harbor but makes no mention of landslide movement along this adjacent slope. With exception of the active surface rock-fall area, slope features observed on aerial photographs taken September 30, 1988 are identical to those observed on photographs taken July 3, 1951, indicating that there have been no major changes in 37 years and confirming that the 1964 earthquake had little or no effect. Additionally, there is no appreciable toe bulge at the base of the slope and no anomaly in the shape of the floor of the harbor as shown on the nautical chart of Womens Bay. These observations suggest that the landslide deposit is old, but its exact age is unknown. Although it appears unlikely that the slide is active, reactivation cannot be ruled out.

For more information on surficial deposits and Quaternary geology, see accompanying report. A soil survey by Cox and Young (1980) provides additional data on soil attributes. Cross sections of unconsolidated overburden and results of seismic-profiling studies are provided by Allely (1989). Permeability classifications are from Lambe and Whitman (1969) for characteristic deposit types: very low, 10^{-9} to 10^{-7} cm/sec; low, 10^{-7} to 10^{-5} cm/sec; moderate, 10^{-5} to 10^{-3} cm/sec; high, 10^{-3} to 10 cm/sec; very high, over 10 cm/sec.

FLUVIAL DEPOSITS

Qfa **Active-floodplain alluvium-** Moderately to well-sorted loose sand and rounded pebbles and cobbles comprising non-vegetated or sparsely vegetated river bars subject to frequent flooding. Up to several feet thick. High permeability.

Qfi **Inactive-floodplain alluvium-** Flat-lying overbank sandy silt and silty sand up to several feet thick overlying moderately sorted, stratified sandy riverbed gravel or shallow till beneath surfaces rarely flooded by streams. Moderate to high permeability.

Qft **Terrace deposits*-** Flat-lying sandy silt and silty sand up to several feet thick overlying moderately sorted, stratified sandy riverbed gravel beneath a surface that is no longer subject to stream flooding. This surface is up to several feet higher than the adjacent flood plain and is bounded on at least one side by a scarp that slopes down away from the terrace to the younger flood plain. Moderate to high permeability.

Qff **Fine-grained alluvial-fan deposits*-** Silt and sand with lenses of gravel deposited where small streams flow from lower hill slopes to near-level ground. Surface of fan-shaped deposit has only slightly greater slope than adjacent low ground (less than 5°). Up to several feet thick. Low permeability.

Qaf **Coarse-grained alluvial-fan deposits*-** Poorly to moderately sorted silt, sand, pebbles, and cobbles deposited where larger streams flow from steep mountain slopes to gentler slopes or near-level ground. Surface generally smooth, cone shaped, and dissected by one or more stream channels. Surface slope less than 20° and slightly concave upward. Up to about 50 ft thick. Low to moderate permeability.

GLACIAL DEPOSITS

Qgt **Till-** Nearly continuous blanket of very poorly sorted, firm to very firm clay, sand, pebbles, cobbles, and rare boulders in varying proportions, deposited beneath glaciers on rounded and scoured bedrock hills. Till thickness ranges from several inches to 15 ft or more, and averages about 3 ft. Locally absent where bedrock is exposed at the surface or where volcanic ash and organic-rich silt directly overlie scoured bedrock. Small bedrock exposures are numerous. Rounded, striated tillstones with long dimensions up to 18 in. are common, although larger cobbles and boulders up to 4½ ft long were are also observed. Bedrock surface beneath till is generally smooth, striated, or grooved from glacial scouring. Till is locally friable to a depth of up to 24 in. where weathered. Permeability very low to low where unweathered; low to moderate where weathered.

Qgo **Outwash deposits*-** Moderately sorted, stratified gravelly sand and sandy pebble-cobble gravel deposited east of Buskin Lake by meltwater streams terminus of a receding glacier. Up to about 20 ft thick. Moderate to high permeability.

Qgi **Ice-contact stratified deposits*-** Poorly sorted and crudely stratified silt, sand, and gravel deposited east of Buskin Lake by meltwater around and beneath stagnant ice near the terminus of a receding glacier. Up to about 10 ft thick. Low to moderate permeability.

COLLUVIAL DEPOSITS

Qegt **Undifferentiated colluvium and till-** Thin, discontinuous deposits of colluvium and till on steep bedrock slopes and ridges. In contrast to the low, rounded hills covered nearly continuously by till (Qgt), these deposits occupy steeper, more rugged slopes at higher elevations on mountain sides and are thinner and less continuous. Although nearly everywhere overlain by organic-rich silt and volcanic ash, this unit appears with any one of three stratigraphic arrangements (from bottom to top): bedrock, colluvium, and till; bedrock and colluvium; or bedrock and till. Locally both colluvium and till may be absent and organic-rich silt and volcanic ash directly overlie bedrock, or bedrock may be exposed. Till is dominant at lower elevations within this unit; colluvium is dominant at higher elevations. No ice-marginal features are visible to indicate a clear upper limit to the extent of till. Some small depressions contain water-transported silt, sand, gravel, or volcanic ash. Up to several feet thick. Variable permeability.

