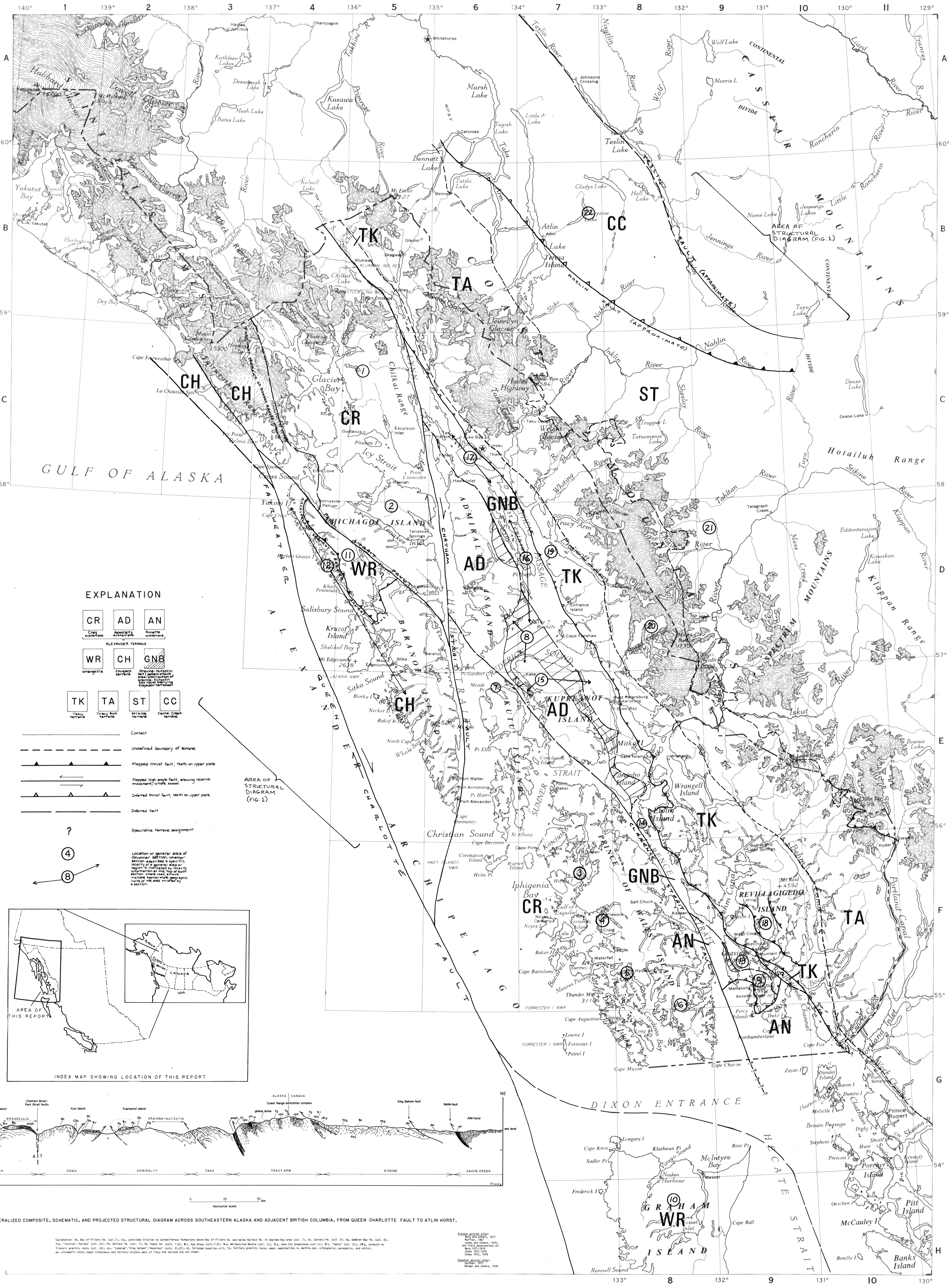
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
78-1085
SHEET 1 OF 2



