U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Reconnaissance Geologic Map of the Petersburg A-3 Quadrangle, Southeastern Alaska

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Open-File Report 97-156-B

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INTRODUCTION

This map and its accompanying information were prepared specifically as a U.S. Geological Survey contribution to the joint State of Alaska Division of Geological and Geophysical Surveys and the U.S. Department of Interior Bureau of Land Management Alaska Minerals Section (Juneau, Alaska) mineral-resource studies of part of the Petersburg, Alaska 1:250,000-scale quadrangle. Those studies are a direct follow-up to geological, geochemical, and geophysical studies (cited below) done in the region by the Alaskan Branch of the U.S. Geological Survey in the 1970's and 1980's.

The geologic information presented here has been released previously in generalized form at 1:250,000 scale (Brew and others, 1984); that map is based on reconnaissance field mapping and therefore the individual maps in this series of 1:63,360-scale maps (Brew, 1997a-m; Brew and Koch, 1997) do not have the density of field-station control, samples, or field observations that are expected in published U.S. Geological Survey 1:63,360-scale geologic maps. There are both a combined description and a combined correlation of the map units for this whole series of maps (Brew and Grybeck, 1997).

The available information on known mineral deposits in the whole Petersburg/Wrangell area was released previously (Grybeck and others, 1984) and Brew and others (1989, 1991). Bedrock, stream-sediment, and other geochemical data were released and interpreted by Karl and others (1985), Karl and Koch (1990), Cathrall and others (1983a-w), and Tripp and Cathrall (1984). Aeromagnetic and aeroradioactivity surveys information was released by the U.S. Geological Survey (1978, 1979) and Bouguer gravity information by Barnes and others (1989). Remotely-sensed features were described by LeCompte (1981). Burrell and others (1982) released a preliminary bibliography of Petersburg and Port Alexander quadrangles-related items.

Assessments of the undiscovered mineral resources for the whole Petersburg/Wrangell area are also available (Brew and others, 1989, 1991,1996; Brew and Drinkwater, 1991). Some of the mineral-resource-assessment tract information in neighboring areas was revised by Brew and others (1996). Brew (1993) presented a generalized view of metallogenic belts that includes this area.

Detailed information on the Late Cretaceous plutonic rocks in the Petersburg 1:250,000-scale quadrangle is found in Burrell (1984abc); major-element chemical and other data for the area were reported by Douglass and others (1989), and relatively young volcanic features were described by Brew and others (1984) and by Brew (1990). McClelland and Gehrels (1990) reinterpreted some of the geology in and around the Duncan Canal area, which lies to the northwest of this quadrangle.

The index map on the over-size sheet shows the major geological elements of the Petersburg/Wrangell area. They are, from west to east, (1) the Alexander belt, consisting of generally unmetamorphosed Lower Paleozoic through Upper Triassic rocks intruded by scattered mid-Cretaceous plutons, (2) the Gravina belt, consisting of unmetamorphosed to highly metamorphosed, variably deformed Upper Jurassic(?) through mid-Cretaceous flysch and volcanic rocks intruded by both mid- and Upper Cretaceous plutons, and (3) the Mainland belt, consisting of metamorphic rocks intruded by Upper Cretaceous, lower Tertiary, and mid-Tertiary plutons. The lower to middle Tertiary Kuiu-Etolin belt is younger than almost all parts of all of these belts, and extends from the Alexander belt across the Gravina and onto the Mainland belt. The Kuiu-Etolin belt consists largely of varied volcanic rocks, associated plutons, and minor sedimentary rocks. The Alexander belt corresponds more or less to the Alexander terrane of Berg and others (1978); the Gravina belt is a refined interpretation of their Gravina belt. This quadrangle includes rocks of the (1) Alexander belt, (2) Duncan Canal-Zarembo Island-Screen Islands sub-belt of the Gravina belt, (3) Gravina belt itself, and (4) Kuiu-Etolin belt (see Correlation of Map Units diagram on the oversize sheet).

DESCRIPTION OF MAP UNITS

[Note: All formational and descriptive map-unit names in the text of the following descriptions are set off with quotation marks to make them easier to identify.]

Qs SURFICIAL DEPOSITS (Holocene and(or) Pleistocene)--Includes alluvium, colluvium, and tidal mudflat deposits. In this quadrangle mapped only on northeastern Prince of Wales Island, and many small areas elsewhere are not shown.

KUIU-ETOLIN BELT

Belt informally named by Brew and others (1979) and redefined by Brew and Morrell (1983).

EXTRUSIVE AND INTRUSIVE VOLCANIC ROCKS OF KUIU-ETOLIN VOLCANIC-PLUTONIC BELT (Quaternary and Tertiary)--Diverse volcanic rocks exposed in a broad area extending from northeastern Kuiu southeastward through Kupreanof and Zarembo Islands; one unit mapped in this quadrangle, namely:

QTr Rhyolite, Rhyodacite, and Related Siliceous Extrusive and Intrusive Rocks--

In general, aphanitic to finely crystalline, generally quartz and feldspar porphyritic; C.I. less than 1. Locally layered, spherulitic, and(or) miarolitic; light gray where fresh; buff, white, green lavendar, maroon, or pink where altered; generally rusty weathering. Pyrite and zeolites common. Many exposures are texturally complicated mixtures of discontinuous mm-scale flow-layered, brecciated, spherulitic, and phenocrystic rocks. Heterogeneous stratigraphy includes lava flows, obsidian flows, lahars, welded and nonwelded ash, tuff, and lapilli, all cut locally by porphyritic rhyolite and rhyodacite dikes. Extreme alteration, brecciation, attitudes of layering, and diking identify vents and domes; massive structureless isolated rhyolite bodies suggest plugs; columnar-jointed cliff exposures in excess of 100 m thick are interpreted as cooling units. Exposed along northeast boundary of quadrangle on Etolin Island and on southern Zarembo Island.

QTa Andesite and Other Intermediate Extrusive Rocks--

Dark gray where fresh, green to maroon altered, blocky weathering, pyroxene and feldspar porphyritic, massive to vesicular and amygdaloidal flows 10-50 cm thick. Apparently intercalated with basalts in southern Rocky Pass area between Kuiu and Kupreanof Islands, also occurs in south central Kupreanof Island, and near exposures of "Rhyolite, Rhyodacite, etc.," (QTr) near Kah Sheets Lake, and, in this quadrangle, on southwestern Zarembo Island.

