

Context:

Gabriola ice-age geology

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Gabriola's glacial drift—glossary

Nick Doe

Terms as used in this series of articles. This is not an authoritative explanation of relationships and textbook writers and other researchers may use different terminology. If in doubt, consulting Wikipedia is highly recommended.

¹²C: the common stable isotope of carbon.

¹³C: a stable isotope of carbon which is a little heavier and not so abundant. Some biological organisms distinguish to some degree between ¹³C and ¹²C even though they are chemically identical.

¹⁴C: the radioactive isotope of carbon used for dating organic material.

¹⁴C BP: years before present (1950 AD) based on the conventional radiocarbon age. Not to be confused with cal. BP.

707CP: The 707-acre community park in the west-centre highlands of Gabriola Island, BC, Canada.

A-horizons: in soil, the mineral layers nearest the surface, but not including any overlying organic (O) horizons.

ablation: loss of ice from a glacier or ice sheet mainly by melting but including calving.

ablation till: till accumulating on the surface of ice as it melts. Usually poorly or very poorly sorted lacking only clay and fine silt.

age: in geology, technically a subdivision of an epoch, but the term is often informally applied to any geological timeframe.

agglomerate: a breccia or conglomerate composed of pyroclastic fragments cemented with ash.

albite: a plagioclase mineral in the sodium-calcium series containing only sodium.

alluvial fan: sand and gravel deposited by streams moving from high ground on to a floodplain.

alpine glacier: see valley glacier. Type of glacier first studied in the Alps.

amphibole: a group of ferromagnesian minerals. Often black or very dark green.

andesine: a plagioclase mineral in the sodium-calcium series containing mostly sodium.

andesite: an extrusive igneous rock, intermediate between felsic and mafic. Very commonly from silicic (explosive, terrigenous) volcanism.

anorthite: a plagioclase mineral in the sodium-calcium series containing only calcium.

anorthosite: an intrusive igneous rock, mafic.

anticline: a \cap -shaped fold. U-shaped folds are called synclines.

aplite: a hypabyssal igneous rock, felsic. Common only as a fracture filling.

ASL, AMSL: above (mean) sea level.

asthenosphere: the viscous region of the upper mantle below the rigid lithosphere.

B-horizons: in soil, layers underlying the A-horizons. Layers where organic content is less and there is soil development as the result of weathering of minerals.

basal till: till from the bottom of a glacier. Sometimes called ground moraine, or when consolidated, lodgement till.

basalt: an extrusive igneous rock, mafic. Very commonly from non-explosive marine volcanism (seafloor spreading).

BC: [apart from Before Christ and British Columbia] a transitional soil horizon from B to C with B dominant.

bench: narrow strip of relatively flat ground with steeper inclines above and below it. Sometimes a former beach or, elsewhere, a river plain, but they could also have been created by parallel normal faults and differential erosion.

biotite: a mica, usually black or dark brown, rarely dark green. Common in intrusive rocks.

blockfield (*felsenmeer*): rock debris not at the bottom of a slope like talus consisting of large angular rocks usually, but not always, formed by freeze-thaw weathering of joints and along bedding planes.

Bølling-Allerød: an interstadial period immediately before the onset of the Younger Dryas.

borrow pit: excavation pit used to provide sand and gravel for construction, usually roads.

boulder: coarser than 64 mm. True boulders are >256 mm and small boulders (64–256 mm) are sometimes called cobbles.

BP: years before present in the radiocarbon dating system (¹⁴C). In these articles, “BP” is never used as a substitute for a calendar or calibrated date (AD/BC) though many authors do use cal.BP in that way, sometimes leaving the reader guessing as to what “present” is. See ¹⁴C BP and cal. BP

breccia: a sedimentary rock composed of cemented angular fragments of rocks which can be of any kind. If the fragments are rounded, the rock is called conglomerate.

brunisol: immature soil commonly found under forested ecosystems. The most identifying trait of these soils is the presence of a B-horizon that is yellowish brown.

C-horizons: in soil, parent material comparatively unaffected by the pedogenic processes operating in A- and B-horizons. They are the least weathered part of the soil profile and overlay the bedrock.

Ca: calcium.

cal. BP: calibrated or calendar years before present. The age calculated by converting a radiocarbon age to a calendar date (BC/AD) and using BP = present date – calendar date (AD +ve, BC –ve), where present date is 1950, 2000, or a date specified by the author.

calcite: a calcium carbonate mineral. Very common.

Capilano Sediments: see Fraser Glaciation.

CB: a transitional soil horizon from B to C with C dominant.

