U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Klondike Gold Rush National Historical Park

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Klondike Gold Rush National Historical Park

klgo_geology.pdf

Version: 9/3/2015

Geologic Resources Inventory Map Document for Klondike Gold Rush National Historical Park

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Geologic Resources Inventory Map Document

Klondike Gold Rush National Historical Park, Alaska

Document to Accompany Digital Geologic-GIS Data

klgo_geology.pdf

Version: 9/3/2015

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Klondike Gold Rush National Historical Park, Alaska (KLGO).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Data Store Search Application: http://irma.nps.gov/App/Reference/Search. To find GRI data for a specific park or parks select the appropriate park

(s), enter “GRI” as a Search Text term, and then select the Search Button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: http://www.nature.nps.gov/geology/inventory, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

GRI Digital Map and Source Map Citations

The GRI digital geologic-GIS map for Klondike Gold Rush National Historical Park, Alaska (KLGO):

GRI Digital Geologic Map of Klondike Gold Rush National Historical Park and Vicinity, Alaska (*GRI MapCode KLGO*)

The map was produced from the following U.S. Geological Survey sources,

Crafford, T.C., 2001, Alaska Resource Data File, Skagway Quadrangle: U.S. Geological Survey, Open-File Report OF-2001-193, scale 1:250,000. (Skagway ARDF). (*GRI Source Map ID 2605*).

Wilson, F.H., Hults, C.P., Mull, C.G., and Karl, S.M, 2015, Geologic Map of Alaska (accompanying database): U.S. Geological Survey, unpublished digital data, scale 1:500,000. (Geologic Map of Alaska). (*GRI Source Map ID 76024*). *Note: Source map unit descriptions were extracted from this publication.*

Wilson, F.H., Hults, C.P., Mull, C.G., and Karl, S.M. (Geologic Map Compilers), and Wilson, F. H., Shew, N., Labay, K.A., Hults, C.P. (Digital Files Preparation), 2015, Unpublished Digital Data for the Geologic Map of Alaska, Skagway 1' x 3' Sheet: U.S. Geological Survey, unpublished digital data, scale 1:500,000. (Skagway Quadrangle). (*GRI Source Map ID 76025*).

Wilson, F.H., Shew, N.B., DuBois, G.D., and Dadisman, S., 1999, Alaska Radiometric Ages, Alaska: U.S. Geological Survey, unpublished digital data, scale 1:250,000. (Alaska Radiometric Ages). (*GRI Source Map ID 75596*).

Additional information pertaining to each source map is also presented in the GRI Source Map Information (KLGOMAP) table included with the GRI geologic-GIS data.

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Klondike Gold Rush National Historical Park, Alaska (KLGO) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qs - Surficial deposits, undifferentiated). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the GRI Geologic Unit Information (KLGOUNIT) table included with the GRI geology-GIS data. Some source unit symbols, names and/or ages may have been changed in this document and in the GRI digital geologic-GIS data. This was done if a unit was considered to be the same unit as one or more units on other source maps used for this project, and these unit symbols, names and/or ages differed. In this case a single unit symbol and name, and the unit's now recognized age, was adopted. Unit symbols, names and/or ages in a unit descriptions, or on a correlation of map units or other source map figure were not edited. If a unit symbol, name or age was changed by the GRI the unit's source map symbol, name and/ or age appears with the unit's source map description.

Cenozoic Era

Quaternary Period

Qs - Surficial deposits, undifferentiated
Qa - Alluvium
Qaf - Alluvial fan deposits
Qct - Talus and colluvium
Qrg - Rock glacier deposits
Qd - Glacial drift

Tertiary Period

Tlqm - Leucocratic quartz monzonite
Tqgv - Hornblende-biotite quartz diorite and granodiorite
Tegd - Granite and granodiorite
Tdgp - Porphyritic K-feldspar granodiorite
Tbgd - Euhedral biotite granodiorite of the Burro Creek pluton
Tbqm - Biotite quartz monzonite of the Burro Creek pluton
Tcg - Clifford granite

Cenozoic and Mesozoic Eras

Tertiary Period and Cretaceous Period

TKtg - Foliated tonalite and granodiorite

Cenozoic, Mesozoic and Paleozoic Eras

Tertiary Period through Paleozoic Era

TMZPZm - Gneiss and migmatite

Mesozoic Era

Cretaceous Period

Khg - Hornblende granodiorite
Kgd - Quartz diorite

Kkqm - Hornblende-biotite quartz monzonite
Kmz - Quartz monzonite and quartz diorite
Kdq - Diorite and quartz diorite
Kum - Ultramafic rocks
Kmb - Metabasalt

Paleozoic Era

PZog - Orthogneiss

Paleozoic Era and Neoproterozoic Eon

PZZym - Marble
PZZyp - Paragneiss and marble

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below. Although the GIS data for this project was obtained from the U.S. Geological Survey unpublished Geologic Map of Alaska, Skagway 1' x 3' Sheet (*GRI Source Map ID 76025)*, geologic unit descriptions listed below were derived by the U.S. Geological Survey from original mapping sources as noted following each description and linked to a list of full source citations. (e.g., SK003).

