

GEOLOGY OF THE BURNABY ISLAND/RAMSAY ISLAND MAP AREA QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA

SHEET 1 OF 2
\$10.00

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SYMBOLS

- ↗↘ bedding (inclined, vertical)
- ↗↘ foliation or cleavage (inclined, vertical)
- ↗↘ fold axial surface (inclined, vertical)
- ↗↘ joint (inclined, vertical)
- ↗↘ fold axis
- ↗↘ mineral lineation
- stratigraphic or intrusive contact (defined, approximate, inferred)
- ↗↘ fault, showing dip amount and direction (defined, approximate, inferred), arrows give apparent offset (D = downthrown side)
- ↗↘ antiform axial surface trace
- ↗↘ synform axial surface trace
- ▲ isotopic date (1 Anderson and Reichenbach, 1991; 2 Young, 1981; 3 UBC geochron file, reported in Hickson, 1991)

LITHOLOGIC UNITS

- TERTIARY**
- Tr intrusive rocks, undifferentiated commonly altered, locally tectonized fine-grained quartz diorite and diorite, felsic dykes and stocks
- Eocene and Oligocene**
- Tv unnamed volcanic rocks, undifferentiated (K-Ar: 36, 41 Ma); mafic to intermediate flows and epiclastic sedimentary rocks
 - Tv1 thickly-stratified lahar with 0.1-2.0 m subangular boulders
 - Tvs epiclastic sandstone and conglomerate
- CRETACEOUS**
- KH Haida Formation thin-bedded shale, siltstone, and fine-grained sandstone
 - KH1 contains >75% felsic to intermediate dykes and sills
 - KS Skidegate Formation thin- to medium-bedded turbidite sandstone and shale
 - KL Longarm Formation thickly-bedded to massive sandstone and conglomerate
- JURASSIC**
- Middle to Late Jurassic
- JrB Burnaby Island Plutonic Suite (U-Pb: 171-172 Ma; K-Ar: 145-164 Ma); medium-grained equigranular, veined quartz diorite, monzodiorite, quartz monzodiorite, and diorite
- Bajocian**
- JrY Yakoun Group epiclastic medium-bedded to massive sandstone, conglomerate, calcareous siltstone
- TRIASSIC AND JURASSIC**
- Upper Carnian to Sinemurian
- JrTrK Kunga Group undifferentiated
 - Upper Norian to Sinemurian
 - JrTrS Sandilands Formation thin-bedded fine-grained sandstone, argillite, limestone, tuffaceous siltstone
 - Lower and Middle Norian
 - JrTrP Peril Formation dark grey to black thin-bedded limestone
 - Upper Carnian and Lower Norian
 - JrTrS Sadler Limestone massive grey crystalline limestone
- TRIASSIC**
- Carnian
- TrX Karmutsen Formation mafic volcanic flows, flow breccias, pillowed flows

DESCRIPTIVE NOTES

STRATIFIED ROCKS

Rocks in the Burnaby Island/Ramsay Island map area range in age from Late Triassic to Tertiary. The Upper Triassic Karmutsen Formation largely comprises basaltic composition pillowed flows, volcanic breccia, and massive flows, and forms extensive outcrops on Moresby Island west of Burnaby Strait and south of Skincuttie Inlet, and on the western part of Burnaby Island. Along Burnaby Strait a sub-mylonitic to strongly mylonitic foliation obscures the original igneous textures. The Karmutsen Formation is conformably succeeded by Upper Triassic and Lower Jurassic carbonate and siliclastic rocks of the Kunga Group (Sadler Limestone, Peril Formation, and Sandilands Formation), best exposed at Huxley Island, Skincuttie Inlet, and along shorelines of Burnaby Island. The lowest unit (Sadler Limestone) locally interfingers with pillowed flows of the underlying Karmutsen Formation. Lithologies present in the Kunga Group reflect gradually increasing water depths on a subsiding shelf, well documented by sedimentological studies elsewhere in the Queen Charlotte Islands (Dewochers and Orchard, 1991).

A regional Middle Jurassic unconformity separates the Karmutsen Formation and Kunga Group from younger strata. Lowermost rocks above this unconformity are Middle Jurassic (Bajocian) pyroclastic and volcanogenic sedimentary rocks of the Yakoun Group. These likely covered extensive parts of the map area when deposited, but are presently limited to three isolated outcrop areas.

