DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 85-143
SHEET 1 OF 2

Introduction

This report describes and maps an area of 4,325 mi^2 (11,279 km^2) along the Glenn Highway transportation corridor connecting Anchorage with the conterminous states via Canada. It is between Mileposts 100 and 170 (161 and 274 km) east of Anchorage and 16 to 86 miles (26 to 138 km) west of Glennallen. The purpose of this report is to provide information at a reconnaissance scale that can be used in regional planning; laying out preliminary highway routes, locating sites for construction materials, airfields, and other facilities; providing information useful in land selection and evaluation of the public and native lands; and assisting individuals in selecting lands that have desirable foundation conditions, easily available materials, and a source of water. The report does not supplant the need for the usual site engineering studies and foundation evaluations, especially in areas of ice-rich permafrost.

The work on which the surficial-deposits studies were based was done by the U.S. Geological Survey in 1952-1954 and in 1957 in cooperation with the Engineer Intelligence Division, Office of the Chief of Engineers, U.S. Army, in 1978-79 under the Geological Survey's Alaska Mineral Resources Assessment Program of the Valdez 1:250,000 quadrangle (Williams and Johnson, 1980, 1981); and in 1980 under its Arctic Environmental Studies Program which includes several similar transportation-corridor studies in Alaska. Bedrock information was taken from published and unpublished sources, chiefly industry (Alaska Geological Society, 1979); U.S. Geological Survey mapping of the Mesozoic section in the Neichina area (Grantz, 1960; 1961a, b; 1965); and the U.S. Geological Survey and Alaska Division of Geological and Geophysical Surveys preliminary report on the northern Chugach Mountains (Markevitt and Fackler, 1974; Pessel and others, 1981; Winkler, Silberman, and others, 1981; Burns, 1982; Burns and others, 1983) and unpublished mapping by Winkler (written communication, 1984).

Geography

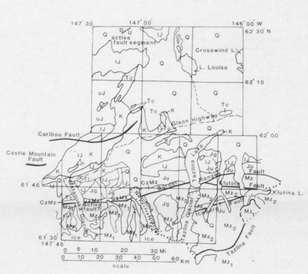
This segment of the Glenn Highway transportation corridor includes that part of the upper Matanuska River valley upstream from the Matanuska Glacier and the southwestern part of the Copper River Basin, as well as a 5 to 15-mi (8 to 24-km) strip of the southeastern Talkeetna Mountains and the northernmost 17 to 30 mi (27 to 48 km) of the Chugach Mountains. The Matanuska River drains to Cook Inlet of the Pacific Ocean, as does that part of the Copper River Basin within the Susitna River drainage basin (Tyone Creek and Tyone River, which includes Lakes Louise, Susitna, and Tyone). The balance of the area in the Mendeltna, Tolsona, Nelchina, Tazlina, and Klutina basins drains via the Copper River through the Chugach Mountains to the Pacific Ocean. Among the larger lakes are Tazlina Lake, nearly 60 sq mi (155 km^2) and locally more than 368 ft (112 m) deep, St. Anne Lake, and Lakes Louise, Susitna, and Tyone.

The eastern part of the area is a flat lacustrine plain broken by river canyons as deep as 500 ft (152 m). Westward and southward the relief increases noticeably on moraine-capped Tolsona and Tazlina Mountains, on Slide Mountain which stands more than 1,000 ft (305 m) above adjacent lowlands, and in mountain foothills where relief is as much as 1,500 ft (457 m). In the mountains the relief is generally 1,500 to 4,000 ft (457 to 1,219 m). Treeline is about 3,500 ft (1,067 m) above sea level, and the sparse spruce forest below that elevation has been affected by frost action, fire, poor soils, wind, and solar exposure, so that the best spruce timber is located on well-drained gravel and sand of the floodplains and terraces and at a few other well drained sites that have been protected from fire. The great soil groups identified by Joe Kubota, U.S. Department of Agriculture, unpublished mapping, 1952) are generally Podzols at well-drained sites below timber line and Subarctic Brown Forest soils in the warmer, well-drained sites at lower elevations. These soil groups are interspersed with Bog or Half Bog soils in the wetter areas, Alluvial soils along streams, and Regosols and Arctic Tundra soils above timber line. The growing season over most of the area above 2,500 ft (914 m) is too short for most crops, and, below that elevation, it is marginal. Drought conditions in summer may require irrigation; total rain and snowfall is less than 15 in (38 cm) at Gulkana to the east of the map area and less than 20 in (51 cm) at Eureka Lodge where summer fog and showers are more frequent in a transitional environment to the even wetter or snowier mountain climate. In addition to strong winds associated with passage of storm fronts, very strong katabatic winds blow toward the north down the Nelchina, Tazlina and other valleys in the Chugach Mountains when atmospheric pressure differentials are favorable.