Qs - Surficial deposits, undifferentiated (Quaternary)

Qs - Undivided alluvial and colluvial deposits (Quaternary)
Undivided alluvial and colluvial deposits. *This unit description was derived from the following source: SK003*

Qu - Quaternary deposits (Quaternary)
Undifferentiated unconsolidated surficial deposits. *This unit description was derived from the following source: SK008*

Qs - Surficial undivided (Quaternary)
Poorly sorted to well-sorted, massive, lenticular, and laminated clay, silt, sand, gravel, and boulders locally cover bedrock, sometimes to depths of many meters. Sediments represent tidal mudflat, alluvial, colluvial, and glacial deposits, undivided. Glacial outwash deposits, peat, and unsorted till locally overlie, underlie, or include thin layers of volcanic ash and lapilli tuff. *This unit description was derived from the following source: SK021*

Qa - Alluvium (Quaternary)

Qa - Alluvium (Quaternary)
Alluvial deposits, undifferentiated**.** *This unit description was derived from the following source: SK005*

Qa - Alluvium (Quaternary)
Alluvial deposits, undifferentiated. *This unit description was derived from the following source: SK007*

Qaf - Alluvial fan deposits (Quaternary)

Alluvial fan deposits. *This unit description was derived from the following source: SK006*

Qct - Talus and colluvium (Quaternary)

Talus and colluvial deposits. *This unit description was derived from the following source: SK005*

Qrg - Rock glacier deposits (Quaternary)

Rock glacier. *This unit description was derived from the following source: SK005*

Qd - Glacial drift (Quaternary)

Qd - Drift (Quaternary)
Glacial deposits, undifferentiated. *This unit description was derived from the following source: SK005*

Qd - Drift (Quaternary)
Glacial deposits, undifferentiated. *This unit description was derived from the following source: SK007*

Tlqm - Leucocratic quartz monzonite (Tertiary)

Small plugs of leucocratic quartz monzonite, medium-grained, color index 3 or less. Average composition is 25% quartz, 30% K-feldspar, and 45% plagioclase. Contains biotite and red garnets in dikes. Scattered miarolitic cavities. Intrudes Mount Kashagnak granodiorite; Tlqm contains K-feldspar phenocrysts to 2 cm and doubly terminated beta quartz crystals near contact. *This unit description was derived from the following source: SK003*

Tqgv - Hornblende-biotite quartz diorite and granodiorite (Tertiary)

Cataclastic hornblende-biotite quartz diorite and granodiorite. Medium-grained, subhedral, color index 20. Takhin block. Large andesitic roof pendants are andesitic, massive, usually porphyritic, gray-green. *This unit description was derived from the following source: SK003*

Tegd - Granite and granodiorite (Tertiary (Eocene?))

Sphene-hornblende-biotite granodiorite and granite. Color index 5-20 Coast Mountains In Atlin area, includes fine- to medium-grained brownish gray weathering, garnet-muscovite-biotite granite, CI about 5 of the White Pass plutonic suite. Locally K-feldspar porphyritic, massive to weakly foliated. In Juneau area, homogeneous, nonfoliated to poorly foliated; medium to coarse grained; color index 6 to 25; light gray to buff fresh, weathers darker gray; euhedral sphene crystals (to 4 mm) common; biotite locally dominant over hornblende; varies to quartz monzonite; minor biotite alaskite and magnetite; petrographic features include slightly inequigranular, hypidiomorphic granular texture; zoned (An40-An25) subhedral plagioclase. In Ketchikan area, Consists mainly of massive to weakly foliated granodiorite and quartz monzonite; the map unit also encompasses outcrops of paragneiss, dikes, and other intrusive rocks too small to show on the map. Typical specimens are medium grained and hypidiomorphic granular, and their average mineral composition is plagioclase (45 percent), potassium feldspar (23 percent), quartz (22 percent), biotite (6 percent), and hornblende (4 percent); the most prominent accessory mineral is sphene, which occurs as golden yellow euhedra as large as 5 mm. *This unit description was derived from the following source: SK021*

Tdgp - Porphyritic K-feldspar granodiorite (Tertiary (Eocene?))

Locally porphyritic; unfoliated to foliated; medium-grained granodiorite in the Coast Mountains. Color Index 4 to 25; gray to buff fresh, weathers to medium gray; with rare mafic inclusions; petrographic features include slightly inequigranular, hypidiomorphic granular texture; biotite more abundant than hornblende; as much as 20 percent euhedral to subhedral K-spar phenocrysts locally as long as 6 cm. Intrudes Coast plutonic-metamorphic complex rocks as sill-like bodies. In Atlin area, includes homogeneous, nonfoliated to poorly foliated; medium to coarse grained granodiorite of the Skagway-

Sloko plutonic suite; color index 6 to 25; light gray to buff fresh, weathers darker gray; euhedral sphene crystals (to 4 mm) common; biotite locally dominant over hornblende; varies to quartz monzonite; minor biotite alaskite and magnetite; petrographic features include slightly inequigranular, hypidiomorphic granular texture; zoned (An40-An25) subhedral plagioclase. In Skagway quadrangle, unit includes medium-grained, subhedral, seriate, granodiorite with hexagonal books of biotite, euhedral hornblende, and a color index of about 15. Quartz ranges from 15-20%, K-feldspar up to 10%. Intrudes Ferebee pluton and associated migmatite unit. In Petersburg quadrangle, gray to buff, foliated and banded, gneissic, fine- to medium-grained, biotite granodiorite and quartz monzonite; porphyritic, and characterized by K-feldspar phenocrysts to 3.5 cm. Locally contains garnet. Also includes granodiorite that is foliated, generally leucocratic, locally porphyritic and banded; medium-grained; light gray fresh, weathers darker gray; with K-feldspar phenocrysts or porphyroblasts up to 3x5 cm, locally augen-like; locally containing inclusions of quartz and hornblende. Differs from other granodiorites by gneissic structure. In Ketchikan quadrangle, consists mainly of weakly foliated to massive, medium-grained, hornblende biotite granodiorite, and locally of foliated and gneissic granodiorite. Mafic minerals generally make up 15 to 25 percent of this pluton. Hornblende is predominant in its southern part; biotite generally equals or locally exceeds hornblende in most of its northern part. Sparse euhedral phenocrysts of potassium feldspar to 2 cm. Intrudes foliated tonalite (TKtg) and is intruded by leucocratic granodiorite (Tegd). Also includes Consists of porphyritic, coarse-grained, homogeneous, biotite hornblende granodiorite that locally grades into quartz diorite and quartz monzonite. It typically contains about 5 percent of euhedral phenocrysts of potassium feldspar as large as 5 cm. Approximate average composition of the pluton is plagioclase (50 percent), quartz (25 percent), potassium feldspar (15 percent), and mafic minerals (10 percent). Intrudes TKft; intruded by Tegd correlative bodies. *This unit description was derived from the following source: SK021*

