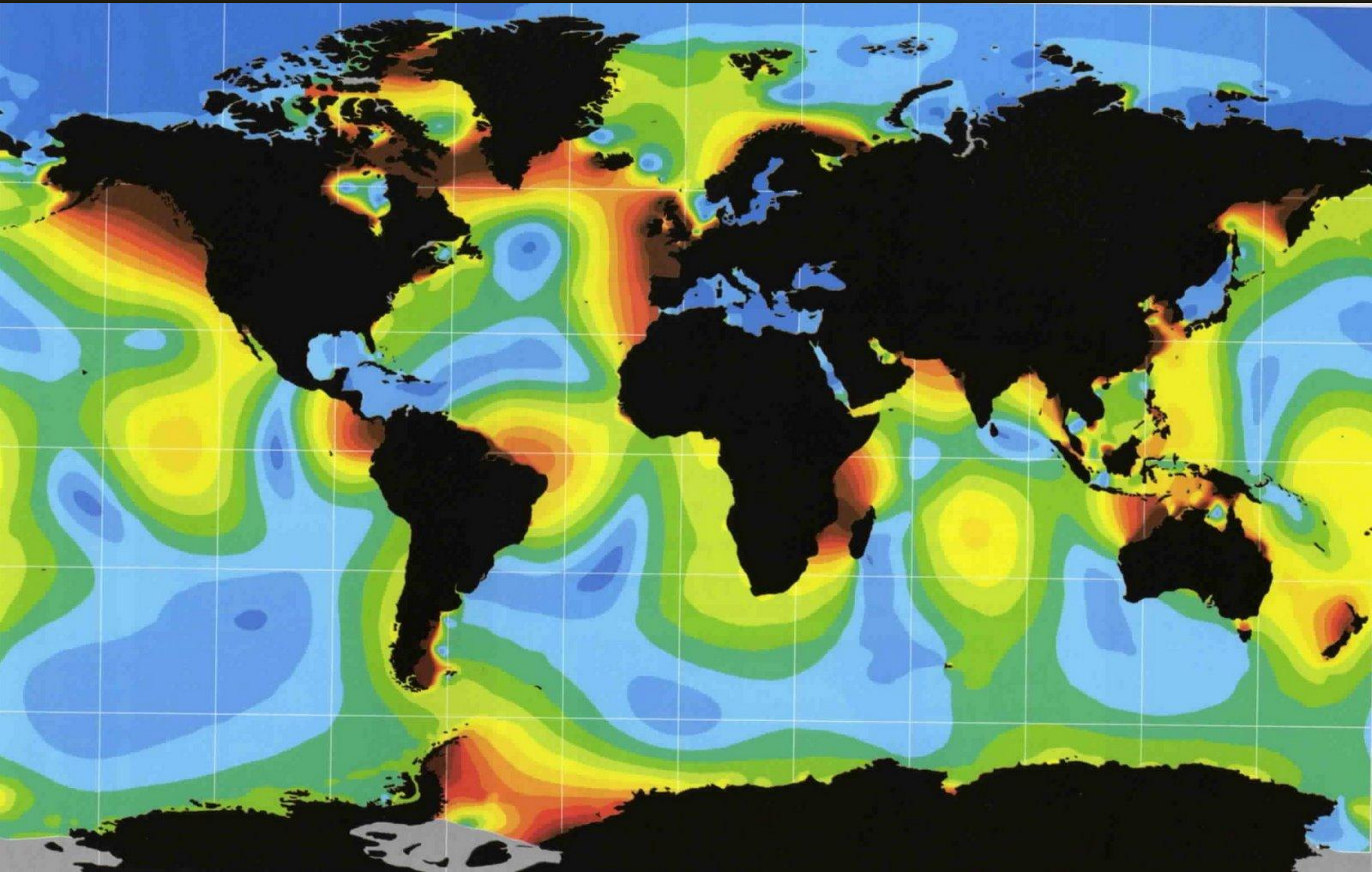
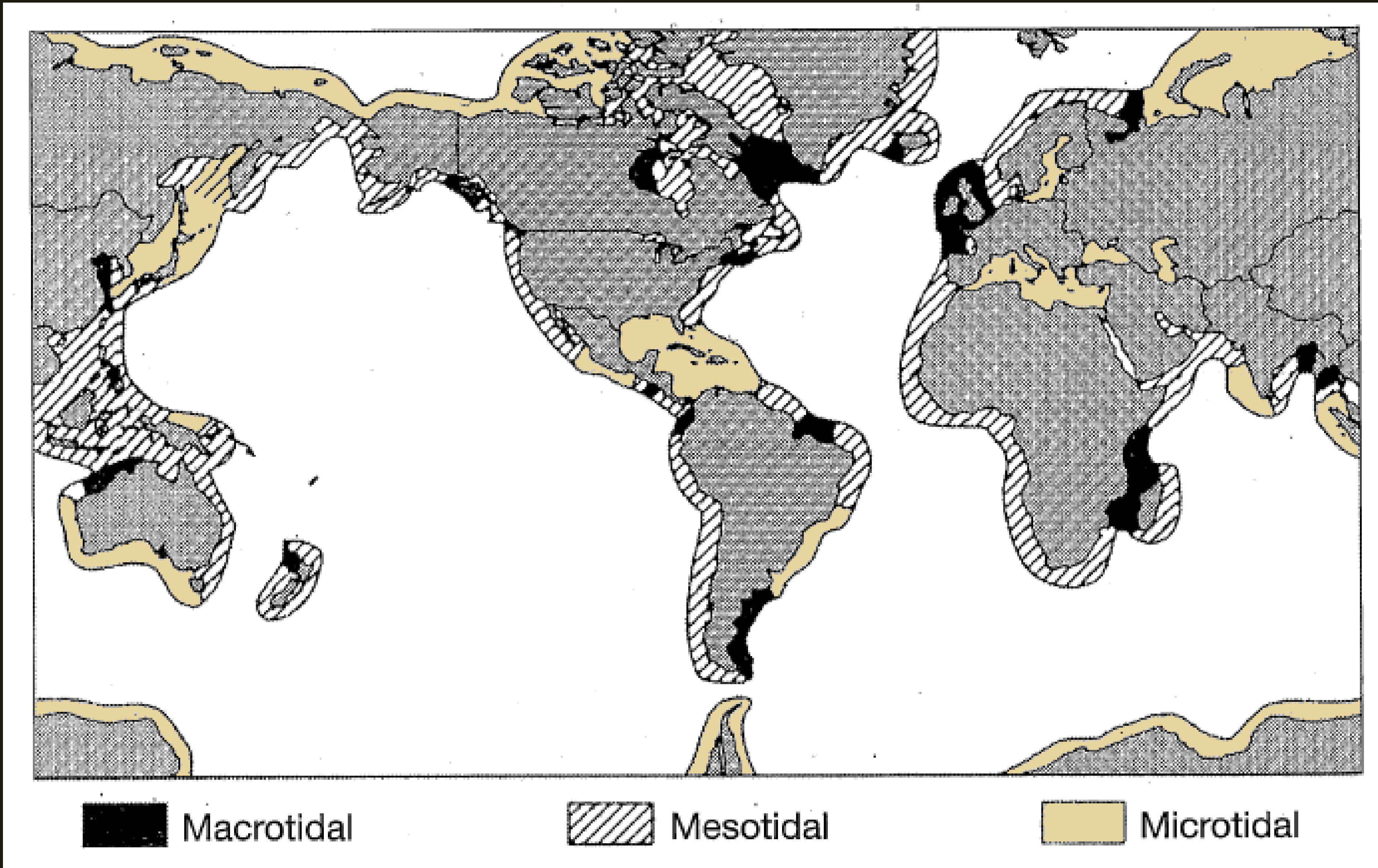
GEOL-201
Shoreline Processes