CDF: Coastal Douglas-Fir ecological zone.

channery (of sandstone): thin flat spalls of weathering rind cemented by iron oxides.

chatter mark: a succession of curved gouges in bedrock made by a single object.

chert: a form of *quartz* similar to flint, often bedded and sometimes derived from marine micro-organisms that use silica in their skeletons (radiolarians). It often looks slightly “soapy” compared to quartzite.

chlorite: a group of greenish minerals resembling micas.

cirque: a topographical feature of glacial origin shaped like a large bowl, open on the downhill side.

clast: an individual grain or fragment of rock. Sandstone and shale are clastic rocks, but igneous, metamorphic, and a few sedimentary rocks like limestone and dolomite are crystalline.

clay: any particle finer than 4 μm, although the word is often understood to mean “clay mineral”. Clay is not necessarily composed of clay minerals, it can be any comminuted mineral.

clayballs: clumps of clay easily crumbled, formed when sand/silt samples containing clay are dried.

clay mineral: a mineral that is nearly always, or only, found in clay-sized particles.

cobble: 64–256 mm. A small boulder.

cold glacier: one containing no meltwater and frozen to the bedrock. Often a continental glacier.

conglomerate: a sedimentary rock composed of cemented fragments of rounded rocks. The cement can be some form of silica, clay, or a mix of both. If the fragments are angular, the rock is called breccia.

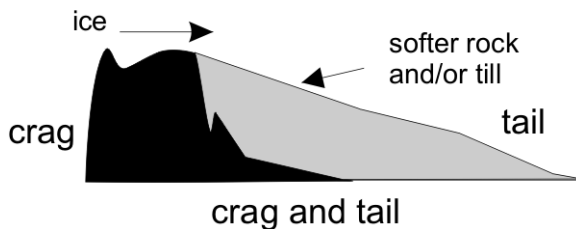
continental glacier: glacier that is so thick its flow is not controlled by landforms. The third and fourth phases of glaciation on the Davis & Mathews (1944) system. Also known as a continental ice sheet.

continental ice sheet: a continental glacier.

Coquitlam Stade: see Fraser Glaciation.

Cordilleran ice sheet: the Pleistocene ice sheet that covered large areas of northwestern North America, including most of British Columbia. Its eastern limit was the Continental Divide where at times it merged with the Laurentide ice sheet that covered most of eastern Canada.

crag and tail: a crag (cragg) is a rock, knoll, or hill, usually isolated, that has resisted erosion by the passage of ice. The tail is a tapered ramp of softer rock and/or till on the sheltered, downstream side. I don't know of any examples on Gabriola.



crenate fracture: a crescentic-shaped hairline fracture, usually convex up-ice. Not seen on Gabriola. See fracture.

crenate gouge: a crescentic-shaped gouge from which small chips of rock have been removed from the bedrock by ice. Normally, the deepest part of the gouge is down-ice and the open ends up-ice, but reverse crenate gouges are occasionally reported.

cross-bedding: strata where the angles of bedding planes vary within it. A common feature of dunes and river sandbars.

crystalline: see clast.

cumulate: a heavy concentration of what is normally a secondary mineral in igneous rocks.

cumulic: recently water-deposited surface soil.

cwm: (koom) Welsh name for a cirque.

dacite: an extrusive igneous rock, intermediate between felsic and mafic. A fine-grained equivalent of granodiorite.

diamict(on): sediment that consists of poorly or unsorted fragments of rocks of various kinds in a matrix of mud. Unlike the term "till", there is no assumption that a diamict has a glacial origin, though that possibility is not ruled out, and may even be likely.

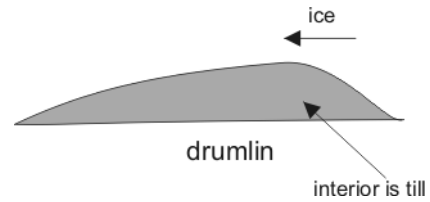
diorite: an intrusive igneous rock, intermediate between felsic and mafic, though commonly with more mafic minerals than granodiorite. Contains very little *quartz*.

draw: a small watercourse with a sloping V profile rather than one that is flat-bottomed with level banks.

drift: material transported by ice including sediment that had been reworked by meltwater or the sea by the time deglaciation was complete. The material is a result of crushing (sand) and abrasion (silt) of bedrock by rocks embedded in the ice, and it also contains gravel; boulders; pre-glacial soil, beach sand, sea-floor sediments; and other unconsolidated material.

dropstone: stone dropped from a melting iceberg into fine sediment. See rain-out.

drumlin: elongated hill or hummock, similar in profile to a crag and tail but composed entirely of till and possibly shaped by meltwater beneath the ice. Not observed on Gabriola, but there may be one at the south end of Mudge. A very common landform on plains that were formerly under a continental icesheet. See also rock drumlin.



dystric: soils lacking a well-developed mineral-organic surface horizon. They occur widely, usually on bedrock, and typically under forest vegetation.