Tbgd - Euhedral biotite granodiorite of the Burro Creek pluton (Tertiary (Eocene?))

Granodiorite, medium-grained, subhedral, seriate, with hexagonal books of biotite, euhedral hornblende, and a color index of about 15. Quartz ranges from 15-20%, K-feldspar up to 10%. Intrudes Ferebee pluton and migmatite unit. *This unit description was derived from the following source: SK003*

Tbqm - Biotite quartz monzonite of the Burro Creek pluton (Tertiary)

Biotite quartz monzonite, fine-grained, subhedral, with 10-15% biotite, 15-20% quartz, and 10-30% K feldspar. Poikilitic plagioclase to 1.5 cm. Intrudes Ferebee pluton and migmatite; gradational to euhedral biotite granodiorite. *This unit description was derived from the following source: SK003*

Tcg - Clifford granite (Tertiary)

Pink to buff, medium- to fine-grained, equigranular biotite granite. Near margins includes xenoliths of fine-grained diorite, diabase, and biotite gneiss, and is intruded by pegmatite dikes. *This unit description was derived from the following source: SK008*

TKtg - Foliated tonalite and granodiorite (Tertiary and Cretaceous)

TKfgd - Foliated hornblende granodiorite of the Ferebee pluton (Tertiary and Cretaceous)
Foliated hornblende-biotite granodiorite, with related hornblende diorite to biotite quartz monzonite.

Medium-grained, subhedral seriate, color index 15-20, biotite usually more abundant than hornblende. Quartz 15-20%, K feldspar 5-15%. Magnetite is common, locally common sphene and zircon. Correlated with the tonalite sill plutons of the Coast plutonic complex. *This unit description was derived from the following source: SK003*

TKfgd - Ferebee plutonic complex (Tertiary and Cretaceous)
Multi-phase complex of medium-grained, anhedral, seriate hornblende-biotite granodiorite, with lesser tonalite, quartz diorite, and quartz monzodiorite. Weak to moderate foliation, strongly foliated near margins. *This unit description was derived from the following source: SK008*

TKtf - Foliated tonalite (Tertiary and Cretaceous)
In Skagway area, foliated hornblende-biotite granodiorite and tonalite, with related hornblende diorite to biotite quartz monzonite. Medium-grained, subhedral seriate, color index 15-20, biotite usually more abundant than hornblende. Quartz 15-20%, K feldspar 5-15%. Magnetite is common, locally common sphene and zircon. Correlated with the tonalitic plutons that form thick sills extending for at least 800 km along the west margin of the Coast Mountains plutonic metamorphic complex. In Juneau area, homogeneous, well foliated, non-layered; locally lineated; medium to coarse grained; color index averages 25, range 12 to 40; gray fresh, weathers darker gray; locally hornblende porphyritic with phenocrysts up to 2 cm; some bodies have distinctive skeletal garnet; inclusions and schlieren of dioritic composition common; gneiss inclusions occur locally; petrographic features include equigranular to seriate texture. In Tracy Arm, biotite-hornblende and hornblende-biotite tonalite, quartz diorite, and minor granodiorite. In the Petersburg area, the tonalite is medium gray, medium-grained, biotite-hornblende tonalite. CI 16-40. Homogeneous, foliated, non-layered; medium- to coarse-grained; gray fresh, weathers darker gray; locally hornblende porphyritic with Seriate, commonly lineated, phenocrysts up to 2 cm; inclusions and schlieren of dioritic composition common; gneiss inclusions occur locally. Syndeformational magmatic foliation. In the Ketchikan area, about 60 percent of the unit is undifferentiated bodies of dark gray weathering, uniformly foliated to gneissic quartz diorite; the rest consists of paragneiss (21 percent), granodiorite (11 percent), and subordinate migmatite, amphibolite, pegmatite, and quartz monzonite. The quartz diorite commonly is at least weakly foliated. Thin sections of typical samples of quartz diorite show medium grained granular to planar aggregates of andesine (54 percent), quartz (18 percent), hornblende (13 percent), biotite (12 percent), and accessory apatite, augite, garnet, magnetite, muscovite, potassium feldspar, and sphene. Mapped with Quattoon pluton in British Columbia, and foliated tonalitic bodies forming the eastern margin of the Coast batholith in southeast Alaska. Color Index 20-30. *This unit description was derived from the following source: SK021*

TMZPZm - Gneiss and migmatite (Paleozoic to Tertiary)