INTRUSIVE GRANITIC AND OTHER ROCKS OF KUIU-ETOLIN VOLCANIC PLUTONIC BELT (Miocene and(or) Oligocene--Preliminary K-Ar determinations of about 20-22 Ma obtained on rocks from the "Granite of Central and Northern Etolin Island" (Tmge) (M. A. Lanphere, U.S. Geological Survey, written communs., 1981, 1982); preliminary descriptions given by Hunt (1984). One unit mapped in this quadrangle:

Tmaz Alkali Granite of Northwestern Etolin and Southeastern Zarembo Islands--

Amphibole-biotite alkali granite and subordinate granite. Massive, nonfoliated; allotriomorphic to hypidiomorphic; equigranular to seriate, some porphyritic; medium- to coarse-grained; C.I. averages 04. Miarolitic cavities common and locally abundant; quite homogeneous at outcrop scale, but with locally abundant hornfels inclusions. Feldspar mineralogy consists of perthitic alkali feldspar, a variety of exotic (and in places pervasive) graphic and micrographic textures, and rare occurrence of plagioclase as a separate feldspar phase; mafic mineralogy is distinctive and includes green, blue-green, and blue (sodic) amphibole (hornblende to riebeckite), dark brown to reddish-brown biotite, and locally abundant green (iron-rich) pyroxene; mafic minerals altered and partially replaced by chlorite; accessories include locally abundant sphene, allanite, apatite(?), magnetite, and minor hematite; epidote fills some miarolitic cavities. Unit on Zarembo Island includes minor coarse-grained, subophitic, hornblende-biotite-pyroxene diorite (C.I. 40-45) that resembles diorites within the "Migmatitic Granitic Rocks of Central and Northern Etolin Island" (Tmme; Brew 1997a) as well as the diorites associated with the granites of Kupreanof and Kuiu Islands. In this quadrangle and the one to the north the unit is exposed in two possibly interconnected bodies at Quiet Harbor on northwestern Etolin Island and at Round Point on southeastern Zarembo Island, as well as in several small plugs and dikes that invade the adjacent country rocks on Zarembo Island. Resembles the "Granite of Central and Northern Etolin Island" (Tmge) in composition and texture, while the mafic mineralogy is similar to the "Alkali Granite Satellitic to Granite of Central Etolin Island" (Tmae) in the Petersburg A-2 quadrangle (Brew, 1997a).

Tsh HORNFELSED SEYMOUR CANAL FORMATION ROCKS (Miocene and(or) Oligocene)--

Albite-epidote hornfels facies rocks, generally preserving both original structures and textures and(or) the metamorphic effects of Cretaceous metamorphic events, in aureoles on Etolin Island. The limits are, as described under the heading "Metamorphosed Stephens Passage Rocks" in the section on the Gravina belt, poorly defined and the unit may not be as extensive as presently shown. Age of protoliths is Late Jurassic to middle Cretaceous, based on an ammonite of Albian age (D. L. Jones, U.S. Geological Survey, written commun., 1979) collected on the northwest shore of Etolin Island and on obvious derivation from the "Seymour Canal Formation" (KJss). Unit is exposed only in northeastern part of this quadrangle.

Tk KOOTZNAHOO FORMATION(?) (Paleogene)--Nonmarine arkosic sandstone, sandstone, shale, and conglomerate.

Medium- to very thick-bedded; locally cross-bedded; dominant rock type is medium- to very coarse-grained lithic feldspathic quartz arenite; conglomerate contains clasts up to 10 cm of granitic rock, slate, schist, chert, felsic volcanics; minor shale is locally carbonaceous and contains plant fossils; rare thin coal beds. Greater than 300 m thick near Dakaneek Bay on Kupreanof Island (K. A. Dickenson, oral commun., 1980). Available fossil evidence suggests that all of this unit in the northern part of the Petersburg-Wrangell map area near Keku Strait is Paleocene in age and that in the southern part on Zarembo Island (which includes the area in this quadrangle) is early Eocene, whereas the type Kootznahoo Formation on Admiralty Island (Lathram and others, 1965) is now considered latest Eocene through early Miocene age (Wolfe, 1966; J.A. Wolfe, written communs., 1979, 1983). The similarities in depositional environment, stratigraphic position, and lithology suggest that the name Kootznahoo Formation is appropriate although the depositional basins may not have been connected. Unit is inferred to underlie most, if not all, of the "Extrusive and Intrusive Volcanic Rocks of Kuiu-Etolin Volcanic-Plutonic Belt" in the Petersburg-Wrangell map area and locally intertongues with at least the lower part of those units. The largest outcrop of the unit is south and southeast of Hamilton Bay on Kupreanof Island, another large area is on the southwest side of Zarembo Island and Bushy Island, small outcrops are at California Bay on Prince of Wales Island, east of Point Nesbitt on Zarembo Island, in the divide between Port Camden and Threemile Arm on Kuiu Island, at Kadake Bay on Kuiu Island, and in the upper drainage of Hamilton Creek on Kupreanof Island; Buddington and Chapin (1929) report an occurrence at Kah Sheets Bay on Kupreanof Island which Brew and others (1984) did not find. See Muffler (1967), Dickinson (1979), Dickinson and Campbell (1982), Wright and Wright (1908), and Loney (1964) for further information.

ALEXANDER BELT

Belt informally named by Brew and others (1984) to denote those rocks that form a coherent stratigraphic section (including the pre-Cenozoic granitic and other rocks intruded into that section) in the western part of the map area, ranging in age from Ordovician to Cretaceous; as defined here does not correspond exactly to the Alexander terrane of Berg and others (1978).

INTRUSIVE ROCKS OF THE CHILKAT-PRINCE OF WALES PLUTONIC PROVINCE (Cretaceous); Province informally named by Sonnevil (1981). Preliminary K-Ar determinations on hornblende from the "Hornblende Quartz Monzodiorite, etc." on Kosciusko and Prince of Wales Islands by M. A. Lanphere (U.S. Geological Survey, written communs., 1981, 1982) give 98.7 and 100.0 Ma, 15;. Locally hornblende porphyritic; local rounded fine-grained mafic inclusions; includes common aplite, less common pegmatite, and several mafic dikes. Typical petrographic features are: seriate twinned and zoned plagioclase with minor alteration; K-feldspar interstitial to plagioclase and occasionally in poikilitic clots; hornblende anhedral to subhedral with some plagioclase inclusions and ubiquitous opaque inclusions; pyroxene and biotite locally present and subordinate to hornblende; respectively; only one unit mapped in this quadrangle:

Kwqo Hornblende Quartz Monzodiorite with Minor Tonalite, Granodiorite, Quartz Diorite, Diorite, Quartz Monzonite, and Monzodiorite--

Massive to foliated, equigranular to locally porphyritic; medium-grained; C.I. 2 to 48, averaging about 15. Pyroxene commonly altering to hornblende and biotite to chlorite; accessories are apatite and sphene. Unit differs in general from the Upper Cretaceous plutons of the Admiralty-Revillagigedo plutonic belt in the Gravina and Mainland Belts to the east by lack of epidote and garnet, lower color index, and by lack of local plagioclase porphyry phase. Unit differs from the "Biotite-Pyroxene-(Hornblende-)Monzodiorite, etc." (Kqo)mapped on northeastern Kupreanof Island north of this quadrangle in having ubiquitous hornblende. Exposed on Prince of Wales Island at south edge of quadrangle.

