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Descriptions of Plutons in the Western Part of the Juneau  
and Parts of the Adjacent Skagway 1:250,000  
Quadrangles, Southeastern Alaska

By

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This report is preliminary and has not  
been reviewed for conformity with  
U.S. Geological Survey editorial standards.

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DESCRIPTIONS OF PLUTONS IN THE WESTERN PART OF THE JUNEAU  
AND PARTS OF THE ADJACENT SKAGWAY 1:250,000 QUADRANGLES,  
SOUTHEASTERN ALASKA

By  
Christine R. Fukuhara

INTRODUCTION

A study of the plutonic bodies in the western half of the Juneau quadrangle and parts of the adjacent Skagway quadrangle was undertaken as part of the Juneau AMRAP (Alaska Mineral Resource Assessment Program) project in southeastern Alaska; it is intended to provide up-to-date descriptions of plutonic units and bodies. These plutonic units are contained within four informally named provinces which are briefly described by Brew and Ford (1985): 1) Icy Strait Belt, 2) Alexander Belt, 3) Muir-Chichagof Plutonic Belt, and 4) Chilkat-Prince of Wales Plutonic Province. The mapped boundaries and map symbols of the plutonic bodies were taken from Brew and Ford (1985); their map was based on those produced by Lathram and others (1959) and Loney and others (1975) and on mapping done in 1978-85 by geologists from the Alaska Branch of the U.S. Geological Survey. The plutons in the Muir-Chichagof belt are indicated by an "m" as in "Kmto" and those in the Chilkat-Prince of Wales province are indicated by a "w" as in "Kwdi".

The descriptions of the plutonic bodies are organized according to the geographic locations of the plutons. The study area was divided into two major geographic regions. The northeastern Chichagof Island represents the southern region and its plutons are characterized by the prefix CH-. The Glacier Bay National Park and Preserve and the Chilkat Range constitute the northern region, and its plutons are characterized by the prefix CM-. Sequential numbers were assigned within these areas, more or less, from south to north.

Various sources were tapped in compiling the data. In addition to information contained in professional papers and published articles, unpublished data from field notes are incorporated in this report. The K-Ar ages were taken from three sources: 1) Loney and others (1967); 2) Brew and Ford (1985); and 3) M.A. Lanphere (oral commun., 1967, 1983). The bulk of the petrographic analyses were made by the author during 1985-86 but a few petrographic descriptions from work done in the late 1960's were used when more recent samples were not available.

Modal compositions and color indices were determined by point counting; the point count data from 1985-86 are plotted on QAP diagrams after Streckeisen (1973; see Figure 1). In addition, this report includes point count data from the 1975-78 study of plutons in that part of Glacier Bay National Park and Preserve that are within the current study area. Where applicable, structural measurements were plotted on the lower hemisphere of a Schmidt equal area net. The structural elements measured include foliation, contacts, faults and shear planes, internal layering and orientation of dikes, mineral lineations, fold axes, and axial planes.

The descriptions of the plutonic map units in this report are arranged in the same order as they appear in Brew and Ford (1985). This report presents

updated and revised versions of the unit descriptions found in that open-file report (with the exception of map unit Andesite (Kwan) for which new data were not available). Plutonic bodies of a given map unit that possess anomalous compositions and characteristics with respect to the other plutonic bodies of that map unit are highlighted in the unit descriptions. For the sake of conformance with Brew and Ford (1985), the map symbols and map unit descriptions of the anomalous plutons were not changed but suggestions are given about how those plutons might be better assigned and/or described. These revisions will be made in future reports. Because the Brew and Ford (1985) map unit descriptions are used, the rock types in those unit descriptions do not conform exactly to the data presented in the figures. In addition, the unit description of map unit Altered Quartz-Bearing Syenite (Kwgr), which was unintentionally left out of the Brew and Ford (1985) report, is included in this report.

For conciseness, the information given in the pluton summaries is intentionally presented in an abridged form. The plutonic bodies are described in numerical order by their pluton number, starting with the northeastern Chichagof Island plutons and followed by the Chilkat Mountain plutons. The summaries are comprised of 8-9 categories of information, as follows:

- 1) map symbol from Brew and Ford (1985);
- 2) major rock type(s) as determined from point counting, petrographic studies, and field observations when neither point counting nor petrographic information was available. The minerals preceding the rock name in the major and minor rock type(s) are arranged in order of increasing abundance from left to right. The order of the minerals was based on petrographic studies where accessory minerals are listed and on field observations where only mafics are listed;
- 3) minor rock type(s), when present;
- 4) general outcrop and hand specimen description from field notes and rock samples;
- 5) original data from petrographic analyses;
- 6) the currently accepted age, as based on published and unpublished information;
- 7) location of the plutonic body;
- 8) comments;
- 9) references to previous maps that showed the pluton, but not including Brew and Ford (1985).

The "comments" section contains information not included in the other categories, for example, data on the structural geology and the nature of faults, dikes, and inclusions present within the pluton boundary.

Special thanks are given to R.A. Loney for his careful and thorough technical review and to D.A. Brew for his guidance in the preparation of this report. I also wish to thank Oleg Polovtsoff for his dedicated assistance in providing point count data, R.A. Sonnevil for generously providing data for plutons in the Chilkat Mountains from his own research, and E.R. Lundin for his efforts in the first stages of organizing the study. Many thanks go to Winnie Trollman for typing the text.

## REVISED MAP UNIT DESCRIPTIONS

### ICY STRAIT BELT

Tgqm

Hornblende Quartz Monzonite (Miocene (?) and Oligocene (?)):  
Massive; fine- to coarse-grained, commonly medium-grained; color index 1-10; pinkish gray to pinkish dark gray color; plagioclase composition is  $An_{32-37}$ ; hypidiomorphic granular to slightly K-feldspar porphyritic; feldspars and hornblende are highly altered to sericite, epidote, calcite, and chlorite; patches of chlorite, calcite, opaques, and secondary greenish biotite may represent altered primary mafics; accessory minerals include opaques, apatite, zircon, sphene, and rare allanite; epidote and clinozoisite can be found as individual grains; CM-27 is cut by basalt and porphyry dikes which may contain garnet and pyrite-filled veins; CM-16 possesses a high rare earth element content and is associated with minor gold and copper mineralization (MacKevett and others, 1971); age based on interpretation of field relations of CM-27 to CM-24 (see below) which is dated at 37.3 and 39.2 Ma (M.A. Lanphere, written commun., 1967); exposed in two small bodies at Sandy Cove (CM-16) and west of Sitth-gha-ee Peak (CM-26), and in a large body near Casement Glacier, Glacier Bay (CM-27); the unit rock name should be changed to "Chloritized Hornblende Granite and Hornblende Quartz Monzonite" on future revisions.

### ALEXANDER BELT

TKgd

Hornblende-Biotite and Biotite-Hornblende Granodiorite (Tertiary and/or) Cretaceous):

Massive to weakly foliated; fine- to coarse-grained, commonly medium-grained; color index 2-20, averaging 7-18; light gray to medium gray color; equigranular to porphyritic texture; plagioclase composition is  $An_{38-53}$ ; plagioclase, hornblende, and biotite are slightly altered to epidote and chlorite; the rocks exhibit more mechanical deformation than chemical alteration; accessory minerals include opaques, apatite, sphene, zircon, and rare calcite and allanite; contains greater than 5% fine-grained mafic inclusions with feldspar porphyroblasts; CM-24 is cut by altered andesitic dikes and quartz veinlets; CM-25 contains abundant metasedimentary inclusions; age based on regional considerations and interpretation of unpublished K-Ar data, including two biotite ages of 37.3 and 39.2 Ma (M.A. Lanphere, written commun., 1967) from CM-24; CM-28 is a very small body consisting of hornblende-biotite quartz monzonite and is probably part of this unit as it does not possess characteristics corresponding to that of map unit Hornblende Quartz Monzonite (Tgqm); exposed east (CM-24), west (CM-25), and north (CM-28) of Casement Glacier, Glacier Bay; the unit rock name should be changed to "Hornblende-Biotite and Biotite-Hornblende Granodiorite, Biotite-Hornblende Tonalite--Also Biotite-Hornblende Monzodiorite, Hornblende Quartz Diorite/Tonalite, Biotite-Hornblende Quartz Monzodiorite, Quartz Monzonite" on future revisions.

### MUIR-CHICHAGOF PLUTONIC BELT I

Kndt

Uralitized Biotite-Pyroxene Diorite, Biotite-Hornblende Diorite, and Biotite-Hornblende Melatonalite (Cretaceous):

Foliated; medium- to coarse-grained; color index 16-23; light to dark gray color; hypidiomorphic equigranular texture; plagioclase composition is  $An_{41}$ ; accessory minerals include apatite, magnetite, and sphene; contains pockets of hornfels and is heterogeneous; opposing dips of compositional layering suggest body may possibly be folded; exposed only in body at head of Tenakee Inlet, Chichagof Island (CH-1); age based on interpretation of K-Ar data (Loney and others, 1967); the present study did not confirm the existence of the biotite-hornblende melatonalite and diorite included in the map unit description; this map unit corresponds to the northeast portion of pluton 27 of Loney and others (1975) from which the description of the melatonalite and diorite was taken; however, the data for the melatonalite and diorite comes from outside the current study area; the unit rock name should be changed to "Uralitized Biotite-Hornblende-Pyroxene Quartz Diorite and Biotite-Hornblende Tonalite" on future revisions.

Kmto

Hornblende Tonalite, Hornblende Diorite, Biotite-Hornblende Diorite, and Biotite-Hornblende Tonalite (Cretaceous):

Massive to poorly foliated; medium- to coarse-grained; color index 11-20, averaging 13-15; light to medium gray color; inequigranular to porphyritic texture; plagioclase composition is  $An_{33-45}$ ; plagioclase, hornblende, and biotite are undergoing variable alteration to sericite, chlorite, and epidote minerals; also minor relict pyroxene rimmed by uraltic hornblende; accessory minerals include magnetite, apatite, sphene, zircon, epidote, and chlorite; older bodies of biotite-hornblende gabbro are present within the body as well as basic undigested material, metasedimentary rocks, and migmatitic breccia; exposed southwest of Mud Bay River and Neka River, Chichagof Island (CH-2); age based on interpretation of K-Ar data (Loney and others, 1967); the present study did not confirm the existence of the hornblende diorite and biotite-hornblende diorite included in the map unit description; this map unit corresponds to the northwest portion of pluton 28 of Loney and others (1975) from which the descriptions were taken; however, the data for these descriptions come from outside the current study area; the unit rock name should be changed to "Biotite-Hornblende Tonalite--Also Hornblende Tonalite, Biotite-Hornblende Quartz Diorite, Hornblende-Biotite Granodiorite, Biotite-Hornblende Quartz Monzonite" on future revisions.

CHILKAT-PRINCE OF WALES

Kwmq

Migmatite and Biotite-Quartz-Feldspar Gneiss (middle Cretaceous):

Foliated; medium- to coarse-grained; color index ranges from 9-60; outcrops as dark and light heterogeneous bodies; the light layers are tonalitic in composition and the dark layers are amphibolite; inequigranular to gneissose texture; plagioclase composition is  $An_{39-42}$ ; plagioclase, biotite, and hornblende are moderately altered to sericite, chlorite, and clinozoisite, respectively; accessory minerals include opaques, apatite, zircon, sphene, allanite, epidote, and chlorite; allanite is usually associated with epidote and is found in rocks with abundant zircon; in the more altered rocks, calcite, epidote, and clinozoisite are found as individual grains; foliation trends E-W and dips steeply north; cut by dikes, one of which is rhyodacitic; possible offshoots of hornblende-plagioclase rock may

extend outward from the southern margin; exposed north of Casement Glacier in Glacier Bay National Park and Preserve (CM-29); the other outcrop area south and east of Casement Glacier (CM-23) mapped as this unit may be closely related to nearby bodies of gabbro corresponding to map unit Gabbro (Kwgb); age based on association of body CM-29 with body CM-30, the age of which is based on lithologic correlation with a dated pluton west of the study area; the unit rock name should be changed to "Migmatite and Hornblende-Biotite-Quartz-Feldspar and Biotite-Hornblende-Quartz-Feldspar Gneiss" on future revisions.