MzPzgm - Gneiss and migmatite (Mesozoic and/or Paleozoic)
Complexly intermixed paragneiss, orthogneiss, and migmatite. Paragneiss consists of quartzofeldspathic gneiss, with marble, quartzite, amphibolite, and biotite schist. The orthogneiss resembles the Ferebee pluton except it has a stronger foliation. Migmatite consists of intimately intermixed paragneiss and orthogneiss, with widespread lit-par-lit injection gneiss. *This unit description was derived from the following source: SK003*

MzPzgm - Gneiss and migmatite (Mesozoic and Paleozoic)
High-grade paragneiss, migmatite, and orthogneiss. Includes strongly deformed quartzofeldspathic gneiss, amphibolite, diopside-garnet marble, and strongly foliated orthogneiss that is probably derived from the Ferebee plutonic complex. *This unit description was derived from the following source: SK008*

TKtm - Migmatite (Tertiary and Cretaceous)
In Skagway area, complexly intermixed paragneiss, orthogneiss, and migmatite. Paragneiss consists of quartzofeldspathic gneiss, with marble, quartzite, amphibolite, and biotite schist. The orthogneiss

resembles the Ferebee pluton except it has a stronger foliation. Migmatite consists of intimately intermixed paragneiss and orthogneiss, with widespread lit-par-lit injection gneiss. In Juneau area, Amphibolite facies (hornblende) biotite quartz feldspar schist and gneiss invaded and deformed by tonalite; schist and gneiss are fine to medium grained, locally include calc-silicate layers, and typically weather rusty; invader is generally the Biotite-Hornblende and Hornblende-Biotite Tonalite characterized by its foliation and local aligned hornblende phenocrysts. Successively invaded by younger neosomes to the east and can be recognized as paleosomes in almost all migmatites of the Coast plutonic metamorphic complex. In Petersburg area, migmatite consisting of deformed, wavy-banded gneiss with raft structures and mafic inclusions, invaded by tonalitic neosomes. Paleosomes include amphibolite, metamorphic grade hornblende and biotite schists and gneisses, calc-silicate gneiss, and granodioritic to dioritic meta-intrusive rocks. *This unit description was derived from the following source: SK021*

Khg - Hornblende granodiorite (Cretaceous)

Kkgd - Porphyritic hornblende granodiorite of the Mt. Kashagnak pluton (Cretaceous)
Hornblende granodiorite with zoned pink K feldspar megacrysts up to 6 cm long, with cores of granodiorite. Rock contains 5-10% hornblende, 10% quartz, 20% K feldspar, subhedral seriate groundmass, accessory sphene, primary epidote, and magnetite. Intrudes the diorite phase. *This unit description was derived from the following source: SK003*

Kgd - Granodiorite (Cretaceous)
Gray, medium-grained, hornblende biotite tonalite and granodiorite, with seriate plagioclase and primary epidote and garnet. Correlated with similar epidote and garnet-bearing plutons that also intrude Gravina belt rocks. Foliated to massive equigranular; average grain size is medium, fine grained near some margins; color index 15 to 30; light to medium gray fresh, weathers medium gray to dark gray; locally distinctively plagioclase porphyritic. Mineralogy includes zoned, complexly twinned plagioclase with minor alteration to sericite; mafic minerals usually hornblende greater than biotite; euhedral and subhedral epidote; and local garnet. Accessory minerals are sphene, apatite, opaque minerals, and allanite. In Petersburg quadrangle, Tonalite, granodiorite, and quartz diorite. Equigranular to sparsely porphyritic. Zoned, seriate plagioclase, interstitial biotite and hornblende, epidote, and rare garnet; porphyritic tonalite, containing zoned and seriate plagioclase up to 1.5 cm, biotite, hornblende, epidote, and garnet, sphene, apatite, and allanite. CI 15-40. Accessory sphene, allanite, apatite. CI 14-52. In Ketchikan quadrangle, massive, medium-grained, plagioclase porphyritic, biotite- and garnet-bearing, hornblende epidote quartz diorite. Typically characterized by crowded centimeter-size subhedral plagioclase phenocrysts separated by a fine to medium grained granular aggregate of the other minerals. Magmatic mineral include essential plagioclase and quartz, accessory epidote and green hornblende, and minor amounts of brown biotite, garnet, potassium feldspar, apatite, and opaque minerals. Typical samples contain conspicuous white plagioclase phenocrysts as large as 3 cm that make up 50 - 60 percent of the rock. The groundmass consists of fine grained quartz (8-20 percent), potassium feldspar (<1-10 percent), biotite (5-25 percent) and hornblende (0-15 percent). Contains magmatic anhedral to euhedral garnet and epidote in groundmass and in cores of plagioclase phenocrysts. Epidote commonly forms 2-5 percent, and locally forms over 10 percent, of the rock. Composition of the epidote varies from sample to sample, but at least some is the iron free variety (clinozosite). Secondary minerals locally include clinozoisite epidote, white mica, and chlorite. Magmatic foliation most conspicuous near margins. On Revillagigedo Island, dominantly medium- to fine-grained, hypidiomorphic granular granodiorite. Locally it is foliated to gneissic, and has thin muscovite or biotite partings evenly spaced 2-10 mm apart. Color index ranges from 0 to 15, but it is mainly between 0 and 2. The abundance of leuocratic aplite varies from sparse patches to more than 70 percent of some outcrops; aplite contains pink garnet. Near Mount Reid this unit forms two stocks of foliated leucocratic biotite quartz monzonite containing 1 to 2 percent dark red garnet. Biotite, the only mafic mineral, makes up as much as 10 percent of the rock, and forms thin films, layers, streaks, and, locally, clots as large as 2 cm in

diameter. *This unit description was derived from the following source: SK021*

Kgd - Quartz diorite (Cretaceous)

