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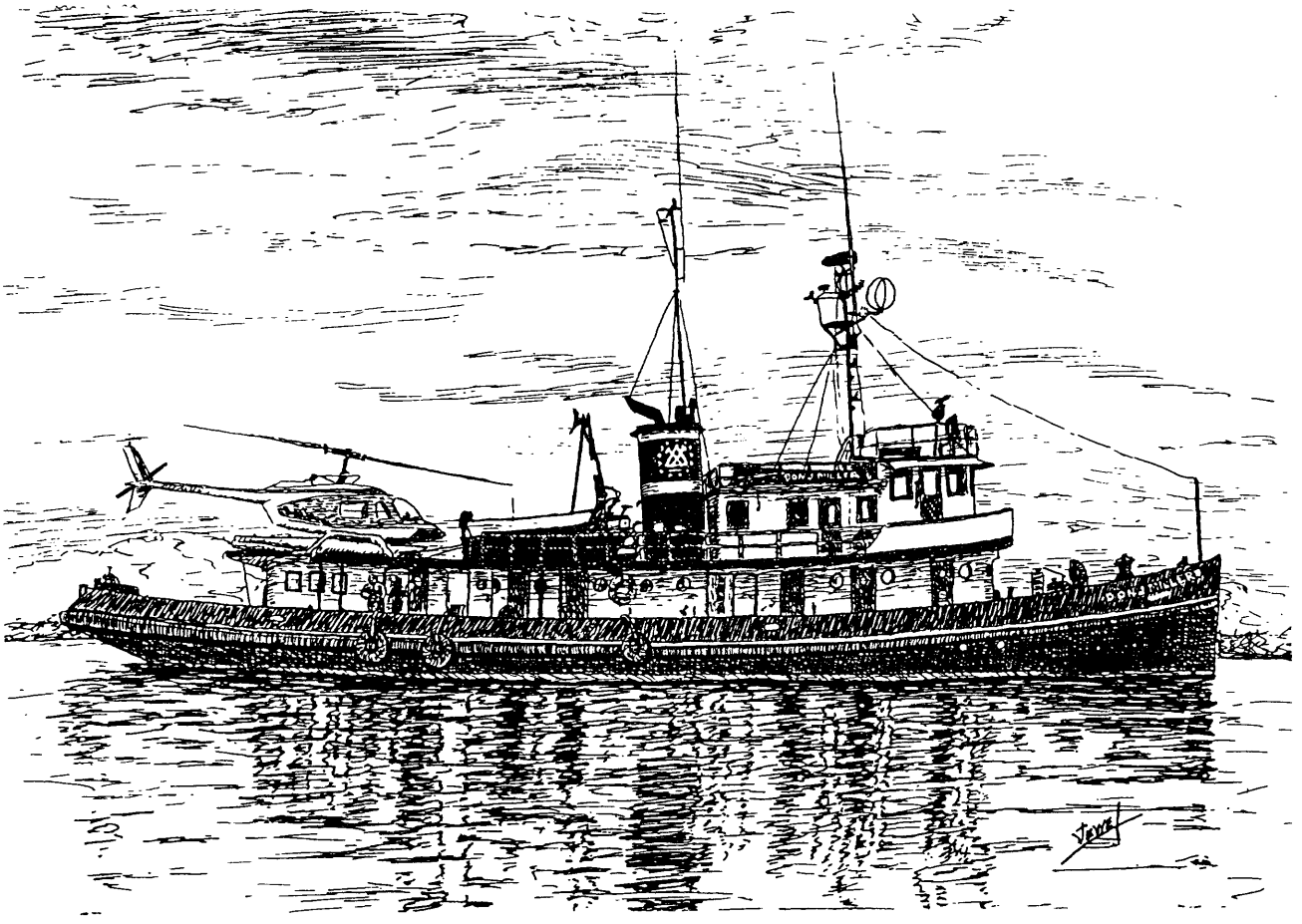

[U.S.G.S. R/V Don J. Miller II]

RECONNAISSANCE GEOLOGIC MAP OF THE PETERSBURG B-3 QUADRANGLE, SOUTHEASTERN ALASKA

Open-File Report 97-156-E

By David A. Brew

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

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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 and Bradfield Canal, Alaska,1:250,000-scale quadrangles. 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 (Brew and others, 1984); the information is based on reconnaissance field mapping and thus does not have the density of field-station control, samples, or field observations that are expected in most U.S. Geological Survey 1:63,360-scale geologic maps. This map is one of a series that share the same format and general information (Brew, 1997a-m; Brew and Koch, 1997). 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 (Berg and Grybeck, 1980; Berg, 1981; 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; 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. Younger than almost all parts of all of these belts, and extending from the Alexander belt across the Gravina and onto the mainland belt, is the lower to middle Tertiary Kuiu-Etolin belt that 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, tidal mudflat deposits, and some glaciofluvial deposits. The distribution of most large areas of surficial deposits was mapped in the field, but the deposits have not been studied in detail; many small areas are not shown.

