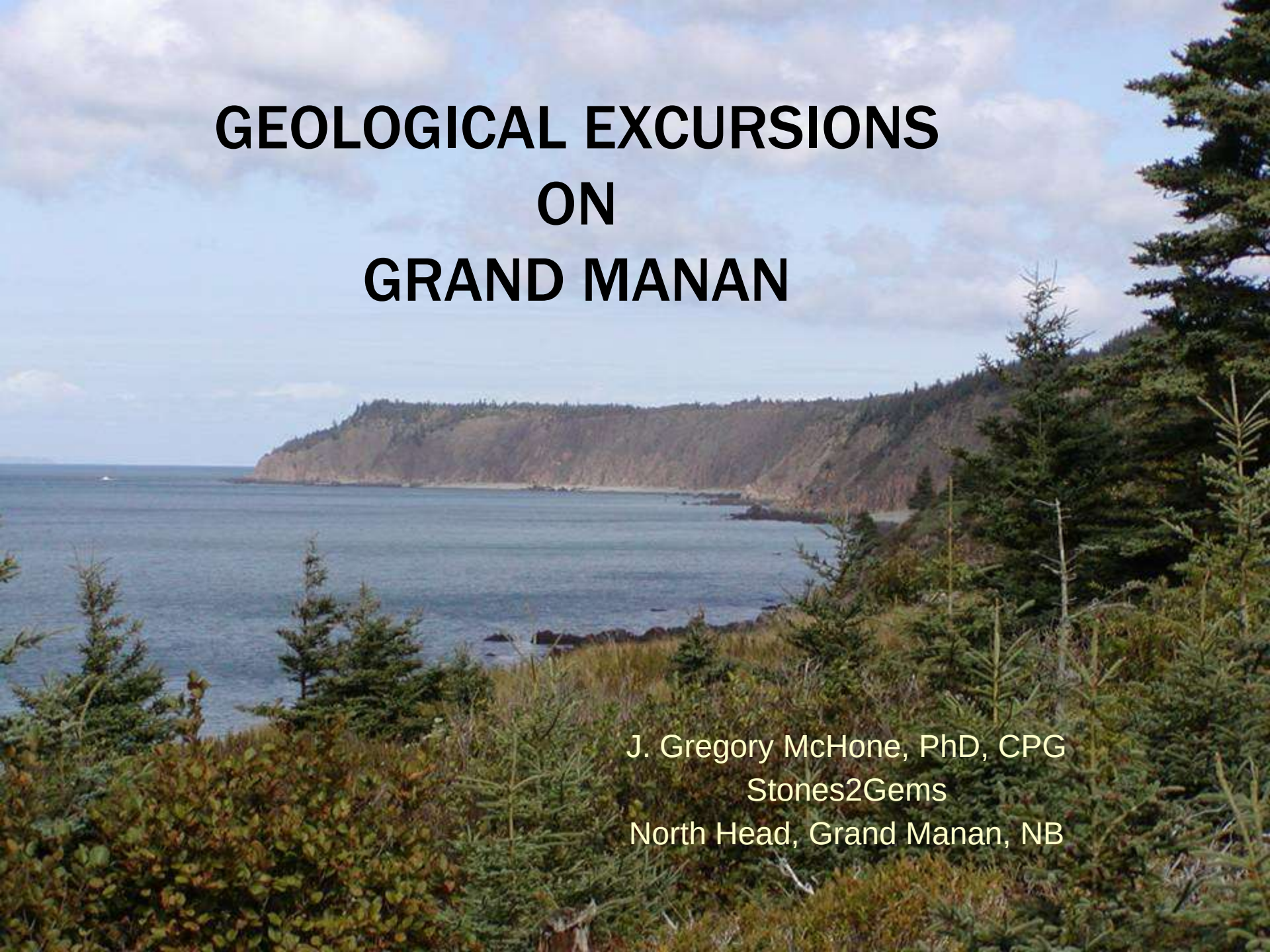
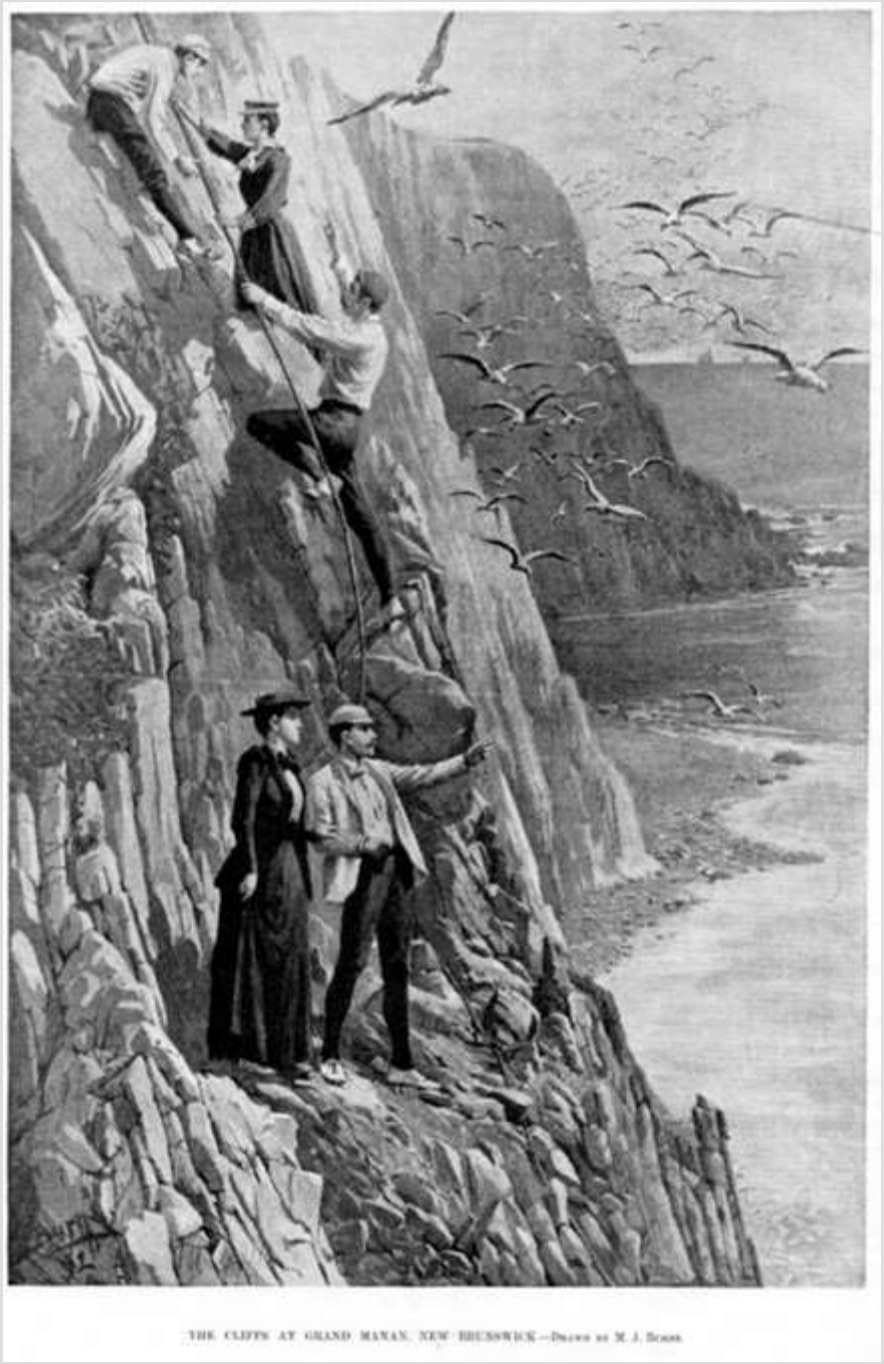
GEOLOGICAL EXCURSIONS ON GRAND MANAN