Variations in tidal range

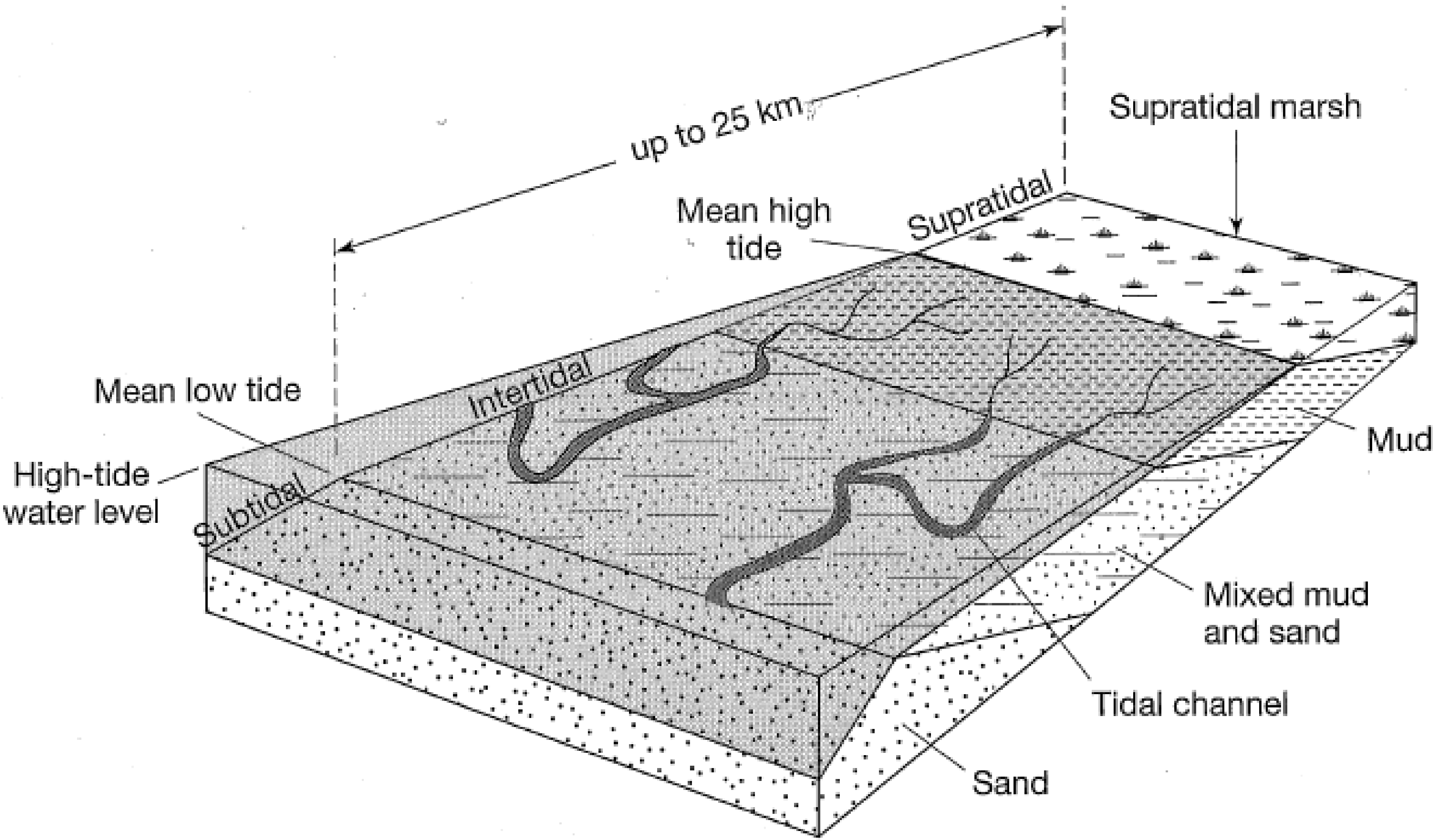




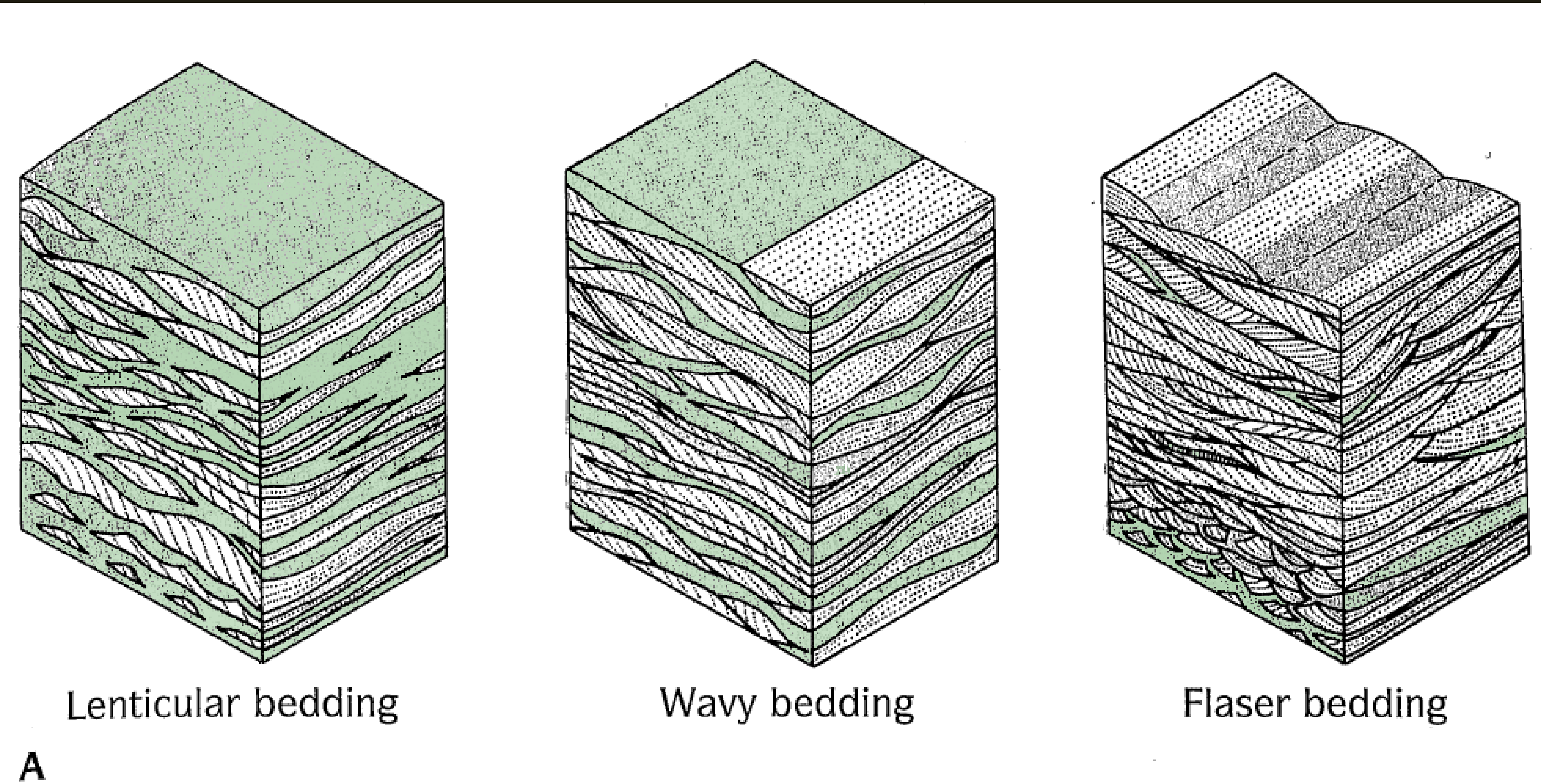
> 4 m

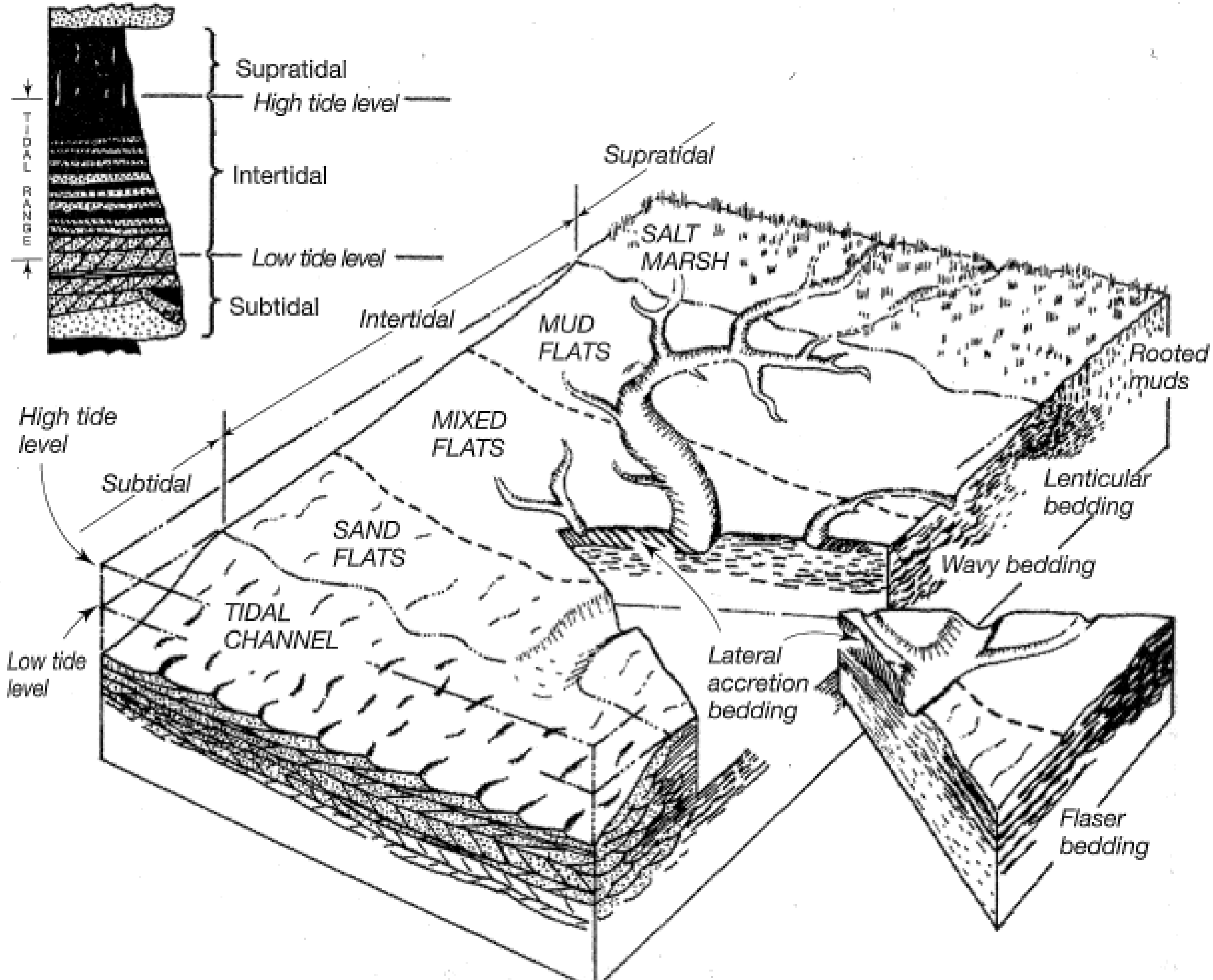
2-4 m

< 2 m


up to 25 km
Supratidal marsh
Supratidal
Mean high tide
Intertidal
Mean low tide
High-tide water level
Subtidal
Mud
Mixed mud and sand
Tidal channel
Sand

Depositional features on tidal flats





Supratidal
High tide level
TIDAL RANGE
Intertidal
Low tide level
Subtidal
Supratidal
SALT MARSH
Intertidal
MUD FLATS
Rooted muds
High tide level
MIXED FLATS
Subtidal
Lenticular bedding
SAND FLATS
Wavy bedding
TIDAL CHANNEL
Low tide level
Lateral accretion bedding
Flaser bedding


