Notes on the Bedrock Geology and Geography of the Stikine Icefield, Coast Mountains Complex, Southeastern Alaska

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Abstract

The Stikine Icefield is the most inaccessible part of the Coast Mountains Complex of southeastern Alaska; its central part has rarely, if ever, been visited by geologists before this study. Recent fieldwork and both published and unpublished investigations of adjacent areas show that the study area is underlain by five generalized map units: (1) polymetamorphic rocks of probably Late Proterozoic and Early Paleozoic protolithic age, whose youngest metamorphic age is middle and Late Eocene; (2) locally foliated and porphyritic granodiorite of middle and late Eocene age—an area associated with these rocks in the upper Baird Glacier area is a possible mineral-exploration target; (3) early Eocene foliated tonalite of the great tonalite sill, herein dated at 56 Ma by the U-Pb method; (4) migmatitic rocks associated with these two plutonic units; and (5) unfoliated tonalite and granodiorite of the Admiralty-Revillagigedo plutonic belt of Late Cretaceous age. In general, metamorphic rocks are most abundant in the southwestern part of the icefield, as is the foliated tonalite of the great tonalite sill. The granodiorite is most common near the Alaska-British Columbia border, and migmatites are scattered throughout the study area. Rocks of the Admiralty-Revillagigedo plutonic belt occur within the metamorphic rocks in the southwestern part of the study area.

Introduction

The Stikine Icefield is the southernmost part of the Stikine-Tracy Arm-Chutine Icefield, which, as described in the following geographic sketch, is the largest icefield in southeastern Alaska and adjacent British Columbia, Canada (figs. 1, 2). The bedrock in the Stikine Icefield is part of the Coast Mountains Complex, as formally defined by Brew and others (1995b). The Coast Mountains Complex is the greater than 1,000-km-long, 40- to 100-km-wide backbone of the Coast Mountains. It consists dominantly of granitic rocks and lesser amounts of migmatitic and metamorphic rocks that underlie spectacular peaks, ridges, icefields, and glaciers.

The Stikine Icefield is the last part of southeastern Alaska to be mapped geologically. As background, the bedrock geology of all but two areas in the Coast Mountains Complex in southeastern Alaska was mapped in reconnaissance fashion by the U.S. Geological Survey (USGS) between 1964 and

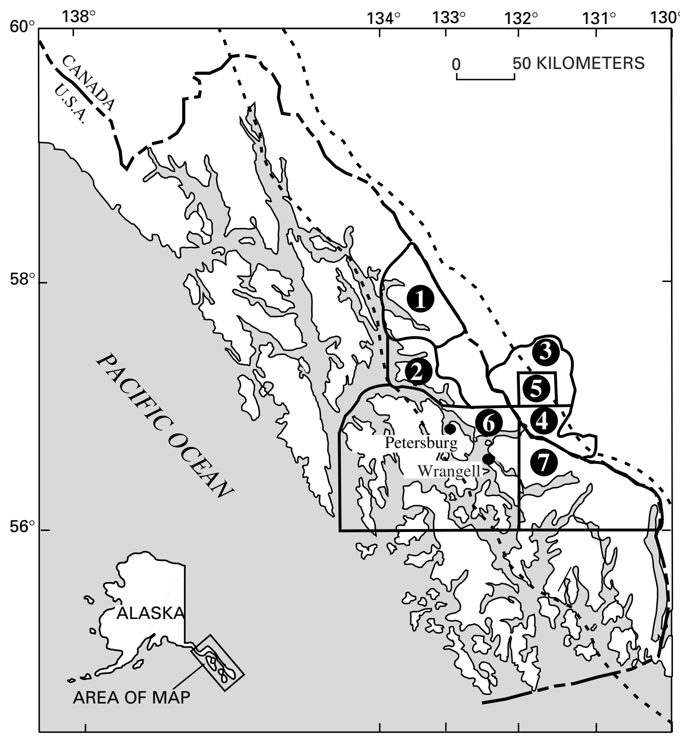


Figure 1. Southeastern Alaska and adjacent British Columbia, Canada, showing locations of the Coast Mountains Complex (dashed outline; after Brew and others, 1995b) and previously mapped adjacent areas (solid outlines): 1, Brew and Grybeck (1984); 2, A.L. Clark, D.A. Brew, and D.J. Grybeck, (unpub. data, 1969); 3, Kerr (1935a); 4, Kerr (1935b), 5, Logan and others (1993); 6, Brew and others (1984); 7, Koch and Berg (1996). All of area in British Columbia mapped by Kerr (1935a, b) east of long 132° W. was remapped by the Geological Survey of Canada (1957) with essentially the same map units.

1980 and by the Alaska Division of Geological and Geophysical Surveys in 1980; the locations of previous mapping close to the study area are shown in figure 1. The two areas left unstudied were (1) east and south of Skagway (fig. 1) in northernmost southeastern Alaska; and (2) the central part of the Stikine Icefield, which lies next to the Alaska-British Columbia border north of the Stikine River (fig. 2). The Skagway area was mapped in reconnaissance fashion by using fixed- and rotor-wing-aircraft support in 1995 and 1996 (D.A. Brew, unpub. data, 1995–96). The Stikine Icefield was mapped, also in reconnaissance fashion as a one-person project, in each of the years 1997 through 2000. The reader should note that the level of information gathered at both the approximately 100 ground stations established during this study and during numerous overflights falls far short of the detail characteristic of other USGS reconnaissance mapping in southeastern Alaska.