Base from National Atlas 1:2,000,000 series:
SOUTHEASTERN ALASKA, SHEET NUMBER 37,
U. S. Geological Survey, 1970

Albers Equal Area Projection

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PRE-CENOZOIC TECTONOSTRATIGRAPHIC TERRANES OF SOUTHEASTERN ALASKA AND ADJACENT AREAS

by

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DISCUSSION

Pre-Cenozoic rocks in southeastern Alaska and adjoining British Columbia and Yukon form 10 tectonostratigraphic terranes bounded by known and inferred faults. Each terrane is characterized by distinctive stratigraphic sequences that differ substantially from those of adjoining terranes. The depositional and structural histories recorded in each terrane are so different that large-scale tectonic juxtaposition seems to be demanded. The result of this juxtaposition is a mosaic of discrete tectonic elements that record a long and complex history of amalgamation and accretion to the continental margin of North America. The history of amalgamation begins in Permian time, the age of the oldest rocks known to overlap any two of the terranes (figure 2 and columnar sections 7 and 8). The major episode of accretion apparently was in Late Cretaceous time, the age of the youngest regionally penetratively deformed rocks in southeastern Alaska (Berg and others, 1972). Subsequent tectonic activity has been mainly (a) redistribution of these terranes along major fault zones, such as the Chatham Strait fault, and (b) Cenozoic intrusion, thermal metamorphism, and local deposition of continental volcanic and sedimentary rocks.

The purpose of this map is to show the distribution of the 10 terranes and their known and inferred bounding faults; the accompanying 22 columnar sections show the internal stratigraphic characteristics; an interpretive cross section (fig. 1) illustrates the dominant structural style of each terrane; and a correlation diagram (fig. 2) shows key stratigraphic units and regional relations of the terranes. The distribution and character of the terranes in Canada are generalized from journal articles and from reports of the Geological Survey of Canada; those of terranes in Alaska are largely based on our fieldwork and our interpretation of investigations by U.S. Geological Survey colleagues.

SUMMARY DESCRIPTIONS OF THE TERRANES

Chugach terrane (columnar section 12): The Chugach terrane comprises complexly deformed and metamorphosed upper Mesozoic graywacke, shale (argillite), mafic volcanic rocks, and melange. It probably is continuous with the Yakutat Formation and correlative accretionary flysch, greenstone, and melange that crops out nearly continuously along the southern margin of Alaska at least as far as Kodiak Island (Plafker, 1967; Plafker and others, 1977). We speculate that the terrane is floored by Upper Jurassic oceanic crust because the melange contains (among other clasts) blocks of radiolarian chert of Late Jurassic to Early Cretaceous (Valanginian) age associated with pillow basalt and minor serpentinite. The Chugach terrane is separated from Wrangellia and probably correlative rocks by the Border Ranges and related faults (Plafker and others, 1976; Brew and others, 1978); the contact with the Alexander (Craig) terrane is the Peril Strait and Chatham Strait faults. The western limit of the terrane is inferred to be an offshore fault west of the Fairweather fault, and the offshore part of the Fairweather fault itself. The name "Chugach terrane" herein replaces "younger Chugach terrane" of earlier reports (Berg and others, 1972); the former term is abandoned because it no longer is necessary to distinguish this terrane from "older Chugach terrane", which now is interpreted as part of "Wrangellia" (Jones and others, 1977).

Wrangellia (columnar sections 10 and 11): As defined by Jones and others (1977), Wrangellia comprises a distinctive suite of Triassic and upper Paleozoic rocks that extends from southern Alaska to Vancouver Island, and perhaps beyond. Key rock types are thick piles of mid-Triassic tholeiitic basalt overlain by shallow-water marine Triassic limestone. Paleomagnetic measurements on this basalt in southern Alaska indicate that it formed in near-equatorial paleolatitudes (Hillhouse, 1977). In southeastern Alaska, the Goon Dip Greenstone and Whitestripe Marble on Baranof and Chichagof Islands (Loney and others, 1975) lithologically resemble these key units, and thus are correlated with them, even though no fossil data are yet available to substantiate this correlation.

