DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Glacier Bay National Monument

Generalized reconnaissance geologic map

OPEN FILE REPORT
OF 78-494
PLATE IA (SHEET 2 OF 2)
1978

PLATE IA (SHEET 2 OF 2)

GENERALIZED RECONNAISSANCE GEOLOGIC MAP OF GLACIER BAY NATIONAL MONUMENT, ALASKA

(EXPLANATION)

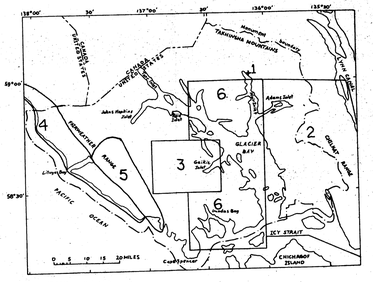
CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS — Qs < Qi — QUATERNARY

LAYERED ROCKS	INTRUSIVE ROCKS	
Ty		PLIOCENE AND MIOCENE — TERTIARY
Ttc	Tg	MIOCENE AND OLIGOCENE — TERTIARY
	TKg	TERTIARY OR CRETACEOUS
Ky	Kg	CRETACEOUS
Pap, Pim, Pvg, Pap		LOWER PERMIAN AND PERMIAN? / LOWER PERMIAN?
DSsg, DSvg, DSsg	Pzh, Pzm, Pzg, Pzh	DEVONIAN AND (OR) SILURIAN
		UPPER SILURIAN
	gb	AGE UNKNOWN
mgp	ms, mg	

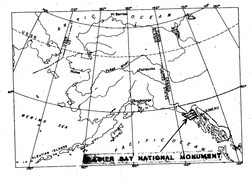
GEOLOGIC MAP SYMBOLS

- CONTACT- DASHED WHERE CONCEALED
- FAULT -DASHED WHERE CONCEALED
- MONUMENT BOUNDARY
- INTERNATIONAL BOUNDARY



Previous mapping

Area 1: Twenhofel (1946); area 2 : Lathram et al (1959);
area 3: Seitz (1959); area 4: Miller (1961) & Plafker (1971);
area 5: Rossman (1963a); area 6: Rossman (1963b).



Index map showing Glacier Bay National Monument, Alaska

DESCRIPTION OF MAP UNITS

Surficial deposits:

Qs — Unconsolidated materials (Holocene) - Alluvium; colluvium; glacial terminal, lateral, and supraglacial moraines; glacial till and ice contact deposits; outwash from glacier termini; and beach deposits.

Qi — Glacial ice and permanent snowfields (Holocene) - Actual boundaries may vary from those shown on map due to local glacier recession or advance; locally covered by unconsolidated materials.

Layered rocks:

Ty — Yakataga Formation (Miocene and Pliocene): Youngest and most widely distributed Tertiary formation in Lituya province; as much as 2,560 m (8,400 feet) thick; lower unit ranges from 185 m (600 feet) to 730 m (7,400 feet) in thickness and consists mainly of interbedded siltstone and sandstone with calcareous lenses or concretions and sparse isolated pebbles; upper unit is at least 1,830 m (6,000 feet) thick and consists of sandy mudstone, siltstone, sandstone, and minor conglomerate interbedded with abundant conglomeratic sandy mudstone (marine tillite which contains unsorted ice-transported clasts of different lithologies); molluscan fauna indicates deposition of a shallow marine cold-water environment (Plafker, 1971).