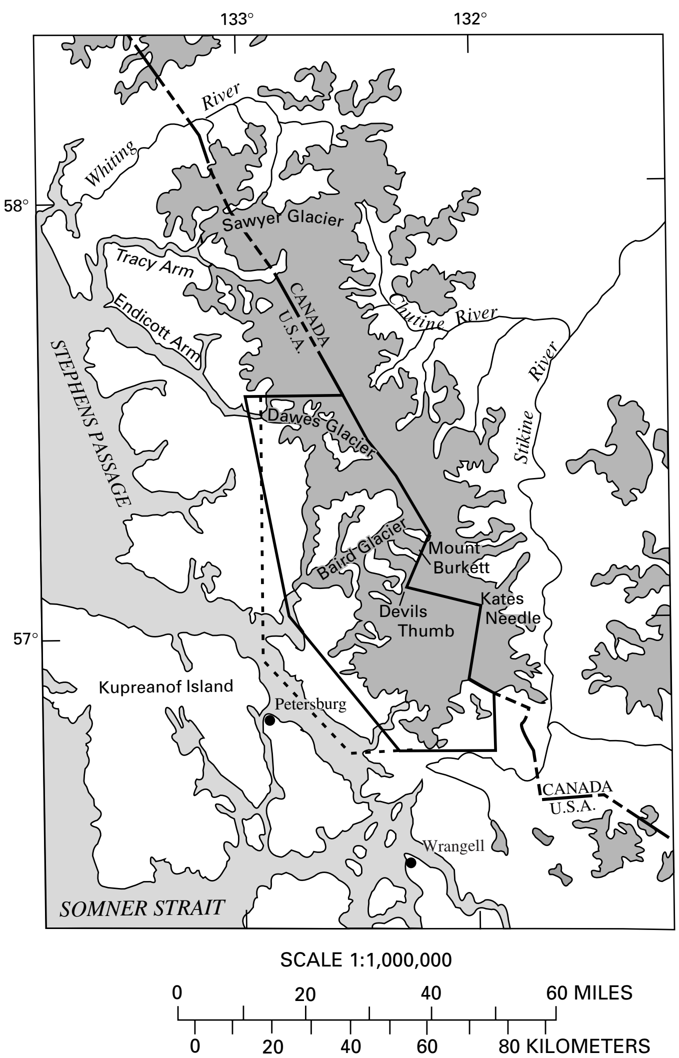


Figure 2. Stikine-Tracy Arm Icefield, southeastern Alaska and British Columbia, showing Stikine Icefield part (solid outline) and the west limit of figure 4 (dashed heavy line) where it differs from icefield boundary. North of the Stikine Icefield is the Tracy Arm-Chutine Icefield. Base map enlarged to 1,000,000 scale from 1:2,000,000-scale southeastern Alaska sheet of National Atlas.

This chapter reports on generalized findings from 1997–2000 mapping in the Stikine Icefield and describes the main map units and their distribution. The mapping and compilation were facilitated by the availability of more detailed mapping in the Tracy Arm-Fords Terror area to the north (Brew and Grybeck, 1984) and in the Petersburg quadrangle to the south (Brew and others, 1984), and by nearby reconnaissance mapping to the west (D.A. Brew, D.J. Grybeck, and A.L. Clark, unpub. data, 1969). The pertinent parts of that mapping are generalized in figure 4. Other nearby mapping is that by Kerr (1935a, 1935b), the Geological Survey of Canada (1957), and Logan and others (1993) in adjacent British Columbia, Canada. Topical studies of value to the interpretation of the study area are those by Gehrels and others (1990) and Samson and others (1991).

The study area (figs. 1, 2) is underlain by five generalized bedrock units: (1) polymetamorphic rocks of possibly Late Proterozoic to Early Paleozoic original age, whose youngest metamorphic age is middle to late Eocene; (2) locally foliated and porphyritic granodiorite of middle and late Eocene age; (3) early Eocene foliated tonalite of the great tonalite sill; (4) migmatitic rocks associated with the two plutonic-rock units; and (5) unfoliated tonalite and granodiorite of the Admiralty-Revillagigedo plutonic belt of Late Cretaceous age.

One of the results of this study is that the central part of the Stikine Icefield is underlain by a greater volume and variety of granodioritic and migmatitic rocks than predicted from the previous mapping in adjacent areas; these units are part of the massive middle and late Eocene biotite granodiorite and granite that dominate the Coast Mountains Complex. Another result is that the abundant and readily recognized high-grade metamorphic rocks that underlie many of the nunataks in the southernmost part of the Stikine Icefield (Brew and others, 1984) apparently grade northward into migmatitic units. One result of possible mineral-resource significance is of a previously unreported, well-exposed, heavily Fe stained contact between an apparently young granitic intrusion and the surrounding and apparently overlying orthogneiss, migmatite, gneiss, and schist.