Kwgr

Altered Quartz-Bearing Syenite (Cretaceous(?)):

Massive and sheared bodies; fine- to medium-grained, locally pegmatitic; color index 5; weathers red and green; inequigranular texture; accessory minerals include opaques and chlorite; primary mafics have been obscured by patches of opaques and calcite; the alkali feldspar and plagioclase are commonly intergrown in a type of exsolution texture; CM-18 is sheared and fractured; CM-19 contains a manganese-rich area and is cut by a fault where pyrite, hematite, and chalcopryite have been reported; exposed in two small bodies (CM-18, CM-19) southeast of Berg Mountain, Chilkat Range; other bodies are reported to exist in the central Chilkat Range (D.A. Brew, oral commun., 1986); unit may also include body CM-21 (see below); age based only on general association with other plutons in the Chilkat Range and the bodies could be significantly younger or older; this unit symbol should be changed to Kwsy on future maps to reflect the apparent dominance of syenite.

Kwgd

Biotite-Hornblende Granodiorite--Also Biotite-Hornblende Granite, Quartz Monzonite, Quartz Diorite, and Diorite (Cretaceous):

Most individual bodies are foliated, otherwise massive; fine- to medium-grained; color index 4-30, averaging 8-15; light to dark greenish gray color; equigranular to locally porphyritic texture; plagioclase composition is An<sub>32-55</sub>; accessory minerals include pyrite, magnetite, sphene, apatite, zircon, chlorite, epidote, and rare sericite and calcite; the chlorite mainly replaces primary biotite; the epidote mainly replaces plagioclase feldspar although, in the more altered rocks, epidote and clinozoisite can be found as individual grains; dark fine-grained inclusions of amphibolite, hornblendite, and hornblende-rich rocks are common and can make up to 40% of an outcrop; some bodies are cut by altered hornblende gabbro dikes which appear to have been emplaced prior to deformation; CM-3 contains undigested limestone and argillite; CM-21 appears to be a syenitic rock from field observations and so may belong to the map unit Altered Quartz-Bearing Syenite (Kwgr); age assignment based on regional considerations and interpretation of K-Ar data including a hornblende age of 103 Ma (M.A. Lanphere, oral commun., 1983); widely exposed north (CM-30) and south and east (CM-20, CM-21, CM-22) of Casement Glacier, in scattered small bodies in the Chilkat Mountains (CM-6), and in the large Nun Mountain body in the southern Chilkat Mountains (CM-3); this map symbol should be changed to Kwtg in the next map revision to reflect the apparent near-equal abundance of granodiorite and tonalite; the unit rock name should also be changed to "(Biotite)-Hornblende Granodiorite and Biotite-Hornblende Tonalite--Also Hornblende-Biotite Quartz Diorite, Biotite-Hornblende Quartz Diorite, Biotite-Hornblende Quartz Monzonite, Hornblende Quartz Monzodiorite" on future revisions.

Kwan Andesite (Cretaceous?): No new data; body CM-13.

Kwqd Biotite-Hornblende Quartz Diorite and Tonalite--Also Granodiorite and Diorite (Cretaceous):

Massive to locally foliated; locally gneissose; fine- to coarse-grained, commonly medium-grained; color index 5-20; plagioclase composition is An<sub>24-44</sub>; light gray to dark greenish gray or tan brown color; equigranular to inequigranular texture; accessory minerals include pyrite, magnetite, sphene, apatite, zircon, chlorite, and epidote; chlorite and epidote are major alteration minerals after biotite, hornblende, pyroxene, and plagioclase; sericite and calcite are minor alteration minerals; locally abundant fine-grained hornfels inclusions are present; cut by fine-grained mafic dikes; fractures and veins are filled with potassium-rich minerals; CM-4 contains an older body of altered and weakly foliated hornblende gabbro whose limits are not known; CM-11 is an altered granitic which is believed to be Tertiary in age based on regional considerations and characteristics (Eakins, 1975); age assignment of other bodies is based on regional considerations and interpretation of K-Ar data including one 114 Ma age on hornblende (M.A. Lanphere, oral commun., 1967); exposed in bodies near Bear Track Cove, Glacier Bay (CM-14, CM-15), on the Porpoise Islands in Icy Strait (CM-1), and near Excursion Inlet (CM-4, CM-5); this map unit is different from the Biotite-Hornblende Granodiorite map unit (Kwgd) in that the individual plutonic bodies are more heterogeneous in terms of composition and texture and in that there may be a significant difference in age; there is a possibility that this map unit is geochronologically and lithologically the same as the Hornblende Tonalite, etc. map unit (Knto) on Chichagof Island; this map symbol should be changed to Kwgd (or Kngd) in the next map revision to reflect the dominance of granodiorite; the unit rock name should also be changed to "(Biotite)-Hornblende Granodiorite, Hornblende-Biotite Granodiorite, and Hornblende Tonalite--Also Biotite-Hornblende Quartz Diorite, Pyroxene-Biotite-Hornblende Quartz Diorite, (Biotite)-Hornblende Quartz Monzonite on future revisions.

Kwdi Biotite-Hornblende and Hornblende-Biotite Diorite (Cretaceous):

Massive; fine- to coarse-grained; color index 10; light greenish gray to medium greenish gray or brownish gray color; porphyritic to diabasic texture; accessory minerals include opaques, sphene, apatite, zircon, and pyrite; chlorite and epidote are present as major alteration minerals; dark gray fine-grained round inclusions are sparse; plutons west of William Henry Bay are sheared, highly altered, and possess serpentinous shear surfaces; small body of augite diorite in the central Chilkat Mountains (CM-12) is cut by diabase or andesite dikes; also exposed as small bodies in the southern Chilkat Range (CM-2, CM-7, CM-8); small body on northern Chichagof Island (CH-4) consists of chloritized biotite-hornblende diorite porphyry and chloritized diorite; body CH-5, which was mapped as Kwdi, resembles the Hornblende Tonalite, etc. map unit (Knto) closely in composition and textural characteristics; body CH-3, also on Chichagof Island, is a poorly exposed, enigmatic volcanic-plutonic mass; the body on Sullivan Island (CM-17) consists of fine- to coarse-grained, foliated and gneissose tonalite, quartz diorite, and granodiorite with a cataclastic to mylonitic texture and a color index of 3-33; plagioclase composition is

An<sub>32-42</sub>; accessory minerals include sphene, opaques, apatite, zircon, chlorite, epidote, clinozoisite, and allanite; chlorite, epidote, and clinozoisite are alteration minerals after biotite and plagioclase; however, the euhedral nature of some of the individual epidote grains suggests they are magmatic in origin; veins filled with calcite, muscovite, and prehnite suggest a low grade metamorphic event; the complex deformation and alteration of this pluton precludes its relationship with the other bodies; the presence of abundant allanite is unlike the other bodies and suggests that this pluton may have crystallized from a different magma; the age of these bodies is based on their association with the other nearby plutons; the unit rock name should be changed to "Biotite-Hornblende Diorite, Augite-Biotite Diorite, Augite Diorite, Augite-Biotite-Hornblende Diorite" on future revisions.

Kwdb

Diabase (Cretaceous(?)):

Massive and sheared bodies; fine- to medium-grained; light greenish gray to light brown color; altered rocks are light orange to reddish brown; diabasic to porphyritic texture; plagioclase is highly altered to sericite, epidote, secondary feldspar, calcite, and clinozoisite; hornblende appears to be uralitic; accessory minerals include sphene, magnetite/ilmenite, and pyrite, some altering to hematite; chlorite and epidote are present as alteration minerals; CM-9 is on the upper plate of a high-angle reverse fault and is also adjacent to an area that is highly serpentinized and faulted; exposed as small bodies west of William Henry Bay (CM-9, CM-10); age based on association with other plutons in the Chilkat Mountains; the unit rock name should be changed to "Biotite-Hornblende-Augite Diabase" on future revisions.

Kwgb

Gabbro (Cretaceous):

Layered (3-4 cm); medium- to coarse-grained; dark greenish gray color; hypidiomorphic to poikilitic to pegmatitic texture; plagioclase composition is An<sub>50-62</sub>; 1.5 cm hornblende is the product of the uralitization of pyroxene; accessory minerals include apatite and magnetite/ilmenite; epidote and clinozoisite are alteration minerals; pyroxene content ranges up to 50% in the layers; two phases appear to be present--1) mixed rock with much variation in composition and texture, and 2) darker, less varied rock; poorly exposed bodies on Snow Dome, Glacier Bay (CM-23); age based on association with nearby plutons, but may be wrong as small bodies of layered hornblende gabbro just west of the study area are Tertiary in age (M.A. Lanphere, oral commun., 1983); the unit rock name should be changed to "Hypersthene-Biotite-Hornblende Gabbro" on future revisions.

## PLUTON SUMMARIES

Pluton No. CH-1

- Map symbol: Kmdt
- Major rock type(s): Apatite-magnetite-biotite-hornblende-pyroxene quartz diorite  
Apatite-magnetite-sphene-biotite-hornblende tonalite (Figure 2)
- Description: Foliated; medium- to coarse-grained; color index 16-23; weathers light gray to dark gray, light to medium gray on fresh surfaces; hypidiomorphic, equigranular texture.
- Petrographic features: Locally normally zoned plagioclase feldspar ( $An_{41}$ ); quartz and alkali feldspar are interstitial; quartz grains exhibit undulatory extinction and polygonization; orthopyroxene (hypersthene) and clinopyroxene (augite) are locally present and appear little altered; pyroxenes coexist in the rock with biotite and hornblende; accessory minerals include apatite, magnetite, and sphene; apatite and sphene are locally present; slight sericitization and chloritization indicates little chemical alteration; hornblende is often intergrown with biotite.
- Age: Cretaceous inferred, no data.
- Location: West of Port Frederick on northeastern Chichagof Island.
- Comments:
- Body is part of the Chichagof plutonic complex (Loney and others, 1975)
  - Pockets of biotite-quartz-garnet-epidote hornfels and biotite-quartz-feldspar gneiss/schist exist within the pluton boundaries.
  - Northwest of Tenakee Inlet is a heterogeneous area of marble, foliated feldspar-biotite-hornblende hornfels, and foliated medium gray biotite-hornblende diorite. The diorite is present as thin (1-2 m) layers or sills in the hornfels and marble. The foliation of the diorite is fairly concordant with that of the hornfels. These dioritic layers probably represent small apophyses into the adjacent country rock.
  - Northwest area is cut by color index 10 hornblende tonalite/granodiorite dikes up to 20 cm thick.
  - The tonalite of this body is probably different from the nearby tonalite of CH-2. The foliation, magnetite, and coarser grain size are distinguishing characteristics. The coarser grain size excludes the possibility of this body being a border phase.
  - Compositional layering could represent the limbs of a fold but more structural data are needed.
- References: This pluton corresponds to body 27 of Loney and others, 1975.  
Lathram and others, 1959.

Map symbol: Kmt0

Major rock type(s): Zircon-apatite-sphene-magnetite-biotite-hornblende tonalite

Minor rock type(s): Apatite-epidote-sphene-hornblende tonalite  
Magnetite-hornblende tonalite  
Magnetite-biotite-hornblende quartz diorite  
Zircon-apatite-opaque-hornblende-biotite granodiorite (Figure 3)

Description: Massive to poorly foliated; medium- to coarse-grained; color index 13-20, averaging 13-15; light gray to medium gray on both fresh and weathered surfaces; hypidiomorphic, equigranular to inequigranular texture, locally porphyritic.

Petrographic features: Moderately to strongly normally zoned plagioclase feldspar (An<sub>33-45</sub>); minor oscillatory zoning is also present; the plagioclase is variably sericitized; alkali feldspar and quartz are interstitial; quartz is often elongated and deformed; locally, medium-grained quartz and alkali feldspar enclose many finer-grained minerals; hornblende is variably altered to epidote minerals; relict pyroxene surrounded by uralitic hornblende observed in one thin section; biotite is variably chloritized and locally displays kink bands and undulatory extinction; accessory minerals include magnetite, apatite, sphene, and zircon; sphene is locally present; opaques are altering to Ti-rich biotite and leucoxene; where porphyritic, the plagioclase laths are up to 1 cm in length.