J. Gregory McHone, PhD, CPG
Stones2Gems
North Head, Grand Manan, NB



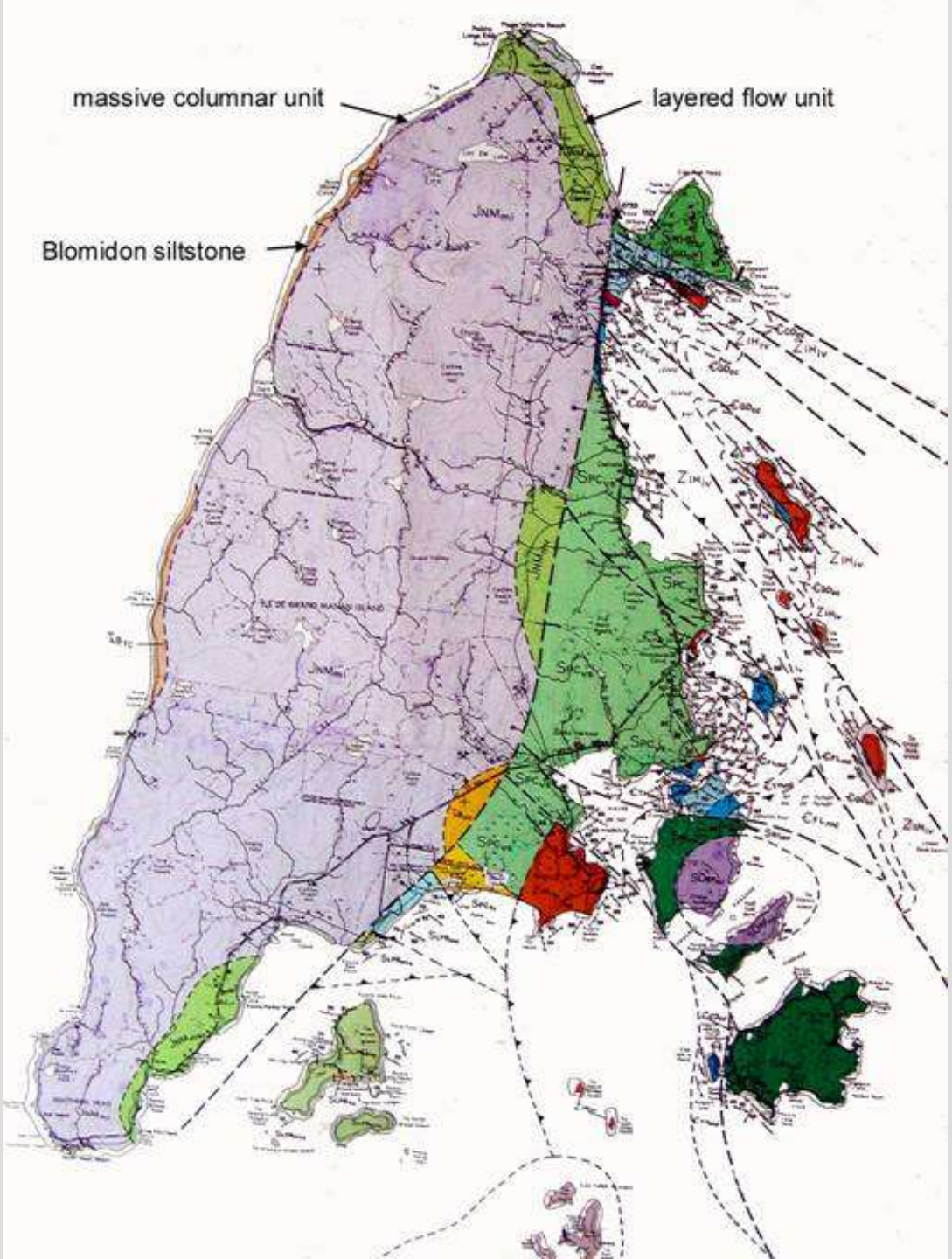
THE CLIFFS AT GRAND MANAN, NEW BRUNSWICK.—Drawn by W. J. Stone.

People have been “geologizing” on Grand Manan since the early 19th century.

In the past 10 years, new field work has been done by Les Fyffe, Malcolm McLeod, Dick Grant, and Sandra Barr.

And me, Greg McHone, along with Nancy McHone.

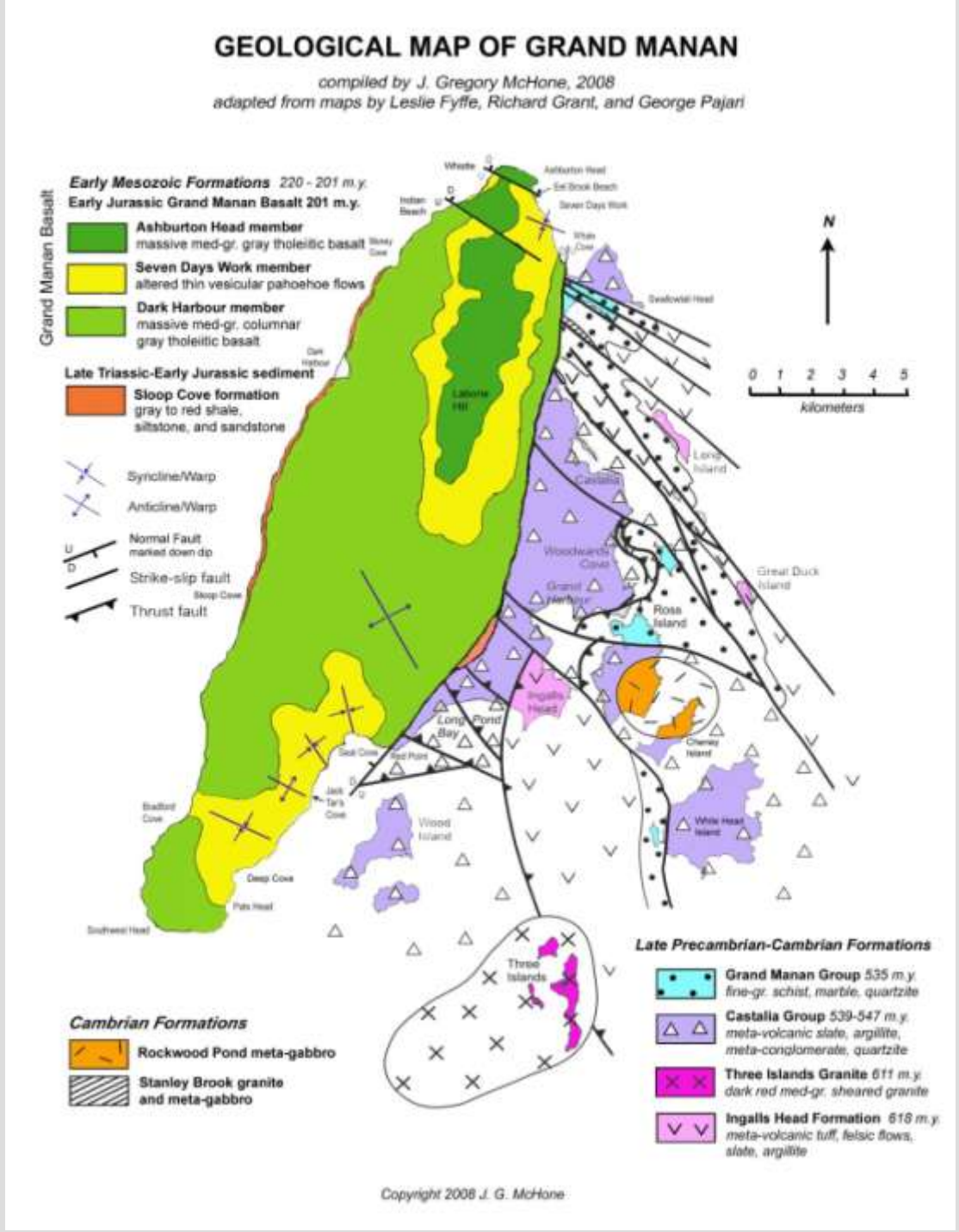
Also see our web page on GM Geology at *http://earth2geologists.net*



Les Fyffe and his colleagues have concentrated on the older metamorphic formations along the eastern side of the island.

Nancy and I have been working more to the west of the great fault that divides the island. That side is mostly volcanic lava flows of the Jurassic Period, or 201 million years old.


The Red Point Fault (normal motion) places the overlying Mesozoic Grand Manan basalt against much older Long Pond Bay argillite.



Here is a preliminary map that combines the geology.

The colors east of the fault are for groups of rock formations that appear to be related to one another.

The colors west of the fault are Mesozoic formations and their subdivisions. Deep underneath the western rocks are ancient formations like the eastern rocks. This can be called the “basement.”

Not shown are glacial deposits from the recent Ice Age.