Wavy bedding
Flaser bedding
Wavy bedd

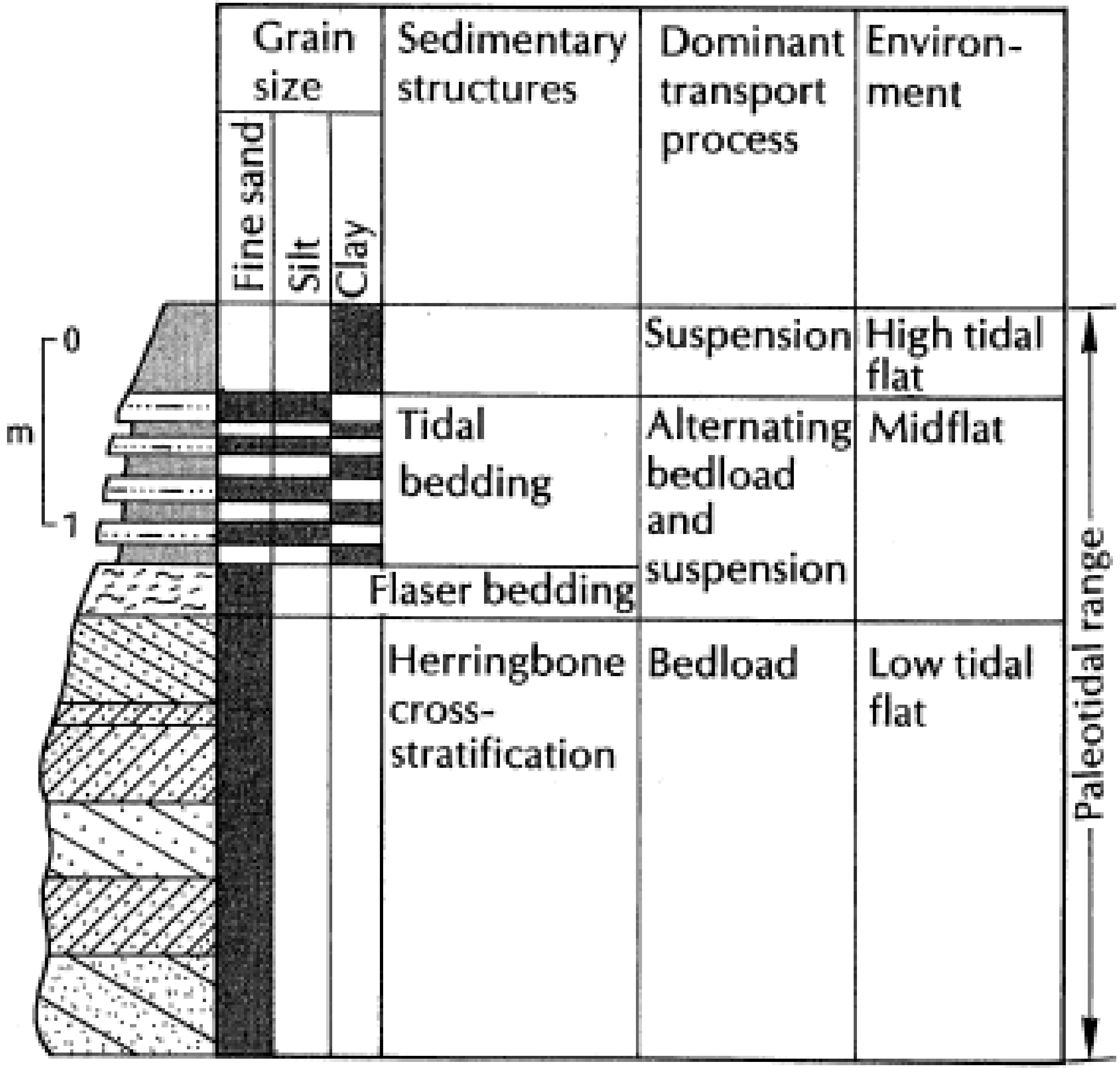
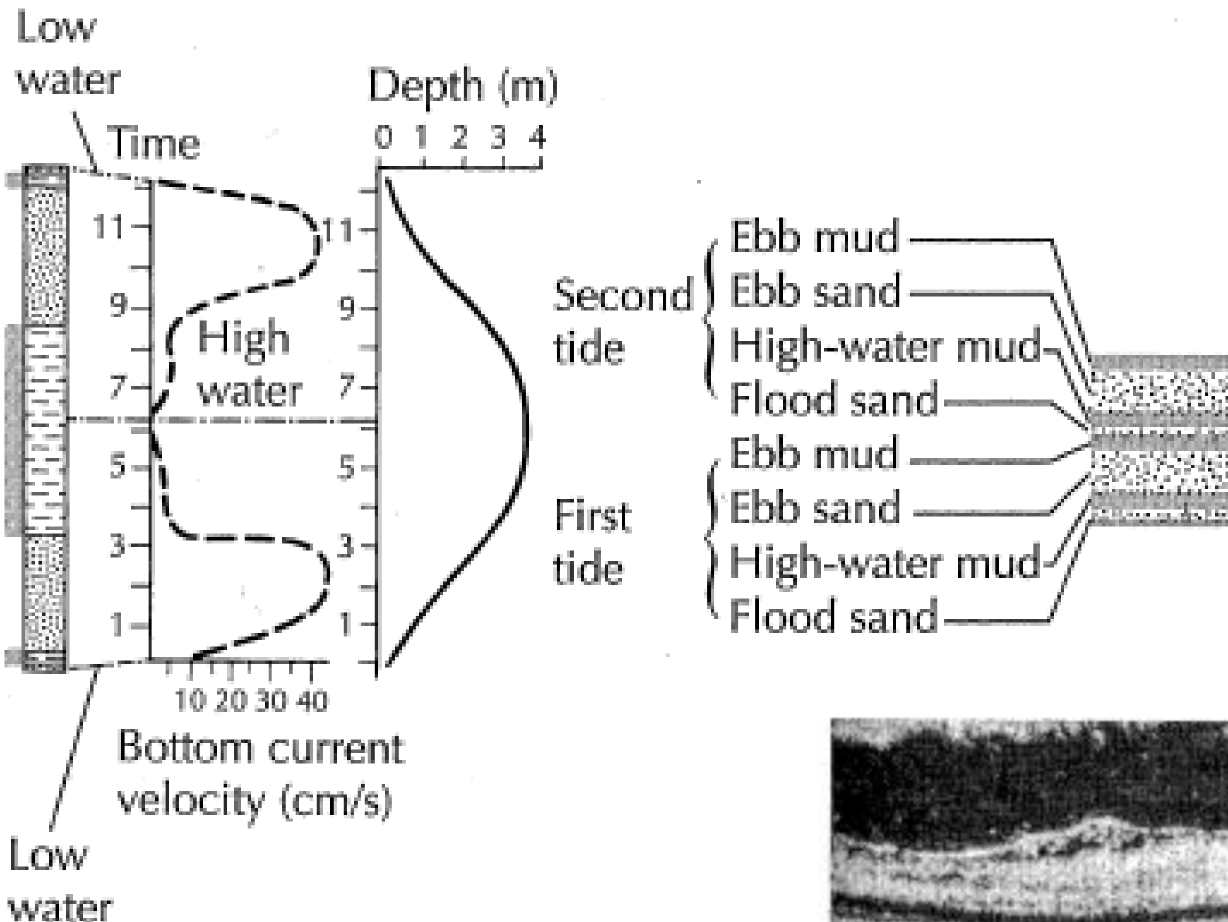
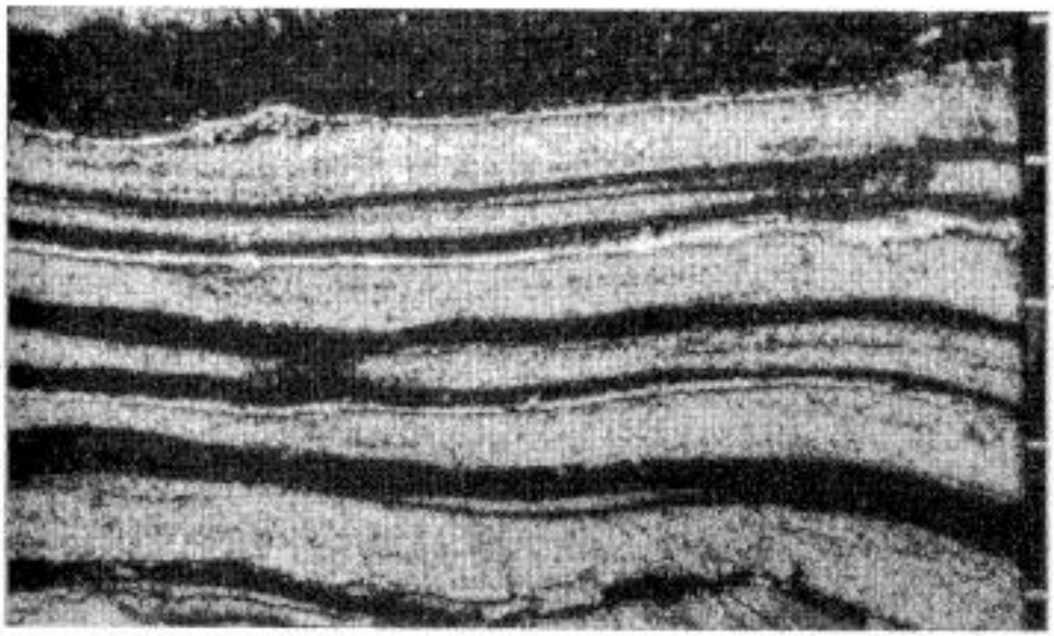