Age: Cretaceous inferred, no data.

Location: Southwest of Mud Bay and Neka River on northeastern Chichagof Island.

Comments:-

- Two biotite-hornblende gabbro bodies are present within the pluton boundaries (see following summary)
- This body contains small patches of undigested mafic igneous rock. Also present are a few inclusions of metasedimentary rocks. One station reported migmatite breccia inclusions.
- This body is very weathered in places.
- The poles to compositional layering are scattered.
- The foliation is present only in the northern 1/3 portion of the pluton. Foliation is not observed elsewhere.

References: This pluton corresponds to body 28 of Loney and others, 1975.  
Lathram and others, 1959.

- Map symbol: Part of Kmt0 map unit
- Major rock type(s): Biotite-hornblende gabbro
- Description: Massive to poorly foliated; medium- to coarse-grained; color index 50; weathers greenish gray, greyish green on fresh surfaces; hypidiomorphic, equigranular texture.
- Petrographic features: Zoned plagioclase feldspar ( $An_{45-61}$ ); Fe-Ti oxides are altered to sphene and biotite; clinopyroxene is altered to hornblende, actinolite, and biotite; clinopyroxene is also altered to epidote; rare relict clinopyroxene (augite) grains occur, rimmed by hornblende; mineral grains, especially the plagioclase, are fractured and often broken into pieces; actinolite is intergrown with the hornblende to form swaths of randomly oriented fibrous crystals; these swaths commonly occur as a core rimmed by biotite; relict tabular clinopyroxene outlines are preserved; in places, the plagioclase is replaced by epidote and clinozoisite; very little sericite, if any.
- Age: No age data available.
- Location: Northeastern Chichagof Island, southwest of Mud Bay and Neka River within the boundary of body CH-2.
- Comments:
  - Field observations suggest that the gabbro was intruded by the other rocks in map unit Kmt0 shortly after emplacement. The gabbro is thought to represent a melanocratic variant of Kmt0. This outcrop is adjacent to a recently mapped lineament (Brew and Ford, 1985). Movement of this lineament could account for the fracturing of the rock, however, so could intrusion.
  - The abundance of biotite as a secondary mineral requires that  $K_2O$  and  $H_2O$  were brought into the system. These elements could have diffused into the gabbro from Kmt0. Both would be late-stage elements which were concentrated in the residual liquid.
  - The presence of an amphibole rimming pyroxene is caused by late-stage magmatic alteration involving water. The mineral assemblage actinolite-chlorite-epidote suggests greenschist facies metamorphism. The gabbro may have been metamorphosed by the intrusion of Kmt0. The late-stage alteration and metamorphic effects are often difficult to separate.
- References: None.

Map symbol: Kwdi

Major rock type(s): No data.

Description: No data.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: Northern Chichagof Island.

Comments: - Mapped by Lathram and others (1959) as "hornblende-biotite diorite, hornblende-biotite quartz diorite, with lesser amounts of quartz monzonite, quartz monzonite gneiss, granodiorite, and hornblendite." Field observations by D.A. Brew (unpublished field notes, 1984) indicate that the body is an enigmatic volcanic-plutonic mass.

References: Lathram and others, 1959.

Map symbol: Kwdi

Major rock type(s): Chloritized zircon-opaque diorite  
Chloritized biotite-hornblende diorite

Description: Massive, fractured; fine- to medium-grained; color index 10; weathers medium greenish gray, light greenish gray on fresh surfaces; seriate, inequigranular to porphyritic texture.

Petrographic features: Plagioclase feldspar is present as phenocrysts averaging 1 cm in length; the plagioclase is highly weathered and altered to clay, chlorite, and calcite; sericite is present in trace amounts; quartz is interstitial and exhibits undulatory extinction and sutured boundaries; no primary mafics other than opaque minerals were observed in thin section; accessory minerals include opaques and zircon; opaques appear as both granular and disseminated grains; zircon is fairly abundant.

Age: Cretaceous inferred, no data.

Location: Northern Chichagof Islands near Burger Point.

Comments:

- Body is small in size.
- The diorite forms beach cliffs.
- The general area is very heterogeneous consisting of the diorite, limestone, argillite, migmatite breccia, and possibly volcanic rocks.
- Diorite contains sparse dark gray fine-grained rounded inclusions.

References: This pluton corresponds to body 46 of Loney and others, 1975.  
Lathram and others, 1959.

- Map symbol: Kwdi (to be changed to Knto on next map revision)
- Major rock type(s): Hornblende tonalite  
Zircon-apatite-sphene-magnetite-biotite-hornblende quartz monzodiorite (Figure 7)
- Description: Massive to poorly foliated; fine- to medium-grained; color index 11-20; light to dark gray on fresh and weathered surfaces; seriate, equigranular to slightly porphyritic texture.
- Petrographic features: Plagioclase feldspar (An<sub>38</sub>) is unzoned to slightly normally zoned; the plagioclase is moderately sericitized with the cores especially affected; epidote and clinozoisite also replace plagioclase in the more highly altered grains; quartz and alkali feldspar are interstitial; the alkali feldspar commonly contains abundant inclusions of the other minerals; hornblende possesses a blue green pleochroism and is probably uralitic (1 relict pyroxene outline observed); hornblende is variably replaced by clinozoisite and epidote; biotite, where present, has been partially to completely replaced by chlorite; accessory minerals include zircon, apatite, sphene, and magnetite.
- Age: Cretaceous inferred, no data.
- Location: Northeastern Chichagof Island, due south of Hoonah.
- Comments:
  - The contact zone is heterogeneous, containing amphibolite, feldspathic schists/gneisses, migmatitic zones, rhyolite, and basalt.
  - Pyrite is locally present.
  - A small body of opaque-biotite-hornblende metagabbro exists near the northern boundary of the pluton. A weak foliation is defined by hornblende and biotite. The metagabbro exhibits textural disequilibrium; highly sericitized patches and areas of recrystallized feldspar are present. The metagabbro is also cut by microveins of muscovite, feldspar and hornblende.
  - Near the northwestern boundary of the pluton is an area containing hornfelsed basalt, slightly chloritized apatite-opaque-sphene-plagioclase-hornblende monzonite, and some amygdaloidal basalt. The monzonite probably represents a border phase or an offshoot of the main pluton.
- References: This pluton corresponds to body 47 of Loney and others, 1975.  
Lathram and others, 1959.

Map symbol: Kwqd

Major rock type(s): Apatite-zircon-(sphene)-opaque-hornblende-biotite granodiorite (Figure 4)

Description: Massive, fine- to medium-grained, locally coarse-grained; color index 3-8; weathers dark gray, light gray on fresh surfaces; an-subhedral, equigranular texture.

Petrographic features: Plagioclase feldspar (An<sub>28-30</sub>) is moderately normally zoned and is slightly sericitized; quartz is interstitial, often encloses abundant finer-grained feldspars, biotite, and hornblende; alkali feldspar is present as subhedral grains; biotite is slightly chloritized; some biotite grains are kinked; the biotite contains some titanium as evidenced by its reddish brown pleochroism; hornblende is much less abundant than biotite; hornblende is variably replaced by calcite and chlorite; accessory minerals include opaques, zircon, apatite, and rare sphene; rare clinozoisite is present; locally, pyroxene deuterically altered to hornblende can be found.

Age: Cretaceous inferred, no age data.

Location: On Porpoise Islands north of Chichagof Island.

Comments:

- Outcrops contain from 0 to 60%, aphanitic to fine-grained hornfels inclusions. In thin section, the hornfels consists of hornblende, quartz, and feldspar with minor biotite, epidote minerals, and opaques. Mafic clots containing opaques, hornblende, and biotite are randomly scattered throughout the hornfels. Randomly oriented feldspar laths are up to 5 mm in length in the hornfels.
- Fine-grained light gray aplitic bodies 4" to 1' wide are present within the body. Some of the aplites appear to flatten out, possibly over a small antiform. Joints also appear to "roll" around. The aplites and joints may indicate a north-plunging antiform. Thus, the pluton may be folded or upwarped.

References: Lathram and others, 1959.

Map symbol: Kwdi

Major rock type(s): No data.

Description: No data.

Petrographic features: No data

Age: Cretaceous inferred, no age data.

Location: Southern end of Chilkat Range.

Comments: - Mapped as "hornblende diorite and hornblende quartz diorite" by Lathram and others (1959).

References: Lathram and others, 1959.

- Map symbol: Kwgd
- Major rock type(s): Apatite-zircon-sphene-magnetite-(biotite)-hornblende tonalite
- Minor rock type(s): Apatite-zircon-sphene-magnetite-(biotite)-hornblende quartz diorite  
Zircon-apatite-sphene-magnetite-hornblende granodiorite (Figure 5)
- Description: Massive, locally foliated; fine- to medium-grained; color index 5-12; light gray to medium gray on both fresh and weathered surfaces; an-subhedral, equigranular texture.
- Petrographic features: Plagioclase feldspar ( $An_{32-35}$ ) exhibits dominant oscillatory zoning and minor normal zoning; oscillatory zoned plagioclase feldspars commonly have an outermost rim of  $An_{25}$ ; plagioclase is very slightly sericitized; quartz is interstitial, exhibits undulatory extinction and polygonization; alkali feldspar is interstitial to granular; some alkali feldspar grains have undulatory extinction; hornblende is slightly altered to chlorite and epidote minerals; hornblende appears to show a zoning in its pleochroic scheme; biotite was not observed in thin section; accessory minerals include magnetite, sphene, apatite, and zircon; some of the magnetite has been altered to sphene; possible relict pyroxenes may be represented by tabular masses of secondary epidote and clinozoisite.
- Age: 103 M.A. Lanphere, oral commun., 1983
- Location: Southeastern end of the Chilkat Range, west of Lynn Canal.
- Comments:
  - Oscillatory zoning of plagioclase and possible zoning of hornblende could indicate a magma mixing event or changes in pressure experienced by the pluton as it crystallized.
  - The foliation is faint but the fracture system is well-developed. The major fracture system in general parallels the strike of folds in the area which is to the northeast with a vertical to steep dip. The basic dikes which cut the pluton are also oriented in the same manner as the major fracture system.
  - Mafic inclusions are generally sparse.
  - Some areas contain undigested limestone and argillite.
  - There may be a possible zoning of the pluton from less sodic to more sodic from the rim to the interior as evidenced by an increase in alkali feldspar content of hand specimens (R. A. Loney and J. S. Pomeroy, unpublished notes).
  - Pluton is cut by numerous basic dikes composed of altered hornblende gabbro. The gabbro is undergoing

- chloritization and epidotization.  
- Apophyses are present at contact zones.

References:

This pluton corresponds to body 3 of Sonnevil (1981); his two samples plot as quartz monzodiorite. Sonnevil describes this pluton as composite based on Map I-303 (Lathram and others, 1959).

Map symbol: Kwqd

Major rock type(s): Zircon-apatite-sphene-opaque-(biotite)-hornblende quartz monzodiorite  
Apatite-sphene-hornblende tonalite (Figure 4)

Description: Massive; medium-grained; color index 6-13; weathers medium gray, light gray on fresh surfaces; an-subhedral, equigranular texture

Petrographic features: Plagioclase feldspar (An<sub>38-44</sub>) exhibits both oscillatory and normal zoning; plagioclase is slightly to highly sericitized; quartz is interstitial, exhibits undulatory extinction and polygonization; alkali feldspar is predominantly interstitial and often shows undulatory extinction; hornblende is variably replaced by clinzoisite; biotite is sparse and has mostly been replaced by chlorite; accessory minerals include opaques, sphene, apatite, and zircon; sphene is very abundant; a minor amount of myrmekite is present.

Age: Cretaceous inferred, no age data.

Location: East of Excursion Inlet at the southeastern end of the Chilkat Range.

Comments:

- Inclusions are sparse.
- Pluton is cut by 6' thick dikes of dark igneous rock.
- Pluton contains a body of altered and weakly foliated hornblende gabbro. Field relations indicate that this gabbro is cut by the pluton; thus, the gabbro is older in age than the pluton and is probably an inclusion.

