DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Base from U.S. Geological Survey, 1959
10,000-foot grid based on Alaska coordinate system, zone 3
1000-meter Universal Transverse Mercator grid ticks, zone 6, shown in blue

SCALE 1:63 360

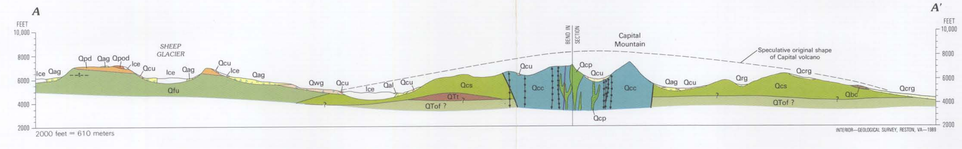
1 ½ 0 1 2 3 4 MILES

1 .5 0 1 2 3 4 KILOMETERS

CONTOUR INTERVAL 100 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

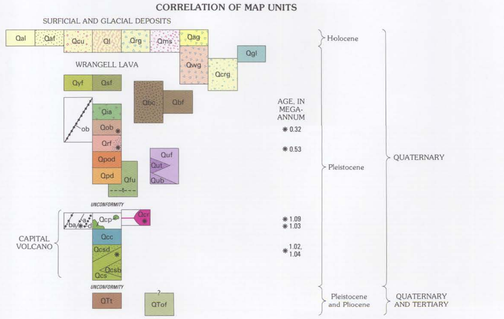
QUADRANGLE LOCATION

Bedrock geology by D. H. Richter, 1981–82; J. G. Smith, 1981, and J. C. Ratté and W. P. Leeman, 1982, in 8 helicopter-supported days. Glacial and surficial geology by H. R. Schmoll and L. A. Yehle chiefly by air photo interpretation supported by 2 days of helicopter field checking in 1983



INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1989

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Alluvial deposits (Holocene)

Qal **Alluvium in streams**—Mainly in active flood plains and terraces of major streams and some minor streams. Includes outwash in channels and aprons related to older phase of the Alaskan glaciation. Chiefly sand and gravel, local cobbles and boulders

Qaf **Alluvium in fans**—Includes large broad fans in low-lying areas and some fans and cones on steep mountain slopes mainly along major streams. Also includes some fans, containing mostly fine-grained material, along minor streams on gentle slopes of Mount Sanford. Chiefly sand, gravel, and boulders

Colluvial deposits (Holocene and Pleistocene)

Qcu **Colluvium, undifferentiated**—Chiefly talus but includes deposits of small landslides, rock glaciers, and other mass-wastage processes, generally includes alluvium in narrow small fans and cones. May also include remnants of valley-glacier moraines. Occurs mainly on steep valley walls in bedrock. Chiefly unsorted silt, sand, gravel, and boulders

Ql **Landslide deposits**—Includes large slump and block-glide deposits and some large debris avalanches in both bedrock and glacial deposits

Qrg **Rock-glacier deposits (Holocene and Pleistocene)**—Includes deposits in active rock glaciers, which have well-defined lobate and tongue-shaped forms, small coalescing rock glaciers, which form linear ridges along bases of steep slopes, and inactive rock glaciers, which have smooth forms. Chiefly angular blocks and diamicton

Qmrs **Mineral-spring(?) deposits (Holocene and Pleistocene)**—Deposits in two conical landforms that may have originated by reworking of glacial deposits through mineral-spring activity; only more northerly of landforms contains a summit lake. Deposits may be similar to those in larger and better formed cones several kilometers southwest (Nichols and Yehle, 1961)

Valley-glacier deposits

Qag **Drift of Alaskan glaciation (Holocene)**—Includes end and lateral moraines of the younger (Tunnel) phase of Alaskan glaciation, deposited after recession of existing glaciers, and end moraines of older (Tustumena?) phase of Alaskan glaciation. Diamicton and rubble, local gravel

Qwg **Drift of Wisconsin glaciation (Pleistocene)**—End, lateral, and ground moraines and local outwash of younger and older phases of Drop Creek moraines (Schmoll, 1984). Locally modified by mass slumping and other colluvial and alluvial processes. Diamicton and boulders, local gravel and sand