E: east. E20°N = 20° north of east (70°).

englacial till: till carried within the body of the ice. Often surface till that has washed into a crevasse.

eon: see epoch.

epidote: a pistachio-green accessory mineral common in metamorphic rocks.

epoch: a geological timeframe analogous to an hour in the scale hour-day-month-year except that the timespans are not constant. The scale is **epoch-period-era-eon**. For example, *Pleistocene Epoch* (0.01–2.6 million-years ago)

Quaternary Period (0–2.6 million-years ago)

Cenozoic Era (0–65.5 million-years ago)

Phanerozoic Eon (0–542 million-years ago).

era: see epoch.

erratic: large boulder that has been transported by ice and is resting on the modern surface, often in isolation and of a type of rock that differs markedly from the bedrock.

escarpment: see scarp.

esker: long winding ridge of sand and gravel originally deposited by a subglacial stream. Common on the praries but not easy to identify here, even if they exist.

eustatic sea level: the average global sea level determined only by the volume of water and the volume of the ocean's basins. It excludes local changes in land level.

Evans Creek Stade: see Fraser Glaciation.

Everson Interstade: see Fraser Glaciation.

extrusive rock: lava. Usually with small crystals scarcely visible or invisible to the naked eye.

facies: any observable attribute of a sedimentary rock formation such as grain size that is in contrast with other parts of the same rock formation, but with no implication that they differ in age. Some authors however use the term more broadly with emphasis on the nature of the attribute, “marine facies” for example.

feldspars: common minerals that are chemically sodium-calcium or potassium aluminosilicate.

feldspathic: (of sandstone). Rich in feldpars in addition to quartz.

felsic: lightweight rock rich in feldspars. It is a continental-type rock, often with a pale or whitish colour unless coloured by iron oxides.

finer: fine silt, very-fine silt, and clay.

firn: snow that has been partially melted and refrozen making it more compact and older than snow or névé. In the articles, I make no distinction between firn and névé.

float: used in paleontology for samples not firmly embedded in bedrock.

flour: high concentration of fine-grained particles, mostly silt, carried by glacial streams.

flowerstone: (in these articles) fine-grained rock, often *basalt*, with large easily visible whitish crystals of what is nearly always *feldspar*. A fairly common beach stone.

flute: vertical groove, not necessarily of glacial origin as they can be created by salt weathering.

formation: any assemblage of rocks with common characteristics, including age, and forming a mappable unit.

Fm.: geological formation.

Fort Langley Formation: see Fraser Glaciation.

FOV: field of view (photograph scale).

fracture: any crack in the bedrock. Fractures caused by the passage of ice are crescentic fractures and friction fractures, neither of which is seen on Gabriola, possibly because the sandstone is too soft or weathers too readily compared to granitic rock.

friction fracture: a fracture caused by tensile stress when adjacent ice moves at different speeds while being fairly firmly frozen to the bedrock. See fracture.

Fraser Glaciation: west coast North American name for the Late Wisconsin Glaciation.

Climate change associated with the glaciation began about 29,000 ¹⁴C BP at the end of the Olympic non-glacial period, but ice probably did not appear in the coastal lowlands until 25,000 ¹⁴C BP. The major stage of the period is known as the Vashon Stade, which peaked *ca* 14,500 ¹⁴C BP. An earlier stage is known as the Coquitlam Stade (Evans Creek in the Skagit Valley), which peaked *ca* 20,000 ¹⁴C BP. Some researchers recognize a third minor stage late in the period called the Sumas Stade, *ca* 10,000–11,400 ¹⁴C BP and associated with the Sumas Drift and globally with the Younger Dryas.

The Port Moody Interstade was *ca* 18,000 ¹⁴C BP (post-Coquitlam Stade, pre-Vashon Stade). The Everson Interstade was a post-Vashon Stade, pre-Sumas Stade, associated with the Capilano Sediments and the Fort Langley Formation, and globally with the Bølling-Allerød Interstade.