References: This pluton corresponds to body 2 of Sonnevil (1981); his two samples plot as quartz monzodiorite.  
Lathram and others, 1959.

Map symbol: Kwqd

Major rock type(s): Zircon-apatite-sphene-opaque-(biotite)-hornblende granodiorite (Figure 4)

Description: Massive, locally very weakly foliated; fine- to medium-grained; color index 5-16; light gray to medium gray on fresh and weathered surfaces; an-subhedral, equigranular texture.

Petrographic features: Plagioclase feldspar ( $An_{24-38}$ ) exhibits oscillatory zoning but unzoned grains are also abundant; oscillatory zoned plagioclase grains have rims of composition  $An_{26}$ ; plagioclase is slightly sericitized and altered to clay minerals; quartz and alkali feldspar are interstitial; both quartz and alkali feldspar enclose abundant finer-grained hornblende, plagioclase, opaques, and apatite; hornblende is slightly replaced by epidote minerals; locally, minor amounts of augite altered to uralitic hornblende are present; biotite was not observed in thin section; accessory minerals include opaques, sphene, apatite, and zircon; some of the opaques are altered to sphene.

Age: Cretaceous inferred, no age data.

Location: Southwestern Chilkat Range near the head of Excursion Inlet.

Comments:

- Pluton is close to a quartz monzodiorite in composition.
- Pluton locally contains mafic inclusions similar to those found on Porpoise Island.
- Pluton also contains very scarce inclusions of sphene-hornblende quartz diorite. These inclusions may represent autoliths.
- A north-northwest trending linear feature (fault?) runs through the length of the intrusive.
- Pluton contains potassium-rich fractures which also trend north-northwest.

References: This pluton corresponds to body 1 of Sonnevil (1981); his sample plots on the line between quartz monzodiorite and granodiorite.  
Lathram and others, 1959.

Map symbol: Kwgd

Major rock type(s): Apatite-sphene-opaque-hornblende quartz monzodiorite (Figure 5)

Description: Foliated; fine- to medium-grained; color index 6; light to medium gray on fresh and weathered surfaces; an-subhedral, equigranular texture.

Petrographic features: Plagioclase feldspar (An<sub>47-55</sub>) exhibits dominant oscillatory zoning; plagioclase is moderately altered to clay minerals, sericite, and epidote minerals with the cores and calcic bands preferentially altered; quartz is granular to interstitial; alkali feldspar is interstitial and moderately altered to clay minerals; hornblende is variably replaced by clinozoisite and calcite; accessory minerals include opaques, sphene, apatite, and zircon; sphene and apatite are both well-developed and abundant; minor amounts of chlorite could represent completely replaced primary biotite.

Age: Cretaceous inferred, no age data.

Location: Southeastern end of Chilkat Range, northeast of Excursion Inlet.

Comments:

- The regular spacing of the oscillatory zoned plagioclase grains and the departure from an equilibrium tabular habit indicate an undercooling history of crystallization. This may suggest emplacement at low temperatures, that is, at shallow depths rather than suggest a magma mixing event.
- Pluton contains many calcium-bearing minerals; the excess calcium may have come from the surrounding limestone unit.
- The chlorite may indicate low grade metamorphism; metamorphism of the pluton may be related to its deformation.
- The foliation strikes about N80W and dips 80NE.

References: Lathram and others, 1959.

Map symbol: Kwdi

Major rock type(s): Altered augite-biotite diorite

Description: Sheared; medium- to coarse-grained; greenish and brownish gray color on both fresh and weathered surfaces; porphyritic texture.

Petrographic features: Plagioclase feldspar is considerably sericitized and cloudy; plagioclase phenocrysts are up to 1.5 cm in length; plagioclase composition is probably oligoclase/andesine; alkali feldspar is restricted to the matrix and as rims bordering plagioclase phenocrysts; myrmekitic and perthitic textures are present; mafic minerals include augite and biotite; accessory minerals include opaques, sphene, apatite, and possibly zircon; some of the opaques appear to be altered to leucoxene; chlorite and epidote are present as secondary alteration minerals; a minor amount of hornblende may be present.

Age: Cretaceous inferred, no age data.

Location: Southwest of William Henry Bay.

Comments: - Cleavage trends north-northeast.

References: Lathram and others, 1959.

Map symbol: Kwdi

Major rock type(s): Altered augite diorite

Description: Sheared; fine- to coarse-grained; greenish gray color on fresh and weathered surfaces; diabasic to glomeroporphyritic texture.

Petrographic features: Plagioclase feldspar is badly altered to cloudy masses of secondary minerals; plagioclase feldspar probably was oligoclase/andesine in composition; alkali feldspar is restricted to the matrix; augite is the only mafic mineral observed; accessory minerals include hematite and apatite; epidote is the dominant alteration mineral.

Age: Cretaceous inferred; no age data.

Location: West of the head of William Henry Bay.

Comments:

- Pluton is similar to CM-7 in its dioritic composition and sheared texture.
- Serpentinous shear surfaces observed on exposed surfaces.
- Pluton ranges from a fine-grained diabase to a porphyritic diorite.
- Pluton appears to have less alkali feldspar than CM-6.

References: Lathram and others, 1959.

Map symbol: Kwdb

Major rock type(s): Altered diabase

Description: Sheared; fine-grained; weathers bluish gray to light orange or red brown, medium grayish green on fresh surfaces; diabasic and porphyritic texture.

Petrographic features: Phenocrysts consist of greenish and brownish hornblende generally altered to pale green uralite and chlorite; matrix is dominantly composed of highly altered plagioclase feldspar; plagioclase feldspar is altered to sericite, epidote, secondary feldspar, calcite, and possibly clinozoisite.

Age: Cretaceous inferred, no age data.

Location: Northwest of William Henry Bay.

Comments:

- Pluton has undergone considerable shearing and alteration.
- The area, in general, is highly serpentized.
- The classification as diabase is doubtful; the pluton may be fairly complex.
- Pluton contains pyrite.
- The serpentinous shear slicks observed on exposed surfaces may indicate an originally more magnesian (mafic) rock.

References: Lathram and others, 1959.

Map symbol: Kwdb

Major rock type(s): Biotite-hornblende-augite diabase

Description: Massive; fine- to medium-grained; weathers light brown, light greenish gray on fresh surfaces; porphyritic, rough diabasic texture.

Petrographic features: Plagioclase feldspar is altered to very fine-grained epidote, sericite, and clinozoisite; plagioclase feldspar probably was originally oligoclase/andesine in composition; mafic minerals include augite, hornblende, and biotite; accessory minerals include sphene, magnetite/ilmenite, and pyrite; pyrite is replaced by hematite; chlorite and epidote are present as secondary minerals.

Age: Cretaceous inferred, no age data.

Location: Northwest of William Henry Bay.

Comments: - A persistent quartz vein runs through the body. The vein is red-stained and fractured, 3' wide, trends N75E, and can be traced for at least 200'.  
- It appears that the surrounding argillites are folded into an anticline.

References: Lathram and others, 1959.

Map symbol: Kwqd (to be changed in next map revision)

Major rock type(s): Altered granitic

Description: Massive; fine- to medium-grained; color index 10; weathers tan brown, pink and gray on fresh surfaces; an-subhedral inequigranular texture.

Petrographic features: Fine-grained plagioclase feldspar (An<sub>30</sub>) appears to be recrystallized; alkali feldspar is granular and microperthitic; quartz is very sparse; abundant fine-grained muscovite and calcite replace what was probably primary plagioclase feldspar; a minor amount of kinked, pleochroic green biotite is present; this biotite is secondary, based on its pleochroic color; some of the biotite grains have a reaction rim of fine-grained calcite and opaques; medium-grain-sized patches of opaque material may represent altered primary mafic minerals; the accessory mineral present is very fractured fine-grained apatite; microfractures are filled by calcite and/or muscovite.

Age: Believed to be Tertiary rather than Cretaceous based on field observations (Eakins, 1975), no age data.

Location: North of William Henry Bay and west of Lynn Canal.

Comments:

- Pluton has undergone deformation and considerable alteration such that the original texture and minerals have been obscured.
- Its original composition was probably a quartz monzonite or quartz monzodiorite. Cannot determine primary mafic minerals based on existing data.
- Pyrite is present.
- Pluton is cut by 20 cm plagioclase-muscovite-quartz veins.
- Surrounding area contains sheared mafic igneous rocks and volcanics.

References: Lathram and others, 1959.  
Eakins, 1975.

Map symbol: Kwdi

Major rock type(s): Augite diorite

Description: Massive; medium-grained; light gray color (unspecified surface); no textural data.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: Central Chilkat Mountains, due west of William Henry Bay.

Comments:

- Pluton contains pyrite.
- Pluton contains wedges of country rock consisting of dark gray thinly banded argillite and volcanic rock.
- Quartz veins and fine-grained variants of the pluton are present.
- Pluton is cut by diabasic or andesitic dikes which trend N35E.

References: Lathram and others, 1959.

Map symbol: Kwan

Major rock type(s): No data.

Description: No data.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: Central Chilkat Range, south of Endicott River.

Comments: - Mapped by Lathram and others (1959) as "andesite dikes and sills".  
- This solitary "pluton" should be combined with the Kwdi map unit in the next map revision.

References: Lathram and others, 1959.

Map symbol: Kwqd

Major rock type(s): No data.

Description: No data.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: North of Bear Track Cove, Glacier Bay.

Comments: Mapped by Lathram and others (1959) as "mostly hornblende granodiorite containing biotite-hornblende diorite and hornblende-hypersthene quartz diorite variants".

References: Lathram and others, 1959.

Map symbol:	Kwqd
Major rock type(s):	Zircon-sphene-apatite-magnetite-biotite-hornblende granodiorite
Minor rock type(s):	Zircon-apatite-sphene-magnetite-hornblende-biotite granodiorite Apatite-magnetite-biotite-hornblende quartz diorite Apatite-opaque-pyroxene-biotite-hornblende quartz diorite (Figure 4)
Description:	Locally foliated, almost gneissose; medium-grained; color index 5-20; weathers dark greenish gray, medium gray on fresh surfaces; hypidiomorphic granular to inequigranular texture.
Petrographic features:	Plagioclase feldspar (An <sub>44</sub> ) is normally zoned and oscillatory zoned; plagioclase is slightly to highly altered to sericite, chlorite, and epidote minerals; quartz and alkali feldspar are interstitial in the quartz diorite, granular in the granodiorite; alkali feldspar is slightly to highly altered to sericite and epidote; hornblende is slightly altered to chlorite and clinozoisite and locally has a reaction rim of chlorite and epidote; biotite is altered to chlorite and is more altered than the hornblende; patches of chlorite and epidote may represent completely altered pyroxene; accessory minerals include magnetite, opaques, apatite, sphene, and zircon; some of the opaques have a reaction rim of biotite; sphene is abundant where biotite exceeds hornblende.
Age:	114 Ma (K-Ar on hornblende) (M.A. Lanphere, oral commun., 1967)
Location:	Western Chilkat Range, north of Beartrack Cove.
Comments:	<ul style="list-style-type: none"> <li>- Pluton appears to be cut and displaced by 2 small faults.</li> <li>- Pluton appears to be a dominantly leucocratic rock.</li> <li>- Fine-grained mafic dikes with nearby pyritic hornfels are present near the eastern contact of the pluton.</li> <li>- There is possibly a finer-grained border phase but not enough data to delineate.</li> <li>- One sample contained a potassium-rich inclusion which might be a result of magma mixing or magma segregation. The biotite rims on the opaques in the sample's thin section may indicate that potassium rich magma was injected later.</li> </ul>
References:	Lathram and others, 1959.

Map symbol: Tgqm

Major rock type(s): Chloritized allanite-zircon-apatite-sphene-opaque-hornblende granite  
Chloritized allanite-zircon-apatite-sphene-opaque-hornblende quartz monzonite (Figure 6)

Description: Massive; fine- to medium-grained, commonly medium-grained; color index 1-7; weathers pinkish dark gray, pinkish gray on fresh surfaces; hypidiomorphic granular to slightly porphyritic texture.