The climate throughout the area is favorable for generation of permafrost, which is distributed discontinuously over most of the area, except in ground that is warmed by favorable exposure or by convective or conductive heat transfer from water bodies or ground water. Much of the permafrost in fine-grained deposits contains excess ice as lenses, veins, and small masses. Thawing of permafrost containing excess ice causes substantial ground settlement.

Bedrock

The bedrock, shown in summary form on the sketch map below, as well as by the lithologic units on the 1:125,000-scale map, is largely of Mesozoic and Cenozoic age. The Chugach Mountains are formed of east-west trending belts of rocks. The southernmost belt, the upper Cretaceous Valdez Group, is separated by the Border Ranges and iceberg faults (Winkler, Silberman, and others, 1981) from a melange and a complicated array of quartz diorite to gabbro to ultramafic intrusive rocks all of Jurassic age. These rocks are bordered along the northern front of the Chugach Mountains by the lower Jurassic Talkeetna Formation, chiefly volcanic rocks, which also form the basement rock beneath the middle to upper Jurassic and Cretaceous marine and the Tertiary terrestrial sedimentary rocks of the Copper River Basin (fig. A-A', sheet 2) (Alaska Geological Society, 1979) and of the eastern Talkeetna Mountains (Andreasen and others, 1964; Grantz, 1965). Tertiary nonmarine sandstone and conglomerate is the uppermost bedrock formation throughout most of the eastern Talkeetna Mountains and Copper River Basin part of the map area. It is as much as 2,600 ft (610 m) thick (section A-A'). It either has been blockfaulted after deposition or has been deposited on an erosion surface of high relief because the elevation of the base of the formation and its thickness vary widely through the area of outcrop, mostly north of the Glenn Highway. Lower Jurassic basement rocks become more shallow northward (section A-A') and are locally exposed along the northern boundary of the area. In the Matanuska River valley, the largely volcanic rocks of the Talkeetna Formation are exposed on the north side of the valley and in horsts between splays of the Castle Mountain fault and its strand, the Caribou fault; marine sediments of upper Cretaceous age, and terrestrial deposits of Tertiary age exposed in the valley have been cut by numerous faults, apparently related to the Border Ranges and Eagle River thrust faults, and have been cut by numerous small intrusive bodies of Mesozoic and Tertiary age (Detterman and others, 1976; Silberman and Grantz, 1984). The lithologic units shown on the map at a scale of 1:125,000 have been generalized from mapping of these complex bedrock units at scales of 1:25,000, 1:63,360, and 1:250,000, as given in the description of bedrock map units.



Generalized bedrock geologic map showing major faults

Diagrammatic sketch map of major bedrock map units and faults that bound them, particularly the Border Ranges fault and its splays, Klutina, Iceberg, and Tazlina faults, and the Castle Mountain fault and its splay the Caribou fault. Active fault segments are known only in northwest corner of map area and on Border Ranges fault a few miles east of Matanuska Glacier. Map units, Q, Quaternary deposits; Tc, Tertiary continental deposits; Ti, Tertiary intrusive rocks; K_v marine sediments of upper Cretaceous (Matanuska Formation) age and Neichina limestone; uJ, marine sediments of middle and upper Jurassic age; lJ marine sediments and volcanic rocks of lower Jurassic Talkeetna Formation; Jg, intermediate granitic and mafic intrusive igneous rocks of Jurassic age; Ju, mafic and ultramafic intrusive igneous rocks of Jurassic age; Mz_v, metasedimentary and metavolcanic rocks of McHugh Group, including related igneous rocks and large blocks of this and other formations; Mz_v, graywacke and phyllite of Valdez Group of Cretaceous age, including minor greenstone; CzMz, melange along major faults. Map from Beikman (1974) based on sources cited for bedrock mapping, and updated by Winkler, Silberman and others, 1981, and Winkler, unpublished geologic mapping, 1984.