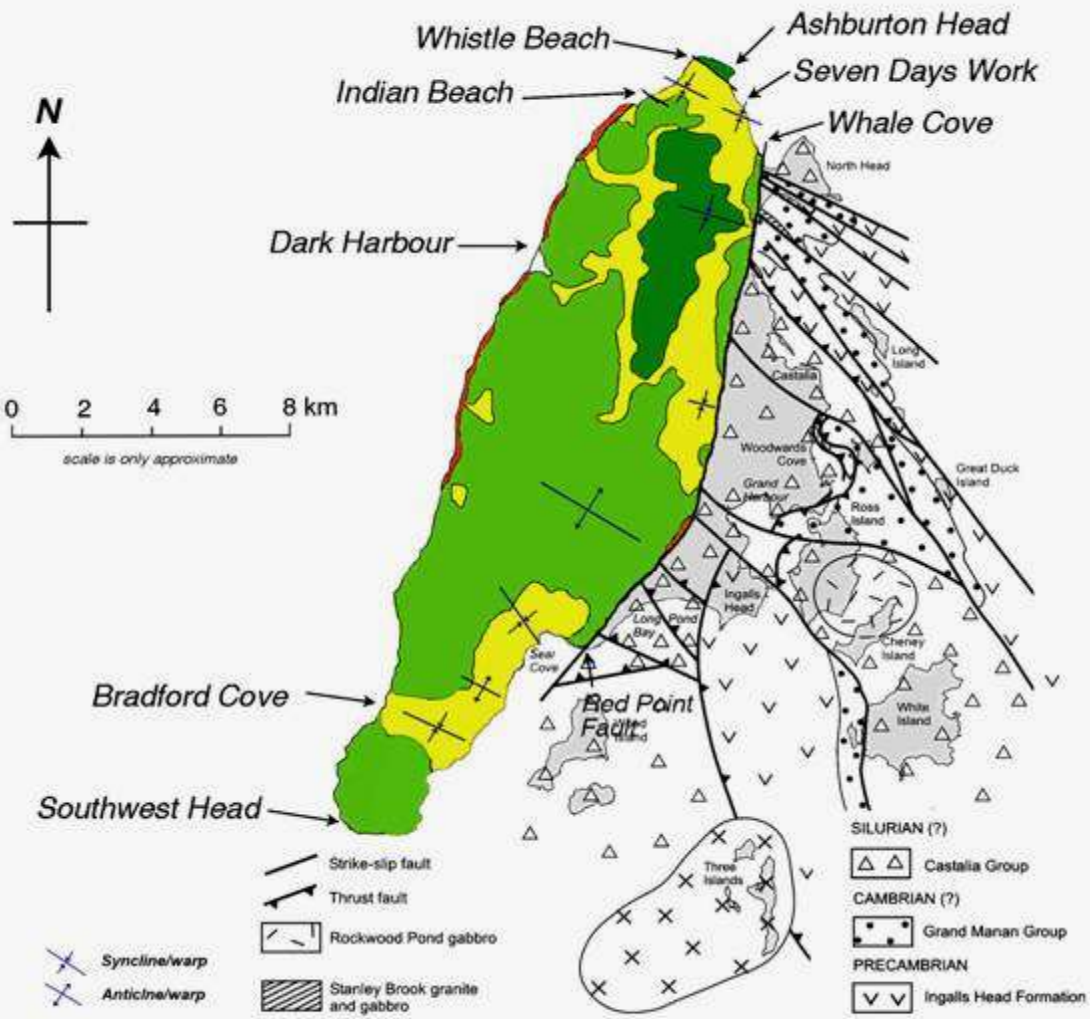
Organization of this talk:

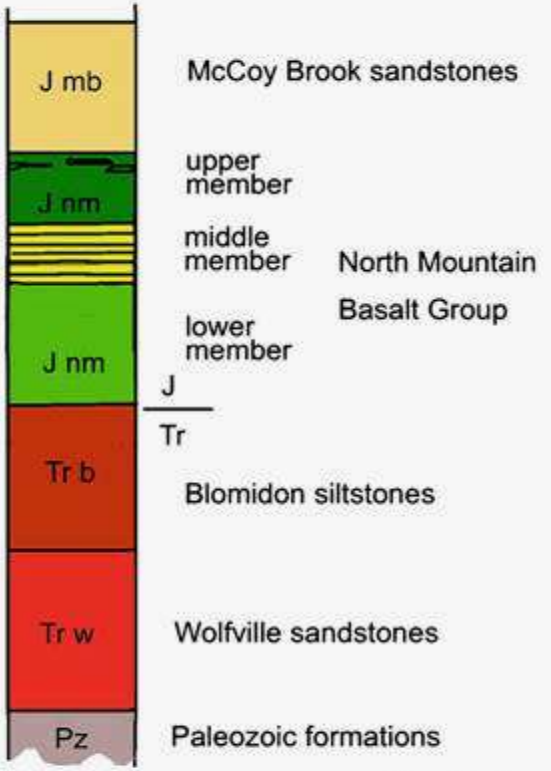
- The “old” (eastern island) events and rocks, Vendian – Early Cambrian periods or about 535 to 618 ma
- The “young” events and rocks (western island), Early Jurassic or about 201 ma
- The “recent” events and features after the Ice Age, Quaternary, about 3-12 ka

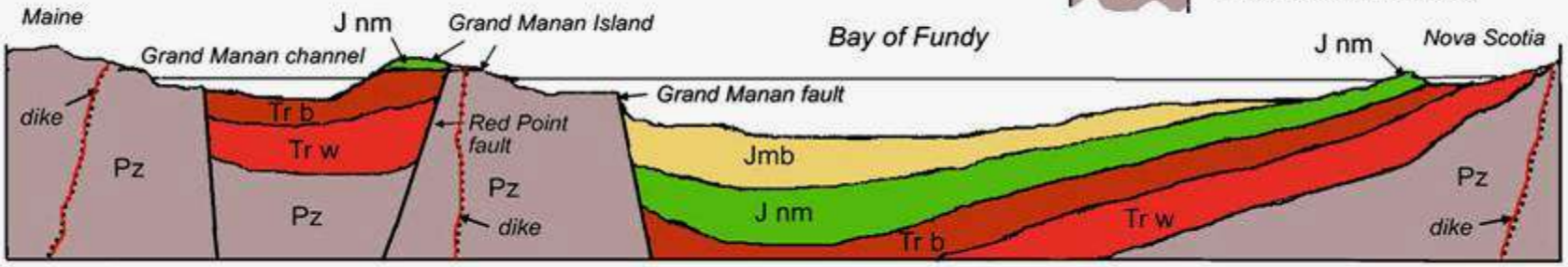
Geology and Stratigraphy of Grand Manan Island and the southern Fundy Basin

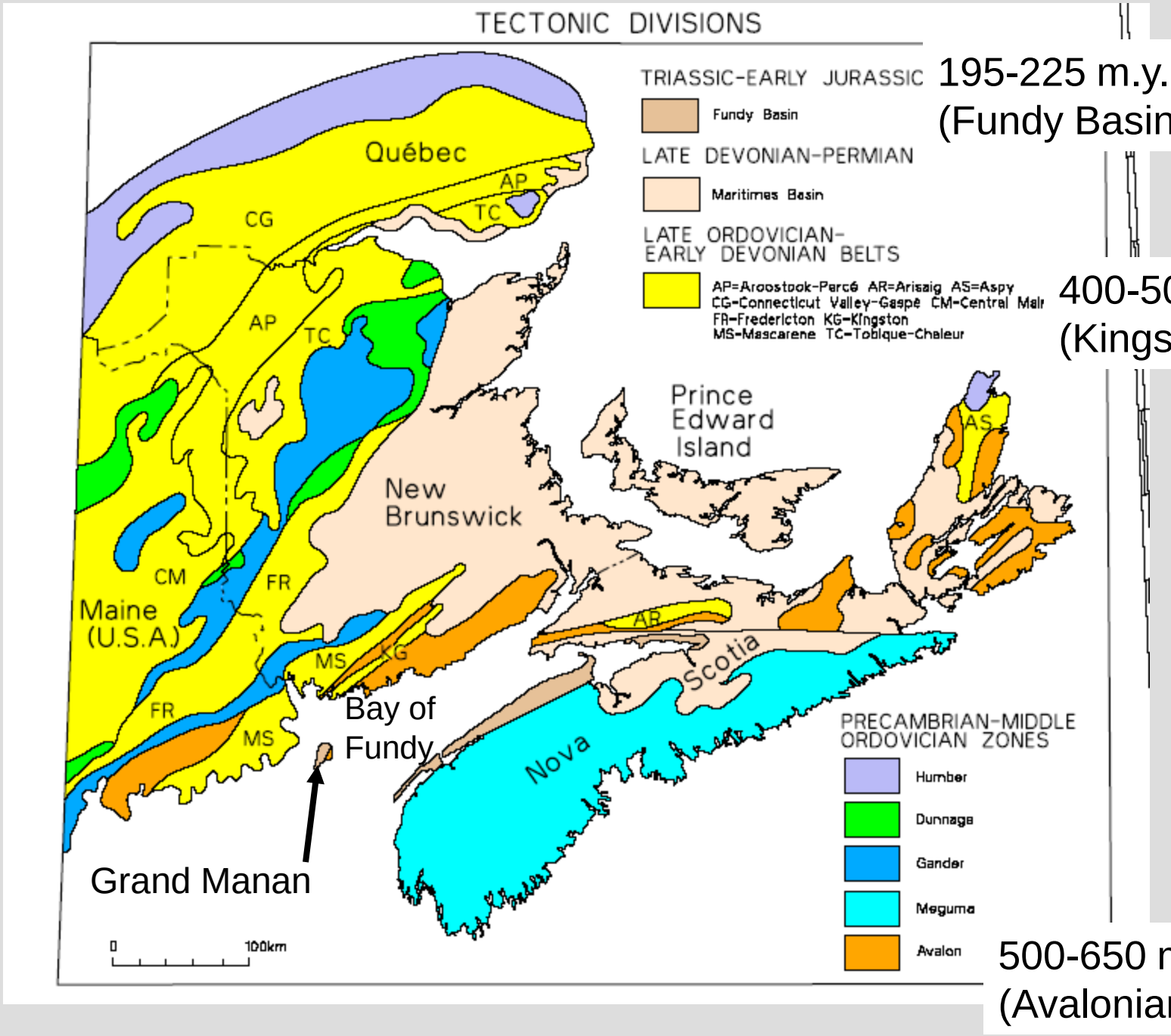
J. G. McHone 2001 - 2005

Mesozoic map modified from G. Pajari, 1976
Pre-Mesozoic geology by Fyfe et al., 2001