Figure 9.12 Typical paleotidal range sequence based on the middle member of the upper Proterozoic–Lower Cambrian Wood Canyon Formation, Nevada. (After Klein, 1972b: 540; by permission of the Geological Society of America.)

Bedding related to daily tidal flows





B

Hummocky cross-stratification: effects of storm waves below the fair-weather wave base

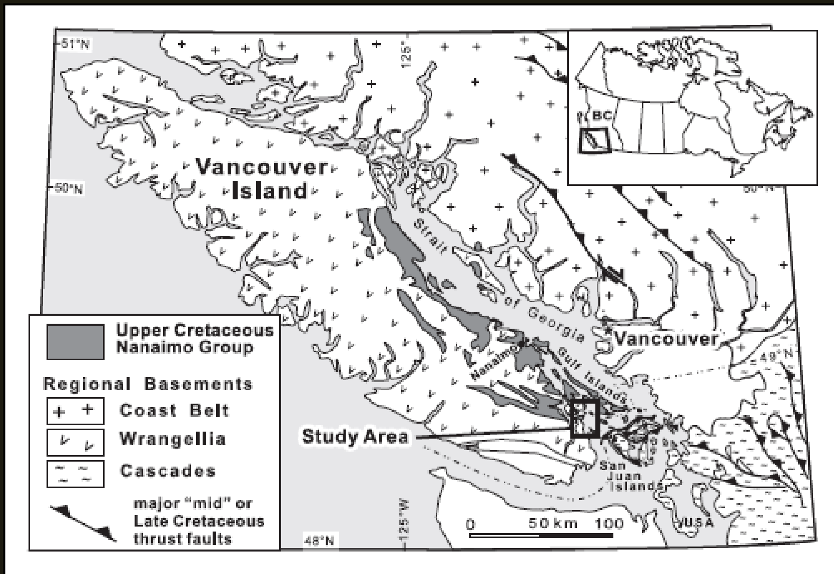
Storm-swept coasts

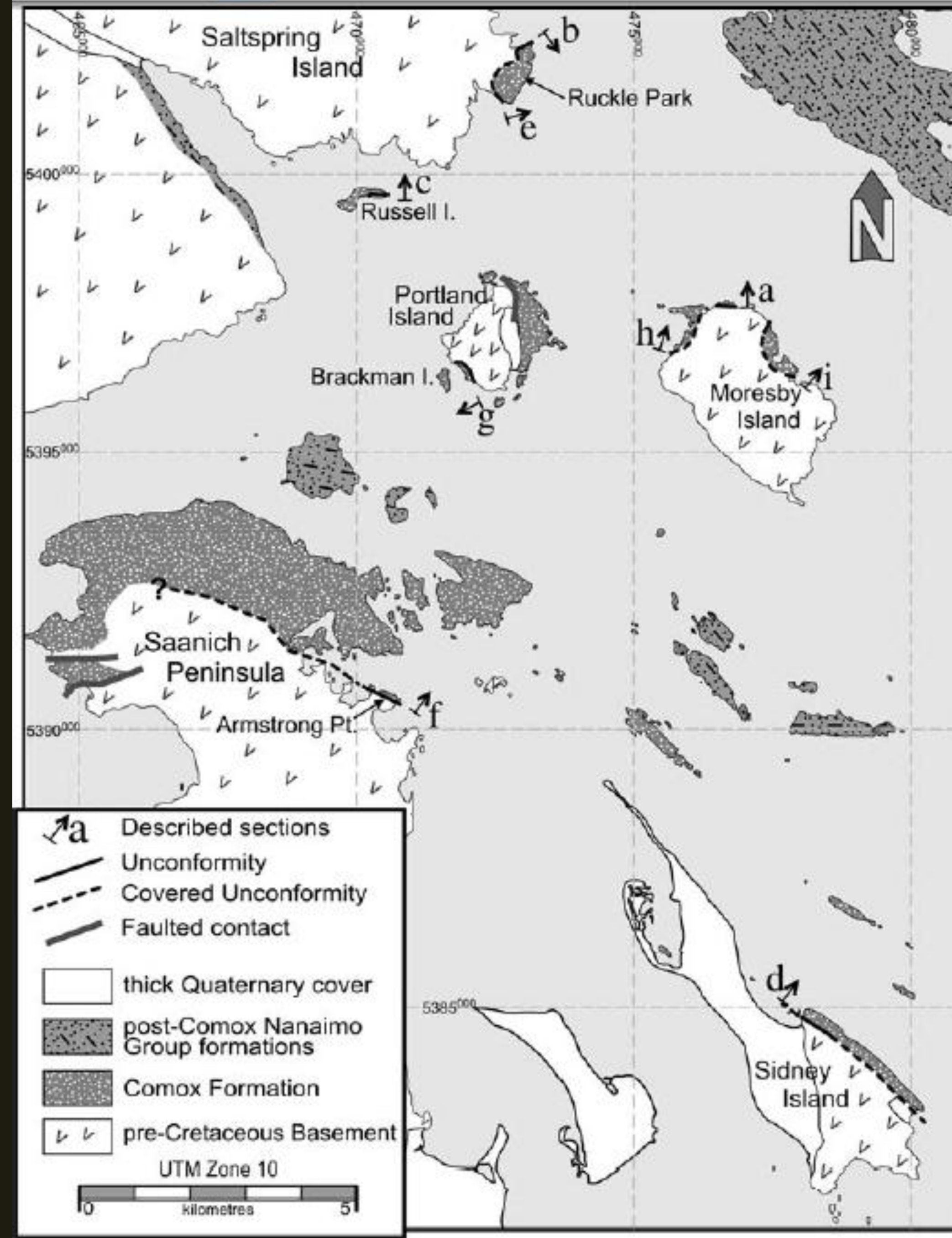
The basal unconformity of the Nanaimo Group, southwestern British Columbia: a Late Cretaceous storm-swept rocky shoreline[1]