Unconsolidated deposits

Unconsolidated deposits of Quaternary age form a mantle that is a few inches (cm) to more than 500 ft (152 m) thick, as shown on the cross sections (sheet 2). These deposits were formed during repeated Quaternary glaciations, mostly during the last major advance of the ice northward from the Chugach Mountains and as valley glaciers moving down Caribou Creek, Ochetna, Little Ochetna, and Little Neichina Rivers in the Talkeetna Mountains. In the Copper River Basin, the glaciers advanced into a large glacial lake formed by ice dams in the Susitna, Copper, and other higher outlets to the basin (Ferrians and Schmoll, 1957; Alaska Glacial Map Committee, 1965; Nichols and Yehle, 1969; Williams and Johnson, 1980, 1981; Ferrians and others, 1983; Williams, 1984). During the maximum advance of the last major glaciation, the lake may have reached an elevation of 3,250 ft (975 m), because the glacial deposits up to that level are covered with lake silt north of a northeast-southwest line through the south end of Lake Louise. As the ice retreated southward, it was followed by successively lower lake levels, the most prominent of which was about 2,450 ft (747 m) above sea level as recorded in wave-cut cliffs and beaches (Williams, 1984) mostly south of Lake Louise; the bottom deposits of this and slightly lower lakes extend up Tazlina and Neichina River valleys to within a few miles of the present glaciers. Similarly, in the Matanuska River drainage (Williams and Ferrians, 1961, p. 84), glacial lakes were formed upstream from Matanuska Glacier. Canyon cutting by present streams exposing the glacial and paraglacial sediments in the Matanuska River valley and in the Copper River Basin (cross section B-B') has taken place over the last 10,000 yrs, or perhaps even longer. The semiarid environment that followed melting of the glaciers has produced a glaciated terrain mantled by thin to thick lake sediments (Williams and Johnson, 1980); on the map the materials underlying the lake sediments are identified where their character could be observed directly or inferred from the landforms or from natural exposures.

Mineral resources

Metallic minerals

The principal metallic minerals are gold, chromite, pyrrhotite, sphalerite, galena, and pyrite. At least 225 gold-placer and lode claims were staked during a small gold rush in early 1980 in the Neichina River area, in the mountains to the east and west, and even along Tazlina Lake. Very little activity was noted in June 1980. Besides the gold, disseminated pyrite and chalcopyrite are common in the volcanic rocks at Sheep Mountain and in the front ranges of the Chugach Mountains from Matanuska Glacier eastward nearly to Nelchina River. The copper prospects at East Fork Creek on Sheep Mountain include barite, chalcocite, chalcopyrite, malachite, and pyrite (Martin and Mertie, 1914, p. 282). Veins containing pyrite, chalcopyrite, galena, and sphalerite occur in igneous rocks one mi (1.6 km) south of the western part of the terminus of Neichina Glacier. Claims staked by P. C. Barnette east of Neichina River, probably in the vicinity of Barnette Creek, had chromite, pyrrhotite, and pyrite. Porphyritic dikes cut by pyritiferous quartz veins at the contact between volcanic and sedimentary rocks along the front of the Chugach Mountains reported (Winkler, Miller, and others, 1981; Winkler, Silberman, and others, 1981; Miller and others, 1982) contained molybdenum, copper, and zinc at the west end of Heavenly Ridge—a location where a 1922 assay of the pyrite is said (L. L. Pennington, oral communication, 1952) to have contained $4-$20 of gold per ton at then-prevailing prices. In 1980 gold was being mined or was being sought from placers on Tacko Creek, on Tyone Creek at and below the confluence of Red Fox Creek, and on Albert Creek, the site of the 1912 discovery that led to the first rush to the region. These placers and other similar prospects such as those on Daisy Creek (Chapin, 1915, 1918; Martin and Mertie, 1914), apparently have been formed by reconcentration of gold contained in the Tertiary sandstone and conglomerate by glacial, silt-charged streams (Martin and Mertie, 1914, p. 278, 281; Grantz, 1956). Pan concentrates collected from the Tertiary sediments contained gold not only in the Talkeetna Mountains but also on Slide Mountain and other locations in the Copper river Basin (O. J. Ferrians, Jr., oral communication, 1983).