METAMORPHIC ROCKS IN THE CHILKAT-PRINCE OF WALES PLUTONIC PROVINCE (Cretaceous)--Aureoles around plutons of the Chilkat-Prince of Wales plutonic province on Kosciusko and northern Prince of Wales Islands; age is that of the plutons (about 100 Ma) based on preliminary K-Ar dating (M. A. Lanphere, U.S. Geological Survey, written commun., 1982). Only one unit mapped in this quadrangle, namely:

Kdh Biotite-Feldspar-Quartz Hornfels--

Fine- to coarse-grained, brown and gray; original textures and structures obliterated; includes minor calc-silicate hornfels layers. Metamorphosed equivalent of the "Graywacke" subunit of the "Descon Formation" near Coffman Cove on northern Prince of Wales Island along the southern boundary of this quadrangle.

ULTRAMAFIC COMPLEX AT BLASHKE ISLANDS AND RELATED ROCKS (Cretaceous)--Preliminary K-Ar dating (Lanphere and Eberlein, 1966) suggests an age of 110 Ma for this complex (Kennedy and Walton, 1946; Walton, 1951ab), which is considered to be a westward outlier of the Klukwan-Duke plutonic belt informally named by Brew and Morrell (1983); reported on by Himmelberg and others (1986) (see Gravina belt). Divided into:

Kbdu Dunite--

Massive, partially (25 to 100 percent) serpentinized; medium-grained; C.I. 100; fresh surfaces gray to dark gray; weathers yellowish-brown; forms smooth, rounded outcrops. Consists of 98 to 99 percent olivine and 1 to 2 percent chromite in very sparse, thin streaks, except near Wehrlite unit (Kbwh) contact where clinopyroxene increases to as much as 5 percent; primary fabric generally preserved.

Kbwh Wehrlite--

Massive; medium-grained; C.I. 100; xenomorphic granular; fresh surfaces dark green; weathers to rough yellowish-brown to dark gray with yellowish-brown patches; clinopyroxene increases outward from Dunite Unit (Kbdu) contact near which the wehrlite grades to olivine clinopyroxenite.

Kbgb Clinopyroxene-Hornblende Gabbro--

Massive to locally flow banded on cm scale; medium-grained; C.I. 65-75; hypidiomorphic granular; fresh surfaces are medium gray; weathers dark gray; locally 5 percent mafic inclusions 2 to 3 cm maximum dimension; fine grained mafic dikes common; grades from clinopyroxene gabbro at sharp contact with Wehrlite unit contact to hornblende gabbro at country rock contact.

Kbqd Magnetite-Bearing Chlorite-Hornblende-Pyroxene Monzodiorite--

Massive, well-jointed, medium- to coarse-grained; C.I. 30-35, weathers grayish-green and gray; up to 20 percent subangular mafic inclusions, generally altered appearance; abundant diorite and gabbro(?) dikes. Unit crops out only on Rose Rock, Rose Island, and Seal Rock in Kashevarof Passage in the south-central part of this quadrangle. Inferred from aeromagnetic anomaly pattern (U.S. Geological Survey, 1979) to be related to the ultramafic complex described above but could be related to the granodiorite of probable Cretaceous age (Kwqo) at Coffman Cove on Prince of Wales Island to the south.

METAMORPHIC ROCKS ADJACENT TO COMPLEX AT BLASHKE ISLANDS (Cretaceous)--Aureole around ultramafic complex at Blashke Islands; age is that inferred for the complex on the basis of preliminary K-Ar dating (Lanphere and Eberlein, 1966); as mapped, includes:

Kph (Garnet-)(Pyroxene-)Biotite-Quartz-Feldspar Hornfels--

Fine- to medium-grained, grayish-brown; forms ragged outcrops; original sedimentary structures and 2-cm to 15-cm-thick alternating graywacke and mudstone turbidite beds preserved; includes minor metapolymictic conglomerate with 3-30 cm diameter rounded cobbles of volcanic and granitic rock. Metamorphosed from the "Graywacke, Slate, and Limestone" of "Bay of Pillars Formation on northeastern Prince of Wales Island".

Kpch Biotite-Quartz-Feldspar Hornfels--

Metapolymictic conglomerate and agglomerate with 3 to 50 cm diameter subrounded to clasts of volcanic and granitic rock, and rounded clasts of volcanic rock in 50 cm to 2 m thick beds. Metamorphosed from the "Conglomerate, Agglomerate, and Volcanic Breccia" of "Bay of Pillars Formation on northeastern Prince of Wales Island".

HYD GROUP (Upper Triassic)--Named by Loney (1964) from exposures in Gambier and Pybus Bays on Admiralty Island; extended to the Keku Islets area and redefined by Muffler (1967). The term Hyd Group was extended to the Clarence Strait area by Brew and others (1984) and to the Screen Islands in Clarence Strait (Karl, 1984), where the name Burnt Island Conglomerate was applied to the whole unit; two formations are distinguished in this quadrangle:

Thhl Hamilton Island Limestone--

Regionally consists of limestone, mudstone, and calcarenite; generally very thin-bedded (1-30 cm), dark-gray aphanitic limestone (locally dolomitic), minor black claystone layers and thin to medium beds of dark-green calcarenite; highly folded, but probably only a few 100 m thick. Age is late Karnian to perhaps earliest Norian based on 16 fossil collections from the Keku Strait area (Muffler, 1967) and one from the Screen Islands in this quadrangle (Karl, 1984). Most outcrops are on Hamilton Island, the north side of Hamilton Bay, or on the northeastern Keku Islets--all in the Keku Strait area. In this quadrangle occurs on the Screen Islands where the unit consists of cross-bedded to massive, amalgamated buff-colored sandstones overlying the Burnt Island Conglomerate; above the sandstones are thin to medium (4-30 cm) bedded, calcisiltite and limestone, along with intraformational limestone conglomerate and sedimentary breccia.

Thhb Burnt Island Conglomerate--

Regionally consists of conglomerate, calcarenite, and limestone; crudely bedded, poorly sorted calcite-matrix pebble conglomerate with clasts of either bluish-green and black argillite, graywacke, and chert derived from the Cannery Formation, or of chert and limestone from the Pybus Formation, depending on which unit it overlies Minor interbedded medium- to very thick-bedded, light-brown-weathering medium gray on fresh surfaces, calcarenite and fossil-fragmental limestone with abundant terrigenous debris; also minor light-brown-weathering limestone and dark-gray fetid sandy and silty limestone similar to that in the overlying Hamilton Limestone. Up to 50 m thick. Age is early to perhaps early late Karnian based on two fossil collections from the Keku Strait area (Muffler, 1967) and three collections from the Screen Islands (Karl, 1984). In this quadrangle the unit is exposed on East Island in Clarence Strait and on the Screen Islands; it also crops out elsewhere in the Petersburg-Wrangell area on the northwestern Keku Islets, near Cape Bendel on Kupreanof Island, and in the Hamilton Bay/Hamilton Island area. Available information is ambiguous about the presence of volcanic rocks in the unit on East Island. On the Screen Islands the conglomerate is massive to cross-bedded, bimodal and polymictic; clasts include well-rounded green or white chert cobbles and angular to plastically deformed masses of limestone, locally Permian-brachiopod-bearing sandstone, and siltstone, as well as angular to subrounded felsic to mafic volcanic clasts; no plutonic or metamorphic clasts have been recognized in the conglomerates or sandstones.