No stratigraphic record exists for the remainder of the Middle Jurassic and all of the Upper Jurassic. A second major unconformity occurs at the base of the Lower Cretaceous Longarm Formation, and is spectacularly exposed on Anichika Island and at Skincuttie Inlet. In these localities a basal conglomerate lag deposit grades upward into thickly-bedded to massive sandstone, turbidite sandstone and siltstone of the Skidegate Formation, and mudstone and siltstone of the Haida Formation form the remainder of Cretaceous strata in the map area. The Skidegate Formation defines a northerly-trending outcrop belt on western Burnaby Island; the Haida Formation crops out on Ramsay, Marchion, and Hespeling islands, and on eastern Moresby Island south of Goodwin Point. Elsewhere in the Queen Charlotte Islands these units conformably succeed sandstones of the Longarm Formation (Haggart, 1991); this relationship generally holds in the present map area except along the south shore of Ramsay Island, where Longarm Formation conglomerate and sandstone overlies turbidite beds typical of the Skidegate Formation. The Longarm and Haida formations are lithologic equivalents to the Cretaceous sandstone and Cretaceous shale map units proposed by Haggart et al. (1991) and used on geologic maps of the central Queen Charlotte Islands by Hesthammer et al. (1991) and Indrelid et al. (1991). The Skidegate Formation is equivalent to the turbidite subdivision of the Cretaceous shale unit.

Youngest stratified rocks in the map area are Tertiary volcanic flows, lahars, and interstratified volcanogenic sedimentary rocks, which unconformably overlie the older units. Volcanic components are intermediate to mafic in composition and commonly feldspar-phyric. Exposures of this unit are limited to the northern map area on Huxley, Ramsay, and adjacent islands. An Oligocene age for the flows is constrained by K-Ar isotopic dates of 35.9 ± 1.4 Ma and 41.1 ± 1.4 Ma (compiled by Hickson, 1991).

INTRUSIVE ROCKS

Intrusive rocks in the map area include Jurassic and Tertiary plutonic suites and extensive Tertiary dykes. The Upper Jurassic Burnaby Island plutonic suite (U-Pb = 158-168 Ma, Anderson and Reichenbach, 1991) is represented by the Pole Point, Jedway, and Colson Bay plutons (Anderson and Greig, 1999). These intrusions are dominantly medium-grained quartz monzonite, quartz monzodiorite, and quartz diorite, and are characterized by pervasive alteration and veining along fracture surfaces (Anderson and Greig, 1999). Slam deposits are associated with these plutons where they intrude calcareous lithologies of the Kunga Group. These deposits have been extensively mined at Jedway and Ikeda Cove, as well as exploited by drilling and tunneling throughout the Skincuttie Inlet area.

The San Christoval plutonic suite was not examined in the present mapping, but is known from previous mapping (Sutherland Brown, 1968) to crop out extensively in the southwest corner of the Burnaby Island map sheet, just outside the present map-area limits.

A belt of northerly-trending Tertiary plutons intrude Cretaceous and older units on western Burnaby Island. These intrusions are typically fine to very fine-grained, highly-altered diorite to quartz diorite, and locally contain tectonic foliations.

STRUCTURAL GEOLOGY

The structural history of the Burnaby Island/Ramsay Island area is substantially different from that outlined for more northerly parts of the Queen Charlotte Islands (Thompson et al., 1991; Lewis and Ross, 1991). No evidence exists in the map area for the well-documented Middle Jurassic and Late Cretaceous tectonic events. Upper Jurassic block faulting and erosion from uplifted areas, described by Thompson et al. (1991) on northern Moresby Island, is supported by two geologic relationships: Firstly, the Lower Cretaceous Longarm Formation overlies a variety of basement rocks, and Yakoun Group strata have been stripped from large areas of the map area. Secondly, the Late Jurassic (U-Pb = 168 Ma, Anderson and Reichenbach, 1991) Poole Point pluton is exposed beneath the Lower Cretaceous unconformity in Poole Inlet, implying Late Jurassic pluton unroofing.

Most structural features in the map area are related to Tertiary movement along the Louscoone Inlet fault system (LIFS) (Lewis, 1991). The LIFS comprises a group of subparallel, north-northwest trending faults which extend for over 120 km through the southern Queen Charlotte Islands (Sutherland Brown, 1968). It crosses the map area from Slim Inlet in the south, to west of Burnaby Island in the north, and divides the region into three structurally distinct domains (Fig. 1). West of the fault system, internally undeformed Karmutsen Formation rocks have moderate southwest stratal dips. The LIFS itself forms a 3 km-wide central fault zone characterized by abundant north-northwest-trending faults and intrusive contacts, locally intensely folded and faulted rocks, and penetrative tectonic fabrics. East of the fault zone, north-dipping beds are cut by orthogonal east-west and north-south trending fault systems.

Western Domain

Almost all of the area west of the fault zone is underlain by pillowed flows and volcanic breccia of the Karmutsen Formation. Stratification generally dips moderately to the southwest, except west of Tangle Cove where bedding in a several hundred metre-thick section of volcanic breccia dips to the south-southeast. Primary igneous features are well preserved, and tectonic fabrics are absent except for narrow (<4 m wide), steeply-dipping brittle shear zones with variable trends. The brittle shear zones are commonly filled with carbonate gouge and breccia, but are not traceable for more than a few hundred metres.