KUIU-ETOLIN BELT

Belt informally named by Brew and others (1979), redefined by Brew and Morrell (1983), and age revised by Brew and others (1985).

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; divided into:

Extrusive and Intrusive Volcanics and Volcaniclastic Rocks (Quaternary(?) and Tertiary)--

Complicated intrusive and extrusive volcanic pile best exposed on southwestern Kupreanof Island and on Zarembo Island: may include rocks that should be assigned to "Extrusive Basaltic Rocks and Underlying Sediments" (Qb) but cannot be distinguished in the field from older basalts. Originally considered to be the southeastern, and more varied extension of "Admiralty Island Volcanics" named by Loney (1964) and assigned a late Eocene to Oligocene age on Admiralty Island. That age revised to Eocene to Miocene(?) by Lathram and others (1965); K-Ar dating (G. E. Plafker, U.S. Geological Survey, oral commun., 1982) of volcanic rocks there indicates a Miocene age. However, the "Admiralty Island Volcanics" are now considered to be a different but possibly time-equivalent unit. Time- and litho-stratigraphic relations are uncertain, but the rhyolites and basalts appear to have erupted at different times and in no obvious or simple sequence during the time from Paleocene (as indicated by the age of the locally underlying "Kootznahoo Formation") to Holocene (as inferred from the possible inclusion of Quaternary volcanic rocks in the unit). The unit may include rocks erupted throughout the Tertiary and Quaternary, but it is believed that there is a significant Oligocene break in the deposition. The unit is stratigraphically complicated with major lithologic types occurring repeatedly throughout the section. Some suggestion that "Altered Dellenite, etc. " (QTf), and the "Gabbro and Microgabbro" (Tmgb) exposed elsewhere in the Petersburg-Wrangell area occur only low in the section. "Siliceous Volcaniclastic Rocks" (QTc) occur in and around "Rhyolite, Rhyodacite, etc." (QTr); see also Muffler (1967). Divided into:

QTv Vent Breccia--

Angular to subangular blocks of fine-grained, light gray, silicic volcanic rock with fragments that range from 5 mm to 15 cm with either no matrix or little (less than 15 percent) matrix of very fine grained, dark-gray volcanic rock or chalcedony. In this quadrangle crops out on southeast shore of Zarembo Island southwest of Round Point; elsewhere in the Petersburg-Wrangell area in Kadake Creek drainage, west of Kadake Bay and north of Washington Bay, all on Kuiu Island.

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. Disseminated 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. Vents and domes are indicated by extreme alteration, brecciation, attitudes of layering, and dikes; isolated massive structureless 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--

Blocky weathering, pyroxene and feldspar porphyritic, massive to vesicular and amygdaloidal flows 10-50 cm thick. Dark gray where fresh, green to maroon where altered. 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. Exposed in this quadrangle on southwestern Zarembo Island.

QTb Basalt and Other Mafic Extrusive Rocks--

Platy, blocky, or columnar jointed basalt flows 50 cm to several meters thick. Dark-gray where fresh, rusty weathering. Commonly vesicular and amygdaloidal; amygdule fillings include calcite, epidote, chalcedony, chlorite, and zeolites, in order of decreasing abundance. Platy flows are pyroxene microporphyritic; massive flows may contain magnetite, pyroxene, and olivine. Intercalated mafic tuff and flow breccia of variable thickness, but generally less than 1 meter thick. Mafic dikes and small localized flows occur higher in the section. Section of gently east-dipping flows greater than 500 m thick extends from Port Camden on Kuiu Island, across Rocky Pass to western Kupreanof Island; also exposed on northwestern Zarembo Island in this quadrangle. It is the most extensive volcanic unit in the Kuiu-Etolin belt; and may also underlie much of exposed extrusive-volcanic section on Kuiu, Kupreanof and Zarembo Islands.