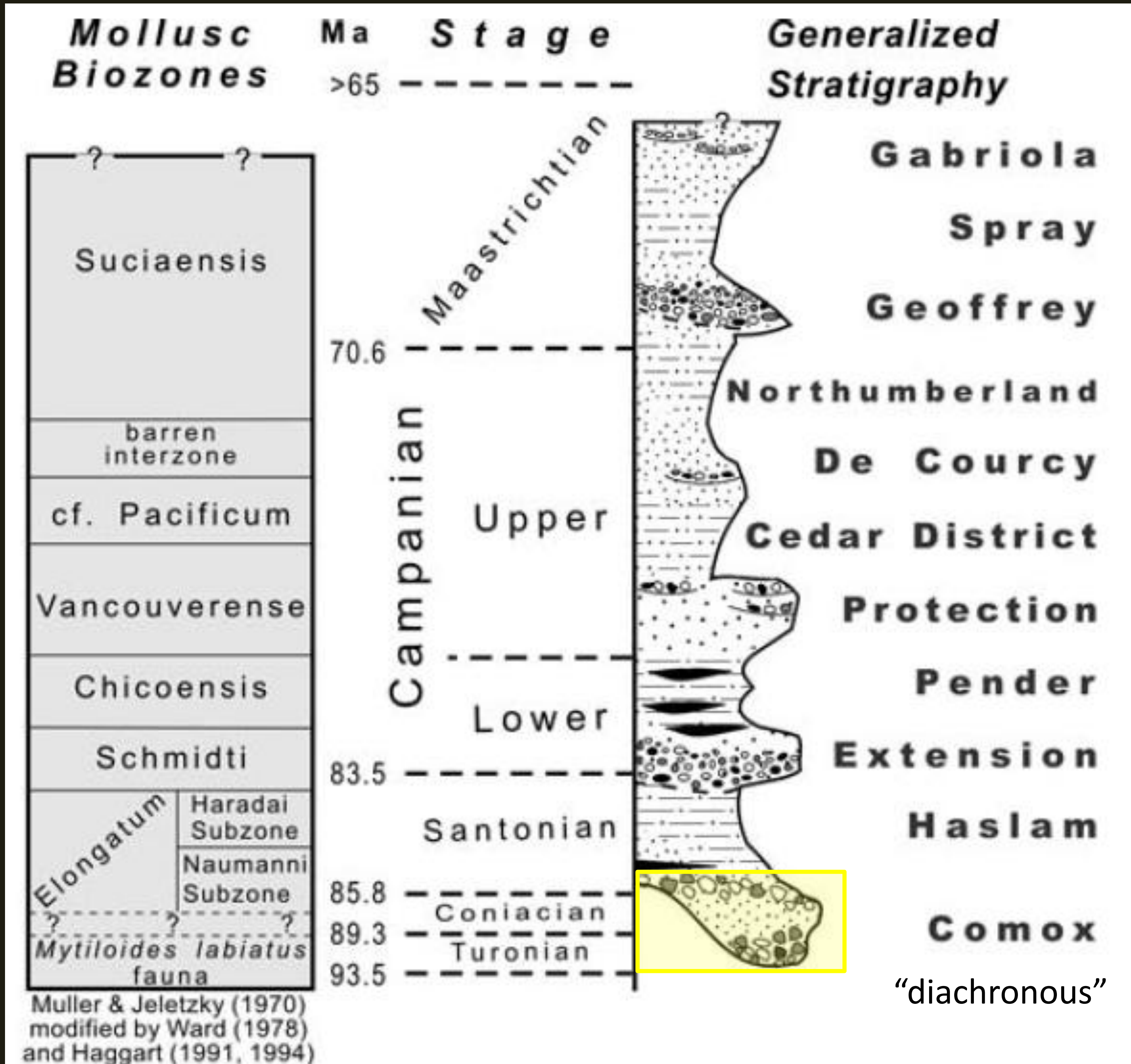
P.D. Johnstone, P.S. Mustard, and J.A. MacEachern

Abstract: The Turonian to Santonian Comox Formation forms the basal unit of the Nanaimo Group. In the southern Gulf Islands of British Columbia, the Comox Formation nonconformably overlies Devonian metavolcanic and Jurassic intrusive rocks and is interpreted to reflect a rocky foreshore reworked by waves and ultimately drowned during transgression. The nonconformity displays a relief of metres to tens of metres. Basal deposits vary in thickness, as does the facies character along the several kilometres of paleoshoreline studied. In the study area, three distinct but related environments are expressed, typical of a complex rocky shoreline with headlands and protected coves. Crudely stratified conglomerates represent gravel-dominated fans characterized by debris-flow processes, building out from local coastal cliffs and gullies directly onto the rocky shoreline. Fine-grained basal units represent shoreline environments protected from higher energy shoreline processes, presumably in small embayments. Sandstone facies associations reflect storm-dominated shoreface environments. The unusual thickness and coarseness of these shoreface intervals suggest a combination of increasing accommodation space, proximal and high sediment supply, and high frequency and energy of storm activity. This, in turn, suggests that the majority of the shoreline was exposed to the full effects of large, open-ocean storms. This interpretation differs from most previous models for the lower Nanaimo Group, which suggest that deposition occurred in more sheltered strait or bay environments.

Canadian Journal of Earth Sciences, V. 43, p. 1165, 2006


51°N
50°N
49°N
48°N
125°
125°W
Vancouver Island
Strait of Georgia
Vancouver
Nanaimo
Gulf Islands
Study Area
San Juan Islands
USA
BC
0 50 km 100
Upper Cretaceous Nanaimo Group
Regional Basements
Coast Belt
Wrangellia
Cascades
major "mid" or Late Cretaceous thrust faults