The Canadian part of the Stikine Icefield is omitted from this discussion. Similarly, the northern part of the Stikine-Tracy Arm-Chutine Icefield (fig. 2), referred to as the Tracy Arm-Chutine Icefield, is omitted because the Alaskan part was described by Brew and Grybeck (1984).

Geographic Sketch

The bedrock geology of the study area (figs. 1, 2) is the main focus of this chapter, but this brief geographic sketch should help the reader understand why this area is the last in southeastern Alaska to be studied geologically, as well as provide information not available elsewhere.

The Stikine Icefield is the southernmost part of the Stikine-Tracy Arm-Chutine Icefield, which is the largest icefield in southeastern Alaska and adjacent British Columbia, Canada (fig. 2). The icefield covers an area of about 6,400 km^2. The U.S. part of the south end of the icefield, which is here termed the Stikine Icefield, covers an area of about 3,000 km^2. The highest peaks in the icefield are above 9,000-ft elevation, and one of the distributary glaciers, the LeConte, reaches tidewater.

The Stikine Icefield as defined here (fig. 2) extends from the south termini of the glaciers that discharge to the south, toward the Stikine River, to the north termini of those that discharge to the north into Endicott Arm, and westward to the limit of distributary glaciers that flow in that direction. According to this definition, the icefield is a total glacier system that includes not only LeConte, unnamed, Patterson, and Baird Glaciers, which flow to the west toward Frederick Sound, but also Mud, Great, Shakes, and Popof Glaciers, which flow toward the Stikine River, and the Dawes Glacier system, which flows to the north into Endicott Arm. As thus defined, the icefield is appreciably larger than the area to which the term was applied by the U.S. Forest Service (1992). The icefield includes the northeastern part of the Petersburg 1:250,000-scale quadrangle and the southeastern part of the Sumdum 1:250,000-scale quadrangle.

The Stikine Icefield is probably the most scenically spectacular, yet least visited, part of the Coast Mountains of southeastern Alaska and adjacent parts of British Columbia and the Yukon Territory, Canada (figs. 1, 3). Most of the infrequent visitors are rock climbers intent on ascending the imposing granitic faces of Devils Thumb, the single most impressive peak in the icefield (for example, Beckey, 1969, p. 263, 276 [first ascents of Devils Thumb at 9,077-ft elevation and Kates Needle at 10,023-ft elevation in 1946, and of nearby Mount Ratz at 10,290-ft elevation in 1964]; Krakauer, 1998; Bebie, 1992) and of Mount Burkett at 9,730-ft elevation. Access to the central part of the Stikine Icefield from tidewater involves traversing many kilometers either over glaciers or across rugged mountains. The central part is the place in all of southeastern Alaska that is farthest from tidewater and from any established community.

Because of these factors and the apparent absence of any mineral resources, the icefield has received little geologic attention. As noted above, until the present study, the only systematic geologic work in or near the icefield was in the southernmost part by Brew and others (1984) and in the northernmost part by Brew and Grybeck (1984); A.L. Clark, D.A. Brew, and D.J. Grybeck mapped along the western margin in 1969, but no report was ever published.

There have been no glacial-geologic studies of the Stikine Icefield, although, on the basis of information and observations from elsewhere in the Coast Mountains, some inferences can be made regarding the glacial history. The glaciers that presently mantle the Coast Mountains here are remnants of Neoglacial and older, probably Late Wisconsin glaciers that covered much of the region. The geomorphology of all the peaks above about 5,500-ft elevation in the west and 7,000-ft