QTd Dikes, Sills, and Extrusive Rocks--

Mutually cross-cutting network of dikes, flows, sills, and breccias that range in composition from basalt to rhyolite. Extremely complicated, heterogenous outcrops; may include xenoliths of metamorphic country rock. Best exposures associated with granitic intrusion west of Threemile Arm on Kuiu Island, and on Conclusion and Zarembo Islands. Interpreted to be feeder system of volcanics in these areas.

INTRUSIVE GRANITIC AND OTHER ROCKS OF KUIU-ETOLIN VOLCANIC PLUTONIC BELT (Miocene and(or) Oligocene--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); descriptions given by Hunt (1984); in this quadrangle, there is one unit:

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

Amphibole-biotite alkali granite and subordinate granite. Both massive and 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, with 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 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. Mapped in aureoles on Etolin Island.; however, 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 shown. Age of protoliths is Late Jurassic to middle Cretaceous, based on 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.

Dominant rock type is medium- to very coarse-grained; medium- to very thick-bedded, locally cross-bedded; lithic feldspathic quartz arenite. Conglomerates contain 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. Unit is greater than 300 m thick near Dakaneek Bay on Kupreanof Island (K. A. Dickinson, U.S. Geological Survey, oral commun., 1980). 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 part 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, U.S. Geological Survey, written communs., 1979, 1983). The similarities in depositional environment, stratigraphic position, and lithology suggest that the name Kootznahoo Formation is appropriate for all of these rocks 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" units in the Petersburg-Wrangell map area and locally intertongues with at least the lower part of that unit. 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 a coherent stratigraphic section; includes the pre-Cenozoic granitic and other rocks intrusive into that section. Rocks range in age from Ordovician to Cretaceous. Does not correspond exactly to the Alexander terrane of Berg and others (1978). Exposed in western part of the Petersburg-Wrangell area.

PRINCE OF WALES ISLAND SEQUENCE (Devonian to Ordovician)--Informally named by Brew and others (1984) to emphasize the island-arc depositional situation 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 part of the first 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, which is mapped in this quadrangle--are interpreted to have formed as fringing reefs or carbonate banks in an island-arc environment dominated by volcanic turbidites. The carbonates 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:

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 where fresh, buff where weathered. Forms rough pockety surfaces in tidal-zone outcrops and karst topography inland; thickness probably greater than 4,000 m in some exposures. Age is Middle and Late Silurian according to Eberlein and Churkin (1970) based on discussion of several collections. 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 map-area to the south; other exposures discussed in detail by Ovenshine and Webster (1970). Exposed in this quadrangle on Bushy Island in the Snow Passage-Clarence Strait area.

Scp Polymictic Conglomerate--

Pebble and cobble conglomerate and other clastic rocks like those described elsewhere (Brew and others, 1984) as the "Polymictic Conglomerate Intercalated with Heceta Limestone" (Schc), but which occur instead between the "Heceta Limestone" (Sch) and the "Graywacke, Mudstone, Turbidites, and Limestone" (DStbg) or other units of the "Bay of Pillars Formation". Thickness probably greater than several thousand m locally. Age is not known directly, but is inferred from the age of the adjacent units noted above. Exposed in the southwestern part of this quadrangle on Bushy Island in the Snow Passage-Clarence Strait area.

Turbidites and associated rocks (Upper Silurian to Lower Ordovician): These very extensive turbidite, conglomerate, and volcanic units--the "Bay of Pillars Formation" in this quadrangle and the "Descon Formation" on Prince of Wales Island--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) described some aspects of the sedimentology. In this quadrangle one main unit is present:

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 . All graptolite collections to date are of Early Silurian age (Claire Carter, U.S. Geological Survey, written commun., 1980). 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.

Stpg Graywacke, Slate, and Limestone--

Greenish-gray where fresh, 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. Mapped in this quadrangle on the Bushy Islands.

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 intrusive into that section) 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 and 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), but does not correspond exactly because of newer information and differing interpretations.