Ttc — Topsy Formation and Cenotoph Volcanics - (Oligocene and Miocene) - Topsy Formation in Lituya province ranges from 365 m (1,200 feet) to 1,340 m (4,400 feet) in thickness; consists of about 75 percent hard calcareous or concretionary brown-weathering siltstone and 25 percent fine-to-medium-grained gray or greenish-gray argillaceous and carbonaceous sandstone; sparse molluscan fauna indicates deposition in marine environment in pre-middle Miocene, probably Oligocene. Cenotoph Volcanics appear to grade into and interfinger with the Topsy Formation; consist of basal unit 260 m (850 feet) thick of green, red, and purple volcanic breccia, tuff, and local andesitic flows overlain by 120 m (400 feet) of interbedded green and red tuffaceous siltstone, green glauconitic sandstone, and glauconitic pebble-cobble conglomerate; lenses and discontinuous beds of low-rank coal locally near top; probably deposited in mostly nonmarine and nearshore environment (Plafker, 1971).

Ky — Yakutat Group (Cretaceous) - Graywacke and argillite, limy slate and phyllite, greenstone, and mélange units in the Lituya province: graywacke and argillite unit consists of an unknown thickness, but probably thousands of meters, of grayish-brown weathering, fine-grained, unfossiliferous marine graywacke, siltstone, argillite, and minor greenstone exposed west of the Fairweather fault between Crillon Lake and Icy Bay and on North, Middle, and South Domes; limy slate and phyllite unit consists of an unknown, but probably thousands of meters, thickness of unfossiliferous marine limy graphitic slate, phyllite, graywacke, and slaty limestone exposed between Fairweather Glacier and Lituya Bay; greenstone unit consists of an unknown thickness, probably hundreds of meters, of discontinuous, low metamorphic grade greenstone structurally above the limy slate and phyllite unit between the Fairweather Glacier and Lituya Bay; mélange unit consists of an unknown thickness, probably hundreds of meters of mélange composed of 10 to 100 meter long lenticular blocks of greenstone, graywacke, phyllite, and some chert exposed on the north and south shores of Lituya Bay near its head, on the long ridge between Lituya Bay and Fairweather Glacier, and northwest of Fairweather Glacier.

Pap — Argillite, phyllite, and slate (Permian and Permian?) - Dominant rock types of two stratigraphic sections - north of Casement Glacier in Muir province and west of White Glacier in Chilkat province - known to be Permian age and of section west of Tarr Inlet inferred to be Permian; units described below (Pim and Pvg) occur as both persistent and discontinuous layers in this unit; in section north of Casement Glacier this unit consists of gray marine phyllite, graywacke, slaty shale, dark gray shale, limy siltstone, and minor limestone; grades locally into the Pvg unit; total thickness of section, including Pvg and Pim, is estimated to be 2,500 m (8,200 feet); in section west of White Glacier consists of thin-bedded limestone, calcareous siltstone, and argillite overlying Pvg unit; in section west of Tarr Inlet is dominant country rock exposed in Tarr Inlet suture zone (Brew and Morrell, 1978) and consists of phyllite, slate, conglomerate and minor chert deposited in a marine environment.

Pim — Limestone and marble (Permian and Permian?) - occur in all three sections described above for Pap unit; in section north of Casement Glacier the main exposure consists of 1,250 m (4,100 feet) of light gray fossiliferous marine limestone, dark gray limestone, conglomerate that grades to volcanic rock along strike, fossiliferous dark gray shale and shaly limestone-clast conglomerate that also grade into volcanic rock along strike; in section west of White Glacier consists of a persistent 915 m (3000 feet) thick unit of locally fossiliferous (brachiopods and bryozoa) gray and dark gray locally cherty marine limestone underlying Pvg unit with about 150 m (500 feet) of conglomerate, graywacke, and red siltstone at contact; in section west of Tarr Inlet consists of discontinous lenses of light to medium gray marble as much as 5 km long and several tens of meters thick.

Pvg — Amygdaloidal volcanic rock and greenstone (Permian and Permian?) - occurs in all three sections described above for Pap unit; in section north of Casement Glacier consists of 335 m (1,100 feet) of dark gray amygdaloidal metabasalt(?); in section west of White Glacier consists of 1,220 m (4,000 feet) of amygdaloidal volcanic rock between Pap and Pim units; in sections west of Tarr Inlet consists of discontinuous units of greenstone, greenschist and other volcanic rocks derived from tuffs or flows.