Qcrg **Copper River basin glacier deposits (Pleistocene)**—Includes Cobb Lakes, Boulder Creek, and Sanford-Copper lateral moraines (Schmoll, 1984), the boundaries of which are shown by line symbol. Also includes ground-moraine, esker, kame, channel, valley-fill, and outwash deposits related to these moraines as well as older ground moraine. Occurs mainly on broad slopes of Mount Sanford and Capital Mountain. Deposits locally extensively modified by colluvial processes, including downslope movement, debris flow, solifluction, and creep, and by stream action. Chiefly diamicton and rubble, local sand and gravel

Qgl **Glaciolacustrine deposits (Pleistocene)**—Deposits on floor and sloping shore areas of glacial Lake Atna. Chiefly interbedded clay, silt, and fine sand, locally pebbly. Exposed only in extreme northwest corner of quadrangle, below elevation of 2,500 ft

Wrangell Lava

Qvf **Olivine andesite flow (Pleistocene)**—Medium-gray, sparsely porphyritic lava containing small (0.5 mm) phenocrysts of olivine in a trachytic groundmass of plagioclase, hypersthene, and opaque minerals. Thick (100 m) single flow, exhibiting intricately contorted columnar joints, that may have flowed down valley beneath ice. Exposed only in secs. 1 and 2, T. 6 N., R. 7 E.

Qsf **Young Sanford flows (Pleistocene)**—Exposed only high in the cirque wall at the head of Drop Glacier. Flows appear to drape over older flat-lying flows (unit Quf) and are probably young lavas from the main cone of Mount Sanford volcano, whose summit is about 6 km south in Gulkana A–1 quadrangle

Qbc **Olivine basalt cinder cones (Pleistocene)**—Small cinder cones, some with small-volume vesicular and scoriaceous flows, appear to be restricted to zone encircling Capital Mountain volcano. Cones consist of reddish-brown cinder, bombs, and irregular masses of spatter; a few still exhibit their original topographic form. Nonoxidized rocks are dark-gray, porphyritic and microporphyritic lava containing phenocrysts of calcic plagioclase (1–20 percent, 0.4–1.5 mm), olivine (1–10 percent, 0.2–1 mm), and opaque minerals (trace to 1 percent) in a pilotaxitic to intersertal groundmass of plagioclase, pyroxene, olivine(?), and glass. An exception is the elongate cinder cone in sec. 22, T. 8 N., R. 7 E., which is composed of augite-hypersthene andesite and may be a rift vent related to Capital Mountain volcanism

Qbf **Basalt or andesite flows (Pleistocene)**—Flows exposed in high west valley wall of Sheep and Boulder Creeks and on east side of Boulder Creek near north edge of quadrangle. Flows may be from two large cinder cones (Qbc) in sec. 15, T. 7 N., R. 6 E., and sec. 13, T. 8 N., R. 6 E. Rocks are porphyritic and contain phenocrysts of calcic plagioclase (trace to 1 0 percent, 1–3 mm) and olivine (trace to 5 percent, 0.2–2 mm) and sparse crystals of hypersthene in a pilotaxitic groundmass. Contact shown between underlying undifferentiated fine-grained andesite flows (Qfu) is mostly conjectural

Qob **Dikes (Pleistocene)**—Chiefly dark-colored andesitic or basaltic dikes probably mostly related to the north Sanford eruptive center. Known olivine basalt dikes labeled "ob." Not all dikes shown on map have been visited on ground. The name north Sanford eruptive center, as used here and throughout the "Description of Map Units," informally refers to an area of dikes, small plutons, domes, and vent deposits on the north flank of Mount Sanford, a large volcanic structure whose summit is 4 km south of the quadrangle in the contiguous Gulkana A–1 quadrangle

Qis **Intrusive andesite (Pleistocene)**—Light- to medium-gray, porphyritic rock containing phenocrysts of plagioclase (4 percent, 1–3 mm in clots), augite (2 percent, 0.4 mm), and hypersthene (1 percent, 0.4 mm) rimmed by clinopyroxene, in an intergranular to felty goundmass of plagioclase, pyroxene, and opaque minerals. Forms a small massive pluton related to north Sanford eruptive center