There are various opinions on when the glaciation was “over”—it depends on location and definition—but the Pleistocene epoch ended about 10,000 ¹⁴C BP, which in calendar years is actually 11,700 years ago. “Ten-thousand years ago” is a phrase habitually used by geologists when there is no call for precision and it is understood that these are radiocarbon years.

geological period: see epoch.

glacial period: a long period (usually many thousands of years) during which average temperatures are below some long-term norm. The timing of a glacial period may vary with location, but not enough to blur its global significance. Within a glacial period there may be several glaciations.

glaciation: a locally recognized interval within a glacial period. Within a glaciation there may be several stades (stadial intervals).

glaciofluvial: drift that has been extensively sorted by flowing meltwater.

glaciolacustrine: drift deposited into a lake. Lakes created by ice dams were common during deglaciation.

glaciomarine: drift that has been deposited from ice directly into the sea.

gley: subsurface waterlogged clay, often grey-green colour with orange streaks (mottles) due to the ingress of oxygen via rootlets.

gleysol: gleyed soil.

gouge: curved indentations in bedrock created by stones transported by a glacier. Typically stones dig into the rock until either stone or ice gives way and the gouging abruptly terminates.

Gp.: geological group of formations.

grab sample: geologists term for a sample taken during operations that might not be part of a scientific investigation. Sample taken blindly or without prolonged consideration as to whether it is representative or not.

granite: a felsic intrusive rock containing *quartz* and a mix of feldspars with minor black or blackish minerals that are *biotite* or *hornblende*. Most “granite” stones and boulders you see on Gabriola are actually granodiorite or dacite. Large granite erratics don't exist here and granite outcrops are rare in

the Coast Mountains. True granite always contains more than 35% K-feldspar which is usually pink or orange.

granitic: any felsic intrusive rock containing *quartz* and a mix of feldspars, including Na/Ca-feldspars (*plagioclase*) and K-feldspars, with minor black or blackish minerals that are usually *biotite* and *hornblende*.

granodiorite: a very common felsic intrusive rock in the Coast Mountains. Like granite, but with only white Na/Ca-feldspar and no pink K-feldspar. Always with crystals of black or blackish minerals that are *biotite* or *hornblende*. When well-weathered, may contain shiny, golden yellow, *hydrobiotite*, or be pitted where mafic minerals and feldspars have eroded leaving *quartz*. A “salt-and-pepper” rock, very common in till and erratics on Gabriola.

granodioritic: same as “granitic” but excluding those rocks with less than 65% Na/Ca-feldspar. In these articles, the term includes granodiorite, tonalite, quartz-diorite, leuco-diorite, and anorthosite. It may also inadvertently be used in these articles for “white granite”, which is not common here, due to my failure to recognize white K-feldspars such as *sanidine* and *orthoclase* in hand samples.

granule: a particle in the range 2–4 mm. A component of gravel.

gravel: collective term for granules (2–4 mm) and pebbles (4–64 mm). Fine gravel is 4–32 mm; coarse gravel is 32–64 mm. Angular gravel is rubble. Well-rounded fine gravel is pea gravel.

groove: glacial grooves are much wider than striae, often a metre or more, and are always polished. Probably created by fast-flowing turbulent meltwater rather than ice. Called “Nye channels”.

gulley: gullies are often good ice-age sites. It is not clear (to me) whether they were meltwater channels following underlying pre-existing bedrock features, or whether they were actually formed by concentrations of meltwater flowing in channels or crevasses in the ice. The MOTI and Somerset pits are good examples.

gumbotil: deeply weathered (leached) clay till, sticky when wet and hard when dry.

gyttja: in these articles, any black, stone-free, organic sludge, from waterlogged wetlands, usually derived from reeds and other aquatic vegetation but rotted to the point of being of unrecognizable composition.

Holocene: post-Pleistocene or “post-ice-age” epoch up to and including the present. The last twelve-thousand years or so.

horizon: a distinguishable layer of soil.

hornblende: a type of amphibole mineral. So common, the term is sometimes used for any amphibole.

humic: gleysol with a dark-coloured A-horizon.

humisol: organic soil in an advanced state of decomposition.

hypabyssal rock: a minor intrusive rock that rose from a great depth as magma and solidified before reaching the surface.

Ice Age (upper case): informal name for the Pleistocene Epoch during which more than eleven ice ages are known to have occurred.

ice age (lower case): a glaciation. Very commonly “the ice age” means the most recent one, known in North America as the Late Wisconsin Glaciation, and here on the west coast as the Fraser Glaciation.

ice cap: small version of a continental glacier.

igneous: volcanic, intrusive, and in some cases metamorphic, but not sedimentary.

imbricated: of stones whose orientation and/or shape indicate the direction of the flow of water or ice from which they were deposited.

interglacial period: a long period (usually many thousands of years) between glacial periods during which average temperatures are above some long-term norm. The timing of an interglacial period may vary with location, but not enough to blur its global significance.

interglaciation interval: between glaciations within a glacial period, commonly a non-glacial interval.

interlayer: a thin stratum sandwiched between two much thicker strata. On Gabriola, it may be a layer of sand- or siltstone in shale bedrock, or a layer of shale or siltstone in sandstone bedrock.