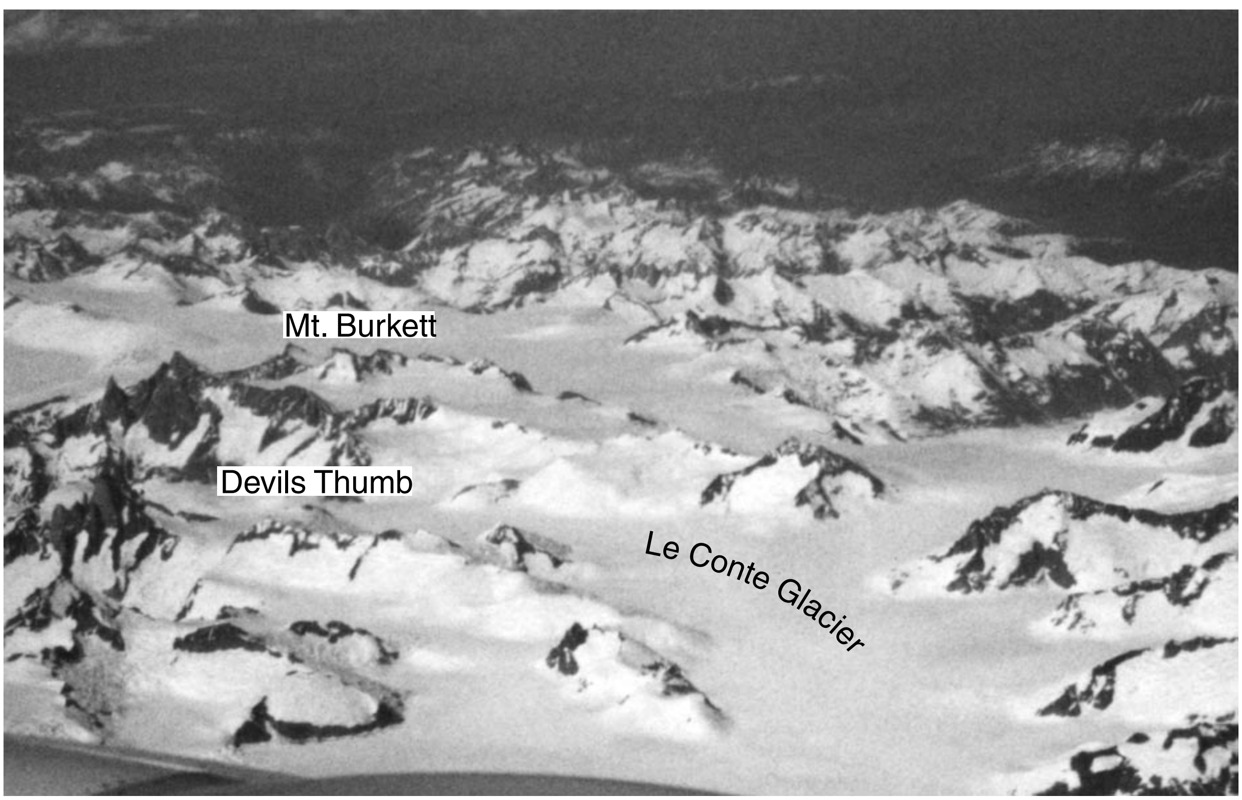


Figure 3. Aerial photograph of central part of the Stikine Icefield. The Stikine River valley in British Columbia, Canada, is dark area in distance. Photograph by D.A. Brew; view northeastward.

elevation at the Alaska-British Columbia border, together with the absence of erratic boulders and glacial striations above those elevations, indicates that the peaks may have existed as nunataks during all the Pleistocene glaciations. At present, the icefield's distributary glaciers are generally receding; LeConte Glacier has been retreating most rapidly (Motyka and others, 1998); and the upper reaches are downwasting. A conspicuous trimline a few hundred feet above the distributary valley glaciers has not been dated but is inferred to represent an early-20th-century stand.

Lithotectonic-Terrane, Metamorphic-Belt, Magmatic-Belt, and Metallogenic-Belt Settings

Almost all rocks of the Stikine Icefield are part of the Nisling lithotectonic terrane of the Intermontane superterrane, as shown by Brew and Ford (1994, 1998), Brew and others (1995a), and Brew (2001). These rocks were originally included in the Tracy Arm terrane of Berg and others (1978), but subsequent studies, especially those by Brew and others (1984) and Gehrels and others (1990), have shown that the rocks most likely fit the Nisling tectonic assemblage, or terrane, as subsequently described by Wheeler and McFeely (1991). Gehrels and others (1990) referred to these rocks as part of the Yukon-Tanana terrane.

Some of the metamorphic rocks in the southwestern part of the study area (fig. 4) may belong to the Gravina overlap assemblage or other rocks in the Coast Mountains structural zones of Brew and Ford (1998) and Brew (2001). These rocks, which are part of the Insular superterrane, are in the western metamorphic belt of Brew and others (1989, 1992). They are also part of the western granitic belt of the Coast Mountains Complex as originally described by Brew and Morrell (1980, 1983) and Brew and Ford (1984); they contain the great tonalite sill and scattered plutons of the Admiralty-Revillagigedo plutonic belt (Brew and Morrell, 1980, 1983). The Coast Range megalineament (Brew and Ford, 1978), which is a conspicuous component of the Coast Mountains structural zones, lies close to the contact between metamorphic rocks to the southwest and dominantly granitic and migmatic rocks to the northeast (Brew and Ford, 1998; Brew, 2001).

The rocks in the rest of the study area (figs. 1, 2, 4) are within the central granitic belt of Brew and Ford (1984); the granitic rocks themselves were assigned by Brew and Morrell (1980, 1983) to the 50-Ma Coast Mountains plutonic belt, the granitic rocks of which were described in some detail by Brew (1994). When the above-cited reports were prepared, the existence in the Coast Mountains of any granitic rocks older than Late Cretaceous and Tertiary was totally unsuspected. Since then, evidence from orthogneissic and other metamorphic-rock units in the Coast Mountains has established the presence of Paleozoic granitic rocks (Gehrels and others, 1990, 1991; D.L. Kimbrough, unpub. data, 1994; Karl and others, 1996) in both large and small bodies.

The southwesternmost rocks in the study area (figs. 1, 2, 4) are included in the Juneau metallogenic belt of Brew (1993), with the probability of undiscovered volcanic-rock-hosted massive sulfide deposits (Brew and others, 1991; Brew and others, 1996). The rocks in the rest of the study area are in the Coast Mountains metallogenic belt of Brew (1993), with undiscovered porphyry, skarn, and vein deposits related to Cenozoic magmatism, according to Brew and others (1996). These Cenozoic rocks were emplaced within metamorphic rocks of the Nisling terrane. Since Brew's (1993) report, such rocks of the Nisling terrane elsewhere have been reported to host volcanic-rock-hosted massive sulfide deposits (Brew and Ford, 1993).