Pp PYBUS FORMATION (Lower Permian)--Limestone, dolomite, and chert.

Conspicuous cliff-forming, medium-bedded to massive non-bedded coarsely crystalline, white to very light gray dolomitic limestone; contains light gray replacement chert as thin beds, nodules, fragments, and crosscutting masses; minor coarse-grained light-gray limestone, fetid medium-gray dolomite near top of unit. Unit is 80 to 160 m thick. Abundant silicified brachiopod fauna has been studied extensively (Buddington and Chapin, 1929; R. E. Grant, U.S. Geological Survey, written commun., 1968; Grant, 1971); collections noted by Muffler (1967) indicate a Leonardian age as do four collections made during our study (J. T. Dutro, Jr., written commun., 1983). Named by Loney (1964) and redefined by Muffler (1967). Crops out on Cornwallis Peninsula of Kuiu Island south to head of Saginaw Bay, on Keku Islets, in Hamilton Bay area and adjacent part of Kupreanof Island, near Cape Bendel on Kupreanof Island, and in this quadrangle on the Middle Islands.

DIs FOSSILIFEROUS LIMESTONE (Lower and Middle Devonian)--

Medium-bedded to massive, fine- to medium-grained; light to medium gray on fresh and weathered surfaces; locally fetid; individual lenses up to several hundred m thick; contains brachiopods, corals, crinoids, and (locally) fusulinids. Northwesternmost exposures in the region, mapped by Muffler (1967) as part of the Gambier Bay Formation, contain corals or stromatoporoids of Middle Devonian or possibly Late Silurian age. Abundant old and new collections from the several fossiliferous lenses at and near the head of Duncan Canal northwest of this quadrangle contain Lower and Middle Devonian corals, brachiopods, and conodonts (Buddington and Chapin, 1929); A. G. Harris, written communs., 1979, 1980, 1983; W. A. Oliver, Jr., written commun., 1979; J. T. Dutro, Jr., written communs., 1979, 1980). smaller lenses in Clarence Strait in this quadrangle (Key Reef and Abraham Island) contain Lower(?) Devonian corals (W. A. Oliver, Jr., written communs., 1978, 1983).

PRINCE OF WALES ISLAND SEQUENCE (Devonian to Ordovician)--Informally named by Brew and others (1984) to emphasize the island-arc depositional environment that persisted from Ordovician through Early Devonian time; consists of two dominant lithologic associations, "Carbonate Rocks and Associated Conglomerates" and "Turbidites and associated rocks"; in this quadrangle the Silurian and Silurian and Ordovician parts of those two associations are mapped:

Carbonate Rocks and Associated Conglomerates (Upper to Lower Silurian): Extensive carbonate units--the Kuiu Limestone and the Heceta Limestone--are interpreted to have formed as fringing reefs or carbonate banks in an island-arc environment dominated by volcanic turbidites. They probably range in age and are not a single stratigraphic horizon. The associated polymictic conglomerates probably represent several separate channels at different horizons carrying material from distant sources. In this quadrangle, represented only by:

Sch Heceta Limestone--

Massive or thick-bedded, fine-grained limestone, minor limestone breccia, sandstone, mudstone, and pods of polymictic conglomerate; commonly fractured, locally fossiliferous, light- to medium-dark gray on fresh surfaces, buff weathered; forms rough pockety surfaces in tidal zone and karst topography inland; probably greater than 4,000 m thick in some exposures. Age is Middle and Late Silurian according to Eberlein and Churkin (1970) based on analyses of several collections. Susequently, Eberlein and others (1983) extended the lower age limit to include late Early Silurian; several new collections confirm this assignment. Named by Eberlein and Churkin (1970) for exposures on Heceta Island in the Craig quadrangle to the south; other exposures discussed in detail by Ovenshine and Webster (1970). Exposed in the Clarence Strait area in this quadrangle.

Turbidites and associated rocks (Upper Silurian to Lower Ordovician): These very extensive turbidite, conglomerate, and volcanic units--the "Bay of Pillars Formation" and the "Descon Formation in this quadrangle"--are interpreted to be the dominant feature of a long-lived island-arc environment. The two formations probably grade into one another. The limestones, conglomerates, and volcanic units that are mapped separately probably vary in age and do not represent persistent stratigraphic horizons. Karl and Giffen (1992) considered some sedimentologic aspects of the "Bay of Pillars Formation". In this quadrangle two main units are present: the "Bay of Pillars Formation on northeastern Prince of Wales Island " and the "Descon Formation":

Bay of Pillars Formation on Northeastern Prince of Wales Island (Upper(?) to Lower Silurian)--Graywacke and siliceous mudstone turbidites.

Amalgamated beds, full Bouma sequences, and high sand/shale ratios suggest a proximal turbidite facies association. Rhythmically bedded limestones, polymictic conglomerate, and volcanic agglomerate and breccia are intercalated with the graywackes. Sandstones and conglomerates are volcaniclastic, immature, and probably reflect local sources (Claire Carter, U.S. Geological Survey, written commun., 1980). All graptolite collections to date are of Early Silurian age. The unit is distinguished from Bay of Pillars rocks on Kuiu and western Prince of Wales Islands by a more volcaniclastic and less calcareous composition. As mapped in this quadrangle in Clarence Strait area, divided into:

Stpg Graywacke, Slate, and Limestone--

Greenish gray, buff weathering, volcaniclastic graywacke and argillite turbidites. Massive to amalgamated, graded, and rhythmic beds corresponding to Mutti and Ricchi-Lucci A, B, C, and E turbidite facies, suggest a proximal depositional environment in moderate water depths. Graptolites may be found on argillaceous bed parting surfaces. Local soft sediment deformation is typically associated with calcareous layers or lenses.

Stpc Conglomerate, Agglomerate, and Volcanic Breccia--

Predominantly volcaniclastic polymictic conglomerate, and volcanic breccia and agglomerate of intermediate to mafic composition. Feldspar and clinopyroxene porphyritic clasts are common. Massive occurrences of coarse volcaniclastic rock may be found on some of the islands in Clarence Strait north and west of the Blashke Islands.

DESCON FORMATION (Lower Silurian to Lower Ordovician)--Massive graywacke, graywacke and argillite turbidites.