Central (Fault Zone) Domain

Map units in the central domain outline northerly-elongate belts bounded by faults and intrusive contacts. Map-scale faults dip steeply and occur in two main orientations: trending 160°-180°, and trending 110°-130°. Map-scale fault offset markers are lacking, but well-developed mesoscopic and microscopic kinematic indicators unequivocally indicate dextral strike-slip motion (Lewis, 1991). These fabrics are best displayed in rocks of the Karmutsen Formation and Kunga Group at Slim Inlet and Smith Point. At these localities, steeply-dipping mylonitic foliations striking 160° to 185° contain subhorizontal elongation lineations. At Slim Inlet, the mylonitic foliation is locally re-oriented by mesoscopic Z-folds and kink bands. Both folds and kink bands have variably plunging axes contained in the regional foliation and subvertical axial surfaces trending 100°-110°.

Thinly to medium-bedded strata of the Peril, Sandilands, and Skidegate formations in the fault zone commonly contain tight to isoclinal folds with penetrative axial planar cleavage. Fold axes plunge shallowly to steeply to the northwest and southeast, and subvertical axial surfaces trend from 130° to 160°. Deformed fossil prints at several localities confirm that cleavage surfaces coincide with the plane of flattening. This flattening orientation is consistent with strains in a northerly-trending, dextral-slip fault zone, and the absence of such folds and fabrics outside the fault zone suggest that faulting and fold formation are genetically related.

Eastern Domain

Areas east of the fault zone have two characteristic structural features: all rocks lack penetrative fabrics, and stratal dips are almost exclusively to the north-northeast. Extensive Jurassic and Tertiary plutons intrude and locally metamorphose these rocks (see Anderson and Greig, 1999). Folds are absent, even in locations where sections of well-bedded strata several kilometres long (Sandilands and Peril formations) are exposed. Two major faults sets occur. Faults trending 070°-100° dip gently to steeply southward, and usually have tens to hundreds of metres of south-side-down, dip-slip offset. These are cut and offset by subvertical to steeply east-dipping faults trending 150°-180°. Faults of both sets occur as discrete surfaces or as narrow (<0.5 m) brecciated zones. Slickensides preserved on the north-northwest trending faults are either subhorizontal or subvertical, and apparent slip directions are right lateral or east-side-down.

Interpretation

The structural geometry of the map area indicates a history dominated by dextral strike-slip faulting along the LIFS. This faulting occurred on north-northwest trending faults distributed across the width of the central fault zone, and was correlative with and linked to extensional faulting to the east. The most compelling evidence supporting strike-slip faulting comes from mesoscopic and microscopic dextral kinematic indicators observed along faults. In addition, flattening fabrics and fold axial planes within the fault zone are steep and trend northwesterly, consistent with dextral offset along a north-northwest-trending fault system. Northwest-trending folds of mylonitic fabrics at Slim Inlet likely record late stage, northeast-directed flattening and folding superimposed on the older, more northerly-trending shear fabric. Map-scale features, although not conclusive in themselves, also support a strike-slip interpretation. The system of braided faults bounding structural blocks with strata of varying ages shown in the present mapping is a geometry typical of wrench fault systems.

DESCRIPTIVE NOTES

Structures east of the fault zone formed during north-south extension. The combination of gentle to moderate north-northwest dips and moderately to steeply-dipping, south-side-down normal faults is strong evidence for asymmetric, south-directed extension. Normal faults do not extend into the fault zone, suggesting that movement on them was either antecedent to or synchronous with dextral strike-slip faulting. If normal faulting had preceded transcurent faulting, structural styles similar to those east of the fault zone should occur offset to the north on the west side of the fault zone, neither present map studies (Tate, 1991; Thompson et al., 1991) nor Sutherland Brown's (1968) original mapping recognize such an area.

DESCRIPTIVE NOTES

Lewis (1991) estimates the amount of offset along the LIFS by assuming that the system is fixed in the central Queen Charlotte Islands where Thompson et al. (1991) find no offset, and assuming that fault motion is transformed into synchronous extension of areas east of the fault. These calculations indicate minimum offsets of at least 10 km. Most of this movement must be subsequent to deposition of Oligocene volcanic strata, which are cut by elements of the fault system and are involved in extensional tilting in the eastern domain.

Major faulting was not observed to the west of the fault zone, which remained rigid during deformation. The regional southwest tilt in this block may reflect younger tilting, postdating the strike-slip faulting.

DESCRIPTIVE NOTES

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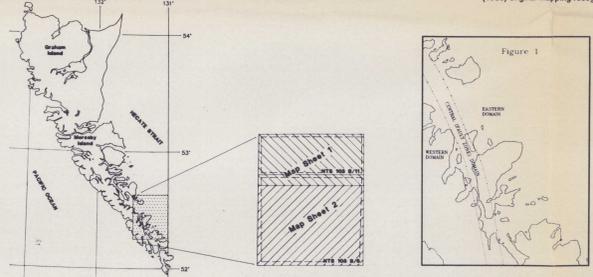
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