DSsg — Graywacke and argillite (Silurian and Devonian) - includes the Tidal and Kendu Formations undivided, graywacke and argillite of Chilkat Mountains (unit 10 of Lathram and others (1959) and equivalent to Point Augusta Formation on nearby Chichagof Island according to Loney and others (1975), siliceous argillite of Chilkat Mountains (unit 13 of Lathram and others, (1959)), all in Chilkat province; Tidal Formation, graywacke and argillite and siliceous argillite of Chilkat Mountains in Muir province; and the Kendu Formation in the Geikie province: the Tidal Formation consists of mostly fine- to thick-bedded gray and brown-weathering, black to light gray fresh, well-indurated fine-grained argillite; medium- to coarse-grained graywacke of similar appearance is locally abundant, all are commonly calcareous; coral from the Tidal Formation suggest a Late Silurian age (Rossman, 1963b) and the whole unit, including the 700 m (2,300 feet) thick limestone described below as part of the DSc unit, is at least 3,080 m (10,000 feet) thick; the Kendu Formation consists of thin-bedded calcareous argillite and silty limestone at least 760 m (2,500 feet) thick, it is fossiliferous; the graywacke and argillite of the Chilkat Mountains are an apparently large thickness of calcareous, fine- to-medium grained, thin-bedded graywacke and argillite with minor slate, conglomerate, and volcanic rocks; this unit contains Upper Silurian graptolites at Point Couverden outside the Monument and graptolites and corals of Middle or Late Silurian age near St. James Bay, also outside the monument (Loney and others, 1975); the siliceous argillite of the Chilkat Mountains consists of dark gray fresh, dark brownish-red-weathering argillite with lenses of pebble to cobble conglomerate, graywacke, and layers of basalt and andesite flows, agglomerates, and tuffs which increase in proportion towards and then grade into the DSbv unit.

DSc — Limestone and minor marble (Silurian and Devonian) - Includes Black Cap Limestone, Pyramid Peak Limestone, Willoughby Limestone, and limestones associated with Tidal Formation (all Rossman, 1963b), graywacke and argillite and siliceous argillite of Chilkat Mountains (units 10a and 13b respectively of Lathram and others, (1959)), all in Chilkat province, Black Cap Limestone and limestones associated with graywacke and argillite and siliceous argillite in Muir province; and Pyramid Peak Limestone in Geikie province: the Black Cap Limestone consists of thin- to thick-bedded black to gray limestone at least 1,370 m (4,500 feet) thick and contains a marine invertebrate fauna of Middle Devonian age (Rossman, 1963b); the Pyramid Peak Limestone and the Willoughby Limestone are interpreted to be the same both here and by Loney and others (1975): the unfossiliferous Pyramid Peak is mainly light gray to brown, thin- to moderately-thick-bedded limestone with some argillite in the upper part and some dark gray limestone near the base, the unit is about 670 m (2,200 feet) thick; the Willoughby Limestone is interpreted to be a reefoid phase of the Pyramid Peak; it consists of massive bluish-gray to white limestone, thick beds are locally present and reef-breccia features are well displayed on some glacially polished surfaces; the unit is greater than 1, 520 m (5,000 feet) thick and is dated as Late Silurian (Rossman, 1963b); all of the limestones associated with the Tidal Formation, the undivided Tidal and Kendu Formations, and with the graywacke and argillite and siliceous argillite of the Chilkat Mountains are all about the same: light to medium gray, thin-to medium-bedded unfossiliferous limestone in individual units as much as 700 m (2,300 feet) thick; some of these are locally marble; Upper Silurian graptolites are present in graywacke intercalated with unfossiliferous limestone at eastern end of Adams Inlet.