Qob **Olivine basalt and basaltic andesite "ribbon flows" (Pleistocene)**—Very thin to medium (<1 m–3 m) flows exhibiting conspicuous reddish-brown scoriaceous tops and bottoms that were erupted from rift vents on the flank of the north Sanford eruptive center. Rock is medium- to dark-gray, sparsely porphyritic lava containing phenocrysts of calcic plagioclase (2–5 percent, 2–4 mm) and olivine (1–5 percent, 0.5–2 mm) in an intersertal to locally intergranular or pilotaxitic groundmass of plagioclase, pyroxene, opaque minerals, and glass. Some flows southeast of Drop Glacier contain as much as a few percent phenocrystic hypersthene. Flows west of Drop Glacier were erupted from a linear zone at least 1 km long in sec. 4, T. 6 N., R. 7 E. (probably extends southwest into sec. 9) that is marked by an olivine basalt dike, scattered patches of olivine basalt pumice and cinder, and copper-stained fractures in the flows. Flows southeast of Drop Glacier apparently were erupted from a rift zone now occupied by a dike in secs. 25 and 26, T. 6 N., R. 7 E. Major-element chemistry for samples BCM–7 and BCM–8 (map localities 1 and 2) is shown in table 1. A potassium-argon date on flows from unit southeast of Drop Glacier in contiguous Nabesna B–6 quadrangle yielded age of 0.32±0.09 Ma (M. A. Lanphere and G. B. Dalrymple, unpub. data, 1973). Aggregate maximum thickness approximately 300 m

Qrf **Rhyodacite flow (Pleistocene)**—Massive, possibly single flow, about 20 km long, 10 km wide, and as much as 360 m thick occurs chiefly in the contiguous Nabesna B–6 quadrangle. Crystalline rock is light to medium-light gray and porphyritic containing phenocrysts of sodic plagioclase (4–7 percent, 2–5 mm), green clinopyroxene (trace to 2 percent, as much as 2 mm), and zero to traces of potassium feldspar and hornblende in a groundmass of microcrystalline to cryptocrystalline felty aggregates dusted with opaque minerals. Dark-gray to brownish-black massive vitrophyre occurs at top and base of flow. Flow apparently erupted from a vent in secs. 15 and 16, T. 6 N., R. 7 E. along the west side of north Sanford eruptive center; vent is marked by a massive rhyodacite dome(?) (stippled) that contains lenses and bands of phenocryst-rich pyroxene andesite(?) and which is cut by a series of northeast-trending olivine basalt dikes. In the Nabesna B–6 quadrangle, chemical analyses and potassium-argon dates indicate a composition of 69–70 percent SiO_2 (D. H. Richter and J. G. Smith, unpub. data, 1981) and an age of 0.53±0.06 Ma (M. A. Lanphere and G. B. Dalrymple, unpub. data, 1973)

Porphyritic dacite flows

Qpod **Porphyritic olivine dacite or andesite (Pleistocene)**—Medium-thick, locally glassy, light- to dark-gray, conspicuously porphyritic rocks containing phenocrysts of plagioclase (1–6 percent, 0.5–4 mm), olivine (1–3 percent, 0.2–3 mm), clinopyroxene (0–2 percent, 0.2–3 mm), and hypersthene (0–1 percent, 0.5–1 mm) in a trachytic to intersertal groundmass. Source vent marked by dike and irregular accumulations of cinder, bombs, and palagonitic ash and lapilli in NE1/4 sec. 11, T. 6 N., R. 6 E.

Qpd **Porphyritic dacite (Pleistocene)**—Extensive single flow, as much as 210 m thick, which underlies less silicic(?) flows of unit Qpod.

Quf **Undifferentiated volcanic rocks**—Chiefly exposed in inaccessible outcrops in cirques at heads of glaciers above about 7,000 ft in elevation. Apparently largely from north Sanford eruptive center

Qut **Flat-lying flows (Pleistocene)**—Thin to thick (1–15 m) flows probably equivalent in part to units Qfu, Qpd, Qpod, and possibly Qob