Hornblende-biotite quartz diorite, with subordinate tonalite and granodiorite, quartz monzodiorite, and diorite. Foliated to massive equigranular; average grain size is medium, locally fine grained near some margins; locally plagioclase porphyritic; color index 15 to 30; light to medium gray fresh, weathers medium gray to dark gray, exposed on the mainland south of Taku Inlet. Includes monzodiorite phases of bodies at Jualin and Treadwell in Juneau quadrangle. In Petersburg area Quartz monzodiorite and tonalite. Locally foliated, plagioclase porphyritic. Interstitial quartz, K-feldspar, hornblende, biotite, epidote. CI 17-48. In Ketchikan quadrangle, generally massive hornblende quartz diorite and granodiorite. In places is weakly foliated or contains abundant ellipsoidal dark inclusions that commonly are parallel to aligned hornblende crystals and impart a pronounced lineation. Garnet partially replaced by chlorite occurs in many outcrops, and all samples of the pluton examined in thin section contain magmatic epidote. *This unit description was derived from the following source: SK021*

Kkqm - Hornblende-biotite quartz monzonite (Cretaceous)

Quartz monzonite, foliated, medium-grained, subhedral, seriate, with 10-15% biotite, 5% hornblende, 10-15% quartz, and 20-30% K feldspar. K feldspar megacrysts range up to 7 cm long are zoned with cores of quartz monzonite in pink feldspar, and outer zones of white feldspar with biotite inclusions. Accessory sphene and magnetite. *This unit description was derived from the following source: SK003*

Kmz - Quartz monzonite and quartz diorite (Cretaceous)

In Chilkat Mountains, quartz monzonite is medium-grained, locally K-feldspar porphyritic. Lineated hornblende defines magmatic foliation. On Kuiu Island, biotite-hornblende quartz monzodiorite, occurs with minor tonalite, granodiorite, quartz diorite, diorite, quartz monzonite, and monzodiorite, massive to foliated, equigranular to locally porphyritic, medium-grained. Secondary epidote locally present. *This unit description was derived from the following source: SK021*

Kdq - Diorite and quartz diorite (Cretaceous)

Kkhd - Hornblende diorite (Cretaceous)

Hornblende diorite, subhedral, seriate, medium-grained, color index 15-20. Inhomogenous texture results form variations in color index. Orbicular texture at peak 4412, zoned orbicules 10-40 cm long. Hornblende is dominant mafic mineral, with rare augite, some hornblende is cored by augite. Hornblende is lineated, trending 140 degrees, plunging moderately NW or SE. Quartz is 5-10%, 5% K feldspar, but locally as much as 30% K feldspar. Accessory sphene, magnetite, epidote. *This unit description was derived from the following source: SK003*

Kdqd - Diorite and quartz diorite (Cretaceous)

Diorite and quartz diorite with subordinate tonalite and gabbro. Steeply dipping NW foliation. Metamorphosed. *This unit description was derived from the following source: SK005*

Kum - Ultramafic rocks (Cretaceous)

Cretaceous mafic and ultramafic rocks. Clinopyroxinite, hornblendite, gabbro, and pegmatite. At Klukwan, fine- to very coarse-grained pyroxenite and hornblendite with inhomogenous distribution of magnetite, and up to 5% biotite, wherlite, and coarse-grained, cumulate clinopyroxenite, with subhedral hornblende and augite crystals from 1-10 cm long, high-temperature Abukuma alteration of augite to hornblende, up to 10% magnetite, trace malachite, fractures healed by pegmatite containing hornblende, plagioclase, and thulite. At Mole Harbor, hornblendite associated with gabbro and diorite. Clinopyroxenite and subordinate hornblendite. Pyroxenite in Port Snettisham contains clinopyroxene, magnetite and subordinate hornblende and predates adjacent quartz diorite. The Windham Bay ultramafic body includes very coarse- to fine-grained sulfide-bearing ultramafic rocks along the shore west of the mouth of the Chuck River for about 3 km. The body is layered in part, and consists largely of clinopyroxenite with secondary amphibole-rich rock. Locally several-cm-size plates of biotite are present. On northeastern Kupreanof Island, ultramafic rocks are dominantly wherlite, gradational into dunite and clinopyroxenite; dark green, brown-weathering, partly serpentinized. No dunite core or gabbro margin; intruded by massive hornblendite at north margin. On Blashke Islands, massive, medium-grained, tan- to gray-weathering, dark green wherlite grades to olivine clinopyroxenite near contact with dunite. Dunite is massive, medium-grained, tan-weathering, dark gray to black, partly serpentinized; olivine locally contains minor thin chromite veinlets. At Union Bay, clinopyroxenite, peridotite, and dunite. On Revillagigedo Island, ultramafic bodies consist chiefly of rusty weathering, massive appearing dark greenish black biotite or clinopyroxene bearing hornblendite and hornblende clinopyroxenite. Thin section studies show coarse xenomorphic aggregates of hornblende and clinopyroxene and accessory sphene, apatite, and opaque minerals; some samples also contain accessory biotite. The clinopyroxene commonly is partly altered to pale green hornblende. Hydrothermal or metamorphic minerals include biotite, chlorite or antigorite, talc(?), actinolite(?), epidote, and calcite. At Duke Island, Dunite, peridotite, clinopyroxenite, and hornblendite, locally serpentinized. The dunite and peridotite in these ultramafic rocks contain small amounts of chromite, asbestose, and platinum group metals, and the clinopyroxenite locally contains accumulations of titaniferous magnetite. Ultramafic complex on Duke Island is zoned and layered. The ultramafic bodies on Duke and Percy Islands have been prospected for iron and chromite. *This unit description was derived from the following source: SK021*