DSvg — Greenstone and other metavolcanic rocks (Silurian and Devonian) - Includes low-grade metavolcanic rocks associated with the Black Cap Limestone, undivided Tidal and Kendu Formations (all Rossman, 1963b) and siliceous argillite of the Chilkat Mountains (unit 13a of Lathram and others (1959)) in the Chilkat province, and with the Black Cap Limestone and siliceous argillite in the Muir province: generally poorly understood dark green and dark gray massive-appearing flows with some agglomerates and tuffs, probably basaltic and(or) andesitic composition; unit in northeastern part of monument is probably thousands of meters thick with some phyllite, slate, graywacke semischist, and thin marble; greenstone, greenschist, and green phyllite near Casement Glacier is greater than 2,320 m (7,600 feet) thick; minor limestone-cobble conglomerate associated with unit between Queen and Kendu Inlets.

Psh — Hornfels, schist, and marble (Paleozoic) - Includes rocks in both Geikie and Muir provinces that are probably derived from all or some of the above-described rocks by metamorphism in Cretaceous time: dominantly biotite-quartz-feldspar schist, semischist, and phyllite west of Muir Inlet and northwest of Riggs Glacier; mostly massive to layered biotite-plagioclase-quartz hornfels, (biotite)-hornblende-quartz-plagioclase hornfels, biotite-orthoclase-quartz-plagioclase hornfels, and calc-silicate hornfels between Tarr and Geikie Inlets; thin light gray marbles common in same area.

Psm — Marble and hornfels (Paleozoic) - Includes rocks in Geikie, Chilkat, and Muir provinces derived from the Black Cap Limestone, Pyramid Peak Limestone, and other limestones by metamorphism in Cretaceous time: mostly light to dark gray, medium- to coarse-grained massive to crudely layered appearing marbles; Seitz (1959) describes the prominent north-striking outcrop belt west of Geikie Inlet as thick-bedded gray limestone with some beds of black limestone and several intercalated layers of hornfels and chlorite schist; he notes the presence of scrappy fossil remains suggesting a post-Silurian, pre-Triassic age.

Psg — Gneiss, amphibolite, and metavolcanic rocks (Paleozoic) - Includes a variety of gneisses and amphibolites in the Geikie, Chilkat, and Muir provinces that were metamorphosed in the Cretaceous: most widespread exposures are near the West Arm of Dundas Bay, where well foliated and locally banded hornblende-quartz-feldspar gneiss, and poorly-foliated to unfoliated "hornblende-plagioclase rock" (Rossman, 1963b) comprise the largest area of high-grade-metamorphic rocks in the monument; other widespread exposures are north of Geikie Inlet, where flows and sills of mafic composition (Seitz, 1959) some of them with relict vesicular surfaces, are intercalated conformably with the rocks of the Psm and Psh units.

mgp — Metagraywacke, phyllite, and muscovite schist (Unknown age) - Includes rocks west of Taylor Bay and near Fairweather Glacier in the Fairweather province: west of Taylor Bay consists of slightly metamorphosed, well-foliated and well-cleaved, medium to dark gray, fine-grained graywacke in 1 to 10 cm thick layers alternating with similarly-colored finer grained slaty phyllite of similar thickness; near Fairweather Glacier consists of well-layered muscovite schist, brown and green phyllite, and metagraywacke and slate like that near Cape Spencer; grades into ms unit with increasing metamorphism, age of unit is unknown, but Brew and others (1977) suggested it and other units in the Fairweather province could be early Paleozoic or Precambrian.

ms — Biotite schist, semischist, and gneiss (Unknown age) - Includes rocks extending north from Cape Spencer and east of the head of Lituya Bay in the Fairweather province: generally derived from graywacke and associated argillite; now well-foliated, medium- to very fine-grained, light to dark gray (garnet)-biotite-quartz schist, semischist, and gneiss in 1 to 10 cm thick layers alternating with finer grained quartz-biotite SCHIST TAYLOR locally; contains discontinuous layers, lenses, and blobs of quartz to 5 cm thick; age and relationship to mgp unit are described above.