Qub **Vent deposits (?) (Pleistocene)**—Gray, steeply dipping, layered tephra

Capital Mountain volcano—Andesitic shield volcano of Pleistocene age that may have covered an area as much as 200 km^2 and has a roughly circular summit caldera 4 km in diameter. The shield consists chiefly of lava flows that dip 3°–25° away from the summit caldera. The caldera, whose walls dip 55°–80° inward, is filled with massive, flat-lying flows. Talus, flow breccias, and pillow-lavas occur locally between the caldera wall and caldera-fill flows. A prominent plug, 100 m high, marks the general center of an area of post-caldera-fill activity and is the locus of a spectacular radial dike swarm. Shield and caldera lavas are chiefly hypersthene andesites, but shield lavas tend to be more diverse and range in composition from basalt to dacite (table 1, fig. 1). The basalt and andesite of Capital Mountain volcano appear to be lower in K_2O than compositionally equivalent flows from younger north Sanford eruptive center (fig. 1)

Qcc **Rhyolite dikes and laccoliths (Pleistocene)**—Crystalline rock is very light gray and sparsely porphyritic containing phenocrysts of sodic plagioclase (trace to 2 percent, as much as 4 mm), biotite (trace to 1 percent, as much as 4 mm), and locally traces of potassium feldspar, hornblende, clinopyroxene, and olivine (rounded) in a cryptocrystalline groundmass dusted with fine opaque minerals. Vitrophyre is medium gray to very dark gray and generally forms margins of dikes and tops and floors of laccoliths. Probably represent last activity of Capital Mountain volcano. Largest dike, averaging 4 m wide, extends discontinuously about 8 km from the laccolithic bodies on southeast flank of shield northwesterly across the central part of the volcano. Major-element chemistry for sample 73–ARh–105 (map locality 6) is shown in table 1. Potassium-argon date on plagioclase from same sample yielded age of 1.09±0.17 Ma (table 2)

Qcp **Radial dike swarm (Pleistocene)**—Chiefly dark-colored dikes of mafic to intermediate composition, generally less than 4 m thick and a few kilometers long, that radiate from a summit area containing many plugs, and intrude both shield and caldera lavas. Not all dikes are shown on geologic map.

ba, basaltic andesite and andesite dikes. Probably constitute more than 90 percent of dike swarm but are not readily distinguishable in field. Basaltic andesite varieties are medium to dark gray and variably porphyritic containing phenocrysts (5–40 percent, 1–7 mm) of andesine to slightly more calcic plagioclase, less fresh olivine, and minor to rare clinopyroxene, opaque minerals, and hypersthene in an intergranular to intersertal, locally hyalopilitic, groundmass of plagioclase, olivine, pyroxene, opaque minerals, and sparse glass. Plagioclase and plagioclase-olivine glomerocrysts as much as 1 cm in diameter are common, and in a few dikes the larger plagioclase phenocrysts appear to be more sodic than smaller plagioclase phenocrysts or groundmass plagioclase. Andesite dikes tend to be less porphyritic containing smaller phenocrysts (2–20 percent, 1–5 mm in diameter) consisting chiefly of andesine and slightly more sodic plagioclase, less hypersthene, and sparse clinopyroxene and opaque minerals in an intersertal to hyalopilitic groundmass of plagioclase, pyroxene, opaque minerals, and glass. Glomerocrysts clots of plagioclase+hypersthene±clinopyroxene are common. Major-element chemistry for sample BCM–1 (map locality 7), a basaltic andesite dike, is shown in table 1.

a, coarsely porphyritic andesite dikes. Resemble porphyritic andesite plugs (unit Qcp) and consist of large, complexly zoned plagioclase phenocrysts (30–40 percent, as much as 1 cm) and smaller (1–5 mm) clinopyroxene and hypersthene, all variably intergrown, in an intersertal groundmass of plagioclase laths (1–2 mm), two pyroxenes, opaque minerals, and glass. Major-element chemistry for sample BCM–4 (map locality 8) is shown in table 1. Potassium-argon whole-rock date on same sample yielded age of 1.03±0.06 Ma (table 2).

d, dacite dikes. Light- to medium-gray, sparsely porphyritic containing phenocrysts of sodic plagioclase (3–4 percent, 3–5 mm), hornblende with black oxide rims (trace to 2 percent, 1 to 3 mm), minor opaque minerals, and locally traces of hypersthene and biotite in a cryptocrystalline to felty groundmass of feldspar and minor opaque minerals