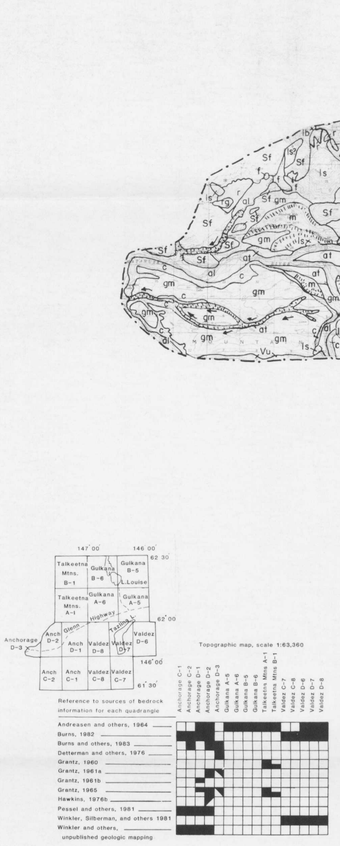
Nonmetallic minerals

Nonmetallic minerals include sand and gravel, the principal present-day mineral product of the region in both volume and value, and also unexploited deposits of clay, gypsiferous rock, limestone, dimension stone, riprap, abrasive material, and mordenite. Sand and gravel are mined from pits along the Glenn Highway and Lake Louise Road, and potential deposits are located on the map as units al, at, ke, b, f, and s, which are described in the table on sheet 2. Clay deposits are largely included in map unit lc, as shown on the map and in the table on sheet 2; these are suitable for brick clay where thick, relatively free of stones, highly plastic, as, for example, along Tolsona Creek near Glenn Highway and along Neichina River upstream from Little Neichina River. Clay from weathered volcanic rock (unit Vu) on Sheep Mountain has been used for manufacture of fire brick (Eckhart, 1953). At the same location Eckhart described six deposits of gypsiferous rock containing on the average of 25-30% percent gypsum, the remainder being quartz, alunite, clay, sericite, pyrite, and included masses of altered volcanic rock. Indefinite reserves of gypsiferous rock are 310,800 short tons (about 282,000 metric tons); inferred reserves are 348,000 short tons (about 315,780 metric tons) (Eckhart, 1953). Quality of the white limestone (unit Sl) in the Little Neichina region is believed to be good, although untested. Suitability of the other rock units, the distribution of which is shown on the map and the description of which is tabulated on sheet 2, depends largely on the degree of alteration, texture, and local fracture system of the rock. Because no special study was made of the properties of the various rock units, about all that can be said is that the graywacke, unaltered granite, quartz diorite, gabbro, and some of the volcanic rocks probably would make good riprap, good sources of crushed stone, and, where jointing is favorable, good dimension stone. Other rocks, like the weak shale, siltstone, and some sandstone, and the altered or sheared volcanic rocks and igneous rock may all be poorly suited for these uses. A deposit of salty sand or volcanic ash is well exposed in 50-ft (15.2-m) high banks along White Sand Creek, over the divide at the head of the creek and at several places west of Tyone Creek within two mi (3.2 km) of the large exposures. It was mined by Alaska Abrasives Inc. up to 1957 and was used under the product name, Alaskasite, by the military for blasting paint and cleaning metal (A. D. Richardson, company president, oral communication, 1957). Perhaps the largest deposit of commercial-grade mordenite in North America forms a body about 100 ft (30 m) thick and 9 mi (14 km) long in the Horn Mountains (unit Vpl) where it is 50 percent mordenite (Iiawkins, 1973; 1976a, b). Mordenite is an abrasion-resistant zeolite mineral that is used as a sorbent for sulfur dioxide.