mg — Hornblende schist and gneiss (Unknown age) - Prominent continuous unit between Sugarloaf Island and monument boundary to the northwest in western part of Fairweather province: well-foliated fine- to medium-grained, locally well-lineated, medium to dark green plagioclase-hornblende gneiss, (garnet)-biotite-plagioclase-hornblende gneiss, chlorite-plagioclase-amphibole gneiss, (chlorite)- plagioclase-hornblende schist, (biotite)-plagioclase-hornblende schist; local amphibolite and metagabbro; local layers and zones of epidote parallel foliation; age is described under mp unit above.

Intrusive rocks and associated migmatites:

Tg — Unfoliated felsic granitic rocks and associated migmatites (Tertiary) - generally light gray, Color Index average 10, medium- to coarse-grained biotite granite, granodiorite and tonalite; lesser amounts of alkali granite syenite, quartz monzodiorite, quartz diorite, and andesite; local accessory minerals are hornblende, muscovite, garnet, chlorite, epidote, apatite, magnetite, and sulfides; locally foliated, generally near contacts; locally porphyritic, locally inclusion-rich; extensive and spectacular migmatite zones near the walls and roofs of some plutons; most common in the Fairweather, Geikie and Muir provinces; age is inferred from field relations and preliminary radiometric dating (M A. Lanphere, oral communication, 1967).

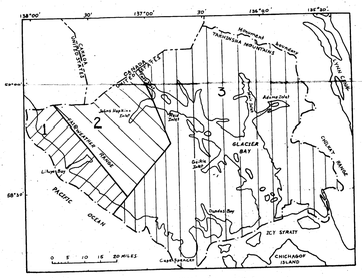
TKg — Locally foliated felsic and intermediate granitic rocks and associated migmatites (Tertiary or Cretaceous) - generally light gray, Color Index average 18, medium-grained biotite-hornblende and hornblende-biotite granodiorite to tonalite; lesser amounts of quartz monzodiorite, diorite, and quartz diorite; local accessory minerals are sphene and chlorite; poorly developed foliation is common; inclusion-rich zones common in granodiorite and tonalite; migmatite zones near walls of some plutons; most common in Fairweather and Muir provinces, also in Geikie and Lituya provinces; age is inferred from field relations and preliminary radiometric dating (M. A. Lanphere, oral communication, 1967).

Kg — Foliated intermediate composition granitic rocks and associated migmatites (Cretaceous) - generally light gray ranging to dark green; Color Index average 20, fine-to coarse-grained biotite-hornblende granodiorite, quartz monzodiorite, tonalite, and quartz diorite; local compositional variants include diorite, monzodiorite, granite, quartz monzonite, and gabbro; accessory minerals include chlorite, sphene, epidote, and sulfides; dark, fine-grained inclusions are common, are aligned parallel to well-developed foliation, and in some places are very abundant and grade into migmatite zones; most common in Geikie and Muir provinces, also present in Lituya and Chilkat provinces; age is based on field relations, similarity to radiometrically dated rocks on Chichagof Island to the south (Loney and others, 1967), and on preliminary results of radiometric dating (N. A. Lanphere, oral communication, 1967).

gb — Layered cumulus-type gabbro complexes (Unknown age) - Includes four major and two minor complexes in the Fairweather province: the major body of Astrolabe Peninsula consists of fine- to coarse-grained, light to dark gray and brown, Color Index 40-80, averaging 55, (olivine) gabbro, gabbronorite, and norite with layers of pyroxenite, local concentrations of magnetite and ilmenite (Rossman, 1963a); major Crillon-La Perouse body consists of similar rocks, but has locally abundant peridotite, and dunite, no magnetite and is generally discontinuously layered except the southern end; major body near Mount Wilbur is poorly known, but is apparently largely poorly layered hornblende gabbro; major body at Mount Fairweather is also poorly known, but limited sampling of float material (Plafker and MacKevett, 1970) suggests that it consists of magnetite- and ilmenite-bearing gabbronorite and olivine gabbro with lesser amounts of sulfide-and chromite- bearing wehrlite, pyroxenite, and dunite; gravity and aeromagnetic field interpretation suggests that all of these complexes have steep contacts that extend to considerable depth and that they may all connect at depth; age information given under unit mgp, above.