interstade (adj. **interstadial**): a short relatively warm period (a few thousand years at most) between stades. For example, the Port Moody Interstade.

interval: a smaller subdivision of time than a period.

intrusive rock: from magma that solidified slowly beneath the surface. Its crystals are large enough to be easily seen. Usually felsic. Associated with subduction zones and a major constituent of the Coast Mountains, but older intrusives (Jurassic) are also present on Vancouver Island.

isostatic depression: lowering of the land level due to the weight of the ice pushing it down into the earth's asthenosphere.

isostatic (post-glacial) rebound: the rise in land level at the end of the ice age as a result of the loss of ice, the weight of which had been pushing continental land down into the viscous rock of the earth's mantle (the asthenosphere).

joint: in these articles, a fracture with no subsequent displacement of one side of the rock relative to the other. In ice-age climates, these were very prone to freeze-thaw weathering.

K: potassium (*kalium*).

K-feldspar: any of the potassium feldspars.

ka: thousands of years (kiloanni).

kame: mounds of drift that originally accumulated in a meltwater-filled depression on the surface of decaying ice. Not known on Gabriola.

kaolinite: a clay mineral, common in Nanimo Gp. mudrock (shale).

kettle: depression in drift left behind when blocks of buried stagnant ice eventually melted. Not known on Gabriola although there are geomorphological features that superficially resemble kettles, (Dutchmans Swamp, for example) but are depressions in the sandstone bedrock of uncertain origin.

lag gravel: till from which all the fines have been washed out forming an erosional pavement.

last ice age: in these articles, the Fraser Glaciation.

lava: molten rock (magma) at the surface.

leucocratic: a light-coloured variant, a term especially used for granitic rocks. Used in the IUGS classification scheme for rock types to take account of percentage of mafic content. *Diorite* for example can be leucocratic (*leuco-diorite*) though it is usually rich in mafic minerals and is dark or melanocratic (*melano-diorite*).

loam: soil containing sand, silt, and clay.

lodgement till: unsorted very firm basal till that has been plastered on to the bedrock. Compacted under great pressure and in relatively dry conditions.

luvic: soil with a light-coloured well-weathered mineral (clay)-organic B-horizon.

luvisol: luvic soil.

mafic: rock comparatively rich in calcium, magnesium, and iron, and lacking *quartz*. Usually lava from gently-erupting submarine volcanoes and vents and commonly rock that makes up the ocean floor, or was formerly ocean floor. Mafic minerals are dark coloured or black due to their high iron content.

magma: molten rock below the surface.

massive: without visible bedding planes.

melanocratic: dark-coloured. See leucocratic.

melt-out till: till deposited from stagnant ice as it wastes away with only light or no sorting by flowing meltwater.

metamorphic: rock that has been altered by high temperature and/or pressure at depth in the earth. Sometimes the term includes metasomatic changes, sometimes not.

metasomatic: rock that has been altered by hot fluids, but without melting the rock.

migmatite: between igneous and metamorphic; often here a banded mix of gneissic *granodiorite* and amphibolite.

mineral: a naturally occurring inorganic solid that forms crystals with a well-defined chemical composition and physical characteristics. Almost all the earth's crust is made up of minerals together with liquids, organic material including coal, and one or two amorphous substances like obsidian. Mineral names are different from chemical names because some minerals, *quartz* and *cristobalite* for example, have identical chemical compositions (silica, silicon dioxide) but different crystalline structures. Ice is a mineral, but water is not.

Moh: Moh's scale is a scale of hardness 1–10. Geologists only define the hardness of minerals, not rocks (because rocks are a mixture), but it's an easy measurement to make, and even though it may be imprecise, it can help identify a rock.

montmorillonite: a clay smectite mineral, very common on Gabriola where it is a weathering product of fine-grained glacial till.

morainal: of landscapes. A blanket or veneer of glacial drift deposited directly on bedrock.

moraine: till deposited along the sides, or at the terminus, of a glacier; also on the divide between two merged glaciers.

MoTI (mow-tee): BC Provincial Ministry of Transportation and Infrastructure, *formerly* MoT, Ministry of Transport(ation).

moulin: well-like shaft in a glacier into which surface meltwater drains.

MRC: marine reservoir correction in radiocarbon years.

mud: mixed silt and clay.

mudrock: collective term for siltstone, claystone, and mudstone.

mudstone: from mud. Sometimes used for mudrocks such as slate and argillite that have been metamorphized to some degree.

N: north. N20°W = 20° west of north (340°).

Na: sodium (*natrium*).