Also siliceous graptolitic shale, polymictic conglomerate, bedded limestone and limestone breccia, and mafic volcanic sills, flows, and tuffs. Sandstone and conglomerates range from predominantly volcaniclastic to polymictic, the latter includes graywacke, shale, chert, limestone, and felsic to gabbroic lithic fragments together with the volcanic grains. The Descon Formation crops out on northeastern and northwestern Prince of Wales Island and in the vicinity of Davidson Inlet, Kosciusko Island. These rocks are locally metamorphosed to greenschist facies. Thickness exceeds 3,000 meters. Graptolites from the Descon Formation yield ages ranging from Tremodocian (Early Ordovician) to Llandoverian (late Early Silurian) (Claire Carter, U.S. Geological Survey, written commun., 1980; Eberlein and others, 1983). This unit is more siliceous and contains more volcanic material than the Bay of Pillars Formation. Unit named by Eberlein and Churkin (1970). As mapped in this quadrangle:

SOtdg Graywacke--

Grayish green, buff weathering, volcaniclastic graywacke and siliceous shale. Massive amalgamated beds, graded beds, full Bouma sequences, thin rhythmic beds, slump deposits, sedimentary breccia and conglomerate suggest a proximal depositional environment. Sandstones and conglomerates include mainly mafic volcanic rock fragments, with feldspar, quartz, graywacke, mudstone, chert, limestone, and plutonic rock fragments in a chloritic matrix. Graptolites are found on partings in siliceous argillite. Some greenschist facies sandstones are pyritic.

GRAVINA BELT

The term Gravina belt is used here to denote sedimentary and volcanic rocks of Late Jurassic and Early Cretaceous age (and the pre-Cenozoic granitic and other rocks that intrude them) in the east-central part of the Petersburg-Wrangell map area. As used here, the term also includes rocks of indeterminate Mesozoic age in a broad zone to the west of and adjoining the Jurassic and Cretaceous rocks. This zone is called the Duncan Canal-Zarembo Island-Screen Island sub-belt; it has within it blocks of Paleozoic and Mesozoic rocks unlike any elsewhere in the Gravina belt, but similar to some in the Alexander belt. The Gravina belt as used here more or less corresponds to the Gravina belt as defined by Berg and others (1978), as modified by newer information and differing interpretations.

STEPHENS PASSAGE GROUP (Upper Cretaceous/Cenomanian to Upper Jurassic(?))--Name proposed by Lathram and others (1965) for the "...sequence of slate, graywacke, conglomerate, and augite-bearing volcanic flow breccia, Late Jurassic and Early Cretaceous in age, which forms a well-defined northwest-trending belt of rocks exposed along the eastern slopes and shores of Admiralty Island...". This sequence also occurs south and east of Admiralty Island (Souther and others, 1979) and extends southward into this map-area. Information presented by Brew and others (1984) showed that the Group is as young as Albian or Cenomanian, i.e., late Early and early Late Cretaceous, in this area. The "Brother's Volcanics"/"Douglas Island Volcanics" unit probably intertongues with the "Seymour Canal Formation", probably near the top of the latter (Loney, 1964). Cohen and Lundberg (1993) reported on details of the "Seymour Canal Formation" north of this quadrangle. As mapped, includes:

KJsv Brothers Volcanics/Douglas Island Volcanics--Augite-bearing flows, volcanic breccia, and intercalated tuff, volcanic graywacke, phyllite and slate.

Andesitic to probably basaltic composition; weathers dark greenish-gray, gray, and green; generally lighter colored where fresh; relict augite phenocrysts conspicuous in most outcrops. Probably a few thousand meters thick; individual flow or breccia units as much as a few hundred meters thick and graywacke, tuff, and slate lenses may also be that thick. No fossils have been found in this unit in the Petersburg-Wrangell map area; its age is based on its close association with the locally fossiliferous "Seymour Canal Formation". The "Brothers Volcanics" named by Loney (1964) from exposures just north of this map area; the "Douglas Island Volcanics" named by Lathram and others(1965) on Admiralty Island from exposures on Douglas Island to the north. Exposed in the eastern part of this quadrangle on Etolin Island; the best and least deformed or metamorphosed outcrops are on southwestern Mitkof Island and near Steamer Bay on Etolin Island. See also Berg and others (1972); Ford and Brew (1977, 1978) and Page and others (1977).

KJss Seymour Canal Formation--Graywacke, slate, and minor conglomerate. Composed largely of volcanic debris, except for the conglomerates, which are polymictic and contain granitic clasts; most are turbidites, but nothing more is known of the depositional environment; weathers dark greenish-gray, brownish gray, and very dark gray; graywacke and slate/argillite are locally calcareous and lighter colored; sedimentary structures common, although few directional features have been noted. Probably a few thousand meters thick; some individual graywacke units are massive and 10's of meters thick, but most are 1 to 20 cm thick. Numerous fossil collections by Loney (1964) established a Late Jurassic and Early Cretaceous age for the unit on Admiralty Island; that age has been confirmed by subsequent collections (Berg and others, 1972), who collected an Albian ammonite, a Valanginian(?) pelecypod, and Berriasian pelecypods from the western Etolin Island area and by collections made by Brew and others (1984), including an Albian or Cenomanian ammonite (D. L. Jones and J. W. Miller, U.S. Geological Survey, written commun., 1979) from hornfelsed "Seymour Canal Formation" and by Kimmeridgian to Tithonian pelecypods from the western Etolin Island area (R. W. Imlay, U.S. Geological Survey, written commun., 1982). The "Seymour Canal Formation" was named by Loney (1964) from exposures at the mouth of Seymour Canal on Admiralty Island; the name was extended to the rest of Admiralty Island by Lathram and others (1965) and to northern Kupreanof Island by Muffler (1967). Probably grades into the more deformed and generally finer grained "Semischist and Phyllite, Etc." (Mzs) and the "Phyllite and Slate, Etc." (Mzp) mapped to the west (Brew and others, 1984). Exposed in this quadrangle on western Etolin Island.

DUNCAN CANAL-ZAREMBO ISLAND-SCREEN ISLAND SUB-BELT OF THE GRAVINA BELT

See "Gravina belt" heading (above) for background information.

METAMORPHOSED STEPHENS PASSAGE GROUP AND OTHER ROCKS (Upper(?) Mesozoic)--Currently interpreted to be mostly metamorphic equivalents of the Stephens Passage Group, but some may be derived from Cannery Formation (Muffler, 1967; Brew and others, 1984), some from a different facies of the Stephens Passage Group, and some from a previously unrecognized facies of Triassic rocks. As mapped in this quadrangle, includes two units:

Mzl Massive Limestone--

Limestone and minor shale where exposed in the Petersburg A-2 quadrangle to the east; weathers light to medium gray; light gray on fresh surfaces; poorly bedded at 10-50 cm scale in a few places; most is fine- to medium-grained and much may be recrystallized. No fossils (including conodonts) found, and Upper(?) Mesozoic age is based on association with the enclosing units in the Petersburg A-2 quadrangle; it is equally likely that these lenses may be related to the "Fossiliferous Limestone" (Dls) of Devonian age exposed elsewhere in the quadrangle. In this quadrangle the unit has been reported only southeast of Kindergarten Bay on Etolin Island, where it is cavernous (E. Kissinger, U.S. Forest Service, oral commun., 1990).

