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WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES
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Geologic Map of the Washington Portion of the Roche Harbor 1:100,000 Quadrangle

by Robert L. Logan

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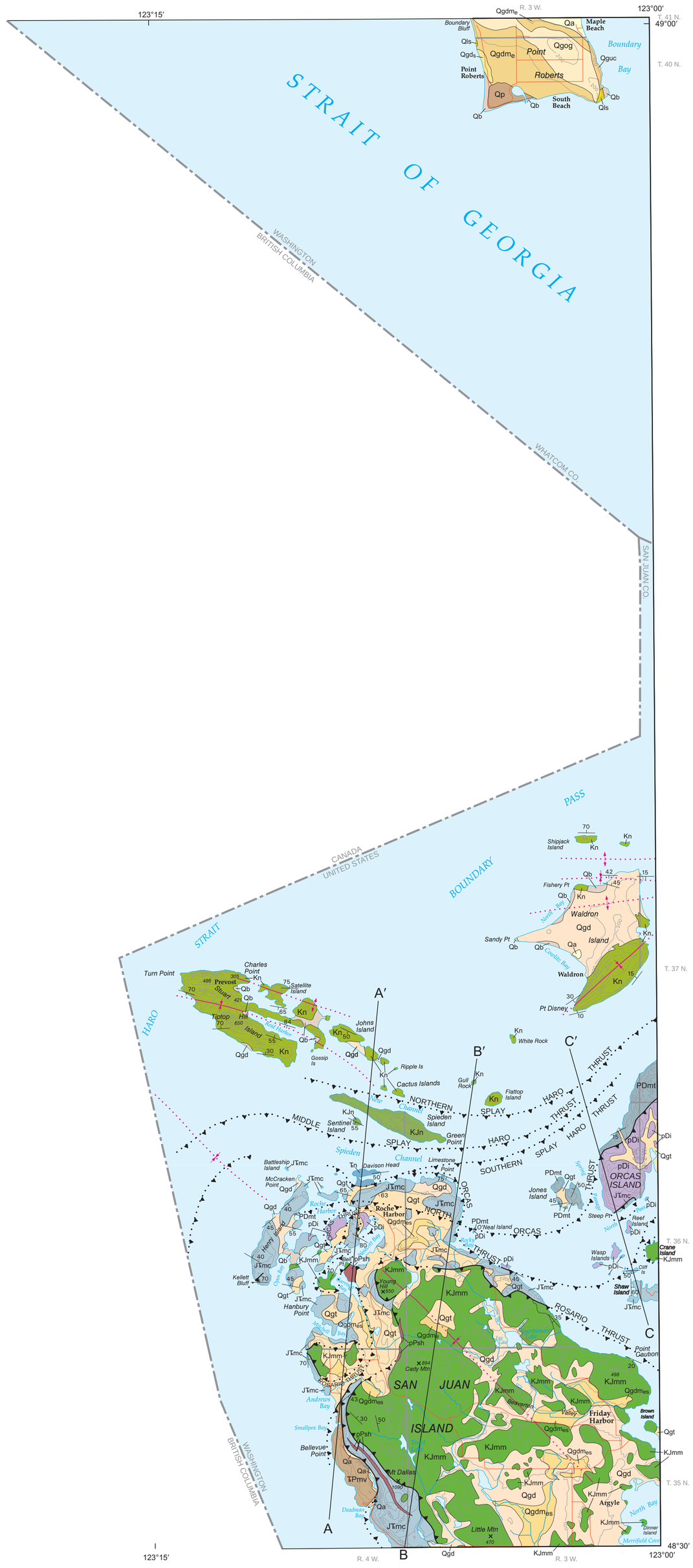

SCALE 1:100,000

1 0 1 2 3 4 5 6 7 8 MILES

1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

contour interval 100 feet

Lambert conformal conic projection
North American Datum of 1927
Base map information from the Washington Department of Natural Resources Geographic Information System
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DESCRIPTION OF MAP UNITS

Quaternary Sediments

NONGLACIAL DEPOSITS

Qa — **Alluvium (Holocene)**—Sorted combinations of silt, sand, and gravel deposited in streambeds and alluvial fans; clasts are generally rounded and derived from local bedrock sources or reworked Puget Lowland glacial deposits.