Kmb - Metabasalt (Cretaceous)

Massive, flow-banded, and locally pillowed or amygdaloidal metabasalt. Contains magnetite, traces of malachite, pods and veins of epidote. Associated tuffaceous metasediments. Metamorphosed to low greenschist facies and intruded by the Mt. Kashagnak pluton. Up to 3.4 km thick. *This unit description was derived from the following source: SK003*

PZog - Orthogneiss (Paleozoic)

Heterogeneous migmatite consisting of biotite-quartz-feldspar gneiss and schist and calcsilicate marble cut by hornblende diorite and biotite granodiorite. Atlin quadrangle. Associated with orthogneiss that intrudes the Stikine terrane. *This unit description was derived from the following source: SK021*

PZZym - Marble (Paleozoic and Precambrian)

Marble in the coast plutonic complex. In northern Coast Mountains includes poorly foliated, rarely lineated marble, calc-silicate granofels and schist interlayered with highly variable amounts of calcareous slate, phyllite, biotite and hornblende schist. Marble is fine to coarse grained, white and light gray or

yellowish gray, some marble masses are several hundreds of m thick and may have been reefoid limestones and/or may be large detached fold hinges. Marble also occurs as 1 cm to 10 cm scale layers intercalated with equal amounts of biotite schist. *This unit description was derived from the following source: SK021*

PZZyp - Paragneiss and marble (Paleozoic and Precambrian)

In Coast Mountains, from Atlin to Ketchikan, includes dominantly well foliated, well layered, locally lineated fine to coarse grained quartz-biotite-feldspar gneiss with lesser amounts of garnet-quartz-biotite-plagioclase schist and still less hornblende-plagioclase schist and gneiss. In Tracy Arm, includes interbedded marble, quartzite, and subordinate metapelite. Proterozoic and Archaean detrital zircons indicate some quartzites must be metaclastic rocks. Some quartzite layers retain fine lamination textures. Association with marble suggests marine protoliths. Rock types alternate on a scale of a meter or less. Amphibolite to granulite facies. In Ketchikan area unit includes rusty brown weathering pelitic paragneiss and schist containing conspicuous root-beer-brown biotite and by subordinate quartzofeldspathic gneiss distinguished mainly by its light color and low content of mafic minerals. Such rocks make up about 66 percent of the unit. The remainder includes migmatite (16 percent), gneissic plutonic rocks (7 percent), marble and calcsilicate gneiss (4 percent), pegmatite (3 percent), quartzite (2 percent), amphibolite (1 percent), and aplite (1 percent). The minerals and textures of the schist and gneiss and the intercalated layers of marble indicate that the metasedimentary protoliths of the paragneiss sequence were deposited in a marine environment. *This unit description was derived from the following source: SK021*

GRI Source Map Information

Unpublished Digital Data for the Geologic Map of Alaska, Skagway 1x3 Sheet

Wilson, F.H., Hults, C.P., Mull, C.G., and Karl, S.M. (Geologic Map Compilers), and Wilson, F. H., Shew, N., Labay, K.A., Hults, C.P. (Digital Files Preparation), 2015, Unpublished Digital Data for the Geologic Map of Alaska, Skagway 1' x 3' Sheet: U.S. Geological Survey, unpublished digital data, scale 1:500,000. (*GRI Source Map ID 76025*).

Geologic Map of Alaska References

Geographic features in the Geologic Map of Alaska are attributed with source information used in the production of that dataset. The GRI has retained that information for this project. Features in the GRI digital geologic-GIS data, attributed with the code (in bold; e.g., **SK002**) preceding each reference, can be linked back to references on this page.

SK001 U.S. Geological Survey topographic base for the Skagway 1' x 3' Quadrangle, scale 1:250,000.

SK002 Brew, D.A., and Ford, A.B., 1985, Preliminary reconnaissance geologic map of the Juneau, Taku River, Atlin, and part of Skagway 1:250,000 quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 85-395, pamphlet, 23 p., 2 sheets, scale 1:250,000.

SK003 Redman, E.C., Retherford, R.M., and Hickok, B.D., 1984, Geology and geochemistry of the Skagway B-2 quadrangle, southeastern Alaska: Alaska Division of Geological and Geophysical Surveys Report of Investigations 84-31, 34 p., 4 sheets, scale 1:40,000.

SK004 Redman, E.C., Gilbert, W.G., Jones, B.K., Rosenkrans, D.S., and Hickok, B.D., 1985, Preliminary bedrock-geologic map of the Skagway B-4 quadrangle: Alaska Division of Geological and Geophysical Surveys Report of Investigations 85-6, 1 sheet, scale 1:40,000.

SK005 Gilbert, W.G., Burns, L.E., Redman, E.C., and Forbes, R.B.,1987, Preliminary bedrock geology and geochemistry of the Skagway B-3 quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Report of Investigations 87-2, 2 sheets, scale 1:36,200.