Descriptions of Generalized Map Units

Each of the five major generalized map units in the Stikine Icefield (fig. 4) is made up of two or more detailed units. The generalized units are listed in table 1, together with the names of the detailed units that are shown on a map by D.A. Brew (unpub. data, 2001). The distribution of these generalized map units adjacent to the Alaska-British Columbia border corresponds fairly well to that of the even more generalized map units on the Canadian side (Kerr, 1935a, b; Geological Survey of Canada, 1957). The generalized map units are discussed below from youngest to oldest, except that the last unit, "undivided polymetamorphic rocks," has both the oldest protolithic age and the youngest metamorphic age.

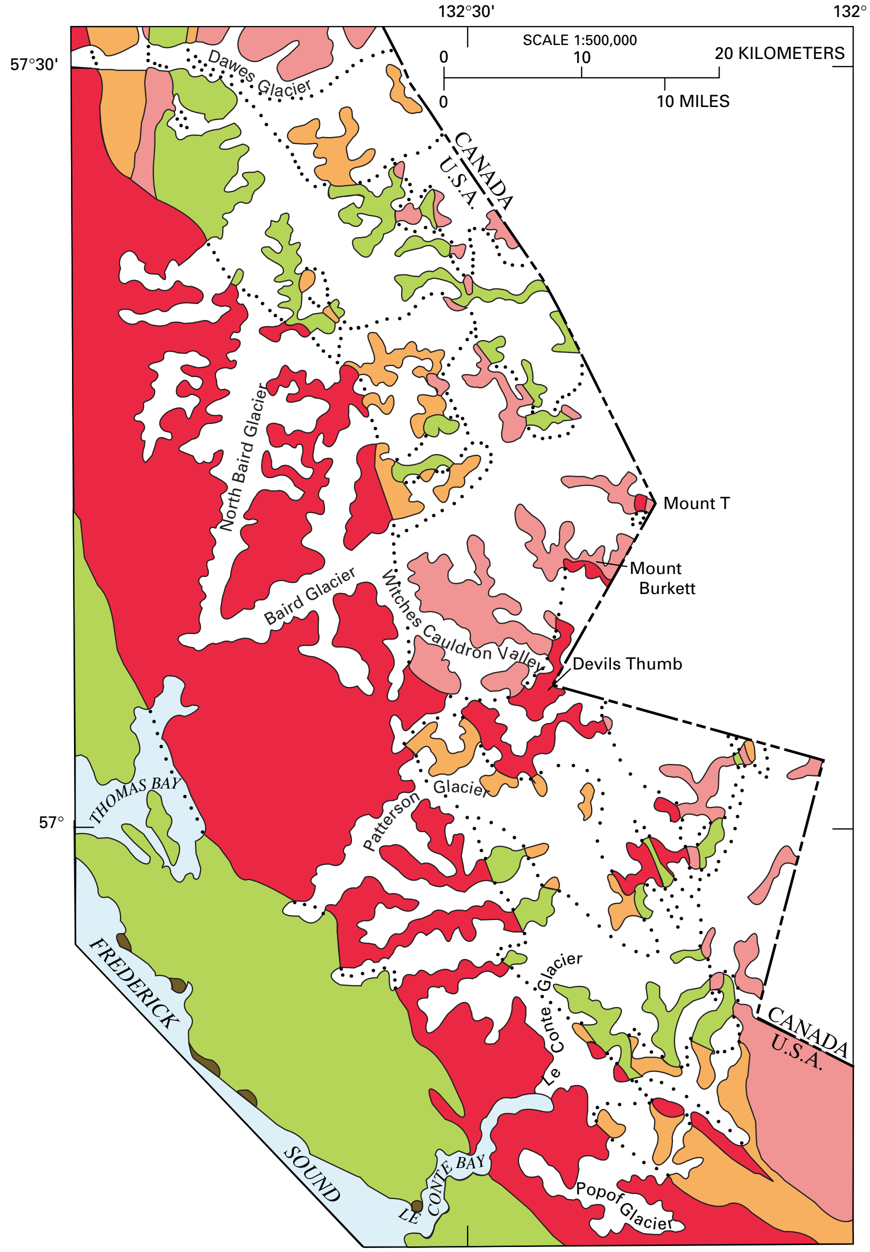
Locally Foliated and Porphyritic Granodiorite

The locally foliated and porphyritic granodiorite (unit 1, fig. 4) consists mainly of sphene-hornblende-biotite granodiorite, with lesser amounts of porphyritic biotite-hornblende granodiorite and gneissic biotite granite and granodiorite (table 1). These intrusive rocks were emplaced from early to late Eocene time (Douglass and others, 1989; Brew, 1994); some of them were discussed in detail by Webster (1984).

Foliated Tonalite of the Great Tonalite Sill

The foliated tonalite of the great tonalite sill (unit 2, fig. 4) is an undivided unit that consists mainly of biotite-hornblende tonalite, hornblende-biotite tonalite, and gneissic biotite granodiorite and quartz monzodiorite (table 1). As discussed elsewhere (Brew and Ford, 1998; Brew, 2001) and briefly above, the great tonalite sill is a remarkable series of echelon tabular plutons that extends the length of southeastern Alaska and into British Columbia, Canada, at both the north and south. Its unusual outcrop width in the Stikine Icefield is discussed below.