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

Aeromagnetic contour map explanation.



Map showing areas flown at different altitudes.

Area 1: 5,000 feet, area 2: 15,000 feet and area 3: 8,000 feet.

Contour interval for areas 1 and 2 is 5 GAMMA.

contour interval for area 3 is 10 GAMMA.

References

Brew, D. A., Johnson, B. R., Nutt, C. J., Grybeck, Donald, and Ford, A. B. 1977, Newly discovered granitic and gabbroic bodies in the Fairweather Range, Glacier Bay National Monument, Alaska, in Blean, K. M., ed., The U.S. Geological Survey in Alaska: Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. 90-91.

Brew, D. A., and Morrell, R. P., 1978, Tarr Inlet suture zone, Glacier Bay National Monument, Alaska, in Johnson, K. M., ed., The U.S. Geological Survey in Alaska: Accomplishments during 1977: U.S. Geological Survey Circular 722-B, p._____, (in press).

Lathram, E. H., Loney, R. A., Condon, W. H., and Berg, H. C., 1959, Progress map of the geology of the Juneau quadrangle, Alaska: U.S. Geological Survey Map I-303, scale 1:250,000.

Losey, R. A., Brew, D. A., and Lanphere, M. A., 1967, Post-Paleozoic radiometric ages and their relevance to fault movements, northern southeastern Alaska: Geological Society of America Bulletin, v. 78, p. 511-526.

Loney, R. A., Brew, D. A., Muffler, L. J. P., and Pomeroy, J. S., 1975, Reconnaissance geology of Chichagof, Baranof, and Kruzof Islands, southeastern Alaska: U.S. Geological Survey Professional Paper 792, 105 p.

Miller, D. J., 1961, Geology of the Lituya district, Gulf of Alaska Territory province, Alaska: U.S. Geological Survey Open-file Report.

Plafker, G., 1971, Petroleum and coal in MacKevett, E. M., Jr. and others, Mineral resources in Glacier Bay National Monument, Alaska: U.S. Geological Survey Professional Paper 632, 90 p.

Plafker, G., MacKevett, Jr., 1970, Mafic and ultramafic rocks from a layered pluton at Mt. Fairweather, Alaska, U.S. Geological Survey Professional Paper 700-B, p. B21-B26.

Rossman, D. L., 1963a, Geology and petrology of two stocks of layered gabbro in the Fairweather Range, Alaska: U.S. Geological Survey Bulletin 1121-F, p. F1-F50.

_____ 1963b, Geology of the eastern part of the Mount Fairweather quadrangle, Glacier Bay, Alaska: U.S. Geological Survey Bulletin 1121-K, p. K1-K57.

Seitz, J. F., 1959, Geology of the Geikie Inlet area, Glacier Bay, Alaska: U.S. Geological Survey Bulletin 1058-C, p. 61-120.

Souther, J. G., Brew, D. A., and Okulitch, A. V., 1974, Iskut River, British Columbia, geological map 1:1,000,000: Geological Survey of Canada Open-file Report no. 214.

Twenhofel, W. S., 1946, Molybdenite deposits of the Nunatak area, Muir Inlet, Glacier Bay, in Twenhofel, W. S., Robinson, G. D., and Caulk, N. R., eds., Molybdenite investigations in southeastern Alaska: U.S. Geological Survey Bulletin 947-B, p. 7-38.