Petrographic features: Plagioclase feldspar (An<sub>32-37</sub>) exhibits dominant normal zoning; plagioclase feldspar is moderately to highly sericitized; fine-grained calcite is sometimes present in plagioclase; some of the plagioclase grains are sheared and fractured; quartz is generally interstitial; granular alkali feldspar often encloses plagioclase; alkali feldspar has microperthitic texture; alkali feldspar is slightly altered to "clay"; hornblende is partially to completely replaced by chlorite, calcite, and minor epidote minerals; anhedral patches of chlorite and calcite are present, usually among opaques (primary mafic?); accessory minerals include opaques, sphene, apatite, zircon, and allanite; opaques are anhedral and commonly have anhedral grains of sphene associated with them; sphene is euhedral and is the most abundant accessory; apatite and zircon are euhedral and fairly abundant; allanite is often present as well-formed grains; epidote and clinozoisite are often present as individual grains; microfractures are filled with calcite and chlorite.

Age: Tertiary inferred, no age data.

Location: Sandy Cove, east side of Glacier Bay.

Comments:

- Field notes indicate that the pluton is cut by a normal fault.
- The abundance of calcium may have come from the surrounding limestone which the pluton intruded.
- The sphene, zircon, and allanite indicate a high rare earth element content.
- Minor gold and copper mineralization is associated with quartz veins which cut the pluton (MacKevett and others, 1971; Brew and others, 1978).
- Pluton appears to have undergone low grade metamorphism or hydrothermal alteration.

References: MacKevett and others, 1971.  
Brew and others, 1978.

- Map symbol: Kwdi (this pluton may be put into another map unit in the next map revision)
- Major rock type(s): (Zircon)-(sphene)-opaque-apatite-allanite-(epidote)-(chlorite)-(biotite) tonalite
- Minor rock type(s): (Sphene)-(zircon)-apatite-opaque-allanite-epidote-(hornblende)-biotite quartz diorite  
Sphene-apatite-zircon-opaque-allanite-epidote-hornblende-biotite granodiorite (Figure 7)
- Description: Foliated; fine- to coarse-grained, commonly medium-grained; color index 3-33, averaging 5-11; weathers light greenish gray, light to medium grayish green on fresh surfaces; anhedral, cataclastic to mylonitic texture.
- Petrographic features: Plagioclase feldspar (An<sub>32-42</sub>) exhibits undulatory extinction; rare oscillatory zoning is present in the plagioclase; plagioclase is slightly altered to epidote and clinozoisite, rounded, and abraded with irregular boundaries; quartz exhibits undulatory extinction, polygonization, and recrystallization; quartz grains have been sheared into elongate lenses; alkali feldspar is generally interstitial; primary biotite is locally present; where absent, the biotite has been completely replaced by chlorite; there is a late-stage pleochroic brownish green biotite; hornblende, with a light yellow green to aqua green pleochroism, is much less abundant than biotite; all the primary minerals are deformed, i.e., fractures and kink bands are pervasive; accessory minerals include opaques, allanite, sphene, apatite, and zircon; allanite is very abundant; sphene and opaques are generally sparse; an- to euhedral epidote and clinozoisite are fairly abundant; zoisite is sparse; veins are filled with calcite, muscovite, clinozoisite, and prehnite; myrmekitic texture is present.
- Age: Cretaceous inferred, no age data.
- Location: West side of Sullivan Island.
- Comments:
  - Pluton is cut by basaltic to gabbroic hypabyssal dikes.
  - Pluton is cut by other felsic dikes which are internally foliated or sheared. Dike foliation is subparallel to the foliation of the pluton (Figure 10a).
  - A few stations report abundant pyrite.
  - Pluton is folded and cut by faults, most of which are right lateral.
  - Foliation trends N45E and dips steeply to vertical (Figure 10a). The foliation is possibly axial plane foliation.

- The mineral lineations are subparallel to fold axes plunging 10-20° at 160°.
- Low grade metamorphism is suggested by epidote and prehnite.
- The presence of allanite indicates a high rare earth element content.
- There is the possibility that some of the euhedral epidote may be primary magmatic epidote which would have formed under moderately high pressures at lower crustal depths. This suggests a possible affinity with the 90 Ma plutons described in the same belt by Brew and Morrell (1983) and by Zen and Hammarstrom (1984).

References:

Lathram and others, 1959.

Map symbol: Kwgr

Major rock type(s): Altered quartz-bearing syenite

Description: Sheared; fine- to medium-grained; weathers red and green, pinkish green on fresh surfaces; an-subhedral, inequigranular texture.

Petrographic features: No data.

Age: Cretaceous inferred but may be Tertiary based on regional interpretation.

Location: West of Adams Inlet in Chilkat Range, near Berg Creek.

Comments:

- Pluton is very similar to CM-19 but appears to have a slightly higher quartz content.
- Slickensides observed in hand sample. The slickensides parallel the foliation.
- Pluton is fractured and deformed.
- The surrounding area is composed mainly of volcanics including altered hornblende andesite.

References: Lathram and others, 1959.

Map symbol: Kwgr

Major rock type(s): Altered pegmatitic quartz-bearing syenite

Description: Massive; very coarse-grained; color index 5; weathers red and green, pinkish green on fresh surfaces; an-euhedral, inequigranular texture.

Petrographic features: Plagioclase feldspar ( $An_{32}$ ) is found as rare isolated grains and, more commonly, intergrown with alkali feldspar in what appears to be an exsolution texture; alkali feldspar is fractured and shows perthitic textures; alkali feldspar is moderately to highly altered to sericite and chlorite; quartz is interstitial, exhibits strong undulatory extinction and fracturing; primary opaques are disseminating to form secondary biotite, some of which is altered to chlorite; accessory minerals include opaques and apatite; patches of calcite and anhedral opaques most likely represent replaced primary mafics.

Age: Cretaceous inferred but may be Tertiary based on regional interpretation.

Location: West of Adams Inlet in Chilkat Range, near Berg Creek.

Comments:

- Syenite appears to be an alkali-lime syenite as evidenced by the greater than 5% modal percentage of plagioclase and the high calcium content of the plagioclase.
- Manganese-rich area present within the pluton.
- Pluton appears to be cut by a fault at its southeastern end. This bleached and altered area contains pyrite, hematite, and chalcopyrite.

References: Lathram and others, 1959.

Map symbol: Kwgd

Major rock type(s): No data.

Description: No data.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: Adams Inlet, Glacier Bay.

Comments: - This exposure is the eastern extension of a pluton that underlies a relatively large area just west of this study area.

References: None.

Map symbol: Kwgd (This assignment should be changed to Kwgr/Kwsy on future maps)

Major rock type(s): Syenite?

Description: Massive; medium-grained; weathers salmon pink to dark pink, light pinkish buff on fresh surfaces; subhedral, equigranular to porphyritic texture.

Petrographic features: No data.

Age: Cretaceous inferred, no age data.

Location: North shore of Adams Inlet, Glacier Bay.

Comments:

- Field observations report 60% alkali feldspar and 15% plagioclase feldspar, lathlike in form, in a dark matrix.
- Less than 10% of the alkali feldspar has a core of white feldspar.
- Schlieren may be present in the pluton.

References: None.

Map symbol: Kwgd

Major rock type(s): Apatite-opaque-biotite-hornblende quartz diorite (Figure 5)

Description: Massive; medium-grained; color index 13-25; weathers dark greenish gray, light greenish gray on fresh surfaces; an-subhedral, equigranular texture.

Petrographic features: Normally zoned plagioclase feldspar (An<sub>44</sub>) is moderately to strongly altered to sericite and chlorite; cores of plagioclase are preferentially altered; quartz and sparse alkali feldspar are interstitial; hornblende grains often have a core of epidote/clinozoisite which is probably altered relict pyroxene; biotite is replaced by chlorite; a few biotite grains are bent; accessory minerals include opaques and apatite; some of the opaques are altered to biotite; apatite is abundant; sparse calcite is also present.

Age: Cretaceous inferred, no age data.

Location: Western Chilkat Range, north of Adams Inlet, south of Snow Dome.

Comments:

- The small plutonic body is cut by quartz veins, biotitic brown mafic dikes, and chloritic veins containing pyrite.
- Pluton is rich in phosphorus, calcium, and potassium, judging from the abundance of sericite and biotite; the potassium may have been introduced into the system from the surrounding argillites as the pluton contains very little primary alkali feldspar.

References: Lathram and others, 1959.

Map symbol: Kwmg (This assignment should be changed to Kwgb on future maps)

Major rock type(s): Hypersthene-biotite-hornblende gabbro

Description: Layered (3-4 cm); medium- to coarse-grained; dark greenish gray color; hypidiomorphic granular to poikilitic to pegmatitic texture.

Petrographic features: Normally zoned plagioclase feldspar is usually interstitial; plagioclase grains have a core of An<sub>50-62</sub> and a rim of An<sub>42</sub>; hornblende crystals are up to 1-1/2 cm long and are the products of the uralitization of the pyroxenes; accessory minerals include apatite and magnetite (or ilmenite); alteration products include epidote and clinozoisite.

Age: Cretaceous inferred, no age data.

Location: Western Chilkats, north of Adams Inlet on Snow Dome.

Comments:
 

- Layering appears to be pervasive.
- There are probably 2 phases of the gabbro:
  - 1) at lower elevation - mixed rock with much variation in texture (fine to pegmatitic) and % of pyroxene;
  - 2) at higher elevation - darker color, less crushed and varied, and more poikilitic.
- This could represent a vertical stratification going from the bottom of the magma chamber to the middle. The dips are moderately steep, suggesting that the unit is overturned and the middle and top are present.
- Pyroxene content is as much as 50%.

References: Lathram and others, 1959.

Map symbol: TKgd

Major rock type(s): (Sphene)-apatite-opaque-hornblende-biotite granodiorite  
(Sphene)-apatite-opaque-biotite-hornblende granodiorite

Minor rock type(s) Zircon-apatite-opaque-biotite-hornblende tonalite  
Apatite-sphene-opaque-biotite-hornblende monzonite  
Sphene-opaque-hornblende quartz diorite/tonalite (Figure 8)

Description: Massive to weakly foliated; fine- to coarse-grained, commonly medium-grained; color index 4-20, averaging 5-13; light to medium gray on both fresh and weathered surfaces; an-subhedral, equigranular to porphyritic texture.

Petrographic features: Plagioclase feldspar (An<sub>38-53</sub>) exhibits oscillatory and normal zoning; oscillatory zoning appears to be dominant; oscillatory zoned feldspars commonly have an outermost rim of An<sub>24-32</sub>; most plagioclase grains are fractured but do not show major alteration to epidote, sericite, and "clay"; quartz is interstitial to granular, dominantly interstitial; alkali feldspar is also interstitial to granular, dominantly interstitial; in most cases, the alkali feldspar exhibits undulatory extinction and appears more altered than the plagioclase in the same sample; hornblende is variably altered to epidote/clinozoisite and most grains are fractured; some hornblendes have a reaction rim of chlorite; the biotite is variably altered to chlorite; some biotite grains are bent and kinked; accessory minerals include opaques, apatite, sphene, and zircon; opaques are often disseminated into breakdown products (notably sphene); apatite is almost always present in appreciable amounts; sphene locally surpasses apatite in quantity but is not always present; calcite is locally present as a minor alteration mineral.

Age: 37.3 (biotite) (M.A. Lanphere, oral commun., 1967)  
39.2 (biotite) (D.A. Brew, unpublished data)

Location: Large body in northern Chilkat Range, east of Casement Glacier.

Comments: - Monzonite is present on the southeastern border; however, the idea of a monzonite border phase is not supported by data.  
- Pluton is cut by a small fault in one area; andesite dikes nearby are altered.  
- Pluton's contact is concordant with the adjacent sediments strike and dip in many places; sediments are locally drag-folded and most certainly forcibly pushed away.