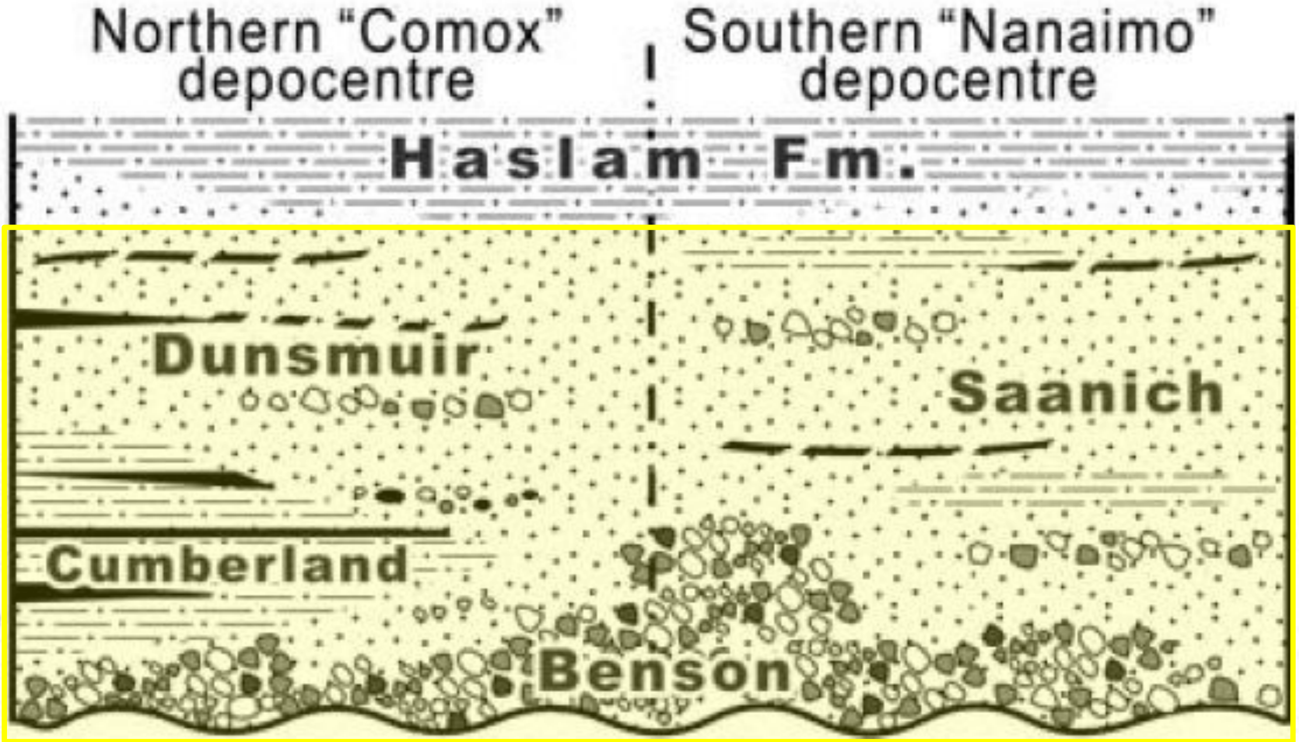

Saltspring Island
Ruckle Park
Russell I.
Portland Island
Brackman I.
Moresby Island
Saanich Peninsula
Armstrong Pt.
Sidney Island
N
a
b
c
d
e
f
g
h
i
Described sections
Unconformity
Covered Unconformity
Faulted contact
thick Quaternary cover
post-Comox Nanaimo Group formations
Comox Formation
pre-Cretaceous Basement
UTM Zone 10
0 kilometres 5