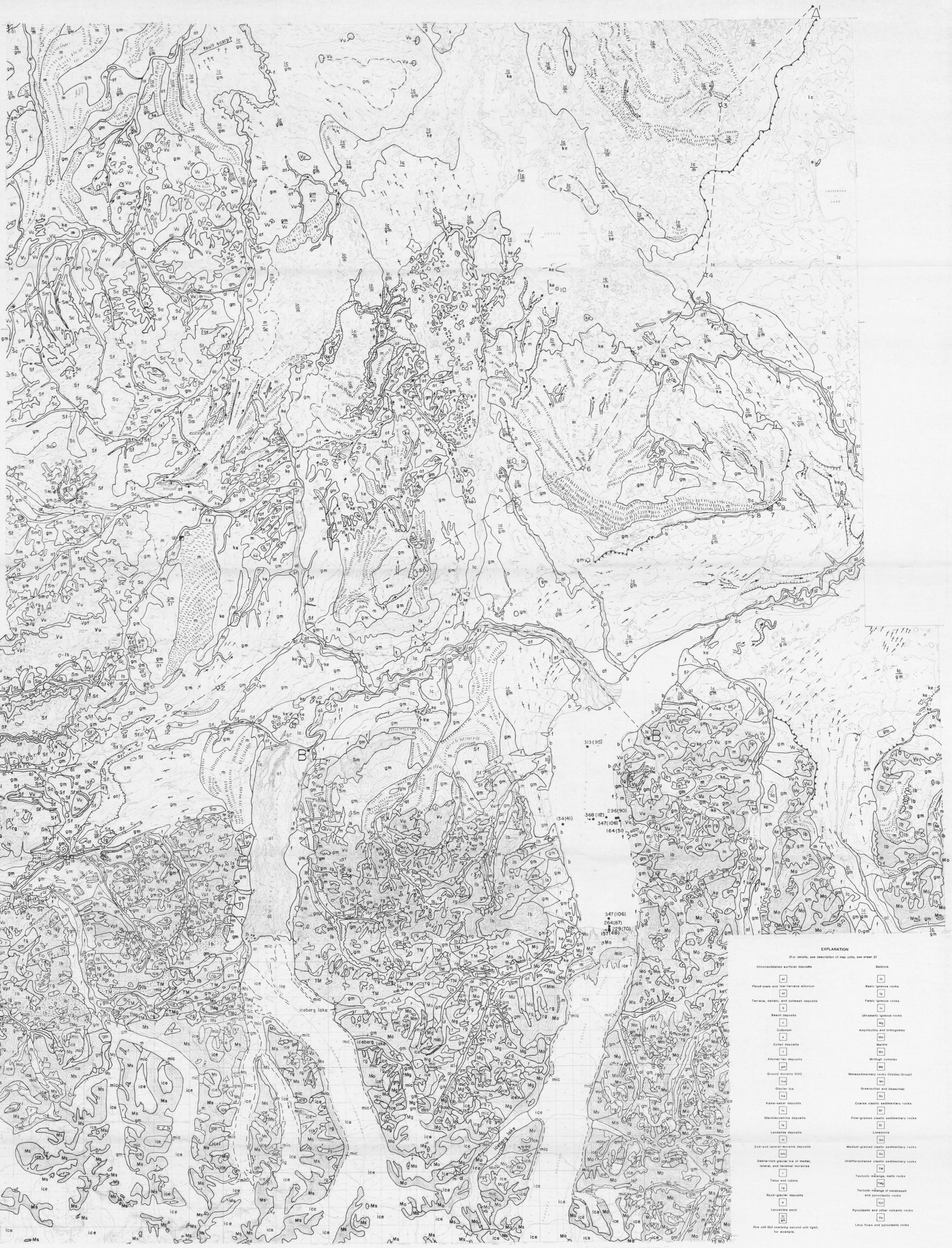
Fuels

Fuels consist of oil, gas, coal or lignite, peat and wood. Exploration by several oil companies between 1953 and 1979 resulted in six test holes in the area (plotted on map and in section A-A'), and others less than a mile (1.6 km) northeast of the area and along Glenn Highway within seven mi (11.3 km) of the eastern boundary of the area. The cross section (A-A'), based on logs of these test holes, was modified from one prepared by Alaska Geological Society (1979) as far as is known, no commercial quantities of oil or gas were discovered. At least one hole yielded methane and salt water under pressure, suggesting that one of the bedrock formations, perhaps that of lower Cretaceous age, is the ultimate source of the saline ground water in unconsolidated deposits in the central part of the Copper River Basin (Grantz and others, 1962; Williams, 1970; Reitsema, 1979). The saline water is discharged chiefly from springs along Tazlina River and in an area east of Tolsona Creek not far beyond the eastern boundary of the map area (Nichols and Yehle, 1961), but two small seepages are located between Moose Lake and Tolsona Lake within the map area.