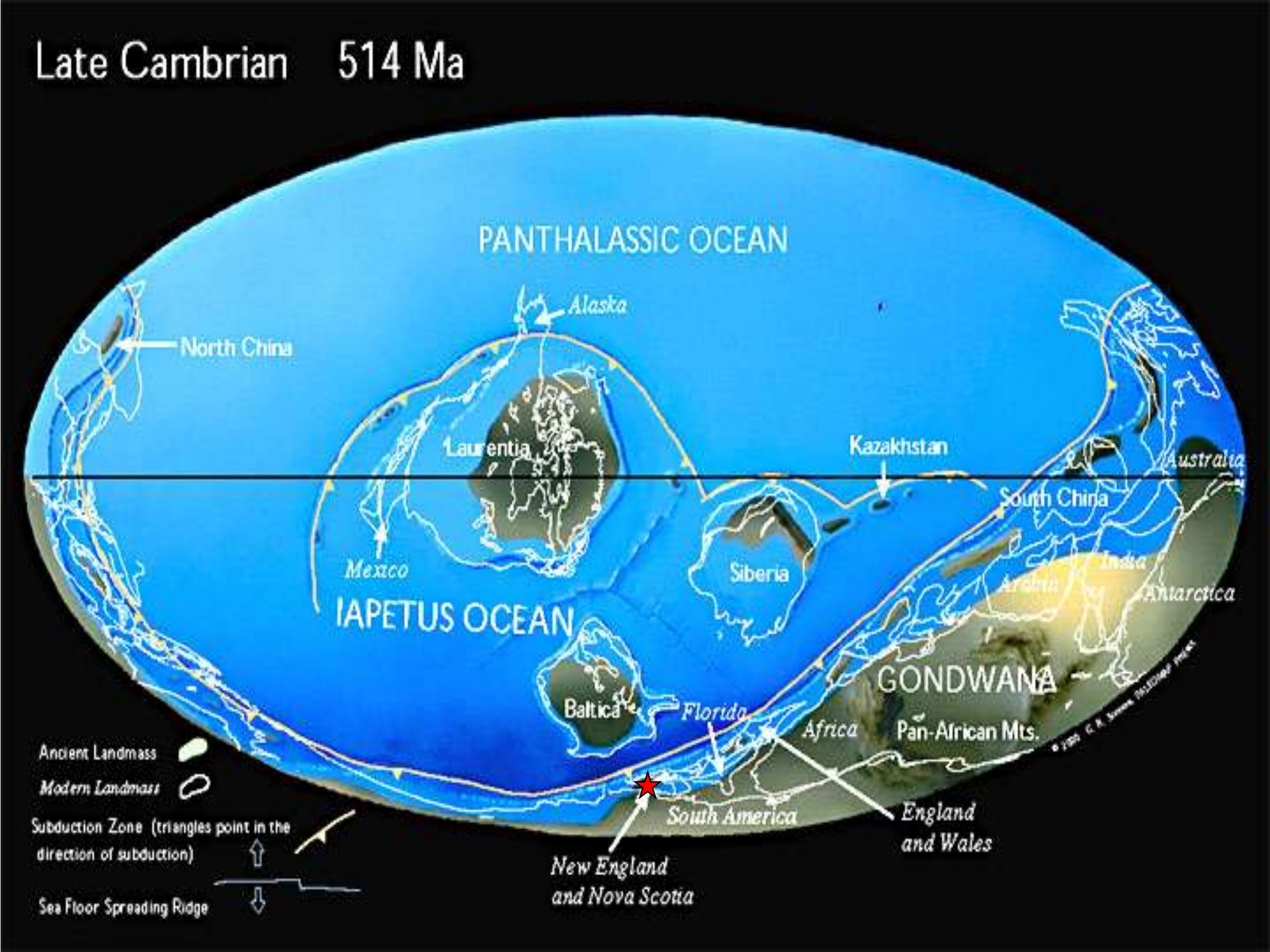


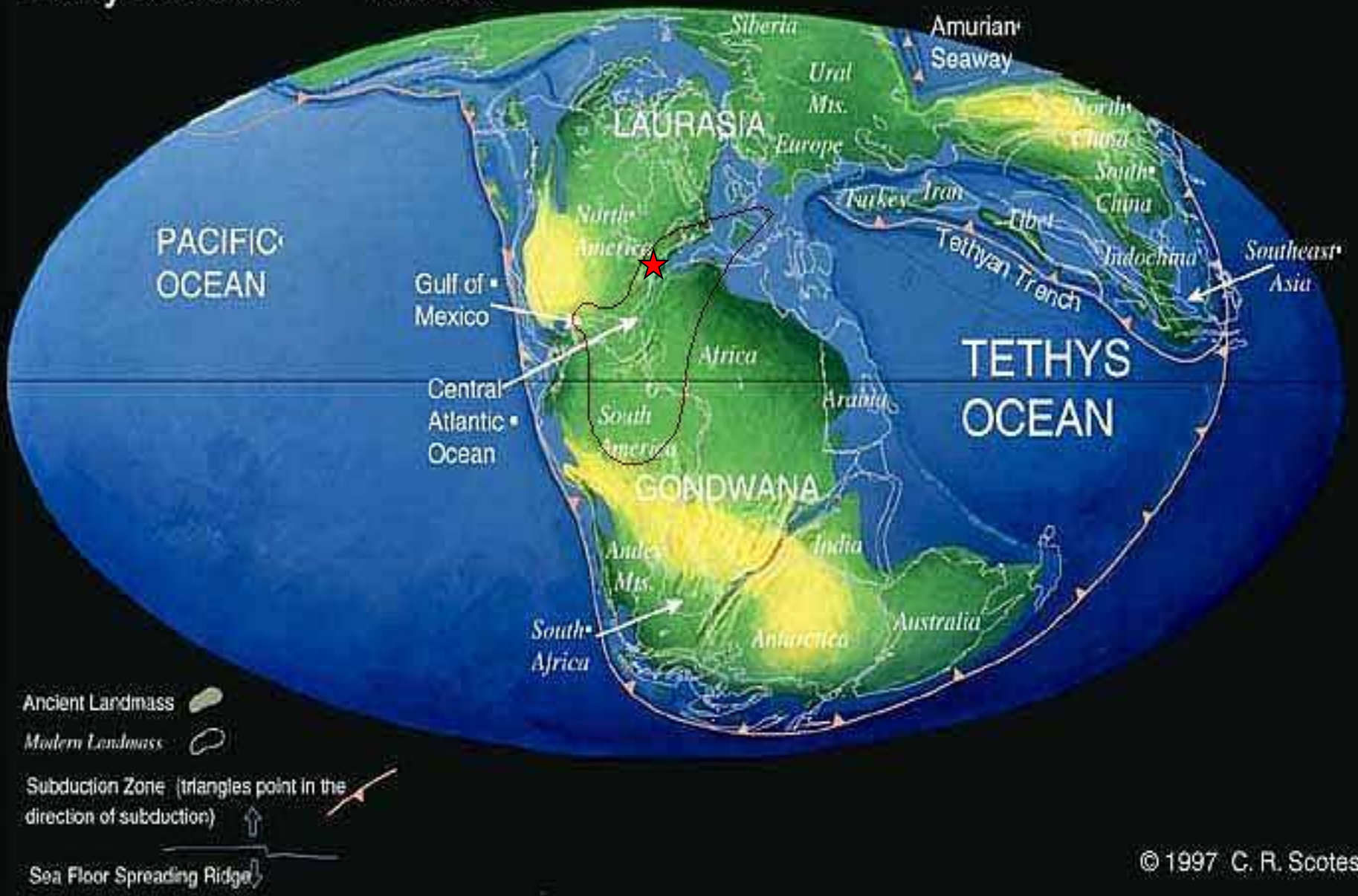


195-225 m.y.
(Fundy Basin)

400-500 m.y.
(Kingston)

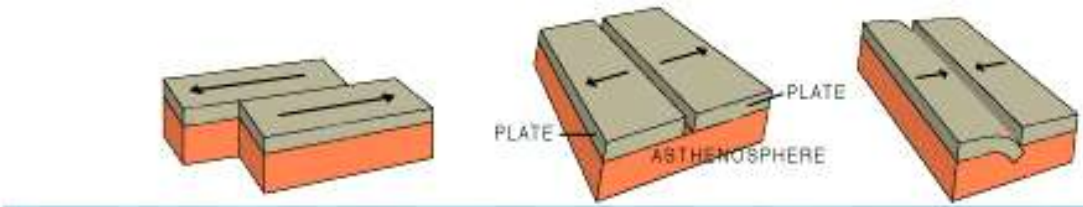
500-650 m.y.
(Avalonian)