INTRUSIVE ROCKS OF ADMIRALTY-REVILLAGIGEDO PLUTONIC BELT AND ASSOCIATED MIGMATITE (Upper Cretaceous)--Belt informally named by Brew and Morrell (1983) and described by Burrell (1984abc); preliminary K-Ar determinations by M. A. Lanphere, U.S. Geological Survey, (written communs., 1981, 1982) interpreted to be applicable to the whole suite, including the rocks in this quadrangle, are as follows:

Map unit	General location	Biotite age	Hornblende age
Ktif unit	Wrangell Is.	83.2 Ma	91.6 Ma
" "	Mitkof Is.	-	89.1 Ma
Ktef unit	Zarembo Is.	90.4 Ma	93.0 Ma

Somewhat similarly dated rocks occur in lithically correlative units to the east in the Bradfield Canal quadrangle (R. L. Elliott and R. D. Koch, oral commun., 1982; Koch and Berg, 1996). As mapped in this quadrangle, divided into:

Ktif Hornblende-Biotite Tonalite, Granodiorite, Quartz Monzodiorite, and Quartz Diorite--Equigranular to sparsely porphyritic, massive to weakly foliated; medium-grained rocks with C.I. 14 to 52 Light gray where fresh, weather yellowish-gray. Rounded, elongate very fine-grained dioritic and local ultramafic inclusions. Mineralogic features include oscillatory-zoned seriate plagioclase, both discrete and small clumps of biotite and hornblende, subhedral (mutually exclusive) epidote and clinozoisite, rare garnet, and accessory sphene, allanite, and apatite. Alteration includes plagioclase to sericite and mafic minerals to epidote. Unit differs from "Hornblende-Biotite Tonalite and Granodiorite, etc." (Ktef) by lack of pyroxene and garnet and better development of seriate plagioclase. "Hornblende-Biotite Tonalite" (Ktop) is a porphyritic variation of this unit. Exposed on Mitkof, Zarembo, and Woronkofski Islands (Burrell, 1984ab).

Kqop Biotite-Epidote-Hornblende Quartz Monzodiorite--Locally foliated; plagioclase porphyritic with medium- and coarse-grained phenocrysts (to 12 mm), fine- to medium-grained groundmass (to 3 mm) and a C.I. range of 17 to 48. Weathers brownish-gray, gray and white where fresh. Margins of bodies are commonly more mafic and have a very fine- to fine-grained groundmass; also common are muscovite-biotite-garnet-epidote-bearing aplite dikes. Mineralogical features include oscillatory-zoned plagioclase with sericite alteration of the cores, interstitial quartz and K-feldspar, euhedral fine-grained hornblende, minor biotite, and occasionally twinned and zoned primary epidote and secondary epidote. Unit is exposed on the Lindenberg Peninsula, Kupreanof Island, and on southwestern Mitkof, Woronofski and northern Zarembo Islands. Where mapped on northern Dry Island and eastern Mitkof Island, the compositions range from quartz monzodiorite to tonalite (Burrell, 1984ab).

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 the map-area described here. 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" probably intertongue 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. In this quadrangle, consists of:

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).

METAMORPHOSED STEPHENS PASSAGE GROUP ROCKS (Upper Cretaceous)--In general, these units are associated with the Upper Cretaceous and Tertiary plutons (of the Kuiu-Etolin Belt) in the Gravina Belt. The unit has been rather arbitrarily assigned a Late Cretaceous age; similar rocks have been assigned a Tertiary age and are described elsewhere as "Hornfelsed Seymour Canal Formation Rocks" (Tsh) based on the known or inferred age of the pluton(s) nearby. This results in a potentially misleading map pattern, however, because the metamorphic rocks adjacent to Tertiary plutons may have undergone Upper Cretaceous metamorphism as well and the units that are based on Tertiary metamorphic effects alone are poorly defined. The Cretaceous age assignment used here is also not entirely satisfactory from either a field mapping or petrographic study viewpoint; this is due to both the complexity of spatial overlapping metamorphic effects and the apparent lack of an unmetamorphosed protolithic unit for one of the metamorphic units mapped outside of this quadrangle. Only one unit is mapped in this quadrangle:

Kss Schist and Hornfels--

Greenschist and albite-epidote to hornblende-hornfels facies metamorphic rocks derived from "Seymour Canal Formation" turbidites and related rocks (KJss). Original textures and structures generally preserved. Dominantly fine- to medium-grained, grayish-brown and reddish-brown weathering, locally foliated, commonly compositionally layered, chlorite-biotite-quartz-feldspar schist and semischist; minor phyllite; some strongly hornfelsed rocks close to plutons. Clear-cut aureoles around Upper Cretaceous plutons are (garnet-andalusite-staurolite-) biotite-quartz-feldspar hornfels and schistose hornfels; some calc-silicate and intermediate composition layers and lensesoccur locally. Age of metamorphism varies as described in headnote above; age of protolith is Late Jurassic to middle Cretaceous based on derivation of this unit from the "Seymour Canal Formation".