Qp — **Peat deposits (Holocene)**—Peat, muck, and lacustrine silt and clay rich in organic matter; deposited mostly in closed depressions.

Qls — **Landslide deposits (Holocene)—**Poorly sorted mixtures of locally derived earth materials emplaced by mass-wasting processes.

Qb — **Beach deposits (Holocene)**—Sand and (or) gravel with minor shell fragments deposited along shorelines; clasts are typically well rounded.

GLACIAL DEPOSITS

Fraser Glaciation

Qgd_s — **Drift, Sumas Stade (Pleistocene)—**Sand and gravel; deposited as strandlines along the west side of Point Roberts and overlying older glaciomarine drift.

$Qgdm_{es}$ — **Glaciomarine subtidal deposits, Everson Interstade (Pleistocene)**—Moderately well- to well-sorted sand, silty sand, and silt containing local pods and lenses of gravel; gray to bluish gray; laminated to thin-bedded, locally massive and cross stratified; deposited in a glaciomarine or marine environment during the Everson Interstade; preserved in topographic depressions below 200 ft elevation; generally overlies marine diamicton, till, and undifferentiated diamicton (units $Qgdm_e$, Qgt, and Qgd respectively); locally fossiliferous; radiocarbon ages from shells range from about 12.9 to 12.5 ka (description and ages compiled from Dethier and others, 1996).

$Qgdm_e$ — **Glaciomarine drift, Everson Interstade (Pleistocene)**—Generally poorly sorted to faintly stratified pebbly sandy silt and pebbly clay; locally capped by shallow-water clay or silt; consists of undifferentiated deposits of the Everson Interstade on Point Roberts.

Qgog — **Outwash gravel, Vashon Stade (Pleistocene)**—Recessional and proglacial stratified pebble, cobble, and boulder gravel deposited in melt-water streambeds and deltas. Includes part of the Vashon Drift.

Qgt — **Till, Vashon Stade (Pleistocene)—**Unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel, and boulders deposited by glacial ice; may contain interbedded stratified sand, silt, and gravel. Includes part of the Vashon Drift.

Qgd — **Drift, Vashon Stade (Pleistocene)—**Undifferentiated till, sand, gravel, silt, and clay; mostly Vashon till and outwash not separately mappable at the map scale. Consists of part of the Vashon Drift and part of the Everson Glaciomarine Drift.

Qguc — **Undifferentiated deposits (Pleistocene)**—Undifferentiated clay, silt, sand, gravel, and till; shown where steep slopes preclude more detailed delineation at map scale; on the east side of Point Roberts, includes units interpreted to be, from top to bottom, Bellingham Drift, Everson Drift, Vashon till, Vashon advance sandy outwash, and possibly a pre-Vashon silty sand.

Pre-Tertiary Rocks

SEDIMENTARY ROCKS

Kn — **Nearshore sedimentary rocks (Cretaceous)**—Sandstone, cobble conglomerate, shale, and turbidites deposited during several deep-marine to terrestrial cycles; strata are gently folded; found on Stuart, Waldron, and other small islands. Includes the Protection, Extension, Haslam, and Pender Formations of the Nanaimo Group as described by Ward (1978).

KJn — **Nearshore sedimentary rocks (Cretaceous–Jurassic)**—Volcanic-lithic pebble conglomerate and breccia with siltstone and sandstone interbeds; metamorphosed to the zeolite facies (Johnson, 1978). Consists of the Spieden Group.

T_Rn — **Nearshore sedimentary rocks (Triassic)**—Andesitic and dacitic siltstone, sandstone, tuff, conglomerate, breccia, and limestone at Davidson Head on the north end of San Juan Island; metamorphosed to the zeolite facies (Johnson, 1978). Consists of the Haro Formation.

METAMORPHIC ROCKS

KJmm — **Marine metasedimentary rocks (Cretaceous–Jurassic)**—Metamorphosed sandstone, argillite, mudstone, and conglomerate; commonly dark gray-brown and highly penetrated by veinlets of secondary minerals. Consists of the Constitution Formation.

JT_Rmc — **Metachert (Jurassic–Triassic)**—Metamorphosed gray or white ribbon chert with minor marble; locally contains quartzite, metamorphosed argillite and pillow basalt, basaltic tuff, greenstone, and phyllitic slate; commonly highly folded and locally chaotically disrupted; radiolarians from chert are early Jurassic to Triassic (Vance 1975); late Triassic conodonts found near Roche Harbor (Vance, 1975). Consists of the Orcas Formation.