On Baranof and Chichagof Islands, amphibolite crops out along with Goon Dip Greenstone and Whitestripe Marble in the upper plate of the Archipelago segment of the Border Ranges fault (Plafker and others, 1976). Based on this association, we speculatively assign this amphibolite to Wrangellia. In southeastern Alaska, Wrangellia is separated from Alexander (Craig) terrane by Peril Strait fault and by the eastern limit of the Tarr Inlet suture zone (Brew and Morrell, 1978). In Queen Charlotte Islands, it is bounded by the offshore Queen Charlotte fault, and by inferred faults beneath Dixon Entrance and Hecate Strait.

Alexander terrane (columnar sections 1-9): Alexander terrane is distinguished by a complex stratigraphic sequence of Precambrian to Permian age. In southern southeastern Alaska, it is characterized by Paleozoic shallow-water carbonate and clastic rocks with interspersed mafic to silicic volcanic rocks; in northern southeastern Alaska, the clastic rocks are dominantly deepwater calcareous turbidite. The rocks in Alexander terrane are regionally less penetratively deformed and complexly metamorphosed than the rocks in adjacent terranes (Berg and others, 1972). The original terrane, as defined by Berg and others, is herein subdivided into three subterranes, as follows:

Craig (columnar sections 1-7)--Craig subterrane contains the only Precambrian rocks known in southeastern Alaska, and is distinguished by a relatively complete and undeformed sequence of Ordovician through Carboniferous strata. These rocks and their assumed correlatives occur mainly on Prince of Wales and Kuiu Islands; a less complete sequence occurs in the block west of the Chatham Strait fault (see Principal References for Craig subterrane). Preliminary results of paleomagnetic studies in the Craig area of Prince of Wales Island indicate that the rocks have undergone about 35° of counterclockwise rotation and 15 1/2° of northward movement since Late Ordovician to Pennsylvanian time (C.S. Gromme, personal communication, 1978). Craig subterrane is bounded by the Chatham Strait and Peril Strait faults, by the Clarence Strait fault and its inferred extension, and by the Tarr Inlet suture zone.

Admiralty (columnar section 8)--Admiralty subterrane is distinguished by a sequence of Paleozoic (Devonian?) marine metabasalt and carbonate, and overlying(?) radiolarian chert and tuff on Admiralty, Kupreanof, and possibly Zarembo Islands. Our reconnaissance field studies in 1978 suggest that older rocks on Admiralty Island are in fault contact with this sequence. A key stratigraphic unit is the Cannery Formation, which previously was considered to be Permian in age (see Principal References for Admiralty subterrane). New collections of conodonts and radiolarians from chert prove a Late Devonian age for the Cannery on Kupreanof Island (D. L. Jones, unpublished field data, 1978). Pebbles and cobbles of Cannery chert, dated as Late Devonian and Mississippian, occur in the eastern part of the Permian Halleck Formation, which is part of the Craig subterrane, on the Keku Islets (columnar sections 7 and 8). Preliminary results of paleomagnetic studies of the Hound Island Volcanics in the Keku Islets area indicate that the rocks have undergone 90° of counterclockwise rotation, but no change in latitude, since Late Triassic time (C. S. Grommé, personal communication, 1978). On the southwest, Admiralty subterrane is separated from Craig subterrane by the Chatham Strait fault and by the Clarence Strait fault and its inferred extension. On the northeast, it is in both stratigraphic and inferred fault contact with rocks of the Gravina-Nutzotin belt.

Annette (columnar section 9)--The Annette subterrane is distinguished by a heterogeneous assemblage of Devonian and older intrusive, extrusive, clastic, and carbonate rocks and their assumed correlatives on and near Annette Island (see Principal References for Annette subterrane), and by the absence of any known post-Middle Devonian Paleozoic strata. Pre-Middle Devonian(?) keratophyre and spilite on Annette and Gravina Islands are lithically and chemically similar to rocks in the Wales Group of Craig subterrane, but available stratigraphic data do not yet warrant correlating them. Annette subterrane is separated from Craig subterrane by Clarence Strait fault and from Taku terrane by mapped and inferred thrust faults. On Annette and Gravina Islands, it is in both fault and stratigraphic contact with the Gravina-Nutzotin belt.