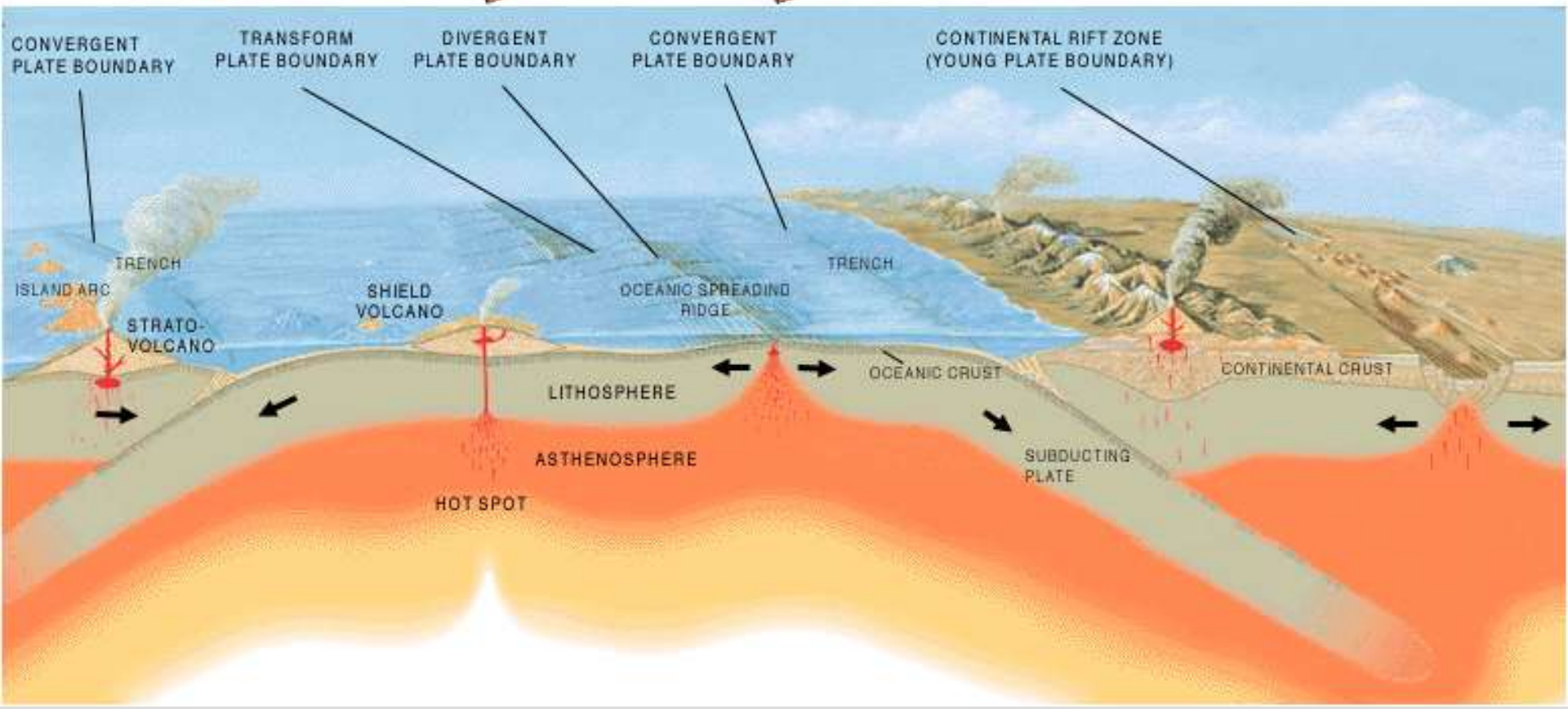

Late Cambrian 514 Ma
PANTHALASSIC OCEAN
Alaska
North China
Laurentia
Kazakhstan
Australia
South China
Mexico
Siberia
India
Arabia
Antarctica
IAPETUS OCEAN
GONDWANA
Baltica
Florida
Africa
Pan-African Mts.
South America
England and Wales
New England and Nova Scotia
Ancient Landmass
Modern Landmass
Subduction Zone (triangles point in the direction of subduction)
Sea Floor Spreading Ridge


Early Jurassic 195 Ma
Siberia
Amurian Seaway
Ural Mts.
LAURASIA
Europe
North China
South China
Turkey
Iran
Tibet
Indochina
Southeast Asia
Tethyan Trench
PACIFIC OCEAN
North America
Gulf of Mexico
Central Atlantic Ocean
Africa
Arabia
TETHYS OCEAN
South America
GONDWANA
Andes Mts.
India
South Africa
Antarctica
Australia
Ancient Landmass
Modern Landmass
Subduction Zone (triangles point in the direction of subduction)
Sea Floor Spreading Ridge
© 1997 C. R. Scotese

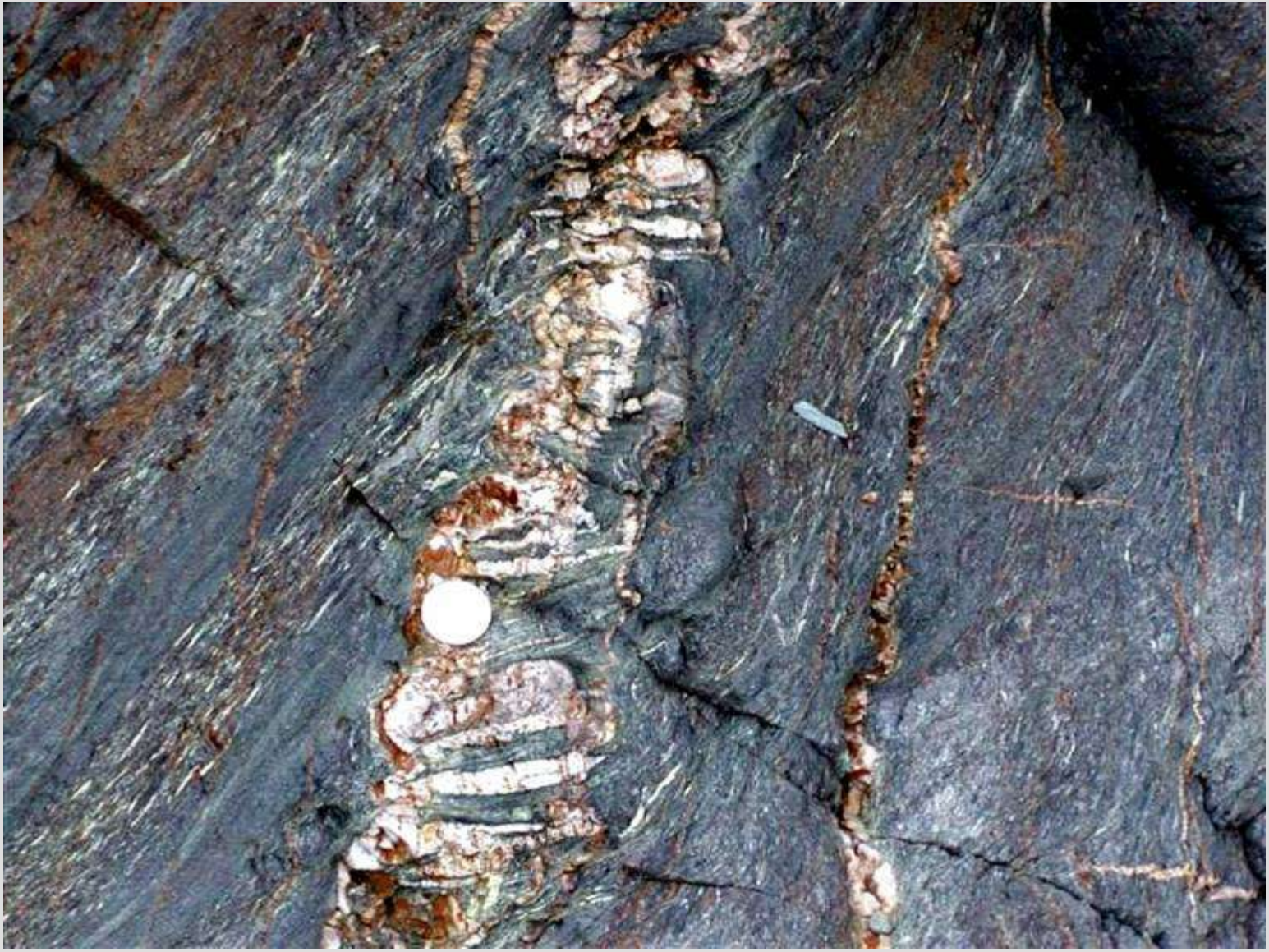
Maps of the ancient Earth are based on our knowledge of plate movements, and of magnetic patterns that indicate locations of rocks when they formed.