These intrusive rocks were emplaced from latest Cretaceous through early Eocene time (Douglass and others, 1989;



EXPLANATION

Glaciers and permanent snowfields—Only the larger masses are shown.

Locally foliated and porphyritic granodiorite (late and middle Eocene)—Dominantly biotite granodiorite and granite.

Foliated tonalite (early Eocene)–Dominantly hornblende tonalite and granodiorite; part of the great tonalite sill.

Contact—Approximately located; dotted where concealed by glaciers or water.

Migmatitic rocks (Eocene)—Variety of rock types associated with the above two units; includes some unassigned granitic rocks.

Unfoliated tonalite and granodiorite (early Late Cretaceous)—Biotite and garnet-bearing; part of 100- to 90-Ma Admiralty-Revillagigedo plutonic belt.

Polymetamorphic rocks (protolith age, early Paleozoic and Late Paleozoic)—Dominantly schist and gneiss; youngest metamorphic age, middle and late Eocene.

Figure 4. Generalized geologic sketch map of the Stikine Icefield, southeastern Alaska (see fig. 2 for location). Information compiled from D.A. Brew, D.J. Grybeck, and A.L. Clark, (unpub. data, 1969), Brew and Grybeck (1984), Brew and others (1984), and Brew (unpub. data, 1998–2000); base map modified from Sumdum and Petersburg 1:250,000-scale topographic maps and reduced to 1:500,000 scale. Major glaciers and nunataks are shown in generalized form.

Table 1. Relations between the generalized map units shown on figure 4 and the detailed units shown on the 1:250,000-scale map of the Stikine Icefield, southeastern Alaska.

[From D.A. Brew (unpub. data, 2001)].

Map unit (fig. 4)	Detailed units shown on 1:250,000-scale geologic map of the Stikine Icefield
Locally foliated and porphyritic granodiorite -----	Sphene-hornblende-biotite granodiorite. Porphyritic biotite-hornblende granodiorite. Gneissic biotite granite and granodiorite.
Foliated tonalite of the great tonalite sill -----------	Biotite-hornblende and hornblende-biotite tonalite, quartz diorite, and minor granodiorite. Gneissic biotite granodiorite and quartz monzodiorite.
Migmatitic rocks associated with the above two plutonic units.	Migmatite consisting of schist and gneiss invaded by tonalite and other rocks of the great tonalite sill. Migmatite consisting of schist, gneiss, tonalite, and granodiorite invaded by biotite granodiorite of the central Coast Mountains.
Unfoliated tonalite and granodiorite of the Admiralty-Revillagigedo plutonic belt.	Migmatite consisting of hornfelsed phyllite and metagraywacke invaded by all of the plutonic units listed below: Hornblende-biotite tonalite and granodiorite. Quartz monzodiorite, and quartz diorite. Biotite tonalite, quartz diorite, and granodiorite.
Polymetamorphic rocks ----------------------------	Undivided metamorphic rocks. Metamigmatite. Undivided sphene-biotite-hornblende (ortho)gneiss. Marble and calc-silicate granofels. Undivided biotite schist and (para)gneiss. Biotite schist. Biotite (para)gneiss. Undivided hornblende schist and (para)gneiss. Hornblende schist and semischist. Hornblende (para)gneiss. Undivided schist and hornfels. Serpentine and other metamorphosed ultramafic rocks. Phyllite and semischist.

Brew, 1994). The most recent U-Pb age determination on the unit, 56 Ma, is discussed in detail below. That determination indicates that the K-Ar age of 49.1 to 51.6 Ma reported for the unit by Douglass and others (1989) resulted from resetting by the younger “locally foliated and porphyritic granodiorite” (unit 1, fig. 4), which has a K-Ar age of 49.3 to 51.3 Ma (Douglass and others, 1989). That unit intrudes all the other rock units.

U-Pb Geochronology

Here, we report new U-Pb data on the great tonalite sill (sample 99DB014A, table 2) from a sample near Devils Thumb on the Alaska-British Columbia border in the Stikine Icefield (fig. 4). The sample yielded both zircon and titanite. The zircons are clear, colorless, and consist of stubby euhedral prisms and broken pieces of larger grains. Cores and zoning were not observed during grain selection. The titanites are clear, medium yellow-brown, and consist mostly of broken fragments of larger euhedral grains. U-Pb data are listed in table 2, and the results are plotted at the 2σ level of uncertainty on a standard concordia diagram in figure 5. Analytical techniques were described by Friedman and others (2001).

U-Pb data on four analyzed multigrain zircon fractions define a linear array on the concordia plot shown in figure 5. A best-fit line through these data gives a lower intercept of 55.6 +2.2/−2.9 Ma (mean square of weighted deviates, 0.1), interpreted to be the crystallization age of this sample. Titanite results of about 53 Ma record cooling of the rock below about 550–650ºC and so provide a minimum age for the great tonalite sill at this locality. An upper intercept of 289 +50/−48 Ma gives an estimate of the average age of inherited zircon in the analyzed fractions, consistent with the age of late Paleozoic arc basement of the Stikine terrane (Wheeler and McFeely, 1991).