SK006 Gilbert, W.G., Forbes, R.B., Redman, E.C., and Burns, L.E., 1988, Preliminary bedrock geology and geochemistry of the Kelsall River area, southeast Alaska: Alaska Division of Geological and Geophysical Surveys Report of Investigations 88-4, 2 sheets, scale 1:36,200.

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SK011 Karl, S.M., 2002, Unpublished data.

SK012 Plafker, George, 2002, Unpublished data.

SK013 Brew, D.A., 2000 Unpublished data.

SK014 Burns, L.E, and Gilbert, W.G., 2002, Unpublished data.

SK015 Gehrels, G.E., and Berg, H.C., 1992, Geology of southeastern Alaska: U.S. Geological Survey Miscellaneous Investigation Series Map I-1867, pamphlet, 24 p.,1 plate, scale 1:600,000.

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SK017 Plafker, George, and Hudson, Travis, 1980, Regional implications of Upper Triassic metavolcanic and metasedimentary rocks on the Chilkat Peninsula, southeastern Alaska: Canadian Journal of Earth Sciences, v. 17, n. 6, p. 681-689.

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SK019 Powell, R.D., 1984, Guide to the glacial geology of Glacier Bay, southeastern Alaska: Alaska Geological Society Guidebook, 85 p., 1 sheet, scale 1:125,000.

SK020 Becker, R.A., Streveler, G.P., and Mickelson, D.M., A 1:100,000-scale map of surficial deposits in Glacier Bay National Park and Preserve, southeast Alaska, National Park Service, Natural Resource Technical Report NPS/GLBA/NRTR--2012/638 (GRI Source Map ID 75616)

SK021 Karl, S.M., 2012, Unpublished data.

SK022 MacKevett, E.M., Jr., Robertson, E.C., and Winkler, G.R., 1974, Geology of the Skagway B-3 and B-4 quadrangles, southeastern Alaska: U.S. Geological Survey Professional Paper 832, 33 p., 1 sheet, scale 1:63,360.

SK023 Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J., and Cooney, R.T., 2005, Digital geology map of British Columbia: Tile NO8 northwest B.C.: B.C. Ministry of Energy and Mines, Geofile 2005-8.

SK024 Brew, D.B., and Plafker, George, in prep., Geologic map of Glacier Bay National Park and Preserve, southeast Alaska: U.S. Geological Survey Scientific Investigations Map SIM-XXXX, scale 1:250,000, 1 sheet, pamphlet.

SK100 Barker, Fred, Arth, J.G., and Stern, T.W., 1986, Evolution of the Coast batholith along the Skagway traverse, Alaska and British Columbia: American Mineralogist, v. 71, p. 632-643.

SK101 Brew, D.A., and Ford, A.B., 1994, The Coast Mountains plutonic-metamorphic complex between Skagway, Alaska, and Fraser, British Columbia--Geologic sketch and road log: U.S. Geological Survey Open-File Report 94-268, 25 p.

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SK103 Plafker, G., Blome, C.D., and Silberling, N.J, 1989, Reinterpretation of the lower Mesozoic rocks on the Chilkat Peninsula, Alaska, as a displaced fragment of Wrangellia: Geology, v. 17, p.3-6.

Extracted from: (Geologic Map of Alaska, Skagway 1' x 3' Sheet).

Geologic Map of Alaska (accompanying unpublished database)

Wilson, F.H., Hults, C.P., Mull, C.G., and Karl, S.M, 2015, Geologic Map of Alaska (accompanying database): U.S. Geological Survey, unpublished digital data, scale 1:500,000. (*GRI Source Map ID 76024*).

Explanation of Accompanying Database

The U.S. Geological Survey geologic map database used in the production of the unpublished Geologic Map of Alaska contains source map unit descriptions that were extracted by the GRI and made available in the Map Unit Descriptions section of this document. All line and polygon layers in the GRI GIS data have an additional field (SOURCE) that has been attributed with a U.S. Geological survey source map ID value (e.g., SK003) that can be linked back to source descriptions in this document. Full citations associated with these ID values can be viewed in the Geologic Map of Alaska References section of this document.

ARDF Skagway Quadrangle (OF-2001-193)

Crafford, T.C., 2001, Alaska Resource Data File (ARDF), Skagway Quadrangle: U.S. Geological Survey, Open-File Report OF-2001-193, scale 1:250,000. (*GRI Source Map ID 2605*).