- Pluton is locally cut by 5-14 cm wide quartz veinlets.
- Pluton locally contains greater than 5% fine-grained mafic inclusions with feldspar porphyroblasts and also small (5-8 cm diameter) rounded mafic clots.
- Pluton may be cut by a dark greenish black porphyritic basalt(?) dike(?).
- Surrounding country rock is intensely folded.
- Fairly steep dips at contact with country rock may suggest that the top of the pluton has been eroded away.
- Eastern extension of pluton CM-25.

References:

Lathram and others, 1959.

Map symbol: TKgd

Major rock type(s): Zircon-(sphene)-apatite-opaque-biotite-hornblende granodiorite  
(Zircon)-(sphene)-apatite-opaque-biotite-hornblende tonalite (Figure 8)

Minor rock type(s): Zircon-apatite-pyroxene-biotite-hornblende quartz monzodiorite  
Quartz monzonite

Description: Massive; fine- to medium-grained; color index 2-19, averaging 15-18; weathers light gray to very light red, gray on fresh surfaces; an-subhedral, equigranular to porphyritic texture.

Petrographic features: Plagioclase feldspar (An<sub>41-45</sub>) exhibits normal and oscillatory zoning; one or the other is usually dominant in an area; plagioclase is slightly to moderately sericitized; quartz is interstitial to granular; alkali feldspar is interstitial and slightly altered; micrographic texture is sparse but present; the bulk of the hornblende present is fibrous and appears to be uralitic; rare relict pyroxene in the cores of hornblende grains is completely replaced by epidote/clinozoisite; hornblende is variably replaced by clinozoisite; biotite is partially to completely replaced by chlorite; locally, biotite is broken down to sphene and opaques; some biotite grains are kinked and fractured; accessory minerals include opaques, apatite, sphene, zircon, and possible allanite; opaques often have rims of biotite or sphene; sphene is generally a secondary mineral; epidote/clinozoisite is more abundant than chlorite.

Age: Tertiary inferred, no age data.

Location: West of Casement Glacier and east of McBride Glacier in northern Chilkat Range.

Comments:

- Pluton appears to be a continuation of CM-24. The modal percentages plot in the same fields as that of CM-24. However, this pluton contains more inclusions than CM-24.
- Pluton contains fairly ubiquitous 2-10 cm ovoid mafic inclusions which have irregular to sharp contacts. Pluton also contains metamorphic (hornfels) inclusions which can be up to 6 m wide. The metamorphic inclusions trend N65-75E and dip 80 NW. Some of the hornfels inclusions show compositional layering, striking N73W and dipping 55 SW.
- A screen is present in the western portion of the pluton consisting of several hundred feet of hornfels which displays bedding striking N85W.
- Iron-stained zones are present in the hornfels inclusions.

- Pluton is cut by steeply dipping NE striking mafic dikes. Some of the dikes are hornblende-plagioclase andesitic dikes which have a hypabyssal texture. A few dikes strike N45-50W and dip 70-80SW.
- The surrounding thin-bedded calc-hornfels is locally folded into series of NE plunging folds of small amplitude and is cut by NE striking mafic dikes and granitic apophyses.
- Altered hornblende-plagioclase andesitic lavas are present near the southern end of the pluton.
- Minor quartz veins and aplitic dikelets striking N75E and dipping vertically are also present.
- The porphyritic texture of the pluton and the abundant metasedimentary inclusions suggest that the exposed sections represent the roof of the pluton emplaced at shallow depths.

References:

None.

Map symbol: Tgqm

Major rock type(s): No data.

Description: No data.

Petrographic features: No data.

Age: Tertiary inferred, no age data.

Location: Eastern arm of McBride Glacier, Glacier Bay.

Comments: - Known only from distant observations by D.A. Brew (oral commun., 1986).

References: None.

Map symbol: Tgqm

Major rock type(s): Altered granitic

Description: Unfoliated; medium- to coarse-grained; weathers pink, greenish gray or pink on fresh surfaces; an-subhedral, slightly porphyritic texture.

Petrographic features: Plagioclase feldspar (An<sub>34</sub>) is altered to sericite, calcite, and epidote; there appears to be some intergrowth-exsolution texture between plagioclase and alkali feldspar; granular alkali feldspar exhibits perthitic texture and is altered to sericite, epidote, and calcite; quartz is granular to interstitial; micrographic texture is present; patches of disseminated opaques intergrown with chlorite; oxidation of opaques to red oxide; fine-grained secondary green biotite is associated with mafics and is present in aggregates with fine-grained chlorite; accessories include apatite, zircon, and opaques.

Age: Tertiary inferred, based on field observations and interpretation of relation to CM-24 and CM-25.

Location: Northern Chilkat Range, northeastern part of Casement Glacier.

Comments:

- Pluton contains veins filled with quartz, sulfides (pyrite), potassium-rich minerals, and opaques.
- The adjacent greenschist with garnet porphyroblasts have a N80E 60NW foliation consistent with the regional trend.
- Pluton is cut by basalt and porphyry dikes. Some dikes may contain garnet.
- Pluton is a quartz monzonite porphyry in places.
- Pluton appears to be a heterogeneous unit.
- Pluton appears to have undergone some low-grade metamorphism.

References: None.

Map symbol: TKgd

Major rock type(s): Hornblende-biotite quartz monzonite

Description: Weakly to strongly foliated; medium-grained; color index 15-20; weathers gray; equigranular texture (inferred from field notes).

Petrographic features: No data.

Age: Tertiary inferred, no age data.

Location: Northeast of Casement Glacier in the northern Chilkat Range.

Comments: - Pluton appears to lack inclusions.

References: None.

Map symbol: Kwmg

Major rock type(s): Zircon-(allanite)-(sphene)-apatite-hornblende-biotite tonalitic migmatite  
Zircon-(allanite)-(sphene)-apatite-biotite-hornblende tonalitic migmatite (Figure 9)

Description: Foliated; medium- to coarse-grained; color index varies from 9 to 60; outcrops as dark and light heterogeneous bodies; an-subhedral, inequigranular to gneissose texture.

Petrographic features: LIGHT LAYER: plagioclase feldspar (An<sub>39-42</sub>) exhibits no dominant zoning; bulk is unzoned but normal and oscillatory zoning are present; plagioclase feldspar is slightly to highly sericitized; plagioclase has irregular edges and the grains are aligned subparallel to the foliation; quartz is granular to interstitial; quartz exhibits undulatory extinction and is elongated; stain test shows very little alkali feldspar (1-2%); hornblende has blue green pleochroism and is fractured; hornblende is partially to completely replaced by clinzoisite; hornblende often has "inclusions"(?) of fine-grained rounded quartz; hornblende grains are crudely aligned; biotite is fractured, "shredded", and partially to completely replaced by chlorite; accessory minerals include opaques, apatite, zircon, sphene, and allanite; sphene and allanite are variably present; in the more altered rocks, calcite, epidote, and clinzoisite are found as individual granular crystals; the allanite is associated with epidote and abundant zircon.

MAFIC INCLUSION: fine-grained; plagioclase feldspar (An<sub>44</sub>), quartz, and alkali feldspar are present; the felsic minerals are less than 50% of the bulk minerals; hornblende is the dominant mafic; hornblende commonly has anhedral inclusions of quartz; hornblende crudely defines the same foliation as that of the light layer; biotite is less abundant than hornblende; accessory minerals include opaques, sphene, apatite, and zircon; sparse patches of sericite are present.

Age: Cretaceous inferred from association with CM-30, no age data.

Location: Northern Chilkat Range, northeast of Casement Glacier.

Comments:

- Foliation strikes about E-W and dips 60-80 N (Figure 10b).
- Pluton is cut by dikes. One is almost a rhyodacite in composition and texture.
- There is a possible offshoot sill of hornblende-plagioclase rock near the southern margin of the body.

References: None.

Map symbol: Kwgd

Major rock type(s): Zircon-apatite-sphene-opaque-(biotite)-hornblende granodiorite  
Zircon-apatite-sphene-opaque-biotite-hornblende tonalite

Minor rock type(s): Hornblende-biotite quartz diorite  
Biotite-hornblende quartz monzonite (Figure 5)

Description: Foliated; medium- to coarse-grained; commonly medium-grained; color index 4-30, averaging 8-15; light gray to dark gray on fresh and weathered surfaces; an-subhedral, inequigranular to gneissose texture; locally porphyritic.

Petrographic features: Plagioclase feldspar (An<sub>36-43</sub>) commonly does not exhibit zoning but some normal and oscillatory zoning are present; plagioclase is slightly to moderately altered to sericite, clinozoisite, epidote, and chlorite; myrmekitic texture is present at edges of plagioclase grains; quartz is elongated, shows undulatory extinction, sutured boundaries, and polygonization; alkali feldspar is interstitial, has undulatory extinction, and exhibits perthitic and microcline twinning; hornblende is fractured and often shows undulatory extinction; locally, the hornblende contains altered relict pyroxene and has blue-green pleochroism suggesting that it is uralitic; hornblende is partially to completely replaced by clinozoisite; biotite is partially to completely replaced by chlorite, shows undulatory extinction, and is deformed; accessory minerals include opaques, sphene, apatite, and zircon; granular epidote and clinozoisite are present as distinct grains; possible prehnite was observed in one thin section.

Age: Cretaceous based on an age determination from a similar pluton not far west of the study area.

Location: Northern Chilkat Range, northeast of McBride Glacier, near Garrison Glacier.

Comments:

- Poles to foliation show a crude E-W steeply north-dipping regional foliation (Figure 11).
- One station reported a 5-6 cm carbonate layer within the pluton.
- Pluton is cut by brown weathering quartz-bearing (?) fine-grained mafic dikes with internal layering subparallel to its contact with the pluton.
- The inclusion content varies from less than 1% to 10-15%. In one location, it is as high as 40%. The inclusions are commonly 3-4 cm x 8 cm to 1/2 m x 4 cm and can reach meter size. The inclusions are commonly amphibolite, hornblendite, and hornblende-rich rocks. Locally, the inclusions have been feldspathized.

- One hand sample showed an irregular granitic-mafic contact which suggests that the mafic material was incorporated while it was partially molten.
- Ultramafic float in the area contained sulfides.
- Pegmatitic phases are present.
- The adjacent limestone is rust-stained and adjacent quartzite(?) contains sparse brown garnets.
- The granular epidote may have formed due to shearing stress and low temperatures.

References :

None.

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- CH-4
- CH-5
- CM-1      Modal composition of rocks from the individual plutonic
- CM-2      body indicated.

AG    Alkali Granite

AQ    Alkali Quartz Syenite

AS    Alkali Syenite

DI    Diorite

GD    Granodiorite

GR    Granite

MD    Monzodiorite

MO    Monzonite

QD    Quartz Diorite

QM    Quartz Monzonite

QO    Quartz Monzodiorite

QS    Quartz Syenite

TO    Tonalite

SY    Syenite

Figure 1. Explanation of symbols used in the Streckeisen classification diagrams: figures 2, 3, 4, 5, 6, 7, 8, 9.