$T_RP$mv — **Metavolcanic rocks (Triassic–Permian)—**Metamorphosed pillow basalt, breccia, tuff breccia, mafic tuff, and chert; contains metamorphic aragonite; contains minor fusulinid limestone (Brandon and others, 1988). Consists of the Deadman Bay Volcanics.

PDmt — **Metasedimentary and metavolcanic rocks, undivided (Permian–Devonian)**—Metamorphosed, well-bedded argillite and volcanic sandstone with basalt to rhyolite breccia, tuffs, and flows, as well as silicic hypabyssal rocks; also contains local pebble conglomerate, non-Tethyan fusulinid limestone, gabbro, and rare chert. Consists of the East Sound Group.

pPsh — **Schist (Pre-Permian)**—Well-foliated amphibolite, greenschist, blueschist, micaceous quartzite (metachert), mica-quartz (± garnet) schist, and rare marble. Consists of the Garrison Schist.

IGNEOUS ROCKS

pDi — **Intrusive rocks (Pre-Devonian)**—Metamorphosed gabbro, quartz diorite, tonalite, trondhjemite, diabase, and rare pyroxenite; local orthogneiss and metamorphosed basaltic to silicic dikes; veins of calcite, aragonite, and prehnite; metamorphosed to greenschist and amphibolite facies; a leucotonalite at Steep Point on Orcas Island yielded a Pb/U date of 405 ±15 Ma. Consists of the Turtleback Complex.

GEOLOGIC SYMBOLS

- Contact
- Fault, unknown offset
- Thrust fault—Sawteeth on upper plate; dotted where concealed
- Anticline—Dotted where concealed
- Syncline—Dotted where concealed
- 42 — Inclined bedding—Showing strike and dip

INTRODUCTION

In the Roche Harbor 1:100,000-scale quadrangle, the island landmass consists of pre-Tertiary sedimentary and metamorphic rocks partially covered by Quaternary sediments. McLellan (1927), Vance (1975, 1977), and Vance and others (1975) named many of the pre-Tertiary bedrock units, and Brandon and others (1988) described emplacement of these rocks along the late-Cretaceous San Juan thrust system. This thrust complex juxtaposed the diverse rock units found throughout the San Juan Islands.

Mapping for this project has better delineated major structures of the fault system that were shown somewhat schematically in Brandon and others (1988, 1994) and Vance (1975). In particular, the contact between the Turtleback Formation (unit pDi) and the East Sound Group (unit PMDmt), which Vance (1977) suggested is a major thrust fault, was mapped across Orcas Island during this study. The contact is exposed on the western shore of Orcas Island and does indeed appear to be a fault contact. This fault is shown on the map as the North Orcas thrust. Just off the western shore of Orcas Island, the North Orcas thrust swings south of Jones Island then westward under the northern tip of San Juan Island (cross section B).

The Orcas thrust (Brandon and others, 1988) is shown on this map passing north of Cliff and Crane Islands, which consist of Orcas Formation and Constitution Formation, respectively, and south of the rest of the Wasp Islands. The Wasp Islands north of the Orcas thrust consist of Turtleback Formation rocks. The Orcas Formation rocks at Steep Point probably represent a deformed klippe (cross section C). The Orcas thrust crosses a small section of the northeast coast of San Juan Island and passes between O'Neal Island and San Juan Island paralleling the shoreline of the larger island into Spieden Channel where it probably merges with the Haro thrust.

Outcrop patterns on northwest San Juan Island can be explained as two klippen and a fenster (cross section A). The klippen are both remnants of Constitution Formation overlying Orcas Formation. The two formations are separated by the Rosario thrust of Brandon and others (1988). The fenster is a hole or window in the Orcas Formation that exposes the underlying Turtleback Formation.

The mapping of Quaternary sediments by Dethier and others (1996) in the Friday Harbor area has been generalized to fit the scale of this map. Mapping from the Coastal Zone Atlas (Washington Dept. of Ecology, 1978) was modified to show the Quaternary sediments at Point Roberts, which is the only projection of the mainland into the quadrangle, and other areas throughout the quadrangle.

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