Gravina-Nutzotin belt (columnar sections 13-17): This terrane comprises Upper Jurassic to mid-Cretaceous marine flyschlike argillite and graywacke, minor nonmarine strata, interbedded andesitic to basaltic volcanic and volcaniclastic rocks, and subvolcanic plutons ranging from quartz diorite to dunite and peridotite. The belt has been traced discontinuously from southernmost southeastern Alaska to, and possibly beyond, the eastern Alaska Range (see Principal References for Gravina-Nutzotin belt). On the southwest, the belt is in both stratigraphic and inferred fault contact with the Craig, Admiralty, and Annette subterranes of the Alexander terrane. Northwest of Juneau, the belt is truncated on the west by the Chatham Strait fault (G. Plafker, personal communication, 1978); near Annette Island, the southern end is truncated by an inferred thrust fault. On the northeast, it is separated from Taku terrane by mapped and inferred thrust faults.

Taku terrane (columnar sections 18 and 19): The Taku terrane consists of a heterogeneous, complexly deformed, intruded, and metamorphosed assemblage of andesitic, basaltic, and minor rhyolitic(?) volcanic and volcaniclastic rocks, widespread marine flyschlike argillite and graywacke, and minor limestone, marble, and conglomerate. The terrane contains sparse, only locally well-preserved, fossils ranging in age from late Paleozoic to Late Triassic (see Principal References for Taku terrane). It is separated from Gravina-Nutzotin belt by mapped and inferred thrust faults, and from Alexander (Craig) terrane by the Chatham Strait fault. The boundary with Tracy Arm terrane herein is defined as the approximate contact between known and inferred late Paleozoic and younger rocks on the southwest, and paragneiss, schist, and marble of unknown premetamorphic age on the northeast. In many places, this boundary coincides with, or lies not far below, the footwall of a foliated tonalite sill that marks the southwest edge of the Coast Range batholithic complex in southeastern Alaska (Brew and others, 1976). South of Whiting River, it also approximates the position of the Coast Range megalineament (Brew and Ford, 1977a, 1978), an enigmatic structural and geophysical feature that locally also marks the southwest edge of the Coast Range batholithic complex.

Tracy Arm terrane (columnar section 20): The Tracy Arm terrane includes paragneiss, schist, marble, and diverse plutons of the Coast Range batholithic complex [also called "Coast Range intrusive and metamorphic complex" (for example, Hutchison and others, 1973), "Coast Plutonic Complex" (for example, Tipper and 1978), and diverse other terms]. The premetamorphic ages of the sedimentary and volcanic protoliths of the paragneiss, etc., are unknown (see Principal References for Tracy Arm terrane). Preliminary results of isotopic (K-Ar, U-Pb) dating studies indicate episodes of plutonism at about 140 m.y. (J. Arth and T. Stern, written communication, 1978); 80-100 m.y.; 45-50 m.y.; and 20-30 m.y. (Berg and others, 1978; J. G. Smith, unpublished data). K-Ar studies of the paragneiss suggest sillimanite-grade regional metamorphism at about 80-100 m.y. and about 45-50 m.y. The boundary between Tracy Arm and Stikine terrane as defined in this report is poorly known, and is drawn along the irregular contact between the Coast Range batholithic complex on the southwest and late Paleozoic and younger rocks of the Intermontane Belt of British Columbia on the northeast (Tipper and others, 1978). As noted below, the actual boundary probably lies within the complex and its definition will require more detailed work there. Near Hyder, the contact is a zone of northeast-dipping thrust faults that has been intruded by mid-Cenozoic plutons; in addition, recent investigations there have failed to produce any evidence that Tracy Arm terrane ever was stratigraphic basement to the upper Paleozoic rocks of Stikine terrane (Berg and others, 1977a). Extrapolating from these admittedly scanty data, and from fundamental differences in Jurassic stratigraphy and tectonic history between Stikine terrane and terranes to the west (see "Stikine terrane"), we infer that the boundary between Tracy Arm and Stikine terranes is a major suture zone that at least locally is marked by a northeast-dipping thrust zone intruded by mid-Cenozoic plutons of the Coast Range batholithic complex. The boundary between Tracy Arm and Taku terrane is described under "Taku terrane".