Na/Ca-feldspar: *plagioclase*.

nailhead stria: short striae that get progressively deeper and then terminate abruptly down-ice (type 1). Some striae do the reverse (type 3), presumably due to plucking rather than ploughing, or oblique non-sliding impact. Type 3s are uncommon on Gabriola possibly because the sandstone bedrock is relatively soft and easily ploughed by harder abraders. There is an intermediate type (type 2) where the striae get progressively deeper and then shallower, possibly due to abrasion of the abrader.

NE: northeast.

névé: compacted, but still fresh snow. see firm.

nivation hollow: cirque-like hollow formed by erosion associated with patches of snow that are slow to melt in spring and early summer. A periglacial phenomenon not known on Gabriola, though I

sometimes wonder about the Commons Land, where a gardener tells me temperatures on the lower south side, in the winter half of the year, can be as much as 2°C lower than elsewhere on the land.

non-glacial interval: an interval within a glacial period when temperatures are cool; yet, glaciers did not advance locally because of lack of moisture. A non-glacial interval is an interglaciation interval, not to be confused with an interglacial period.

nunatak: high ground that protudes above the surface of an ice sheet. Such features remain ice free on stable ice sheets because their slopes are too steep to retain the ice.

NW: northwest.

Nye channel: broad groove cut by subglacial meltwater under high pressure.

Older Dryas: see Younger Dryas. The Older Dryas was an earlier cold period, *ca* 14,000 ¹⁴C BP, but evidence for it is not found globally.

Olympic Interglaciation Interval: An interglaciation interval from about 60-thousand years ago to the start of the Fraser Glaciation. It lies within the Wisconsin Glacial Period.

Olympic Non-glacial Interval: see Olympic Interglaciation Interval.

orthic: (loosely) very common soils with A, B, and C-horizons.

orthoclase: a potassium feldspar.

outwash: sand and gravel deposited by streams flowing from a glacier or ice cap often in alluvial fans.

pavement: accumulated stones (lag gravel) with a noticeable number lying on sides that were ground flat by a glacier (imbricated).

pea gravel: well-rounded fine gravel.

peat: in these articles, any black or dark-brown primarily organic material, drier than gyttja and not so well rotted. On Gabriola, often layered and mixed with diatomaceous earth.

pebble: 4–64 mm. A component of gravel.

pedology: a branch of soil science dealing with the formation, chemistry, morphology, and classification of soils.

period: see geological period or glacial period.

phenocryst: large crystal, usually of feldspar, in a fine-grained matrix. Commonly forming volcanic rocks called “flowerstones”.

pit run sand and gravel: extracted from a pit for use “as is”.

plagioclase: a type of feldspar containing sodium, calcium, or both, but not potassium. Very common.

Pleistocene: epoch from 2.6-million to 12-thousand years ago. Sometimes called the Ice Age (capitalized), but not to be confused with the ice age (lower case).

plucking: glacial freeze-thaw weathering that exploits pre-existing fractures on rock slopes. The fractures are infiltrated by meltwater and then welded to the glacier by freezing. Subsequent movement of the glacier eases large segments of rock away from the rock face. Common on the lee side of a *roche moutonnée*.

plutonic: from intrusive magma.

porphyry: rock with large, easily-visible crystals (phenocrysts) set in a very fine matrix.

Port Moody Interstade: see Fraser Glaciation.

pyroclastic: from an explosively erupting volcano.

Quadra Sand (upper case): sedimentary stratigraphic unit deposited *ca* 29,000–21,000 ¹⁴C BP by south-eastward flowing streams on what, at the time, were ice-free lowlands and tidal flats (sandurs)

during the earliest phase of the Fraser Glaciation. Found at Point Grey, the east coast of Vancouver Island, and on some Gulf Islands. It has not been recorded on Gabriola, but see Quadra sand (lower case).

Quadra sand (lower case): in these articles, sand whose parent material was the Quadra Sand unit (upper case) but that was re-worked to form a post-Vashon-Stade glaciofluvial deposit.

quartz: a mineral form of silica.

quartz-diorite: an intrusive igneous rock, intermediate between felsic and mafic. Similar to tonalite but with less quartz. Common.

quartzite: a metamorphic rock that consists mostly of *quartz*. It is found on Gabriola only as rounded cobbles in conglomerate, where it is common. It appears in some regional geological texts as *chert*, but I consider this to be misleading.