Qc **Undifferentiated colluvium-** Very poorly sorted, loose silt, sand, pebbles, cobbles, and boulders derived from underlying bedrock by weathering and transported only short distances down slope by sheet wash and mass movement. Larger clasts are generally very angular to subangular. Thickness ranges from several inches to several feet. Moderate to high permeability.

Qct **Talus-** Very poorly sorted, loose angular rock rubble, locally mixed with till, deposited by debris falls on steep slopes and at the base of cliffs. Surface is generally steep (greater than 20°) and cone shaped. Up to about 20 ft thick. Very high permeability.

Qcl **Landslide deposits-** Highly variable accumulations of rock, till, and soil that have moved down slope as a result of slope failure. All landslides in the study area are classed as debris slides (Varnes, 1978), and show no photogeologic evidence of recent activity. Thickness may be as much as 100 ft. Low to moderate permeability.

Qca **Colluvial-alluvial (debris-cone) deposits-** Poorly sorted and crudely bedded silt, sand, pebbles, cobbles, and boulders deposited at the base of gullies and steep slopes through a combination of water transport and mass wasting. Larger clasts are very angular to subangular, with median size about ½ in. and maximum long dimension up to 2 ft. Thickness up to about 50 ft. Moderate to high permeability. Springs are common along excavated faces. Along Chiniak road adjacent to the Coast Guard harbor, gravel excavations undercut the slopes of these generally saturated deposits, resulting in small debris flows. Where excavated, the material periodically falls from the cut face and flows out onto level ground.

LACUSTRINE AND PALUDAL DEPOSITS

Ql **Lake deposits*-** Primarily silt and fine sand, locally organic rich, deposited in basins formerly occupied by lakes. May contain a significant proportion of retransported volcanic ash, especially near steep slopes. Up to several feet thick. Very low to low permeability.

Qp **Paludal (marsh) deposits-** Primarily saturated peat and organic-rich silt accumulated in former lake basins, marshes, and near margins of existing lakes. Up to several feet thick. Very low permeability.

MARINE DEPOSITS

Qmb **Beach deposits-** Well sorted sand or gravel deposited by waves on modern beaches. Generally less than 3 ft thick. Moderate to very high permeability.

Qmt **Tidal-flat deposits-** Moderately to well sorted silty fine sand and fine sandy silt deposited in the modern intertidal zone. Thickness unknown. Low to moderate permeability.

ARTIFICIAL DEPOSITS

Qhc **Compacted artificial fill-** Artificially emplaced or modified deposits, generally of sand and pebble-cobble gravel, that have been compacted to provide base material for structures, roads, parking areas, storage areas, or aircraft runways. Locally contains lenses of silt or volcanic ash. Roads are not mapped except where they coalesce with larger areas of fill. Up to about 25 ft thick. Low to high permeability.

Qhu **Uncompacted artificial fill-** Artificially emplaced or modified deposits, generally of sand and pebble-cobble gravel, that are uncompacted or minimally compacted. Includes protective barriers for storage tanks and fuel pumps, shelters for aircraft tiedowns, and spoil piles. Generally emplaced as mounds or ridges up to about 20 ft high. Moderate to high permeability.

BEDROCK

Kk **Kodiak Formation-** Dark gray to black mudstone, siltstone, sandstone and minor conglomerate that have undergone varying degrees of compaction and low-grade metamorphism (Solie and Reifenstuhl, 1989). Fine-grained rocks range from shale to slate, with a phyllitic sheen locally. The ratio of sandstone to shale/slate ranges from 10:1 to 1:1, with very fine- to fine-grained sandstone the most abundant. Sandstone and shale layers are laterally continuous at outcrop scale without changes in thickness or grain size, but generally cannot be traced between outcrops. Bedding is generally thin (¼ to 2 in.) and parallel-bedded. Bedding orientation is consistent throughout the study area, with most strikes between N30°E and N40°E and most dips between 75°W and 90°. Cleavage is roughly parallel to bedding. All observed outcrops contain at least one set of fractures; most contain two or more, but rarely are more than two sets well-developed. The most common fracture orientation is perpendicular to bedding/cleavage. Spacing of these fractures range from extremely close to wide (< 1/16 in. to > 3 ft), with generally closer spacing in finer-grained rocks.

MAP SYMBOLS

Approximate geologic contact- Interpreted from aerial photographs; limited confirmation in field. Natural transitions between closely related deposits, such as Qgt/Qcgt and Qcgt/Qc, are diffuse and cannot be readily identified in the field.

Terrace scarp- Denotes edge of older alluvial surface where incised by stream to form younger, lower surface. Tick marks on downslope side.

Landslide scarp- Denotes headwall of landslide failure surface. Tick marks indicate failure direction. See text above for more information on landslide areas.

Q Spring- Natural flowage of water from rock or soil. Observed at one locality, in debris-cone deposits along Chiniak Road on the southeast side of Old Womens Mountain; other localities are likely.

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GEOLOGIC MAP OF AREA I, U.S. COAST GUARD RESERVATION, KODIAK, ALASKA

by

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1989