Andesite plugs (Pleistocene)—Concentrated chiefly in an area 1.5 km in diameter near the center of the caldera. Two types are recognized: principal type, which forms a prominent 100 m high spire, is a gray, medium-grained (1–2 mm), subhedral, granular rock containing about 80 percent plagioclase, 15 percent hypersthene, a few percent opaque minerals, and locally some cryptocrystalline interstitial material. The other type (stippled) occurs in smaller plugs and is dark gray to dark brownish gray, diabasic in texture, and contains phenocrysts of large, complexly zoned andesine (25–30 percent, as much as 2 cm), clinopyroxene (5 percent, 1 mm), and opaque minerals (2–4 percent, up to 1 mm) in an intergranular groundmass of plagioclase, pyroxene, opaque minerals, and locally glass. Andesine phenocrysts are typically intergrown with each other and with the smaller clinopyroxene and opaque-mineral phenocrysts. A few plugs have been mapped outside main vent area. The largest, in sec. 27, T. 8 N., R. 7 E., is massive, light-gray andesite composed of a felty aggregate of plagioclase (0.2 mm), pyroxene, and opaque minerals

Qcc **Caldera lavas (Pleistocene)**—Flat-lying flows 10–90 m thick generally have scoriaceous tops but no observable pyroclastic or epiclastic interbeds. Flows are almost entirely gray, highly porphyritic hypersthene andesite containing phenocrysts of plagioclase (5–50 percent, 0.5–5 mm), hypersthene (2–10 percent, 0.2–1.5 mm), and an occasional crystal of clinopyroxene and rounded olivine in a matrix of cryptocrystalline material, locally glassy, containing scattered opaque minerals. Crystal-rich varieties are almost equigranular and contain subophitic hypersthene and very minor interstitial glass. Stippling indicates area of intense brecciation and hydrothermal alteration containing numerous dikes, plugs, and irregular small intrusive bodies. Major-element chemistry for sample BCM–3 (map locality 9) is shown in table 1. Maximum thickness greater than 450 m

Shield lavas and pyroclastic deposits (Pleistocene)

Qcs **Thin to thick (2–10 m) flows**—Contains sparse thin (less than 2 m) interbeds of palagonitic lapilli tuff and pyroclastic breccia. Flows are chiefly gray to dark-gray, porphyritic hypersthene andesite but include hypersthene-augite andesite and basaltic andesite, hypersthene-olivine andesite and basaltic andesite, and olivine basaltic andesite and basalt. Typical hypersthene andesite contains phenocrysts of plagioclase (5–15 percent, 0.5–1 mm) and hypersthene (1–5 percent, 0.1–1 mm) in an intersertal to pilotaxitic groundmass of plagioclase microlites, pyroxene, opaque minerals, and cryptocrystalline material. Flows of this unit are less porphyritic and tend to be more mafic than caldera flows (Qcc). Major-element chemistry for samples BCM–2, BCM–5, and BCM–6 (map localities 11, 12, and 13, respectively) is shown in table 1. Potassium-argon whole-rock dates on samples BCM–5 and BCM–6 (localities 12 and 13) yielded ages of 1.04±0.11 Ma and 1.02±0.08 Ma, respectively (table 2)

Qcsd **Massive dacite flow or flows**—As much as 100 m thick, which probably erupted late in the shield-building sequence. Rock is medium gray, porphyritic, and locally glassy containing phenocrysts of plagioclase (3–10 percent, 1–2 mm), augite (1 percent, 0.5 mm), hypersthene (1–2 percent, 0.1–0.5 mm), and opaque minerals (1 percent) in a microtrachytic to cryptocrystalline groundmass. Major-element chemistry for sample BCM–9 (map locality 10) is shown in table 1

Qcsb **Larger deposits of pyroclastic breccia**—Mapped separately from unit Qcs. Breccia deposits are chiefly explosive vent deposits and consist of crudely layered beds of angular blocks (as much as 1 m in diameter) of andesite in a brownish-gray, fine-grained hydrothermal matrix interlayered with sparse, short, rubbly flows. Unit may include some mudflow deposits