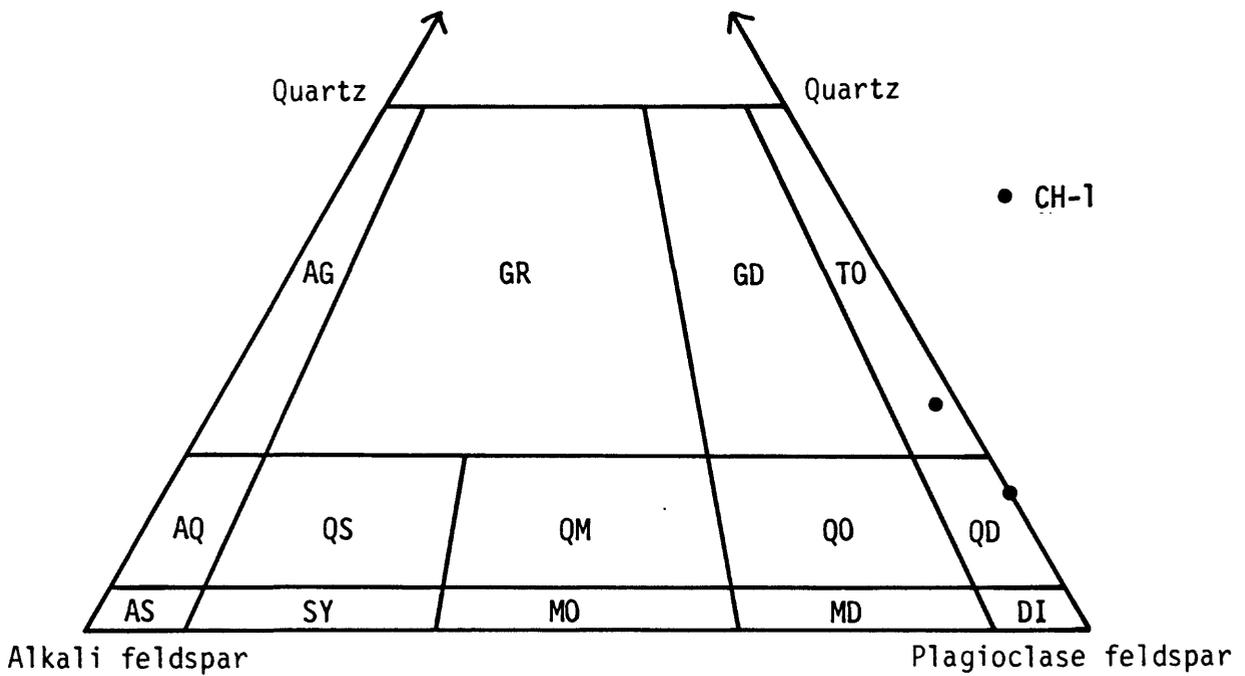


Figure 2. QAP diagram for rocks from the Uralitized Biotite-Pyroxene Diorite, Biotite-Hornblende Diorite, and Biotite-Hornblende Melatonalite map unit (Kmdt) on northern Chichagof Island.

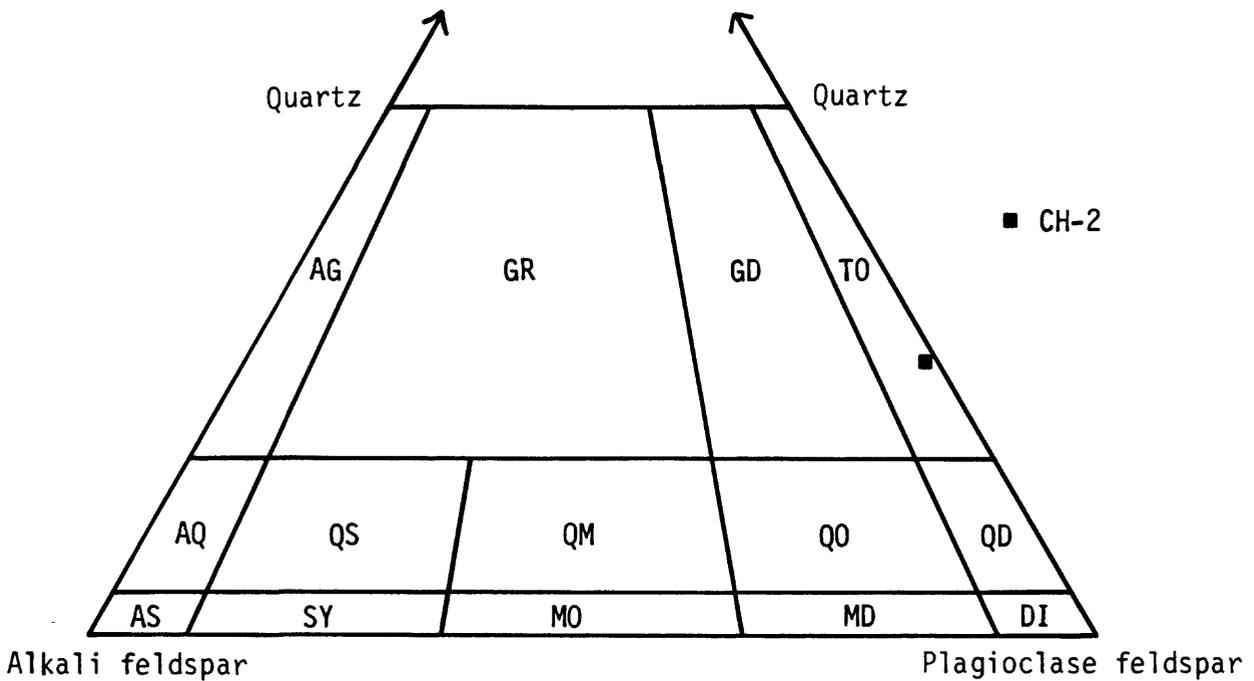


Figure 3. QAP diagram for rocks from the Hornblende Tonalite, Hornblende Diorite, Biotite-Hornblende Diorite, and Biotite-Hornblende Tonalite map unit (Knto) on northern Chichagof Island.

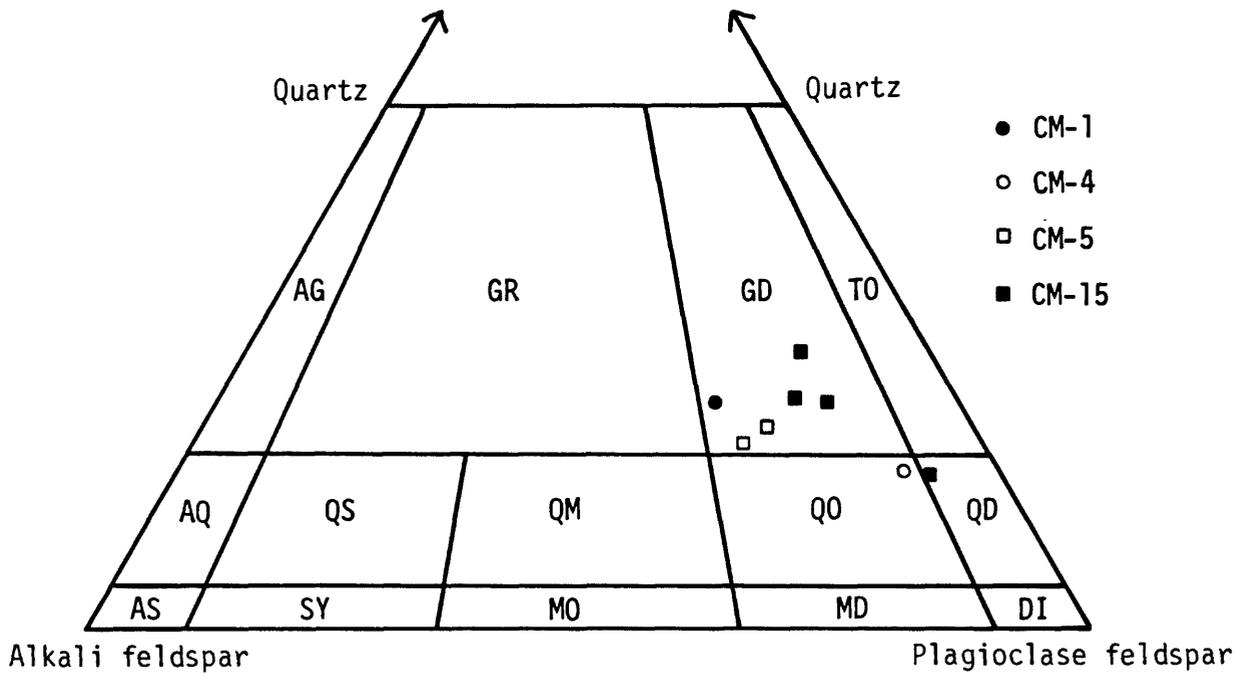


Figure 4. QAP diagram for rocks from the Biotite-Hornblende Quartz Diorite and Tonalite map unit (Kwqd) exposed on Porpoise Island, in the southern Chilkat Range, and north of Bear Track Cove, Glacier Bay.

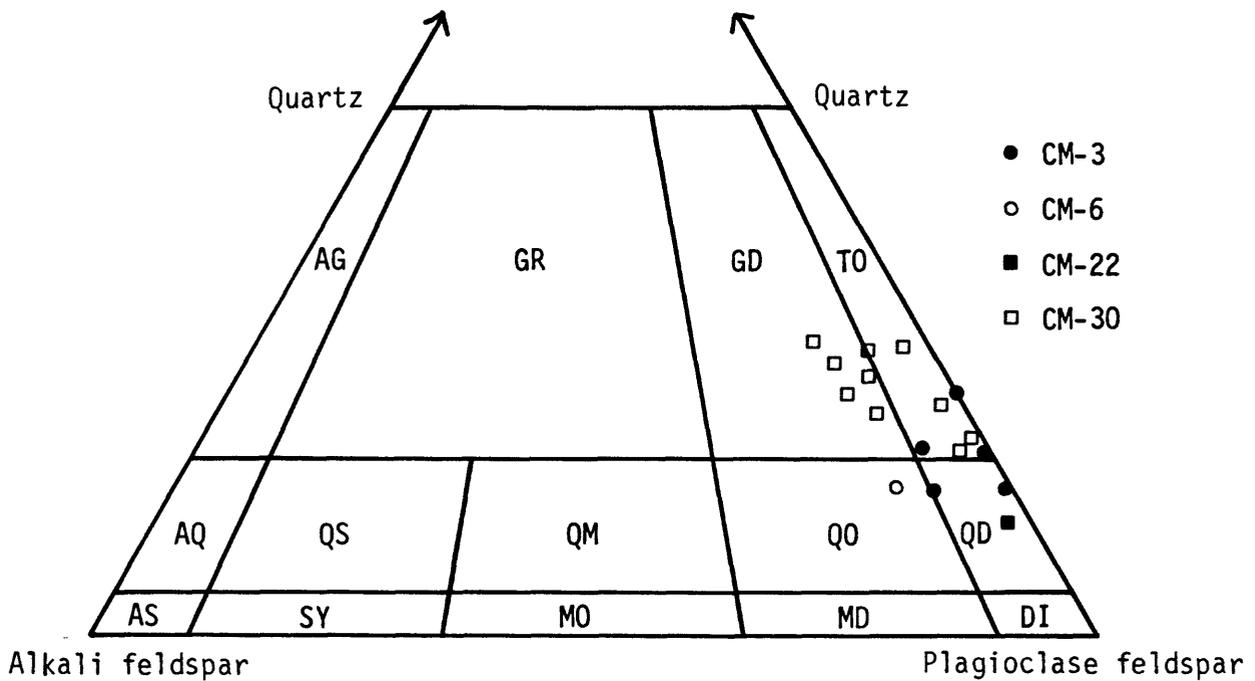


Figure 5. QAP diagram for rocks from the Biotite-Hornblende Granodiorite map unit (Kwgd) exposed in the southern Chilkat Range and in northern Glacier Bay National Park and Preserve.



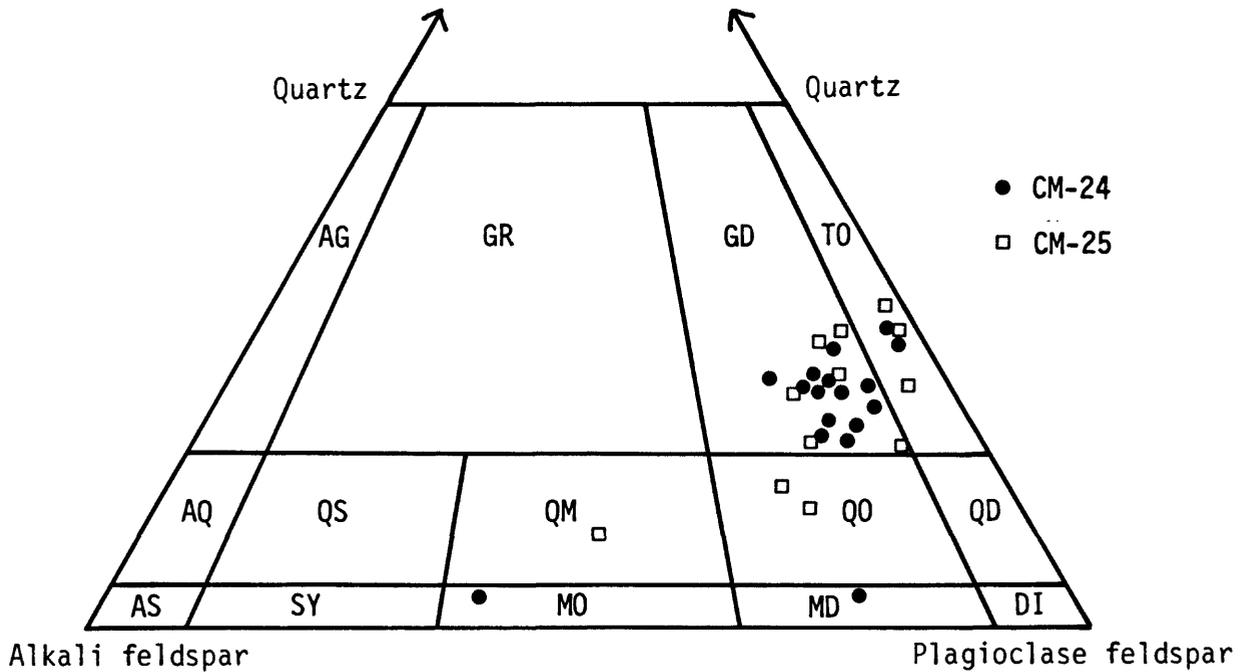


Figure 8. QAP diagram for rocks from the Hornblende-Biotite and Biotite-Hornblende Granodiorite map unit (TKgd) exposed east and west of Casement Glacier, Glacier Bay.