Migmatitic Rocks Associated with the Above Two Plutonic-Rock Units

The migmatitic rocks (unit 3, fig. 4) include two types of migmatite: one consists of schist and gneiss invaded by rocks of the great tonalite sill, and the other of schist, gneiss, tonalite, and granodiorite invaded by biotite granodiorite of the central Coast Mountains (table 1).

Unfoliated Tonalite and Granodiorite of the Admiralty-Revillagigedo Plutonic Belt

The unfoliated tonalite and granodiorite (unit 4, fig. 4) consist mainly of hornblende-biotite tonalite and granodiorite, quartz monzodiorite, quartz diorite, and associated migmatite (Table 1). These intrusive and related rocks were emplaced during the Late Cretaceous (Brew and others, 1984; Burrell, 1984a–c; Douglass and others, 1989).

Polymetamorphic Rocks

The polymetamorphic rocks (unit 5, fig. 4) are an undivided unit that consists of a great variety of metamorphic rocks, including phyllite, biotite and hornblende schist and semischist, biotite-hornblende (para)gneiss, biotite-hornblende (ortho)gneiss, marble, calc-silicate hornfels, and serpentine (table 1).

The protolithic age of these rocks is probably Late Proterozoic to early Paleozoic (Gehrels and others, 1990; Samson and others, 1991; Wheeler and McFeely, 1991), and the youngest metamorphic age is middle and late Eocene (Brew and others, 1989, 1992). At least some of the phyllite and semischist in the southwestern part of the study area (figs. 1, 2) may belong to the Gravina overlap assemblage and may not be polymetamorphosed. Metamorphic grade ranges from subgreenschist to amphibolite facies.

Upper Baird Glacier Intrusive Contact

One feature of potential mineral-resource significance was noted during the 1998 mapping: a well-exposed Fe-stained contact between an apparently young granitic intrusive and

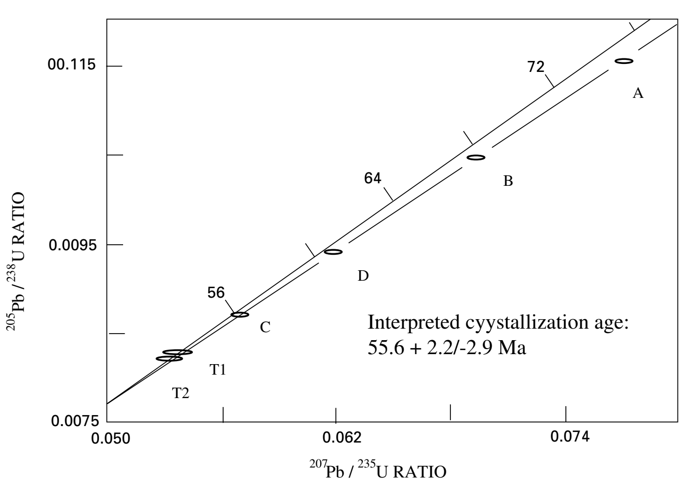


Figure 5. Standard concordia diagram showing zircon and titanite results for sample 99DB014A from the great tonalite sill at the Devils Thumb in the Stikine Icefield, southeastern Alaska (fig. 3). Results plotted at 2σ level of uncertainty; analyst, Richard M. Friedman, University of British Columbia.

Table 2. U-Pb analytical data for sample 99DB014A from the great tonalite sill.

[Interpreted crystallization age, 55.6 (+2.2/−2.9) Ma, based on lower intercept of four-point regression. Analyst, Richard M. Friedman, University of British Columbia]

Fraction[1]	Wt (mg)	U[2] (ppm)	Pb[3] (ppm)	^{206}Pb[4] / ^{204}Pb	Pb[5] (pg)	^{208}Pb[3] (%)	Isotopic ratio (1σ, %)[6] ^{206}Pb/^{238}U	^{207}Pb/^{235}U	^{207}Pb/^{206}Pb	Apparent age (2σ, Ma)[6] ^{206}Pb/^{238}U	^{207}Pb/^{235}U	^{207}Pb/^{206}Pb
A	0.05	365	4.4	1,669	7.9	14	0.01151 (0.14)	0.0772 (0.28)	0.04864 (0.24)	73.8 (0.2)	75.5 (0.4)	131 (11)
B	.05	247	2.8	1,447	5.5	16	.01045 (0.15)	.0694 (0.37)	.04816 (0.31)	67.0 (0.2)	68.1 (0.5)	107 (15)
C	.05	186	1.7	940	5.5	13	.00871 (0.13)	.0567 (0.34)	.04716 (0.28)	55.9 (0.1)	56.0 (0.4)	57 (14)
D	.05	238	2.4	1,074	6.5	17	.00941 (0.13)	.0618 (0.36)	.04763 (0.31)	60.4 (0.2)	60.9 (0.4)	81 (15)
T1	.42	763	6.7	211	864	17	.00816 (0.31)	.0527 (1.10)	.04685 (0.86)	52.4 (0.3)	52.2 (1.1)	42 (41/42)
T2	.30	731	6.5	255	487	16	.00828 (0.21)	.0536 (0.78)	.04697 (0.65)	53.2 (0.8)	53.1 (0.8)	48 (31)

[1]Uppercase letter, zircon identifier; T1, T2, titanites. All zircons clear, colorless, stubby prisms and fragments of larger grains, >149 µm across (intermediate dimension). All zircons were strongly air abraded. Titanites clear, medium yellow-brown, broken fragments of euhedral grains; grain size, >180 µm. Zircons nonmagnetic on Frantz magnetic separator at field strength of 1.8 A and sideslope of 5°; titanites nonmagnetic at field strength of 0.6 Aand sideslope of 20°. Front slope of 20° for all.

