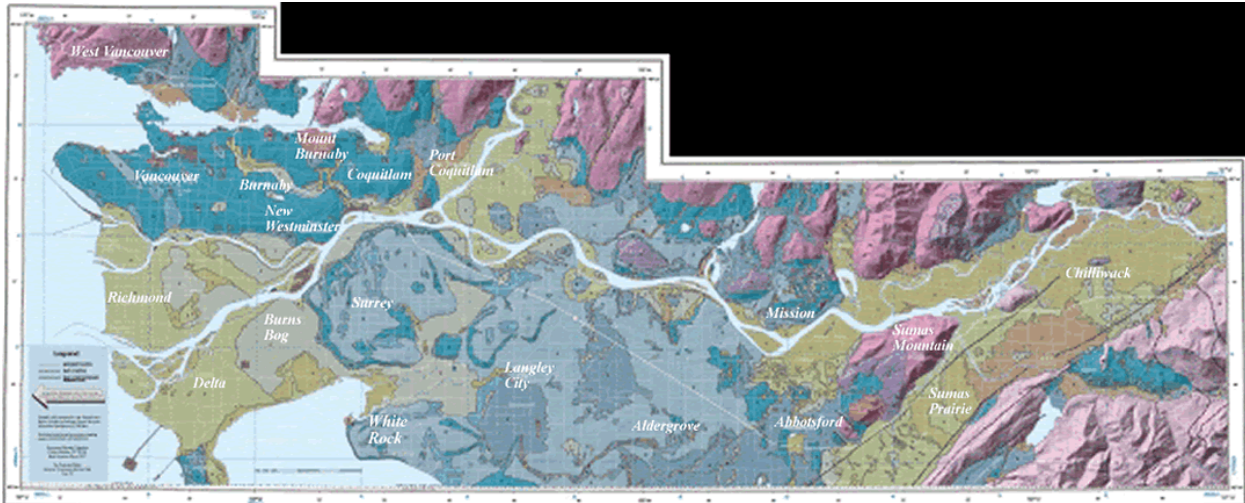


# Geomap Vancouver

**Note:** The map and information below indicates the dominant geological materials near the surface.



Modern Sediments		Ice Age Sediments		Bedrock	
1	Landfill	6	Silt and clay	11	Volcanic rock
2	Peat	7	Sand	12	Sandstone
3	Silt and clay	8	Gravel and sand	13	Granitic rock
4	Sand and silt	9	Till	14	Foliated sedimentary and volcanic rock
5	Gravel and sand	10	Steepland sediments		

## Modern Sediments

### Landfill



Sand landfill along False Creek  
J.J. Clague



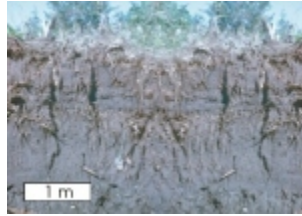
Port Mann landfill  
R. Turner

Landfill is material deposited by humans. Fill materials have been dumped in shallow waters and on tidal flats and other wetlands to extend the area of useable land. Recent recognition of the ecological importance of areas destroyed by this practice has led to limitations on placements of fills. Landfill in the Vancouver area is found mainly along shorelines, both marine (False Creek and Burrard Inlet) and river (Annacis Island). It is heterogeneous and includes sand and gravel, till, and/or crushed rock. Landfill also includes waste materials disposed of in municipal dumps (Burns Bog in Delta, Port Mann landfill); these dumps can contribute leachates to local surface and groundwaters and therefore require containment systems. Poorly designed and compacted landfills can be problematic for foundations, and could liquefy and settle during a strong earthquake.

## Peat



Mined peat area, Burns Bog, Fraser delta  
J.J. Clague



Peat layers exposed in excavation  
J.J. Clague

Peat is partly decomposed plant material found below bogs, swamps, and marshes. Peat up to 5 m thick covers much of the Fraser delta east of Highway 99 and the Nicomekl-Serpentine lowland. It also occurs locally on the Fraser River floodplain between New Westminster and Mission, at the base of some upland escarpments, at mountain fronts, and within poorly drained depressions in upland areas. Several bogs (e.g. Pitt Meadows bog, Burns Bog) have been mined for sphagnum peat moss, and the peatlands on the Fraser delta are important producers of blueberries and cranberries. Because of their high compressibility, peats are extremely poor foundation materials. Recognition of the ecological importance of bogs has led to increased efforts to protect them from development.

## Silt and clay



Tidal mud, Serpentine River estuary  
A.C. Clague



Modern clayey silt, Serpentine River estuary  
A.C. Clague

Silt, clay, and loam (mixed clay, silt, and sand) are common on the Fraser River floodplain below Mission, the Pitt River floodplain (Pitt Polder), the Fraser delta, and the Nicomekl-Serpentine flats. These sediments were deposited over thousands of years by seasonal floodwaters that spread across these lowlands. Silt and clay beneath the Nicomekl-Serpentine flats are ancient marine deposits. They were formed by the slow settling of fine river-borne sediment onto the sea floor. These fine-grained sediments make poor foundation materials because of their low bearing capacity, but are generally not prone to liquefaction. They are important agricultural soils, although poor drainage can be a problem.