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, consists of:

Mzs Semischist and phyllite metamorphosed From Graywacke and Siltstone--

Low-grade (probably sub-greenschist facies) metamorphic rocks, locally highly folded but generally poorly foliated; finer-grained phases have good cleavage, however. Brownish-gray where fresh, gray to brown where weathered. Relict textures and sedimentary structures indicate derivation from a graywacke and siltstone or mudstone turbidite sequence. Unit encloses several large lenses of "Fossiliferous Limestone" (Dls) of Devonian age, but there is no direct indication of the original age of the metamorphic rocks. Proximity to "Seymour Canal Formation" (KJss) outcrops in other quadrangles and compatibility of the protoliths with that formation suggest that this unit is a metamorphic and deformed equivalent. Unit contrasts with the "Phyllite and Slate Metamorphosed From Mudstone and Minor Graywacke" (Mzp) mapped elsewhere in the proportion of originally coarse-grained sediments, and in the general absence of volcanic(?) protolith phyllite in this unit; the two units probably intertongue much more complexly than is shown on the map. Exposed on Duncan Canal, and on Woewodski, Zarembo, and Etolin Islands.

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

Greenschist, greenstone, phyllite, and minor semischist. Weathers light to dark green. Some lbrownish 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 and (in this quadrangle) Zarembo Islands, and on Key Reef in Clarence Strait.

Mzgb Gabbro--

Hornblende gabbro and pyroxene-hornblende gabbro. Medium to very coarse grained, C.I. 60 to 80. Weathers dark greenish black and very dark green; some interstitial indeterminate sulfide noted. Cut by numerous dikes of medium-grained, C.I. 05 to 25, quartz diorite like that in adjacent pluton. Crops out near east shore of Zarembo Island.

HYD GROUP(?) (Upper Triassic)--One unit mapped is in this quadrangle:

Thv Felsic and Intermediate Volcanic Flows and Breccia, Limestone, and Argillite--

Dominantly very-fine to fine-grained, chlorite-quartz-muscovite-feldspar phyllite; light to dark green where fresh, rusty and green where weathered. Locally chertlike; interpreted by Berg and Grybeck (1980) and Berg (1981) to be felsic metatuff. Also thinly-layered to laminated quartz-feldspar phyllite or semischist interpreted by the same workers to be metarhyolite. Associated with dark-gray, thin-bedded carbonaceous mudstone, siltstone, and limestone. Thickness unknown, but probably at least several hundred meters. Age Late Triassic-early Karnian for the unit inferred from one collection of halobiid pelecypods from exposures on the west side of Duncan Canal (N. J. Silberling, U.S. Geological Survey, written commun., 1980). Host unit for massive sulfide deposits. Exposed along and near Duncan Canal, on the Castle Islands, Woewodski Island, and in this quadrangle on northwestern Zarembo Island. The exposures on Rookery Island in Duncan Canal and on the northeast side of East Island in the Kashevarof Islands are well-bedded silty limestone of different and more uniform character.

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REFERENCES CITED FOR THE PETERSBURG B-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., 1981, Upper Triassic volcanogenic massive sulfide metallogenic province identified in 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. B104-B108.

Berg, H. C., and Grybeck, Donald, 1980, Upper Triassic volcanogenic Zn-Pb-Ag (-Cu-Au)-barite mineral deposits near Petersburg, Alaska: U.S. Geological Survey Open-File Report 80-527, 11 p.

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., 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, 21 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.

____ 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, 20 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, 21 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, 23 p. pamphlet. (This Report)

____ 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., 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 1:250,000.

____ 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 1:250,000.

____ 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 1:250,000.

____ 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 1:250,000.

____ 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 1:250,000.

____ 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 1:250,000.

____ 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 1:250,000.

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.

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.

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, 67 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.

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.

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., 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.

Koch, R.D., and Berg, H.C., 1996, Reconnaissance geologic map of the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-A, scale 1:250,000, 35 p. pamphlet.

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.

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 1:63,360.

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

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.