[2]U blank correction of 1 pg ±20 percent; U fractionation corrections were measured for each run with a double ^{235}U-^{235}U spike (approx 0.004/amu).

[3]Radiogenic Pb.

[4]Measured ratio corrected for spike and Pb fractionation of 0.0035/amu ±20 percent (Daly collector), which was determined by repeated analysis of NBS Pb 981 standard throughout the course of the study.

[5]Total common Pb in analysis based on blank isotopic composition.

[6]Corrected for blank Pb (2–5 pg), U (1 pg), and common Pb-isotopic compositions on the basis of Stacey and Kramers' (1975) model Pb at the age or the ^{207}Pb/^{206}Pb age of the rock.

migmatitic country rocks in the upper Baird Glacier area. Somewhat similar situations elsewhere in the Coast Mountains have been investigated for molybdenum resources (Brew and Ford, 1969; Koch and others, 1987; Miller and others, 1997).

At this locality, what appears to be the uppermost part of a 50-Ma or younger granitic body intrudes orthogranitic and migmatitic rocks on the west side of Baird Glacier. The country rocks have been mapped at nearby localities, but the apparent 50-Ma age of the pluton is based on visual resemblance of the outcrop to the locally foliated and porphyritic granodiorite (unit 1, fig. 4) some distance away. The Fe-stained locality, which has not been reported on before, is at approximately lat 57°15′16″ N., long 132°02′40″ W., on the north side of the main Baird Glacier at about 4,100- to 4,500-ft elevation in the Sumdum B–2 quadrangle. It is about 5 km from the Alaska-British Columbia border and is within the Stikine area of Tongass National Forest, between the Stikine-LeConte and Tracy Arm-Fords Terror Wildernesses.

The locality was observed from the air during both fixed-wing-aircraft reconnaissance and helicopter-supported regional geologic mapping in June 1998; whether it has ever been visited by a geologist is unknown. The locality is at the edge of the glacier and should be accessible with care and proper equipment. It is easy to spot because of the conspicuous Fe stain along the contact and on the exposed part of the granitic intrusion. The intrusion crosscuts the uniformly gray K-feldspar-porphyritic/porphyroblastic biotite (ortho)gneiss, well-layered migmatite, schist, and gneiss that make up much of the nearby bedrock. The contact appears to be well exposed; however, in high-snow years (such as 1999 and 2000), the contact is obscured.

It is unclear to which of the several families of intrusive rocks in the icefield that this granitic intrusion belongs. As noted above, one hypothesis is that it is part of the locally foliated and porphyritic 50-Ma granodiorite which is conspicuous at the north boundary of the Petersburg quadrangle south of this locality; that unit is only locally exposed north of LeConte Glacier. Similarly, none of the abundant 50-Ma granodiorite of the upper main Dawes Glacier area to the north has been mapped anywhere south of the north-central part of the Sumdum B–2 quadrangle. An alternative hypothesis is that the intrusion is a younger, different intrusive-rock unit; some such younger intrusions in the Coast Mountains contain significant Mo mineralization (Brew and others, 1991, p. 106).

Discussion

The distribution and proportion of metamorphic, granitic, and migmatitic rocks in the central part of the Stikine Icefield differ significantly from those to the north in the Tracy Arm-Fords Terror area and to the south in the Petersburg quadrangle part of the icefield. Though unexpected before the field mapping, this observation is not surprising, given the variations that are known to exist elsewhere along the length of the Coast Mountains. One interpretation is that the rocks exposed in the Stikine Icefield represent a deeper structural level than those exposed to the north and south, explaining the greater abundance of granitic and migmatitic rocks and the lesser abundance of straightforward metamorphic rocks, including metacarbonate and metavolcanic rocks.

Two other points stand out on the geologic map (fig. 4): (1) the possible presence of undiscovered mineralized granitic-rock cupolas associated with the 50-Ma granodiorite or with possibly younger intrusive rocks, similar to the one discussed above; and (2) the width of the great tonalite sill belt (fig. 4) and its extent into the central part of the Stikine Icefield to the vicinity of Devils Thumb.

This first point can be evaluated only through more detailed investigation than that provided by the present study. The second point, together with the relatively low volume of 50-Ma granodiorite (fig. 4), suggests that in this part of the icefield, the crustal extension required to accommodate these rocks was less than in other parts of the Coast Mountains Complex. This part of the icefield contrasts strongly with both the Juneau Icefield, where isolated remnants of the great tonalite sill occur east of the main bulk of the 50-Ma granodiorite (Brew and Ford, 1985; Drinkwater and others, 1995), and the Bradfield Canal quadrangle, where 50-Ma granitic rocks occur across almost all of the Coast Mountains Complex (Koch and Berg, 1996).

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