QTf **Basaltic scoria and tuff (Pleistocene and Pliocene)**—Reddish-brown basaltic scoria containing abundant ribbon and breadcrust bombs overlain by about 5 m of indurated, yellowish-brown, palagonitic, basaltic lapilli tuff. Exposed in small area in secs. 16 and 21, T. 7 N., R. 7 E. where unit is unconformably overlain by shield lavas of Capital Mountain volcano (unit Qcs)

QTof **Old andesite flows (Pleistocene and Pliocene)**—Chiefly medium- to dark-gray, fine-grained to sparsely porphyritic augite-andesite containing 1–2 percent small (<1 mm) phenocrysts of plagioclase and augite in a pilotaxitic groundmass. Exposed in northeast corner of quadrangle; apparently older than deposits of Capital Mountain volcano

Contact—Known, approximate, and inferred; queried where uncertain

Caldera wall, showing dip—Dotted where concealed. Hachures on caldera collapse side

Area of alteration and brecciation—Intense hydrothermal alteration and extreme brecciation within Capital Mountain caldera

Glacial boundaries—Generalized upper limits of glacial deposits related to the following lateral moraines

CL Cobb Lakes—Youngest and lowest

BC Boulder Creek

SC Sanford-Copper—Oldest and highest

Attitude of bedding and flow layering
- Inclined
- Horizontal

Attitude of flow banding in rhyolite
- Inclined
- Vertical

Sample locality—Locality numbers correspond to numbers in tables 1 and 2

- Petrographic sample
- Petrographic sample that was also chemically analyzed
- Petrographic sample that was also chemically analyzed and dated by potassium-argon methods
- Copper-stained fracture

REFERENCES CITED

Ewart, A., 1979, A review of the mineralogy and chemistry of Tertiary-Recent dacitic, latitic, rhyolitic, and related salic volcanic rocks, in Barker, Fred, ed., Trondhjemites, dacites, and related rocks: Amsterdam, Elsevier Scientific Publishing Company, p. 121–131.

Nichols, D. R., and Yehle, L. A., 1961, Mud volcanoes in the Copper River basin, Alaska, *in* Raasch, G. O., ed., Geology of the Arctic: International Symposium Arctic Geology, 1st, Calgary, 1960, Proceedings, v. 2, p. 1063–1087.

Peccerillo, Angelo, and Taylor, S. R., 1976, Geochemistry of Eocene calcalkaline volcanic rocks from the Kastamonu area, northern Turkey: Contributions to Mineralogy and Petrology, v. 58, p. 63–81.

Schmoll, H. R., 1984, Late Pleistocene morainal and lacustrine geology in the upper Copper River-Mentasta Pass area, Alaska: Geological Society of America Abstracts with Programs, v. 16, no. 5, p. 332.

Table 1.—*Chemical analyses of samples of Wrangell Lava from the Gulkana B–1 Quadrangle, Alaska*

[Analyses by U.S. Geological Survey X-ray spectroscopy methods (with exception of sample 73–ARh–105), analysts, A. J. Bartel, K. C. Stewart, and J. E. Taggart, Jr., and rock analysis methods (FeO, H_2O^+, H_2O^-, CO_2), analysts H. G. Neiman, Georgia Mason, and C. L. Stone. Sample 73–ARh–105 analyzed by U.S. Geological Survey rapid rock method, analyst, P.L.D. Elmore]