Coal occurs very sparingly in upper Cretaceous sandstone along Neichina River and elsewhere and slightly more commonly in Tertiary sandstone and conglomerate near Aliasta House where prospecting has exposed beds as much as 2 ft (0.6 m) thick and at Lake Louise where coal 5 ft thick (1.5 m) was recorded in a drill hole on the south shore of the lake and where it is exposed as thin slabs in tilted stratified gravel. As far as is known, no deposits of coal or lignite are located near enough to the surface or are thick enough and continuous enough to be of commercial value. No peat deposits large enough to be worked commercially are known. Wood is the chief fuel used by local residents. The largest trees including those of saw quality grow along the streams and on well drained gravelly deposits, such as those of units al and at. Elsewhere the stunted spruce and the deciduous cover grows in a mosaic pattern that reflects the distribution of poorly drained soils and the history of forest fires. Most of this small spruce timber is less than 4 in (10 cm) in diameter and can be used for firewood.



Index to bedrock geologic mapping



Base: U.S. Geological Survey, compiled from following 1:63,360 quadrangles: Anchorage C-1, C-2, D-1, D-2, D-3, Gulkana A-5, A-6, B-5, B-6, Talkeetna Mountains A-1, B-1, Valdez C-7, C-8, D-6, D-7, D-8.

0 5 10 Mi
0 5 10 15 Km
Scale 1:125,000

Geology: Bedrock as indicated in credit box beneath description of map units on sheet 2. Surficial deposits mapped by J.R. Williams assisted 1952 by Meyer Rubin, D.G. Wise, 1953-1954 by O.J. Ferrians, Jr., 1957 by Livingston Chase, 1978 by K.M. Johnson, 1980 by C.L. Connor, supplemented by field notes and personal communication from Arthur Grantz, L.F. Fay, W.H. Condon, and Richard Hoare, U.S. Geological Survey.

EXPLANATION

(For details, see description of map units, see sheet 2)

Unconsolidated surficial deposits

- al — Flood-plain and low-terrace alluvium
- at — Terrace, deltaic, and outwash deposits
- b — Beach deposits
- c — Colluvium
- e — Eolian deposits
- f — Alluvial-fan deposits
- gm — Ground moraine (till)
- Ice — Glacier ice
- ke — Kame-esker deposits
- lc — Glaciolacustrine deposits
- ls — Landslide deposits
- m — End-and lateral-moraine deposits
- mic — Debris-rich glacial ice of medial, lateral, and terminal moraines
- r — Talus and rubble
- rg — Rock-glacier deposits
- s — Lacustrine sand
- lc/gm — One unit (lc) overlying second unit (gm), for example.

Bedrock

- Ib — Basic igneous rocks
- Ig — Felsic igneous rocks
- Iu — Ultramafic igneous rocks
- Mg — Amphibolite and orthogneiss
- Mm — Marble
- Mo — McHugh complex
- Ms — Metasedimentary rocks (Valdez Group)
- Mv — Greenschist and blueschist
- Sc — Coarse clastic sedimentary rocks
- Sf — Fine-grained clastic sedimentary rocks
- Sl — Limestone
- Sm — Medium-grained clastic sedimentary rocks
- Su — Undifferentiated clastic sedimentary rocks
- TM — Tectonic melange, mafic rocks
- TMg — Tectonic melange of metabasalt and pyroclastic rocks
- Vpt — Pyroclastic and other volcanic rocks
- Vu — Lava flows and pyroclastic rocks

SYMBOLS

Drumlin forms, cross bar near and toward which glacier was moving.

Outwash or ice-marginal stream channel; arrow in direction of flow.

Morainal ridge(s)

10 Well or test boring — 5 Exploratory oil well, dry and abandoned — 15 Shaft

Number of well, boring, shaft, exploratory oil well, or shaft listed in table and shown on map and cross section AA'.

● 515 (95) Depth in ft (m) of Tazlina Lake

Sheared and altered rocks of map units Ib, Ig, Tm, TMg, and Vu.

Contact between units: solid where plotted from aerial photographs; hachured (points downslope) where contact coincides with stream cut scarp; barbed, with barbs downslope, where contact is a wave-cut shoreline, and dashed or queried where indefinitely located or inferred.

fault scarp

Fault scarp along line segment indicating apparent displacement of unconsolidated deposits, as determined from aerial photographs.

Boundary of map area

ENGINEERING - GEOLOGIC MAP OF THE SOUTHWESTERN COPPER RIVER BASIN AND UPPER MATANUSKA RIVER VALLEY, ALASKA

BY
JOHN R. WILLIAMS

1985