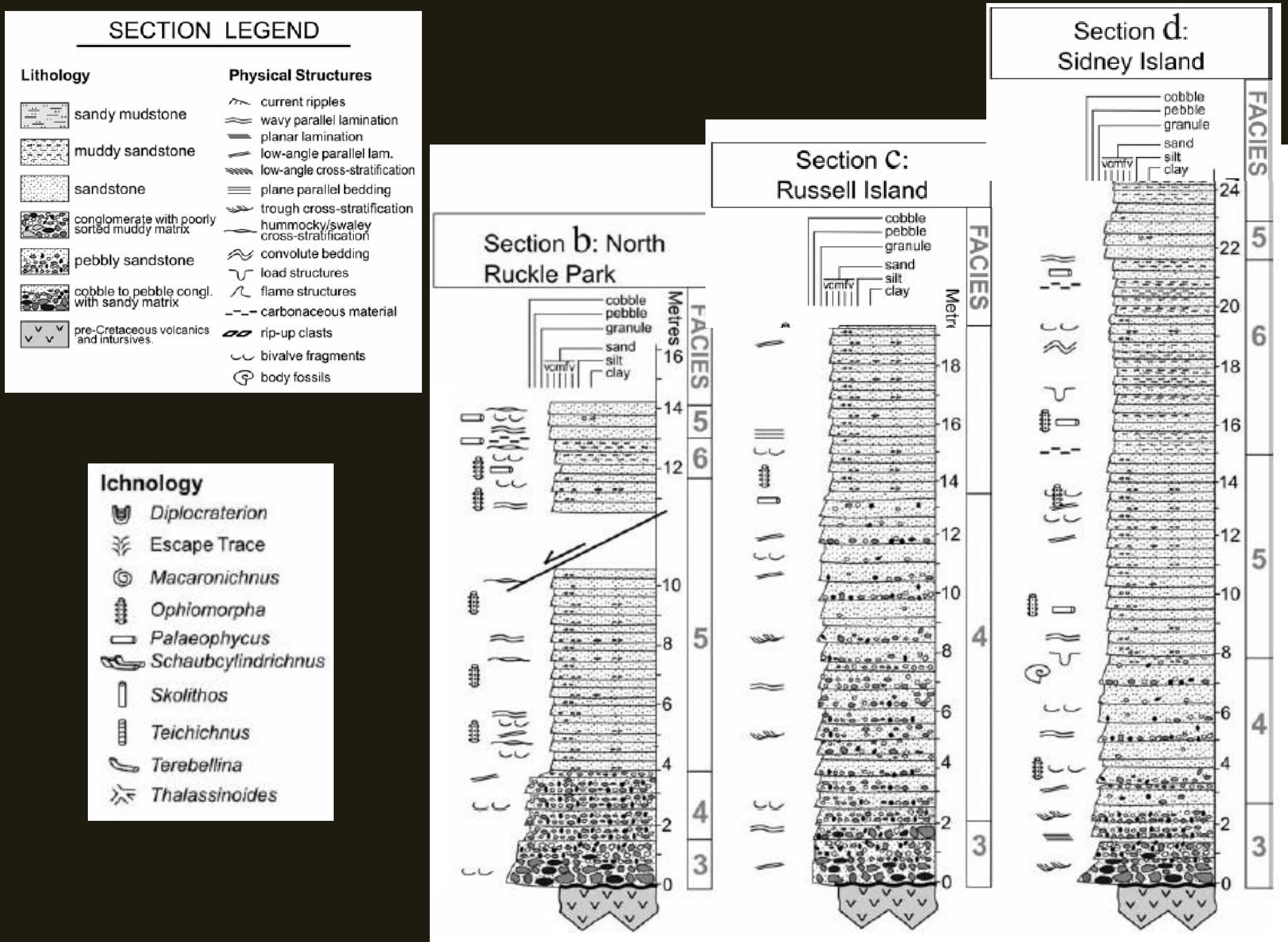


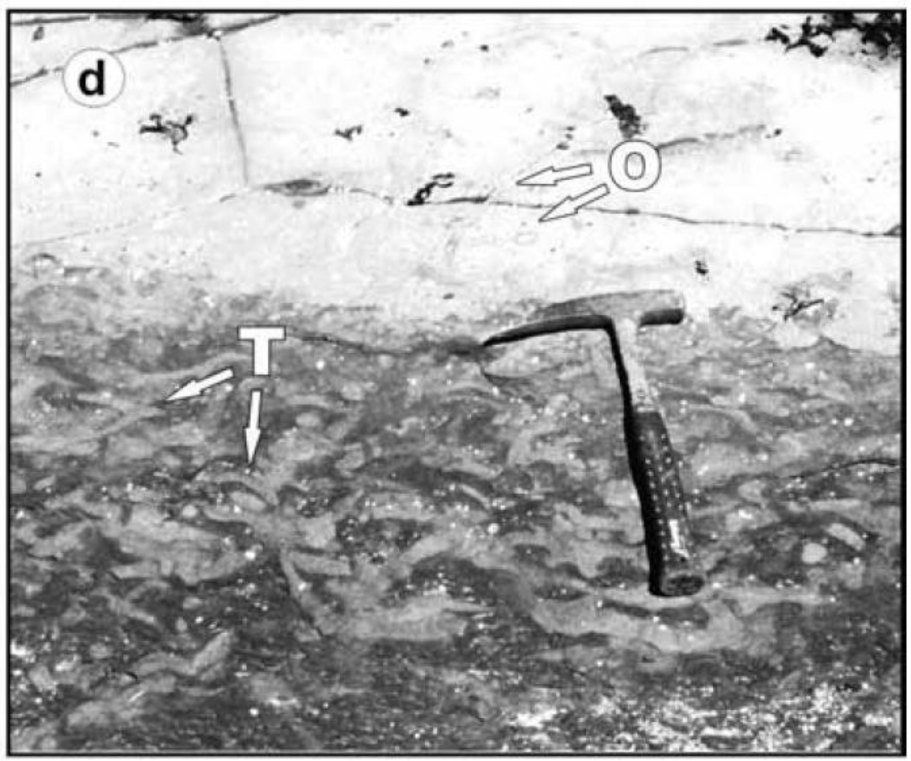
"diachronous"

Generalized Stratigraphy of the four members of the Comox Formation.

Bickford & Kenyon (1988)
modified by
Mustard (1994)




SECTION LEGEND
Lithology
sandy mudstone
muddy sandstone
sandstone
conglomerate with poorly sorted muddy matrix
pebbly sandstone
cobble to pebble congl. with sandy matrix
pre-Cretaceous volcanics and intursives.
Physical Structures
current ripples
wavy parallel lamination
planar lamination
low-angle parallel lam.
low-angle cross-stratification
plane parallel bedding
trough cross-stratification
hummocky/swaley cross-stratification
convolute bedding
load structures
flame structures
carbonaceous material
rip-up clasts
bivalve fragments
body fossils
Ichnology
Diplocraterion
Escape Trace
Macaronichnus
Ophiomorpha
Palaeophycus
Schaubcylindrichnus
Skolithos
Teichichnus
Terebellina
Thalassinoides
Section b: North Ruckle Park
cobble
pebble
granule
sand
silt
clay
vcmfv
Metres
FACIES
16
14
12
10
8
6
4
2
0
5
6
5
4
3
Section c: Russell Island
cobble
pebble
granule
sand
silt
clay
vcmfv
Metres
FACIES
18
16
14
12
10
8
6
4
2
0
4
3
Section d: Sidney Island
cobble
pebble
granule
sand
silt
clay
vcmfv
FACIES
24
22
20
18
16
14
12
10
8
6
4
2
0
5
6
5
4
3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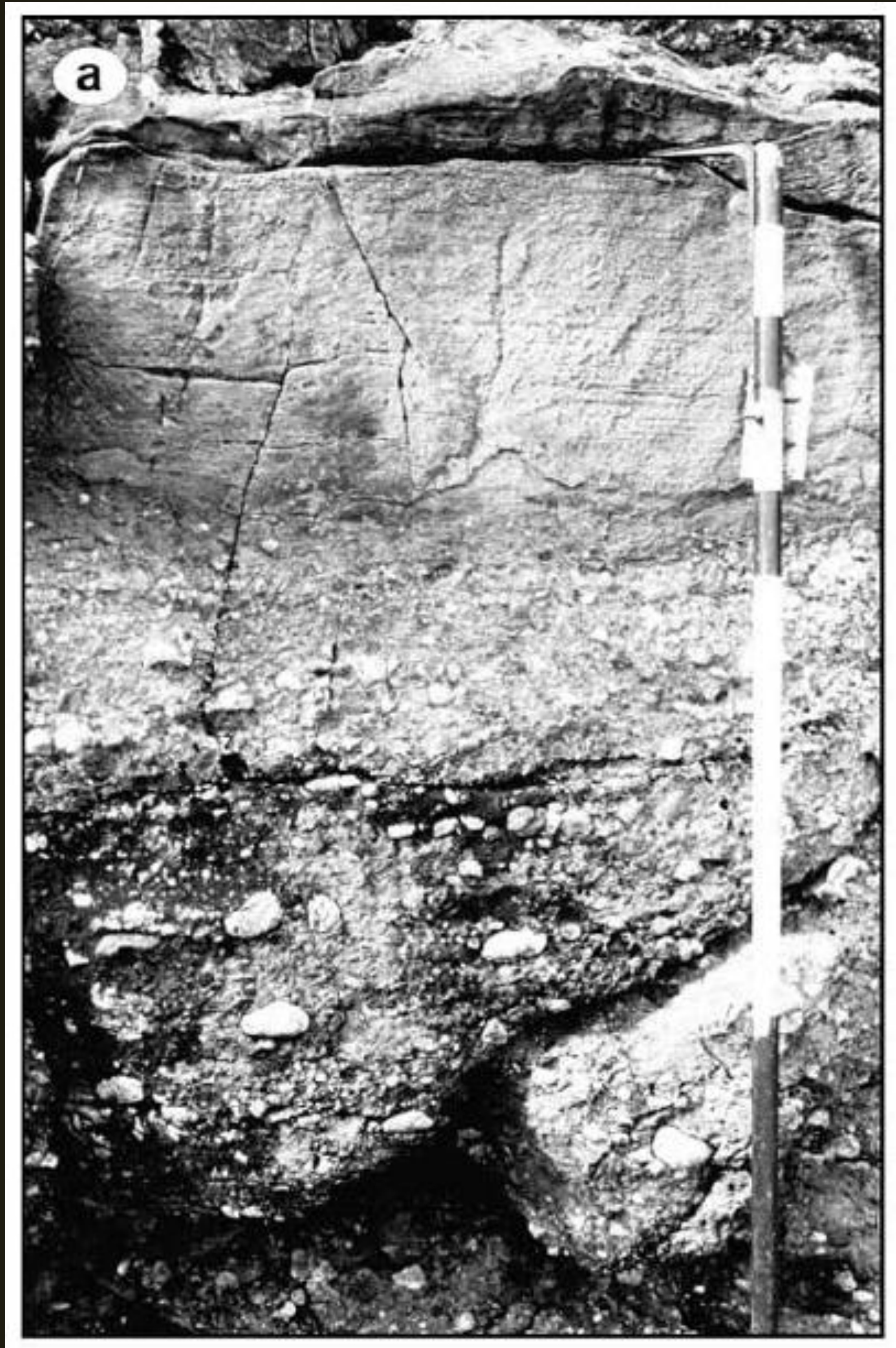
a

Fig. 11. Block model of Nanaimo Basin during early Comox Formation deposition. Within the study area, the Comox Formation was deposited upon a partially emergent Wrangellia Terrane, with the majority of the terrane submerged, exposing the shoreline to the full force of proto-Pacific Ocean storms. A rocky shoreline with high local relief result in varied energy conditions and three distinct facies associations: FA1, storm-dominated rocky shoreline; FA2, low-energy rocky shoreline; and FA3, drowned fan delta.