Stikine terrane (columnar section 21): In this report the Stikine terrane includes Carboniferous and Permian andesitic, basaltic, and minor rhyolitic volcanic and volcaniclastic rocks and interbedded marine clastic sedimentary rocks and limestone. This key basal assemblage is stratigraphically overlain by Upper Triassic to Upper Jurassic marine sedimentary, basaltic, and andesitic volcanic rocks, and by lower Cretaceous and younger marine and continental volcanic and sedimentary strata (see Principal References for Stikine terrane). A fundamental distinguishing feature of the Stikine terrane is that it contains widespread lower and Middle Jurassic volcanic rocks (Souther, 1977) that nowhere occur in terranes to the west. This implies a major tectonic suture at the southwest boundary of the Stikine terrane. Reconnaissance field studies (Berg and others, 1977a) indicate that the boundary between Stikine and Tracy Arm terranes at least locally is a northeast-dipping thrust zone intruded by mid-Cenozoic plutons (see description of Tracy Arm terrane). Stikine terrane is separated from Cache Creek terrane by the Nahlin fault and its inferred extensions.

Cache Creek terrane (columnar section 22): In this report, the Cache Creek terrane is distinguished by a key basal sequence of Mississippian alpine ultramafic rocks and overlying younger Paleozoic marine basaltic pillow flows and breccia, and chert, limestone, and clastic rocks. Distinctive Permian fusulinid faunas indicative of the Tethyan faunal province are abundant in the limestone (Monger and Ross, 1971). This assemblage is in fault contact with lower Mesozoic marine clastic and subordinate volcanic rocks, and is overlain by Jurassic and Cretaceous marine and nonmarine strata (see Principal References for Cache Creek terrane). The Cache Creek terrane is bounded on the southwest by the Nahlin fault and its inferred extensions, and on the northeast by the Teslin fault and its inferred extensions.

PRINCIPAL REFERENCES FOR THE TERRANES

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- Plafker, 1967
- Plakfer and others, 1976, 1977

Wrangellia:
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- Brew and others, 1978
- Hillhouse, 1977
- Jones and others, 1977
- Loney and others, 1975
- Plafker and others, 1976
- Sutherland Brown, 1968

Alexander terrane:
- Berg and others, 1972

Craig subterrane:
- Brew and others, 1978
- Buddington and Chapin, 1929
- Churkin and Eberlein, 1977
- Eberlein and Churkin, 1970
- Loney and others, 1975
- Rossman, 1963

Admiralty subterrane:
- Buddington and Chapin, 1929
- Lathram and others, 1965
- Loney, 1964
- Muffler, 1967

Annette subterrane:
- Berg, 1972a, b
- Berg and others, 1978

Gravina-Nutzotin belt:
- Berg, 1972a, b
- Berg and others, 1972
- Berg and others, 1978
- Buddington and Chapin, 1929
- Ford and Brew, 1973
- Lathram and others, 1965
- Loney, 1964

Taku terrane:
- Berg and others, 1977a, b; 1978
- Brew and Ford, 1977a, b; 1978
- Brew and others, 1977
- Buddington and Chapin, 1929
- Ford and Brew, 1973

Tracy Arm terrane:
- Berg and others, 1976, 1977a
- Brew and Ford, 1977b
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- Ford and Brew, 1973, 1977
- Tipper, 1978

Stikine terrane:
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- Smith, 1977
- Souther, 1971
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- Tipper, 1976

Cache Creek terrane:
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MAP SHOWING PRE-CENOZOIC TECTONOSTRATIGRAPHIC TERRANES OF SOUTHEASTERN ALASKA AND ADJACENT AREAS

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1978
Revised 1980