### Sand and silt



Locarno Beach  
J.J. Clague



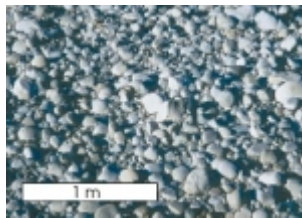
Beach sand  
J.J. Clague

Interlayered sand, silt, and loam underlie parts of Sumas Prairie, the Fraser River floodplain downstream of Mission, and the Fraser delta. Similar sediments also occur along some small streams. The sand and silt unit, like the aforementioned silt and clay unit, was deposited during floods. Construction of dykes has greatly reduced such flooding and interrupted the natural deposition of these materials. Sand and silt are important agricultural soils and can be important shallow groundwater reservoirs (aquifers). Sand-rich deposits have moderate to high bearing capacity and are good foundation materials, but could liquefy during a strong earthquake.

### Gravel and sand



River bar, Capilano River  
R. Turner



River gravel  
R. Turner

Deposits of gravel and sand occur along steep-gradient streams in mountain valleys (Chilliwack Valley), on alluvial fans and marine deltas at valley mouths (Capilano and Seymour rivers, North Vancouver), and on islands and bars of the Fraser River upstream of Mission. Gravel and sand also occur as beach deposits (Jericho, White Rock) and as debris cones and fans at the base of mountain slopes. Most areas mapped as gravel and sand are at risk of flooding and have a moderate to high liquefaction potential. Gravel and sand deposits are permeable (they transmit

water), and are thus important shallow aquifers. They are also potential sources of aggregate, but shallow water tables limit their use for this purpose.

## Ice Age Sediments

### Silt and clay



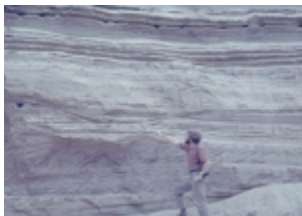
Blocky weathering, massive marine clay  
J.J. Clague



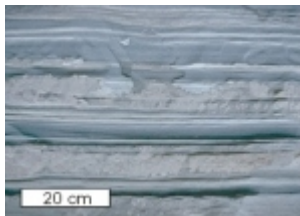
Layered silt and clay  
J.J. Clague

Thick silt and clay of marine origin are the most widespread surface sediments in the Surrey, White Rock, and Langley-Aldergrove uplands. This unit includes massive and bedded sediments with variable bearing capacities, depending partly on whether or not they were overridden and loaded by glaciers. In general, deposits east of Aldergrove have been loaded by ice and thus have higher bearing strengths. Water infiltration is poor because the sediments are fine grained; this can result in poor surface drainage if the land is flat. Silt and clay deposits on steep slopes (>20°) are prone to landsliding. Silt and clay deposits exposed during construction activities erode easily and can be a major source of stream siltation.

### Sand



Layered sand deposited in an ancient lake  
J.J. Clague



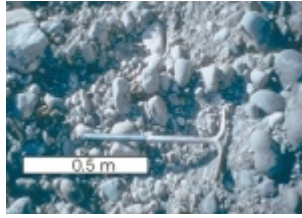
Close-up of layered sand  
J.J. Clague

Scattered sand deposits up to 5 m thick occur on the Vancouver, Tsawwassen, White Rock, and Surrey uplands; they are absent from uplands east of Langley. The sands are beach deposits that formed when uplands emerged from the sea at the end of the last glaciation. They have good bearing strength, but are generally too thin to affect foundations. Water passes through sands with ease, thus soils developed on these materials are well drained.

## Gravel and sand



Gravel pit, Aldergrove  
J.J. Clague



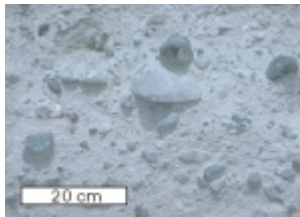
Glacial gravel  
P.T. Bobrowsky

Deposits of gravel and sand up to 40 m thick are widespread on uplands between Langley and Abbotsford, and north of the Fraser River between Pitt Meadows and Mission. Important deposits also occur on the North Shore, adjacent to the Capilano, Seymour, and Coquitlam rivers, and in the Columbia Valley south of Cultus Lake. Gravel and sand have high bearing capacity and excellent drainage. Thick gravel and sand deposits are important sources of aggregate; there are numerous gravel pits south and east of Aldergrove, and south of Langley. Gravel and sand are also important aquifers (the Abbotsford and Brookwood aquifers). Shallow aquifers are vulnerable to contamination from agricultural and industrial activities.