Quaternary: period consisting of the Pleistocene and Holocene Epochs.

radiocarbon years: age before present (1950) as measured by carbon-14 dating. Unfortunately the relationship between radiocarbon ages reported by dating laboratories to calendar dates is significantly non-linear in the ice-age. For this reason, researchers nearly always quote ages in radiocarbon years, this being what was actually measured. Conversion to calendar years can then be made using whatever the current state of on-going research says the relationship should be. A serious further complication in the dating of marine shells is that the carbon dioxide in the ocean has an average age that is greater than that of the carbon dioxide in the atmosphere.

rain-out: poorly sorted gravel that was deposited into a lake by a melting iceberg. Often in the form of a small lens in much finer sediment. See ice-rafted dropstones.

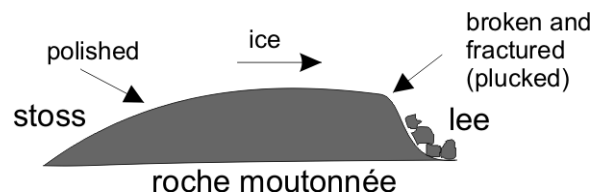
rat-tail striae: tails formed in the shelter of small obstructions resistant to erosion by ice. If the obstructions are boulder size or larger, the features are called crag and tails.

regolith: the soft and loose rock particles that result from weathering of bedrock. Regoliths subsequently develop into soils by sorting, further weathering, and addition of organic material.

repose (angle of): the steepest angle relative to the horizontal a heap of granular material adopts before sliding.

reverse crescentic gouge: see crescentic gouge.

roche moutonnée: “Sheep rock”, so called for an uncertain reason. Glaciated rocky outcrop elongated in the direction of the ice movement with a stoss side (gently sloping and polished—the upstream side) and a lee side (steeper and broken—the downstream side). They can be as small as a horse, and as large as a hill. Common in glaciated landscapes.



rocher profilé: a term not in widespread use that was initially proposed for a rock drumlin.

rock: an aggregate of minerals. Rocks are the “soup” and minerals the “ingredients”.

rock drumlin: a glacial feature (*rocher profilé*) that resembles a drumlin, and has the same orientation with respect to the ice, but is not a drumlin. Rock drumlins are composed entirely of bedrock, not till, and were formed by thick cold ice flowing over the rock without melting (no plucking). Small rock drumlins are called whalebacks. There are a few rock drumlins in Howe Sound (Bowyer Island) but as far as I know, none locally.

rubble: like gravel, but with granules that have not been rounded.

S: south. S20°E = 20° east of south (160°).

sand: a particle in the range 64 µm–2 mm. Very fine sand (64–128 µm); fine sand (128–256 µm); medium sand (256–500 µm); coarse sand (500 µm – 1 mm); very coarse sand (1–2 mm); granules (2–4 mm).

scarp: a cliff or slope between two landforms (an escarpment). Mostly caused on Gabriola by differential erosion, but they can also be created by faults.

scree: see talus.

SE: southeast.

sedimentary rock: from sediment. Sandstone, mudrock (shale), conglomerate, limestone, etc.

shale: laminated mudrock. The term is often used (incorrectly) for all mudrock on Gabriola.

shonkinite: an intrusive igneous rock, mafic. A dark syenite with K-feldspar and *augite*.

silt: a particle in the range 4 μm –64 μm . Very fine silt (4–8 μm); fine silt (8–16 μm); medium silt (16–32 μm); coarse silt (32–64 μm); very fine sand (64–128 μm).

sombrie: soils with a dark, organic surface horizon.

sorted: well-sorted means having grain sizes all about the same size. Stone-free sand is a good example. Till is mostly unsorted. The common sorting agents are streams and ocean waves.

stade (adj. **stadial**): a short, cold interval within a glaciation. For example, the Vashon Stade or Vashon stadial (interval).

stone: anything in the pebble to cobble range, usually well-rounded by weathering. Not necessarily representative of the parent rock as it may be an uncharacteristically hard fragment.

stoss and lee: see *roche moutonnée*. “Stoss” is from the German *stoß*, meaning impacted.

stria (**striae**): striation(s) abraded in bedrock created by gravel embedded in a passing glacier.

sub-: a prefix geologists sometimes apply to terms, especially geometric terms, to indicate “roughly” or “approximately” as in sub-parallel.

subglacial: on the bedrock below the ice.

Sumas Drift: see Fraser Glaciation.

Sumas Stade: see Fraser Glaciation.

supraglacial debris: debris on the surface from valley walls. Many of the large granodioritic erratics on Gabriola appear to have been transported on the surface of the ice.

syenite: an intrusive igneous rock, intermediate between felsic and mafic. Contains K-feldspar and *amphibole*. Grey or pink.

syncline: a U-shaped fold. \cap -shaped folds are called anticlines and the two types typically abut concertina-fashion in a folded landscape.

SW: southwest.