Mzv Greenschist And Greenstone Metamorphosed From Intermediate To Mafic Volcanic Rocks--

Greenschist, greenstone, phyllite, minor semischist; weathers light to dark green, locally brownish pillow breccia, agglomerate flows, and possible tuffs; appears less deformed and less metamorphosed than other nearby rock units; probably several thousand meters thick. Locally abundant relict pyroxene phenocrysts suggest a close link to the "Douglas Island Volcanics" (KJsv). Inferred upper Mesozoic age based on association with other units. Unit contrasts with the "Phyllite and Slate Metamorphosed From Mudstone and Minor Graywacke" (Mzp) mapped elsewhere in the Petersburg-Wrangell area in its apparent lesser metatuff and its higher proportion of rocks of volcanic origin. Exposed along and near Duncan Canal and on Woewodski Island; In this quadrangle found on Zarembo Island and Key Reef in Clarence Strait.

ACKNOWLEDGEMENTS

This report could not have been produced without the efforts of my mapping colleagues, all of whom are identified in the note on the map; the supportive and enthusiatic crew of the former U.S. Geological Survey research vessel, the R/V Don J. Miller II; the several helicopter pilots and mechanics who provided efficient air transport during the field mapping; the reviewer, D.J. Grybeck, Computer Graphics Specialist J. B. Weathers, and Illustrator Kevin Ghequiere. I thank them all.

REFERENCES CITED FOR THE PETERSBURG A-3 QUADRANGLE

Barnes, D.F., Brew, D.A., and Morin, R.L., 1989, Bouguer gravity map of the Petersburg quadrangle and parts of the Port Alexander, Sitka, and Sumdum quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1970-A , scale 1:250,000, 21 p. pamphlet.

Berg, H. C., Jones, D. L., and Coney, P.J., 1978, Pre-Cenozoic tectonostratigraphic terranes of southeastern Alaska and adjacent areas: U.S. Geological Survey Open-File Report 78-1085, scale 1:1,000,000, 2 sheets.

Berg, H. C., Jones, D. L., and Richter, D. H., 1972, Gravina-Nutzotin belt--Tectonic significance of an upper Mesozoic sedimentary and volcanic sequence in southern and southeastern Alaska, *in* Geological Survey Research 1972: U.S. Geological Survey Professional Paper 800-D, p. D1-D24.

Brew, D.A., 1990, Volcanoes of Alaska--Duncan Canal, Tlevak Strait and Suemez Island, Behm Canal and Rudyerd Bay, *in* Wood, C.A., and Kienle, J., eds., Volcanoes of North America: United States and Canada: Cambridge, University Press, p. 94-96.

____ 1993, Regional geologic setting of mineral resources in southeastern Alaska, *in* Godwin, L.H., and Smith, B. D., eds., Economic mineral resources of the Annette Islands Reserve, Alaska: U.S. Dept. of the Interior, Bureau of Indian Affairs, Division of Energy and Mineral Resources Publication, p. 13-20.

____ 1997a, Reconnaissance geologic map of the Petersburg A-2 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-A, scale 1:63,360, one sheet, 20 p. pamphlet.

____ 1997b, Reconnaissance geologic map of the Petersburg A-3 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-B, scale 1:63,360, one sheet, 24 p. pamphlet. (This report)

____ 1997c, Reconnaissance geologic map of the Petersburg B-1 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-C, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997d, Reconnaissance geologic map of the Petersburg B-2 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-D, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997e, Reconnaissance geologic map of the Petersburg B-3 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-E, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997f, Reconnaissance geologic map of the Petersburg B-4 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-F, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997g, Reconnaissance geologic map of the Petersburg B-5 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-G scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997h, Reconnaissance geologic map of the Petersburg C-1 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-H, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997i, Reconnaissance geologic map of the Petersburg C-3 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-I, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997j, Reconnaissance geologic map of the Petersburg C-4 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-J, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997k, Reconnaissance geologic map of the Petersburg C-5 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-K, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997l, Reconnaissance geologic map of the Petersburg D-4 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-L, scale 1:63,360, one sheet, __ p. pamphlet.

____ 1997m, Reconnaissance geologic map of the Petersburg D-5 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-M, scale 1:63,360, one sheet, __ p. pamphlet.

Brew, D. A., Berg, H. C., Morrell, R. P., Sonnevil, R. S., and Hunt, S. J., 1979, The mid-Tertiary Kuiu-Etolin volcanic-plutonic belt, southeastern Alaska, *in* Johnson, K. M., and Williams, J. R., eds., The United States Geological Survey in Alaska: Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B129-B130.

Brew, D.A., Drew, L.J., Schmidt, L.M., Root, D.H., and Huber, D.F, 1991, Undiscovered locatable mineral resources of the Tongass National Forest and adjacent areas, southeastern Alaska: U.S. Geological Survey Open-File Report 91-10, 370 p., 15 maps at 1:250,000, 1 map at 1:500,000, 11 figs.

Brew, D.A., and Drinkwater, J.L., 1991, Tongass Timber Reform Act Wilderness Areas supplement to U.S. Geological Survey Open-File Report 91-10 (Undiscovered locatable mineral resources of the Tongass National Forest and adjacent lands, southeastern Alaska): U.S. Geological Survey Open-File Report 91-343: 56 p.

Brew, D.A., and Grybeck, D.J., 1997, Combined description of map units and correlation of map units for the Petersburg-Wrangell area 1:63,360-scale geologic maps, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-O, __ p.

Brew, D.A., Grybeck, D.J., Cathrall, J.B., Karl, S.M., Koch, R.D., Barnes, D.F., Newberry, R.J., Griscom, A., and Berg, H.C., 1989, Mineral-resource map of the Petersburg and parts of the Port Alexander and Sumdum 1:250,000 quadrangles, southeastern Alaska: U.S. Geological Survey MF-1970-B, scale 1:250,000, 1 sheet, 47 p. pamphlet.

Brew, D.A, Grybeck, D.J., Taylor, C.D., Jachens, R.C., Cox, D.P., Barnes, D.F., Koch, R.D., Morin, R.L., and Drinkwater, J.L., 1996, Undiscovered mineral resources of southeastern Alaska--Revised mineral-resource-assessment-tract descriptions: U.S. Geological Survey Open-File Report 96-716, 131 p.; one map, scale 1:1,000,000.

Brew, D.A., and Koch, R.D., 1997, Reconnaissance geologic map of the Bradfield Canal B-6 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 97-156-N, scale 1:63,360, one sheet, __ p. pamphlet.

Brew, D.A., Karl, S.M., and Tobey, E.F., 1985, Re-interpretation of age of Kuiu-Etolin belt volcanic rocks, Kupreanof Island, southeastern Alaska, *in* Bartsch-Winkler, S., ed., The U.S. Geological Survey in Alaska: Accomplishments during 1983: U.S. Geological Survey Circular 945, p. 86-88.