## Till



Ridges of till at snout of Coast  
Mountain glacier  
J.J. Clague



Compact till  
J.J. Clague

Till is a heterogeneous glacial deposit consisting of clay, silt, sand, and stones ranging from pebble to boulder size. Till up to 25 m thick is the dominant surface and near-surface material over much of the Vancouver upland, where it is overlain by patchy marine silt and sand. Farther east, till is an important, but less extensive surface material; it is buried by thick silt and clay in the Surrey and Aldergrove areas. The lower slopes of the Coast Mountains are mantled by up to several metres of till. Some tills are compact and concrete-like, whereas others are sandy and loose. Till commonly has a high bearing capacity and thus is an excellent foundation material. Compact till is nearly impervious; for good drainage, the surface must slope. Silt- and clay-bearing tills disturbed during construction activities can be a major source of stream siltation.

## Stepland sediments



Buildings near unstable cliff of Ice Age sand and silt, U.B.C. University of B.C.



Residences along a steep coastal bluff, Tsawwassen  
J.J. Clague

Steep escarpments occur locally at the borders of uplands. Escarpments expose Ice Age sediments that, elsewhere on the uplands, are covered by younger sediments, discussed above. These older sediments include clay, silt, sand, gravel, and till. The bases of some escarpments are being actively undercut by ocean waves (Tsawwassen, White Rock, Point Grey) or streams (Chilliwack, Capilano, Seymour, and Coquitlam rivers), making them vulnerable to landsliding. Many residential areas extend to the edges and bases of escarpments; even small slides in these localities can damage or destroy houses, roads, and other structures.

## Bedrock

### Volcanic rock



Basalt with columnar jointing, near Whistler  
J.J. Clague



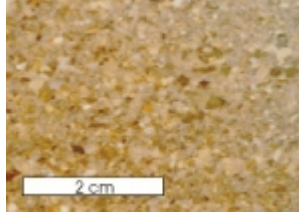
Queen Elizabeth Park -- an old basalt quarry turned into a garden  
J.J. Clague

Dark, fine grained volcanic rocks, chiefly basalt and andesite, are exposed at the northern edge of the Fraser Valley. These rocks formed as lavas, shallow intrusions, and volcanic ash deposits. Most volcanic rocks are resistant to erosion and form prominent hills in the Fraser Valley (Sentinel Hill, Queen Elizabeth Park, Grant Hill). Young volcanic rocks (35-17 million years old) occur as thick tabular sills, parallel to the layers in the rocks into which they were injected (Grant Hill) and as smaller subvertical dykes that cut across rock layering (Prospect Point, Stanley Park). Much older (185 million years) volcanic rocks are exposed on Sumas Mountain and near the confluence of the Harrison and Fraser rivers.

### Sandstone



Layered sandstone and siltstone, Sumas Mountain  
P.S. Mustard



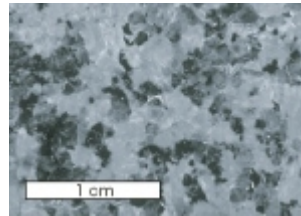
Polished slab of sandstone  
J.J. Clague

Sandstone, siltstone, and conglomerate (85-37 million years old) occur as scattered outcrops in Vancouver, Burnaby, and on the North Shore (Stanley Park, Kitsilano, Burnaby Mountain, Capilano River). These rocks also occur at depth through much of the Fraser Valley. Sandstone layers resistant to erosion and tilted down to the south form ridges with steep north-facing bluffs and gentler south-facing slopes (Burnaby Mountain, Stanley Park). Ridges are separated by valleys eroded into softer siltstone (First Narrows, Burrard Inlet). These rocks are weakly cemented and can be excavated without blasting. About 5-15% of the rock is open pore space making deeply buried sandstones potential natural gas reservoirs.

### Granitic rock



Stawamus Chief near Squamish  
T. Turner



Close-up view of granitic rock  
J.J. Clague

Granitic rocks are a family of medium- to coarse-grained igneous rocks (granite, granodiorite, quartz diorite, diorite). They consist of interlocking light-coloured grains of feldspar and quartz, and dark-coloured biotite and hornblende, which give the rock a distinctive "salt-and-pepper" texture. Granitic rocks in the map area range from 165 to 95 million years old. Where not extensively fractured and faulted, granitic rock is resistant to erosion and can form steep mountain slopes. Granitic rock is locally quarried for use as building stone and crushed rock (Pitt River).

### Foliated sedimentary and volcanic rock



Platy weathering of strongly foliated phyllite  
J.J. Clague



Folds in interlayered sandstone and argillite  
J.M. Journeay

Metamorphosed sedimentary and volcanic rocks occur widely in the Cascade Mountains, and also form small hills in the eastern Fraser Valley (Chilliwack Mountain). These rocks are characterized by a planar fabric (foliation) formed during burial, deformation, and metamorphism of the rock. This fabric reduces rock strength, causing some rock types to weather into thin platy fragments. Bedrock exposed on Vedder Mountain and east of Cultus Lake is made up of thinly layered, dark argillite, and lesser phyllite, gneiss, limestone, and chert. Volcanic rock with interlayers of limestone, argillite, and sandstone is exposed on mountain slopes in the upper Chilliwack River basin.