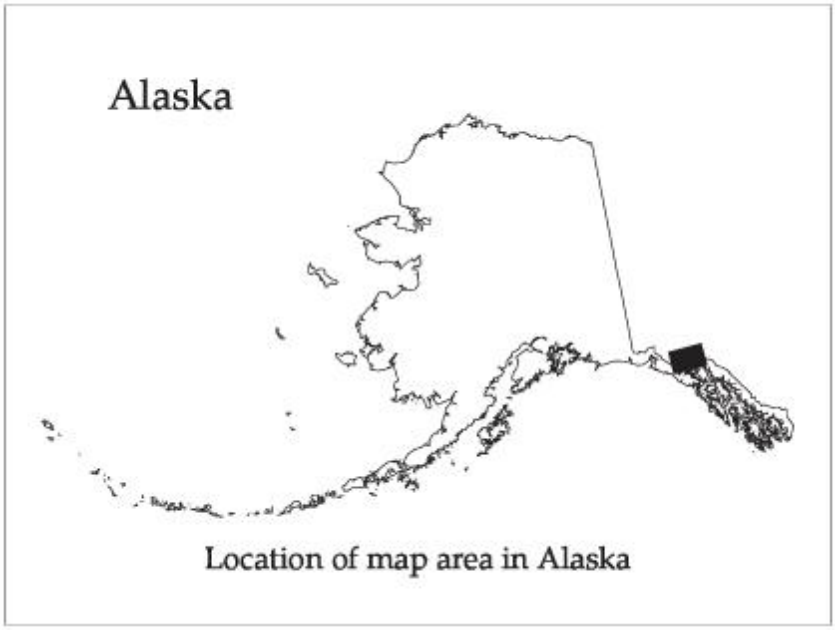
OF-2001-193 ARDF Report

The Alaska Resource Data File (ARDF) report, including mineral data and references, for the Skagway Quadrangle, Alaska (OF-2001-193) is available for download at the following link: Alaska Resource Data Report PDF (Skagway).

OF-2001-193 ARDF Data

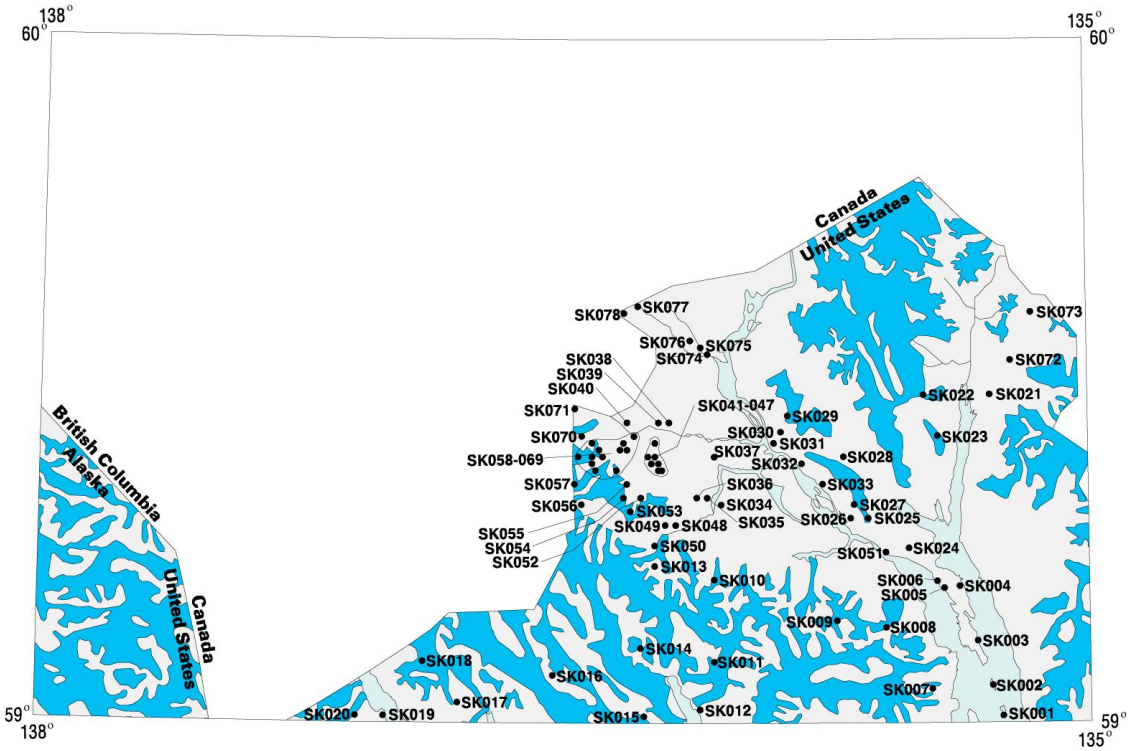
The Alaska Resource Data File (ARDF) data for the Skagway, Alaska (OF-2001-193) are available for download at the following link: Alaska Resource Data (Skagway).

OF-2001-193 Index Map



Extracted from: (Skagway Quadrangle).

OF-2001-193 Mineral Occurence Map



Distribution of mineral occurrences in the Skagway 1:250,000-scale quadrangle, Alaska

Extracted from: (Skagway Quadrangle).

Alaska Radiometric Ages (unpublished)

Crafford, T.C., 2001, Alaska Resource Data File, Skagway Quadrangle: U.S. Geological Survey, Open-File Report OF-2001-193, scale 1:250,000. (*GRI Source Map ID 2605*).

Alaska Radiometric Ages Data

The data set consists of radiometric ages of rocks or minerals sampled from Alaska. The data were collected from professional publications and/or received from researchers and used by permission. The GRI Digital Geologic Map for Klondike Gold Rush National Historical Park and Vicinity, Alaska (*GRI MapCode KLGO*) utilized data from the Skagway quadrangle. The U.S. Geological Survey Alaska radiometric ages data (unpublished) are available for download at the following link: U.S. Geological Survey Alaska Radiometric Ages Data.

GRI Digital Data Credits

This document was developed and completed by James Chappell (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by Stephanie O'Meara (Colorado State University).

The information in this document was compiled from GRI source maps, and intended to accompany the digital geologic-GIS map and other digital data for Klondike Gold Rush National Historical Park, Alaska (KLGO) developed by Ron Karpilo and James Chappell (Colorado State University) (see the GRI Digital Map and Source Map Citations section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS map).

GRI finalization by James Chappell (Colorado State University).

GRI program coordination and scoping provided by Bruce Heise and Tim Connors (NPS GRD, Lakewood, Colorado).