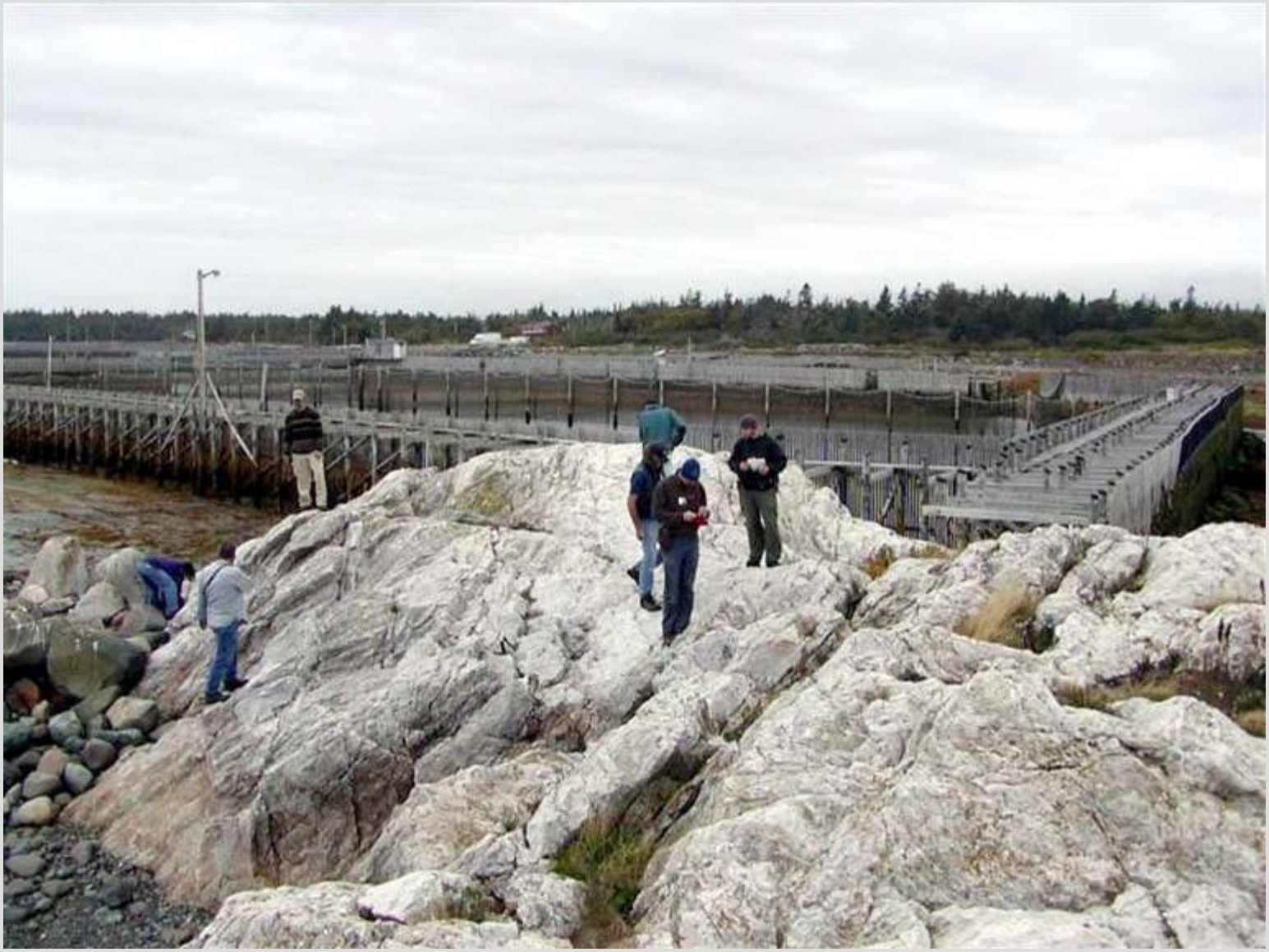
diagram from Wikipedia

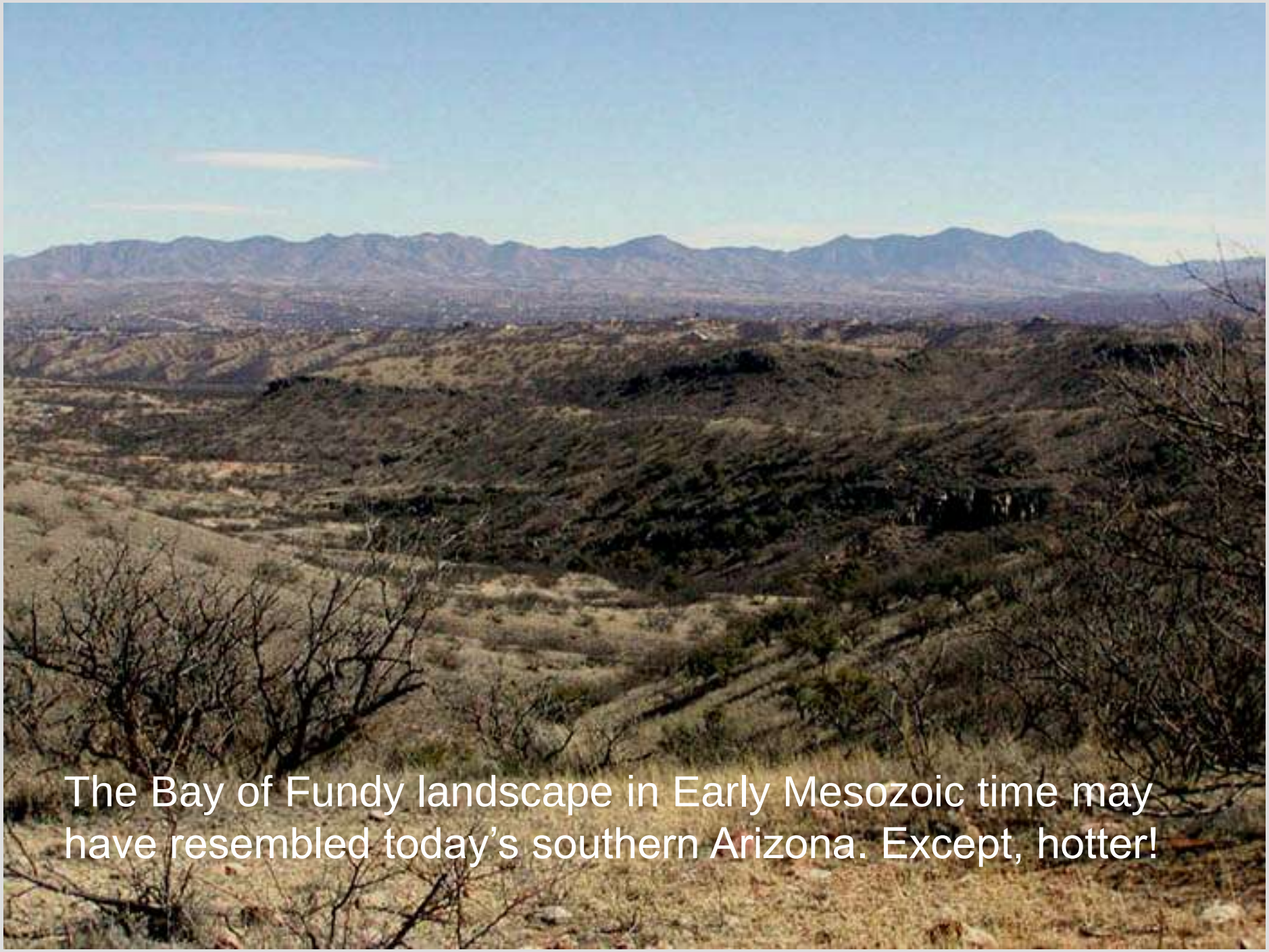


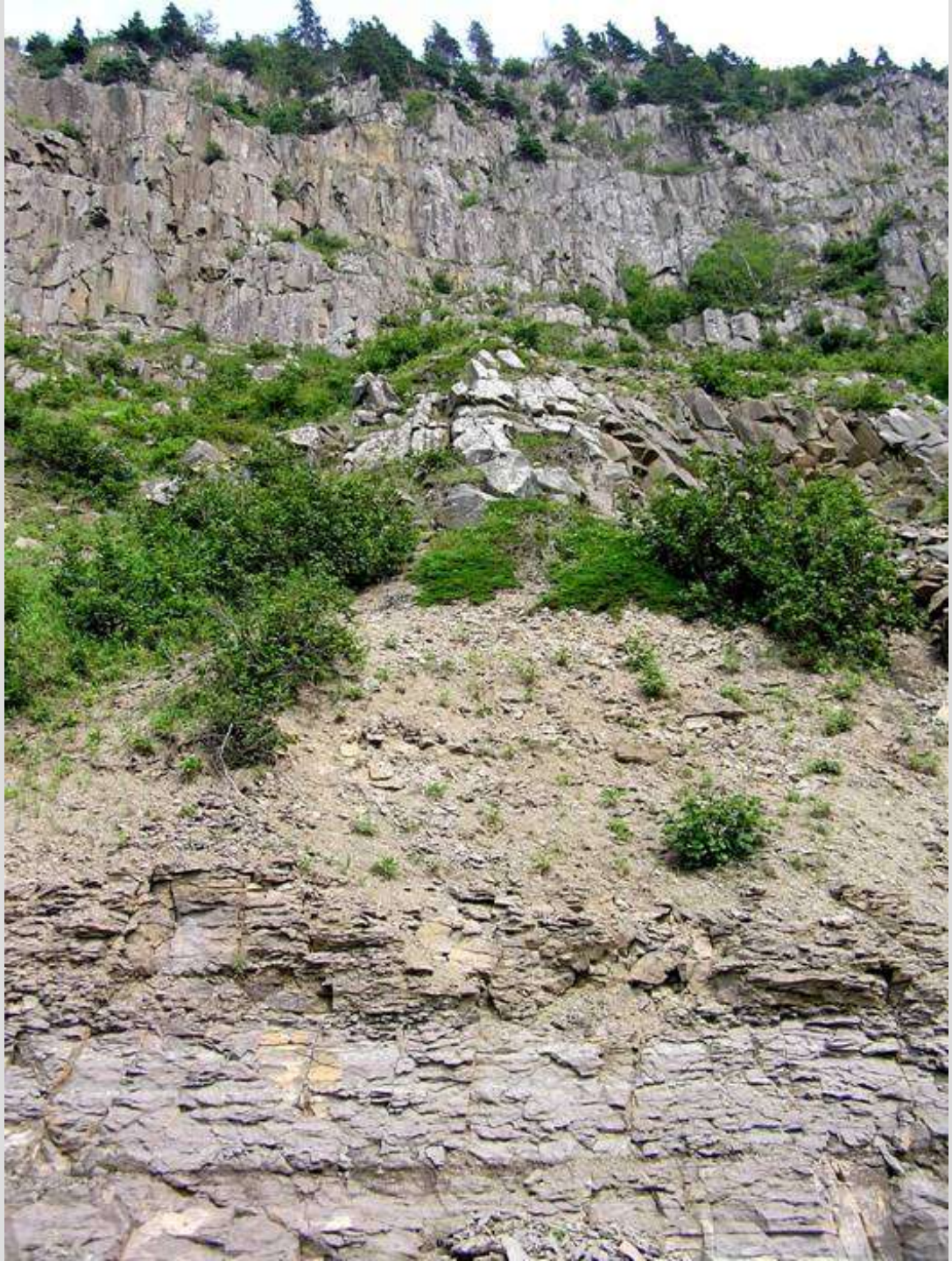


Pieces of the earth's outer layers, or plates collide as they move. Where that happens, rocks become buried, heated, bent, broken, and "metamorphosed" by new minerals.






The Bay of Fundy landscape in Early Mesozoic time may have resembled today's southern Arizona. Except, hotter!



Lava flows of the Dark Harbour member of the Grand Manan basalt (Early Jurassic, 201 ma)