Brew, D.A., and Morrell, R.M., 1983, Intrusive rocks and plutonic belts in southeastern Alaska, *in* Roddick, J. A., ed., Circum-Pacific plutonic terranes: Geological Society of America Memoir 159, p. 171-193.

Brew, D.A., Ovenshine, A.T., Karl, S.M., and Hunt, S.J., 1984, Preliminary reconnaissance geologic map of the Petersburg and parts of the Port Alexander and Sumdum 1:250,000 quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 84-405, 2 sheets, 43 p. pamphlet.

Buddington, A.F., and Chapin, T., 1929, Geology and mineral deposits of southeastern Alaska: U.S. Geological Survey Bulletin 800, 398 p.

Burrell, P.D., 1984a, Map and table describing the Admiralty-Revillagedo intrusive belt plutons in the Petersburg 1:250,000 quadrangle, Alaska: U.S. Geological Survey Open-File Report 84-171, scale 1:250,000, 6 p. pamphlet.

Burrell, P.D., 1984b, Cretaceous plutonic rocks, Mitkof and Kupreanof Islands, Petersburg quadrangle, southeastern Alaska, *in* Coonrad, W.L., and Elliott, R.L., eds., The United States Geological Survey in Alaska: Accomplishments during 1981: U.S. Geological Survey Circular 868, p. 124-126.

Burrell, P.D., 1984c, Late Cretaceous plutonic rocks, Petersburg quadrangle, southeastern Alaska, *in* Reed, K.M., and Bartsch-Winkler, eds., The United States Geological Survey in Alaska: Accomplishments during 1982: U.S. Geological Survey Circular 939, p. 93-96.

Burrell, P.D., Cobb, E.H., and Brew, D.A., 1982, Geologic bibliography of the Petersburg project area, Alaska: U.S. Geological Survey Open-File Report 82-483, 30 p.

Cathrall, J.B., Day, G.W., Hoffman, J.D., and McDanal, S.K., 1983a, A listing and statistical summary of analytical results for pebbles, stream sediments, and heavy-mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-A, 48p., I sheet, scale I:250,000.

____ 1983b, Distribution and abundance of copper, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-B, I sheet, scale I:250,000.

____ 1983c, Distribution and abundance of copper, determined by spectrographic analysis, in the nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-C, I sheet, scale I:250,000.

____ 1983d, Distribution and abundance of lead, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-D, I sheet, scale I:250,000.

____ 1983e, Distribution and abundance of lead, determined by spectrographic analysis, in the nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-E, I sheet, scale I:250,000.

____ 1983f, Distribution and abundance of zinc, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-F, I sheet, scale I:250,000.

____ 1983g, Distribution and abundance of zinc, determined by spectrographic analysis, in the nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-G, I sheet, scale I:250,000.

____ 1983h, Distribution and abundance of barium, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-H, I sheet, scale I:250,000.

____ 1983i, Distribution and abundance of barium, determined by spectrographic analysis, in the nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-I, I sheet, scale I:250,000.

____ 1983j, Distribution and abundance of determinable silver by spectrographic analysis, in nonmagnetic fraction of heavy- mineral concentrates from stream sediments and in the minus-80- mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-J, 1 sheet, scale I:250,000.

____ 1983k, Distribution and abundance of detectable gold, arsenic, bismuth, and antimony in the nonmagnetic fraction of heavy- mineral concentrates and in the minus-80-mesh fraction from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-K, 1 sheet, scale I:250,000.

____ 1983l, Distribution and abundance of tin, determined by spectrographic analysis, in nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open File Report 83-420-L, 1 sheet, scale I:250,000.

____ 1983m, Distribution and abundance of cadmium, determined by spectrographic analysis, in nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-M, 1 sheet, scale I:250,000.

____ 1983n, Distribution and abundance of molybdenum, determined by spectrographic analysis, in the minus-80-mesh fraction of of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-N, 1 sheet, scale I:250,000.

____ 1983o, Distribution and abundance of molybdenum, determined by spectrographic analysis, in nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area,southeast Alaska: U.S. Geological Survey Open-File Report 83-420-O, 1 sheet, scale I:250,000.

____ 1983p, Distribution and abundance of nickel, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments from the Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-P, 1 sheet, scale I:250,000.

____ 1983q, Distribution and abundance of nickel, determined by spectrographic analysis, in nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83- 420-Q, 1 sheet, scale I:250,000.

____ 1983r, Distribution and abundance of cobalt, determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-R, 1 sheet, scale I:250,000.

____ 1983s, Distribution and abundance of cobalt, determined by spectrographic analysis, in the nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-S, 1 sheet, scale I:250,000.

____ 1983t, Distribution and abundance of chromium, as determined by spectrographic analysis, in the minus-80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-T, 1 sheet, scale I:250,000.

____ 1983u, Distribution and abundance of chromium, as determined by spectrographic analysis, in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-U, 1 sheet, scale I:250,000.

____ 1983v, Distribution and abundance of tungsten, determined from colorimetric and spectrographic analysis, in the minus- 80-mesh fraction of stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-V, 1 sheet, scale I:250,000.

____ 1983w, Distribution and abundance of tungsten, determined by spectrographic analysis, in nonmagnetic fraction of heavy- mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-W, 1 sheet, scale I:250,000.

Cohen, H.A., and Lundberg, N., 1993, Detrital record of the Gravina arc, southeastern Alaska: Petrology and provenance of Seymour Canal Formation sandstones: Geological Society of America Bulletin, v. 105, p. 1400-1414.

Dickinson, K. A., 1979, A uranium occurrence in the Tertiary Kootznahoo Formation on Kuiu Island, southeast Alaska: U.S. Geological Survey Open-File Report 79-1427, 5 p.

Dickinson, K.A., and Campbell, J. A., 1982, The potential for uranium deposits in the Tertiary Kootznahoo Formation of the southern part of the Admiralty trough, southeastern Alaska: U.S. Geological Survey Open-File Report 82-983, 18 p.

Douglass, S.L., Webster, J.H., Burrell, P.D., Lanphere, M.L., and Brew, D.A., 1989, Major element chemistry, radiometric values, and locations of samples from the Petersburg and parts of the Port Alexander and Sumdum quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 89-527, map at 1: 250,000, 66 p. pamphlet.

Eberlein, G. D., and Churkin, Michael, Jr., 1970, Paleozoic stratigraphy on the northwest coastal area of Prince of Wales Island, southeastern Alaska: U.S. Geological Survey Bulletin 1284, __ p.

Eberlein, G.D., Churkin, M., Jr., Carter, C., Berg, H. C., and Ovenshine, A. T., 1983, Geology of the Craig quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-91, 2 sheets, scale 1:250,000, pamphlet.