Locality no. – –	1	2	3	4	5	6	7	8	9	10	11	12	13
Sample no. – –	BCM–7	BCM–8	BCM–10	BCM–11	BCM–12	73–ARh–105	BCM–1	BCM–4	BCM–3	BCM–9	BCM–2	BCM–5	BCM–6
Map unit – – –	Qob	Qpd	Qpd	Qpd	Qfu	Qcr	dike ba	dike a	Qcsd	Qcsb	Qcs	Qcs	Qcs
SiO_2	53.0	52.8	62.6	63.4	54.2	70.7	53.6	57.2	55.8	63.2	54.5	54.1	52.2
Al_2O_3	15.8	16.9	16.2	16.1	17.1	16.0	17.9	18.0	17.7	16.2	17.8	17.6	17.6
Fe_2O_3	2.21	2.59	1.48	1.28	2.39	0.80	3.94	1.84	4.00	2.60	3.83	2.25	1.90
FeO	7.08	5.65	4.19	4.01	6.84	1.0	4.23	4.00	3.29	2.27	2.97	5.19	6.47
MgO	4.89	5.94	1.68	1.48	4.01	0.52	4.03	4.30	4.37	1.46	5.21	5.33	6.27
CaO	7.54	8.43	4.02	3.64	7.39	1.5	7.40	7.71	7.29	3.50	8.25	8.32	8.89
Na_2O	3.83	3.68	4.92	5.18	3.97	4.5	3.92	3.67	3.72	5.05	3.29	3.55	3.66
K_2O	1.57	1.15	2.35	2.55	1.32	3.6	1.03	1.03	1.24	2.70	0.97	1.00	0.92
H_2O^+	0.50	0.13	0.34	0.27	0.28	0.53	0.99	0.80	0.23	0.84	0.90	0.62	0.15
H_2O^-	0.09	0.09	0.11	0.08	0.10	0.11	0.32	0.18	0.81	0.09	0.64	0.57	0.09
TiO_2	1.94	1.50	1.01	0.94	1.89	0.36	1.34	0.86	0.96	0.94	0.96	1.13	1.53
P_2O_5	0.98	0.52	0.32	0.30	0.45	0.08	0.35	0.23	0.30	0.33	0.23	0.30	0.36
MnO	0.16	0.13	0.14	0.14	0.16	0.10	0.14	0.10	0.11	0.12	0.11	0.12	0.14
CO_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	0.64	<0.01	0.02	<0.01	<0.01	0.02	<0.01
Total	99.59	99.51	99.36	99.37	100.01	99.80	99.83	99.72	99.84	99.30	99.66	100.01	100.18
SiO_2 (water-free normalized to 100)	53.5	53.2	63.3	64.0	54.4	71.0	54.4	57.8	56.5	64.2	55.5	54.7	52.2

Table 2.—*K-Ar determinations and analytical data on volcanic rocks from the Gulkana B–1 quadrangle, Alaska*

[Potassium analyses by F. R. Klock, S. T. Neil, and D. V. Vivit. Argon analyses by J. E. Conrad, L.B.G. Pickthorn, J. C. Von Essen, and J. G. Smith. Ages calculated using the following constants: λ_e=0.581×10^{-10} yr^{-1}, λ_β=4.962×10^{-10} yr^{-1}, and $^{40}K/K$=1.167×10^{-4} atom percent]

Sample locality number	Sample number	Sample locality Latitude (North)	Sample locality Longitude (West)	Material dated and treatment[1]	K_2O (weight percent) First	K_2O (weight percent) Second	K_2O (weight percent) Third	K_2O (weight percent) Average	Radiogenic argon, moles / gram (×10^{-10})	% rad argon	Age (×10^6 years)
6	73–ARh–105	62°24.1'	144°01.1'	Plag	0.487	0.487	----	0.487	0.7621	9.2	1.09±0.17
8	BCM–4	62°25.8'	144°07.4'	Wr, nit	1.185	1.172	----	1.169	1.737	8.9	1.03±0.06
12	BCM–5	62°26.4'	144°08.3'	Wr, nit	1.095	1.160	1.130	1.128	1.687	4.1	1.04±0.11
13	BCM–6	62°27.3'	144°08.0'	Wr, nit	1.008	1.004	----	1.006	1.480	8.8	1.02±0.08

[1] Wr=whole rock, nit=nitric acid treated, Plag=plagioclase.

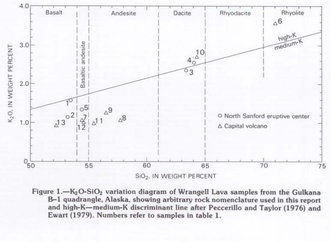


Figure 1.—K_2O-SiO_2 variation diagram of Wrangell Lava samples from the Gulkana B–1 quadrangle, Alaska, showing arbitrary rock nomenclature used in this report and high-K—medium-K discriminant line after Peccerillo and Taylor (1976) and Ewart (1979). Numbers refer to samples in table 1.

GEOLOGIC MAP OF THE GULKANA B–1 QUADRANGLE, SOUTH-CENTRAL ALASKA

By

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1989

GEOLOGIC QUADRANGLE MAP
GULKANA B–1 QUADRANGLE, ALASKA
GQ–1655