SWE: snow water equivalent; the depth of melted snow as a fraction of the depth of the snow. Its value depends on the density of the snow, which usually is in the range of 5-20% with 10% being an average value.

talus: rock debris forming a slope at the base of a cliff. Usually free of vegetation. Climbers sometimes call talus that is free of boulders and large cobbles “scree”.

temperate glacier: containing considerable meltwater and very mobile compared to a cold glacier. Usually a valley glacier.

terrane: a cluster of rock formations forming a region with a shared geological history. Sometimes big enough to be regarded as a mini-continent.

terrific: unconsolidated mineral layer in a soil.

terrigenous: of land (not marine).

till: drift that has not been sorted or only poorly sorted.

tonalite: an intrusive igneous rock, intermediate between felsic and mafic. Similar to granodiorite. Common.

travel angle: also known as the “reach angle” and “travel distance angle”. The angle whose tangent is the vertical distance dropped by a rockfall divided by the furthest horizontal distance travelled.

typic: of soils, having all the characteristics of the group.

undermelt till: till deposited from the bottom of a glacier in relatively wet conditions. Commonly sediment deposited from floating ice.

valley glacier: glacier confined by mountainous valley walls. Sometimes called an alpine glacier. The first and second phases of glaciation on the Davis & Mathews (1944) system.

varve: sequence of sedimentary layers in a lake. Usually the result of seasonal inflow.

Vashon Stade: see Fraser Glaciation.

volcanic breccia: breccia cemented with lava.

volcanic rock: lava. Crystals in its matrix are usually too small to be seen without a microscope, but there may be phenocrysts. Explosive volcanoes produce felsic rocks like *ryholite*; while gently erupting submarine volcanoes and vents produce mafic rocks like *basalt*. Many rocks of Vancouver Island are volcanic mafic rocks, but there also intrusives.

W: west. W20°S = 20° south of west (250°).

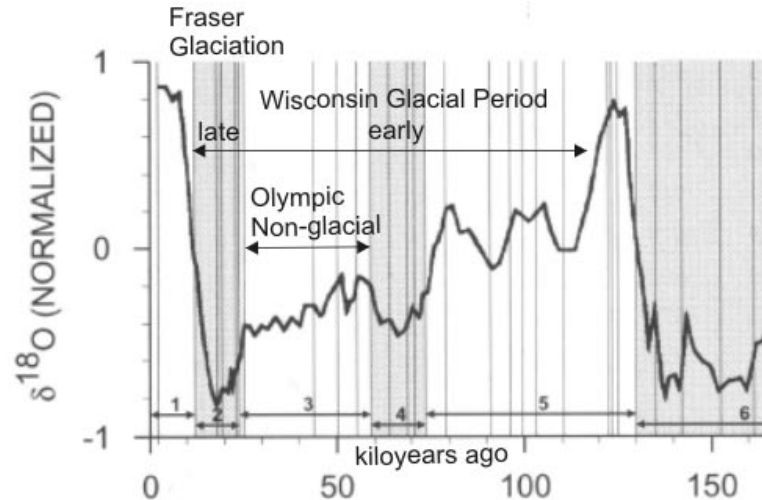
wacke: (of sandstone) “dirty”, containing clay.

whaleback: a small rock drumlin, but also sometimes used loosely to mean any glacial feature like a *roche moutonnée*, rock drumlin (*rocher profilé*), or crag and tail.

Wisconsin (Wisconsinan) Glacial Period: A glacial period that in North America lasted from about 110- to 12-thousand years ago. On the west coast, there were two non-contiguous glaciations within this period, the Early Wisconsin or Penultimate Glaciation, ~75–60,000 years ago and the Late Wisconsin Glaciation, which is the west coast Fraser Glaciation. The time between the Early and Late Wisconsin Glaciations is known locally as the Olympic Non-glacial Interval.

Wrangellia: a terrane extending from the coast of Alaska down to southern BC. It includes most of Vancouver Island, Haida Gwaii (the Queen Charlotte Islands), and some coastal mountains of Alaska. The terrane originated in the southern Pacific Ocean and is not part of the old North American Continent.

Younger Dryas: an interlude (stade) of about 1300 years that began toward the end of the last ice age when deglaciation was in full swing during which the cold ice-age climate returned globally, but particularly in Europe. The wasting away of the ice locally still continued throughout the Younger Dryas, but at a significantly reduced rate. The interlude is thought to have been caused by the disruption of warm ocean currents by meltwater from the North American ice sheets. *Dryas octopetala* is a flower common on the tundra and the presence of its pollen in the soils of the Netherlands was one of the earliest clues that there had been such an interlude.



Adapted from Bradley, *Paleoclimatology*, 1999

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