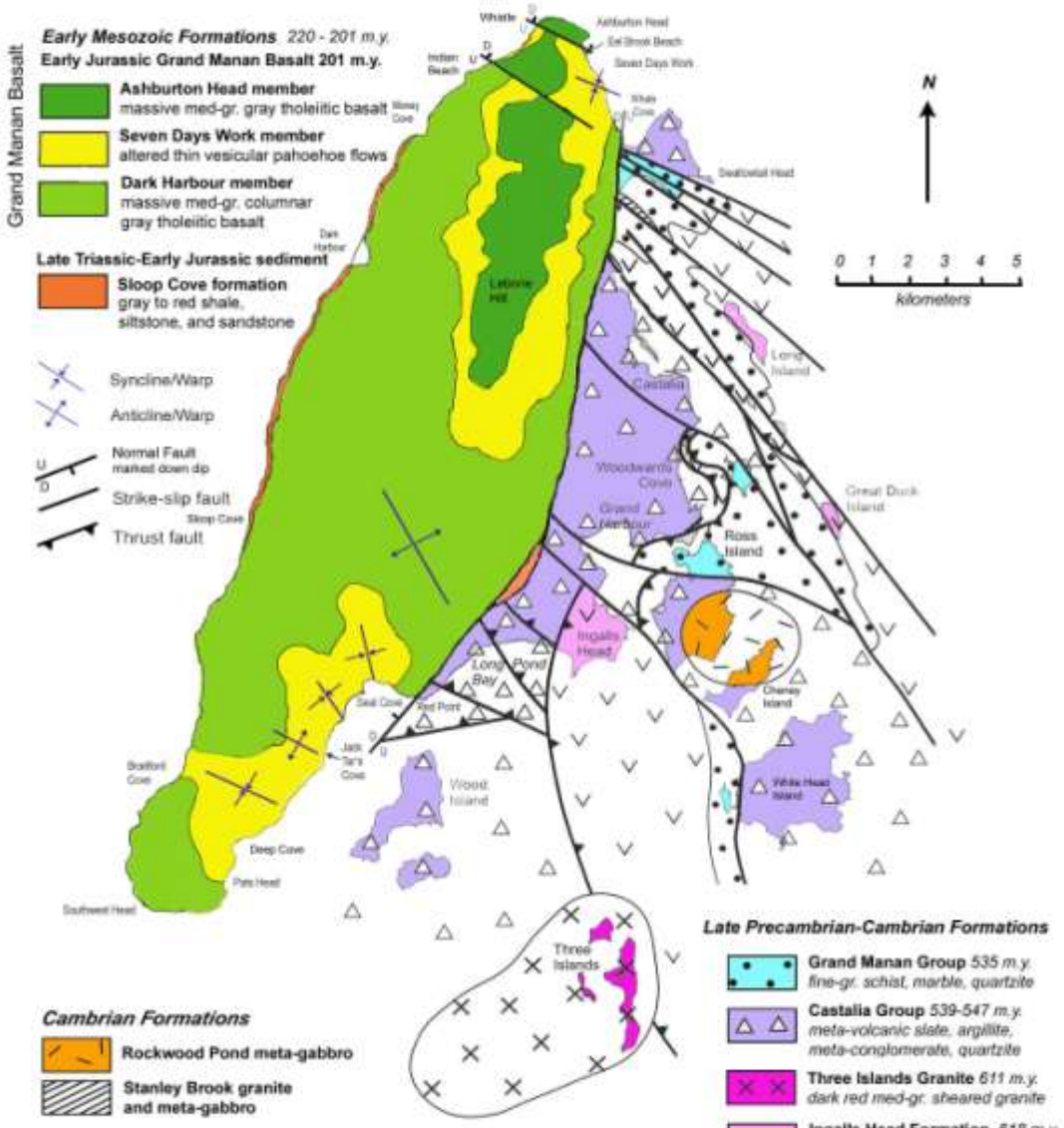
Jurassic Period

Triassic Period

Mud, silt and sand stones of the Sloop Cove formation (ancient playas and lake beds)

GEOLOGICAL MAP OF GRAND MANAN

compiled by J. Gregory McHone, 2008
adapted from maps by Leslie Fyffe, Richard Grant, and George Pajari



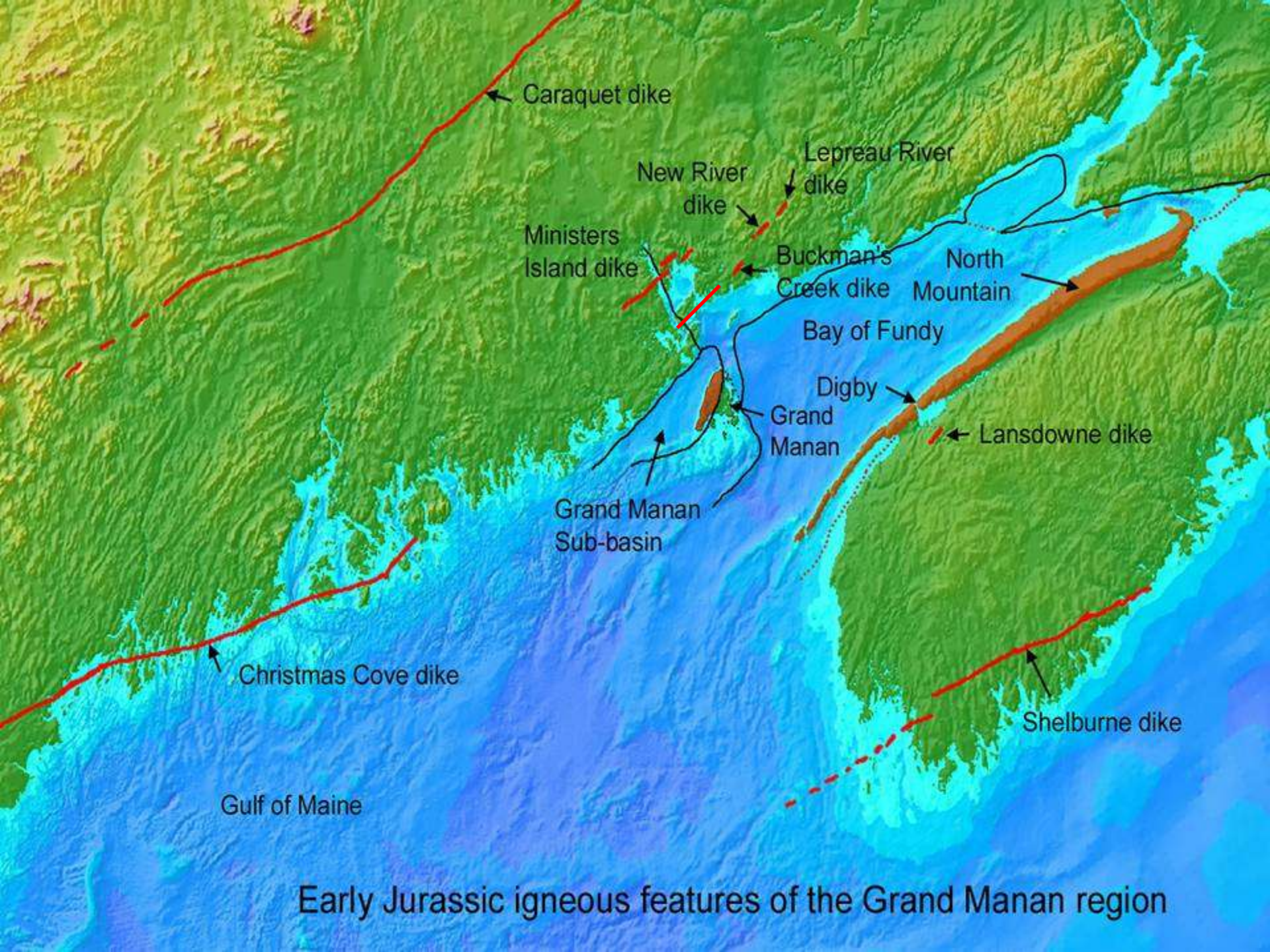

The mural by William Sillin called “In the Late Triassic” depicts plants and animals that lived in our region.