Ford, A. B., and Brew, D. A., 1977, Chemical nature of Cretaceous greenstone near Juneau, Alaska, *in* Blean, K. M., ed., The United States Geological Survey in Alaska: Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. B88-B90.

_____1978, Minor metal content of Cretaceous greenstone near Juneau, Alaska, *in* Albert, N. R. D., and Hudson, Travis, eds., The United States Geological Survey in Alaska: Accomplishments during 1979: U.S. Geological Survey Circular 823-B, p. B99-B101.

Grant, R. E., 1971, Taxonomy and autecology of two Arctic Permian rhynchonelloid brachiopods, *in* Dutro, J. T., Jr., ed., Paleozoic perspectives: A tribute to G. Arthur Cooper: Smithsonian Institution Contributions to Paleontology, no. 3, p. 313-335.

Grybeck, D.J., Berg, H.C., and Karl, S.M., 1984, Map and description of the mineral deposits in the Petersburg and eastern Port Alexander quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 84-837, scale 1:250,000, 87 p. pamphlet.

Hillhouse, J. W., and Grommé, C. S., 1980, Paleomagnetism of the Triassic Hound Island Volcanics, Alexander Terrane, southeastern Alaska: Journal of Geophysical Research, v. 85, no. B5, p. 2594-2602.

Himmelberg, G.R., Loney, R.A., and Craig, J.T., 1986, Petrogenesis of the ultramafic complex at the Blashke Islands,southeastern Alaska: U.S. Geological Survey Bulletin 1662, 14 p.

Hunt, S. J., 1984, Preliminary study of a zoned leucocratic granite body on central Etolin Island, southeast Alaska, *in* Coonrad, W. C., and Elliott, R.L., eds., The United States Geological Survey in Alaska: Accomplishments during 1981: U.S. Geological Survey Circular 868, p. 128-131.

Karl, S. M., 1984, Recognition of Burnt Island Conglomerate on the Screen Islands, southeastern Alaska, *in* Coonrad, W. C., and Elliott, R. L., eds., The United States Geological Survey in Alaska: Accomplishments during 1981: U.S. Geological Survey Circular 868, p. 115-117.

Karl, S.M., and Giffen, C.D., 1992, Sedimentology of the Bay of Pillars and Point Augusta Formations, Alexander Archipelago, Alaska: *in* Bradley, D.W., and Dusel-Bacon, C., eds., The United States Geological Survey in Alaska: Accomplishments during 1991: U.S. Geological Survey Bulletin 2041, p. 171-185

Karl, S.M., and Koch, R.D., 1990, Maps and preliminary interpretation of anomalous rock geochemical data from the Petersburg quadrangle and parts of the Port Alexander, Sitka, and Sumdum quadrangles, southeastern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF 1970-C, 40 p. pamphlet, 7 sheets.

Karl, S.M., Koch, R.D., Hoffman, J.D., Day, G.W., Sutley, S.J., and McDanal, S.K., 1985, Trace element data for rock samples from the Petersburg, and parts of the Port Alexander and Sumdum quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 85-146, scale 1:250,000, 698 p.

Kennedy, G. C., and Walton, M. S., Jr., 1946, Geology and associated mineral deposits of some ultrabasic rock bodies in southeastern Alaska: U.S. Geological Survey Bulletin 947-D, p. 65-84.

Lanphere, M.A., and Eberlein, G. D., 1966, Potassium-argon ages of magnetite bearing ultramafic complexes in southeastern Alaska (abs.): Geological Society of America Special Paper 87, p. 94.

Lathram, E. H., Pomeroy, J. S., Berg, H. C., and Loney, R. A., 1965, Reconnaissance geology of Admiralty Island, Alaska: U.S.Geological Survey Bulletin 1181-R, p. B1-R48, 2 pls., scale 1:250,000.

LeCompte, J.R., 1981, Landsat features maps of the Petersburg quadrangle and vicinity, southeastern Alaska: U.S. Geological Survey Open-File Report 81-799, 2 sheets, scale I:250,000.

Loney, R. A., 1964, Stratigraphy and petrography of the Pybus-Gambier area, Admiralty Island, Alaska: U.S. Geological Survey Bulletin 1178, 103 p.

McClelland, W. C., and Gehrels, G.E., 1990, Geology of the Duncan Canal shear zone: Evidence for Early-Middle Jurassic deformation of the Alexander terrane, southeastern Alaska: Geological Society of America Bulletin, v. 102, p. 1378-1392.

Muffler, L. J. P., 1967, Stratigraphy of the Keku Islets and neighboring parts of Kuiu and Kupreanof Islands, southeastern Alaska: U.S. Geological Survey Bulletin 1241-C, p. C1-C52.

Ovenshine, A. T., and Webster, G. D., 1970, Age and stratigraphy of the Heceta Limestone in northern Sea Otter Sound, southeastern Alaska, *in* Geological Survey Research 1970: U.S. Geological Survey Professional Paper 700-C, p. C170-C174.

Page, N. J., Berg, H. C., and Haffty, J., 1977, Platinum, palladium, and rhodium in volcanic and plutonic rocks from the Gravina-Nutzotin belt, Alaska: U.S. Geological Survey Journal of Research, v. 5, p. 629-636.

Tripp, R.B., and Cathrall, J.B., 1984, Mineralogical map showing the distribution of selected minerals in nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Petersburg area, southeast Alaska: U.S. Geological Survey Open-File Report 83-420-X, 1 sheet, scale 1:250,000.

Sonnevil, R. A., 1981, The Chilkat-Prince of Wales plutonic province, southeastern Alaska, *in* Albert, N.R. D., and Hudson, Travis, eds., United States Geological Survey in Alaska: Accomplishments during 1979: U.S. Geological Survey Circular 823-B, p. B112-B115.

Souther, J. G., Brew, D. A., and Okulitch, A. V., 1979, Sheet 104-114, Iskut River, British Columbia-Alaska: Geological Survey of Canada, Geological Atlas Map 1418A, 3 sheets, scale 1:1,000,000.

U.S. Geological Survey, 1978, Aeroradioactivity of Kosciusko Island, Alaska: U.S. Geological Survey Open-File Report 79-831, 1 sheet, scale I:63,360.

____1979, Aeromagnetic map of Petersburg area, Alaska: U.S. Geological Survey Open-File Report 79-832, 1 sheet, scale I:250,000.

Walton, M. S., Jr., 1951a, The Blashke Island ultrabasic complex with notes on related areas in southeastern Alaska: U.S. Geological Survey Open-File Report 51-29, 266 p.

_____1951b, The Blashke Island ultrabasic complex; with notes on related areas in southeastern Alaska: New York Academy of Science Transactions, v. 13, p. 320-323.

Wolfe, J. A., 1966, Tertiary plants from the Cook Inlet region, Alaska: U.S. Geological Survey Professional Paper 398-B, p. B1-B32.

Wright, F. E., and Wright, C. W., 1908, The Ketchikan and Wrangell mining districts, Alaska: U.S. Geological Survey Bulletin 347, 210 p.