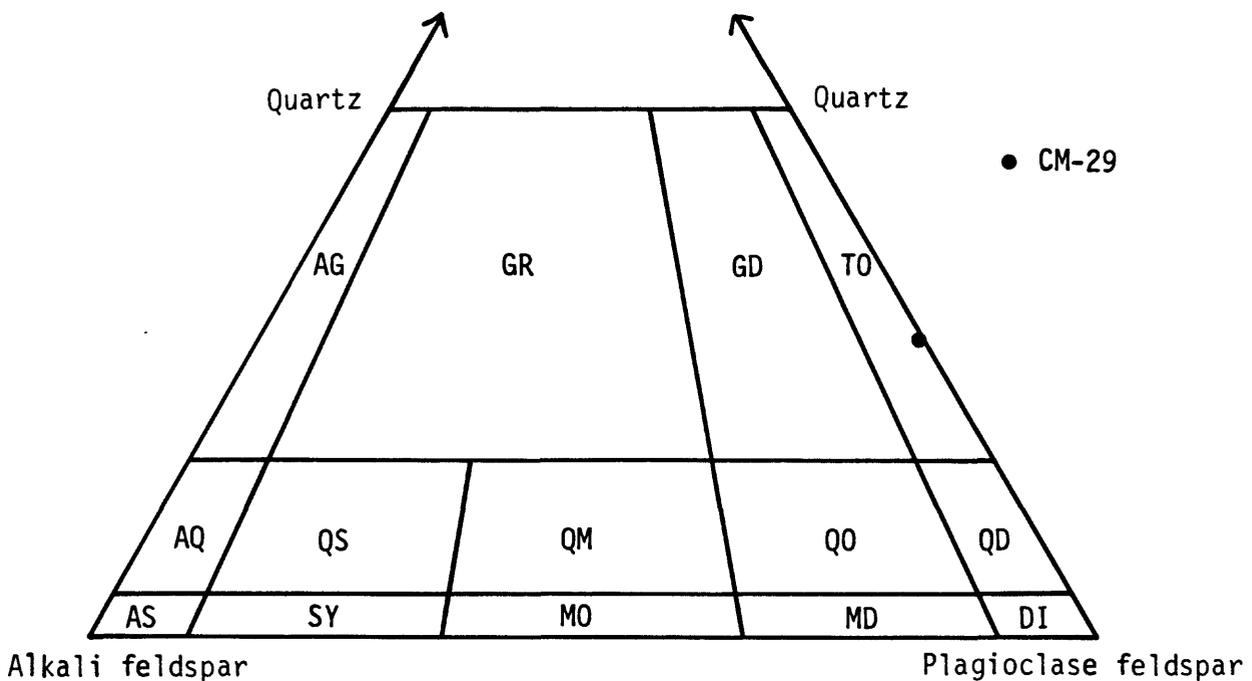


Figure 9. QAP diagram for rocks from the Migmatite and Biotite-Quartz-Feldspar gneiss map unit (Kwmg) exposed north of Casement Glacier, Glacier Bay.

Figure 10a. Equal area plot of data from CM-17.

- poles to foliation of intrusive
- mineral lineations
- poles to fault and shear planes
- ▲ pole to axial plane
- + fold axes
- poles to dike foliation or dike orientation

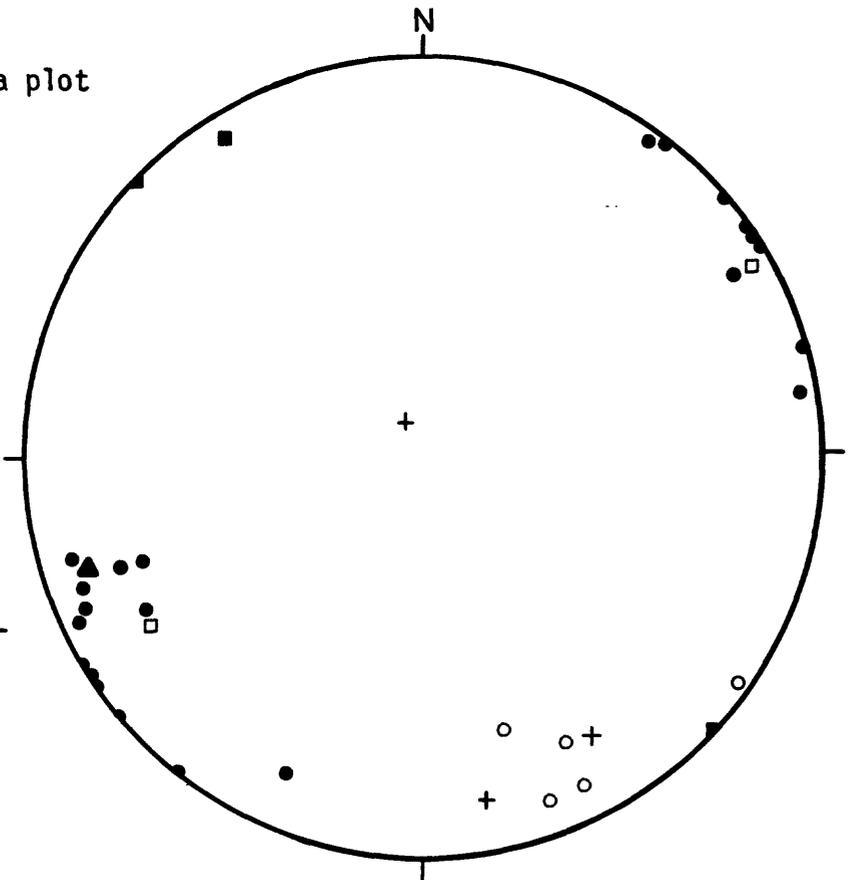
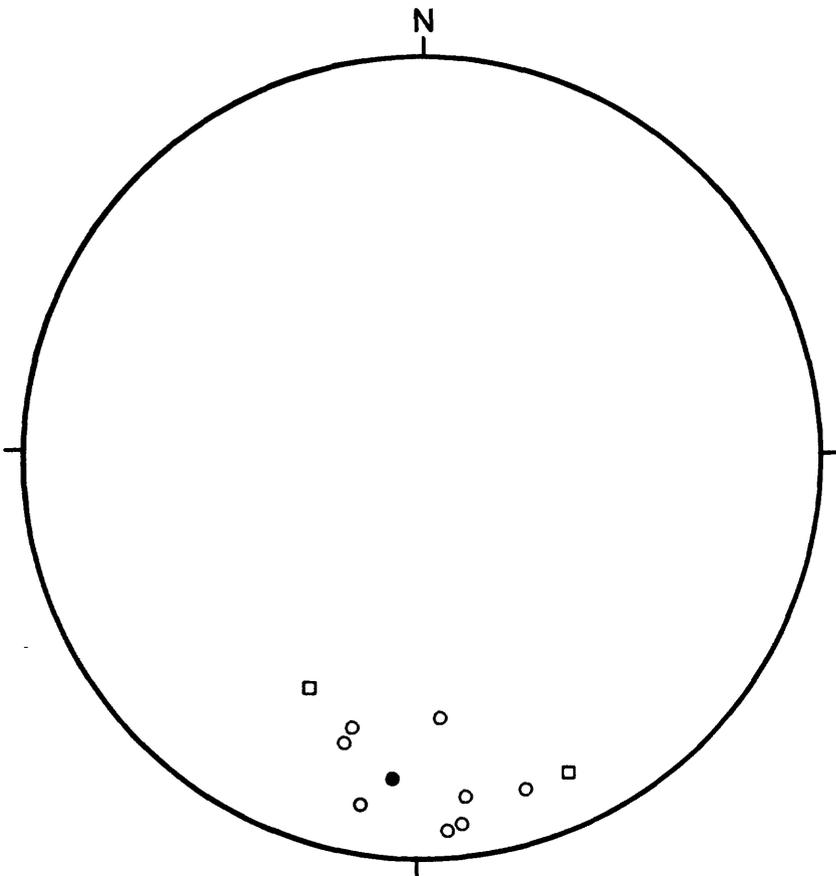


Figure 10b. Equal area plot of data from CM-29.

- poles to gneissose foliation
- pole to metasedimentary layering or foliation
- poles to dike orientation



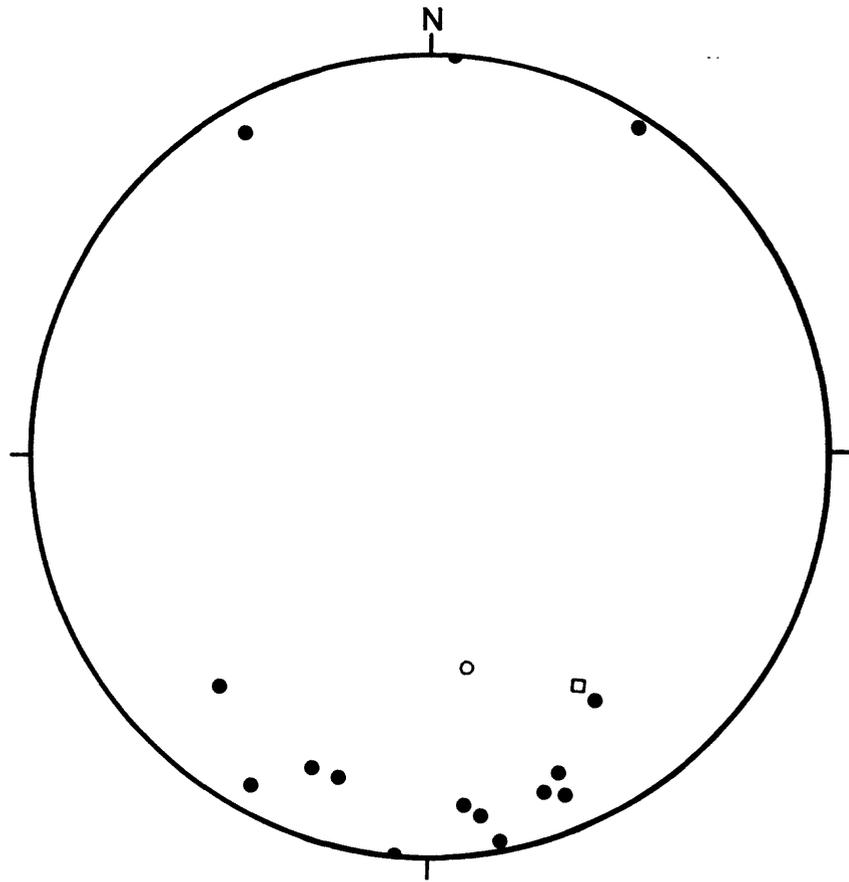


Figure 11. Equal area plot of data from CM-30.

- poles to foliation of intrusive
- pole to internal layering of dike
- pole to dike contact with intrusive