Anchisaurus was an ancestor to the giant Sauropods like *Apatosaurus (Brontosaurus).*

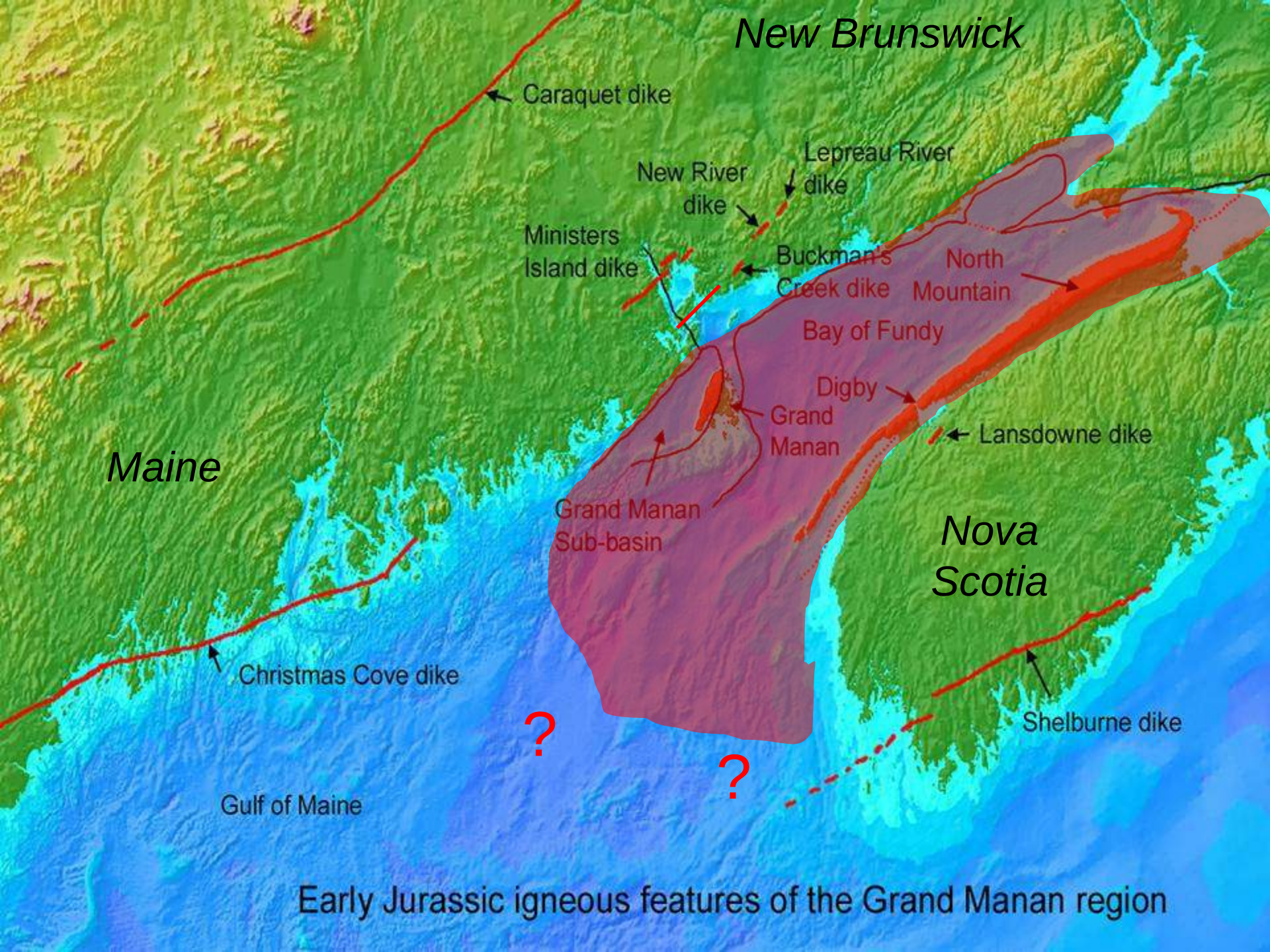
Small early ornithischians of the Fabrosaur suborder. Rather bird-like, but not ancestors to modern birds.

The biggest carnivore around this time was Dilophosaurus, a theropod dinosaur.

Fissure eruption of the 1977 Krafla volcanic event, Iceland



Early Jurassic igneous features of the Grand Manan region



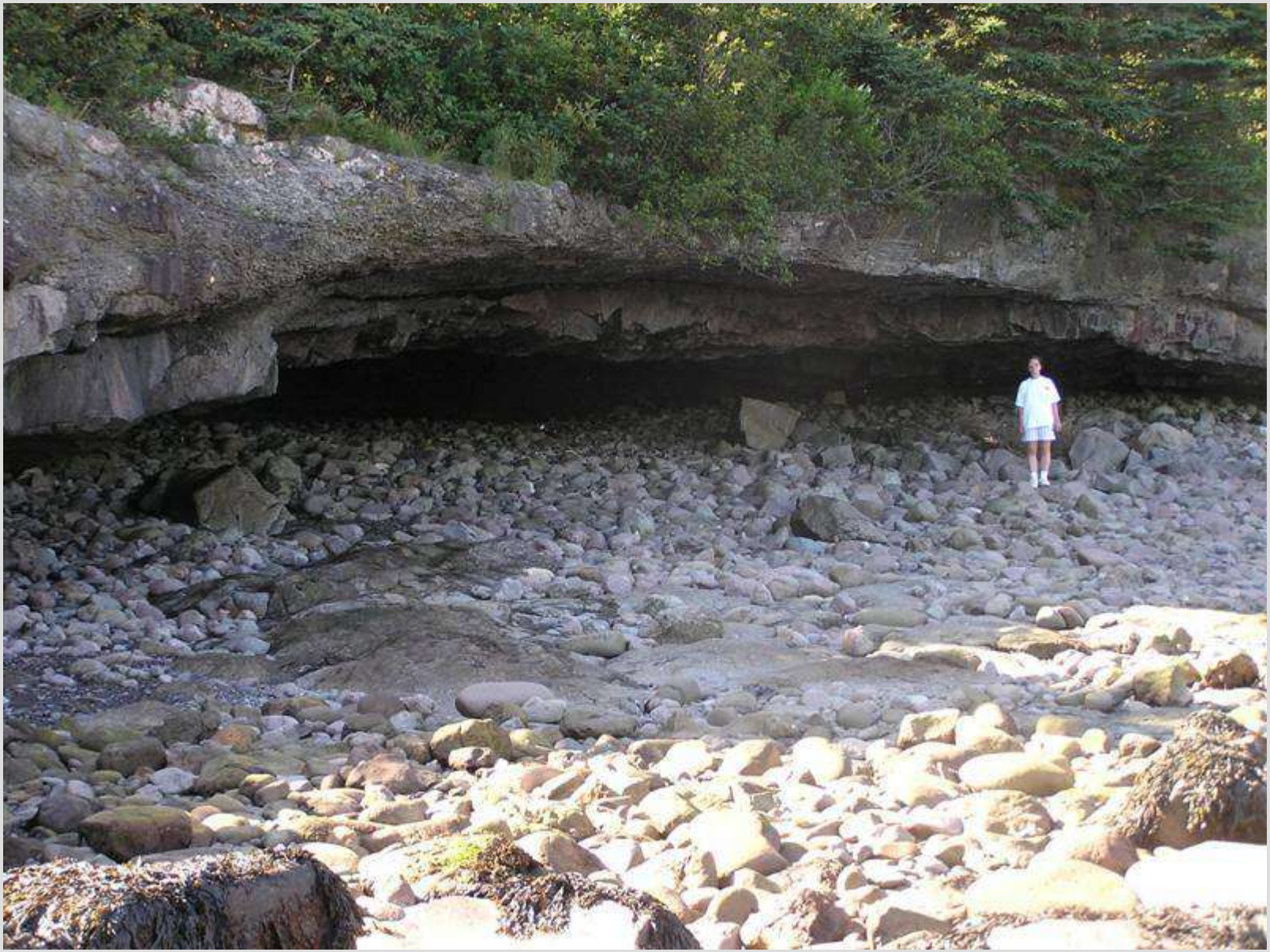
Early Jurassic igneous features of the Grand Manan region


Lower member in a
90 m colonnade at
Southwest Head


The thin-flow middle unit rests *conformably* on the columnar lower unit at Whale Cove.

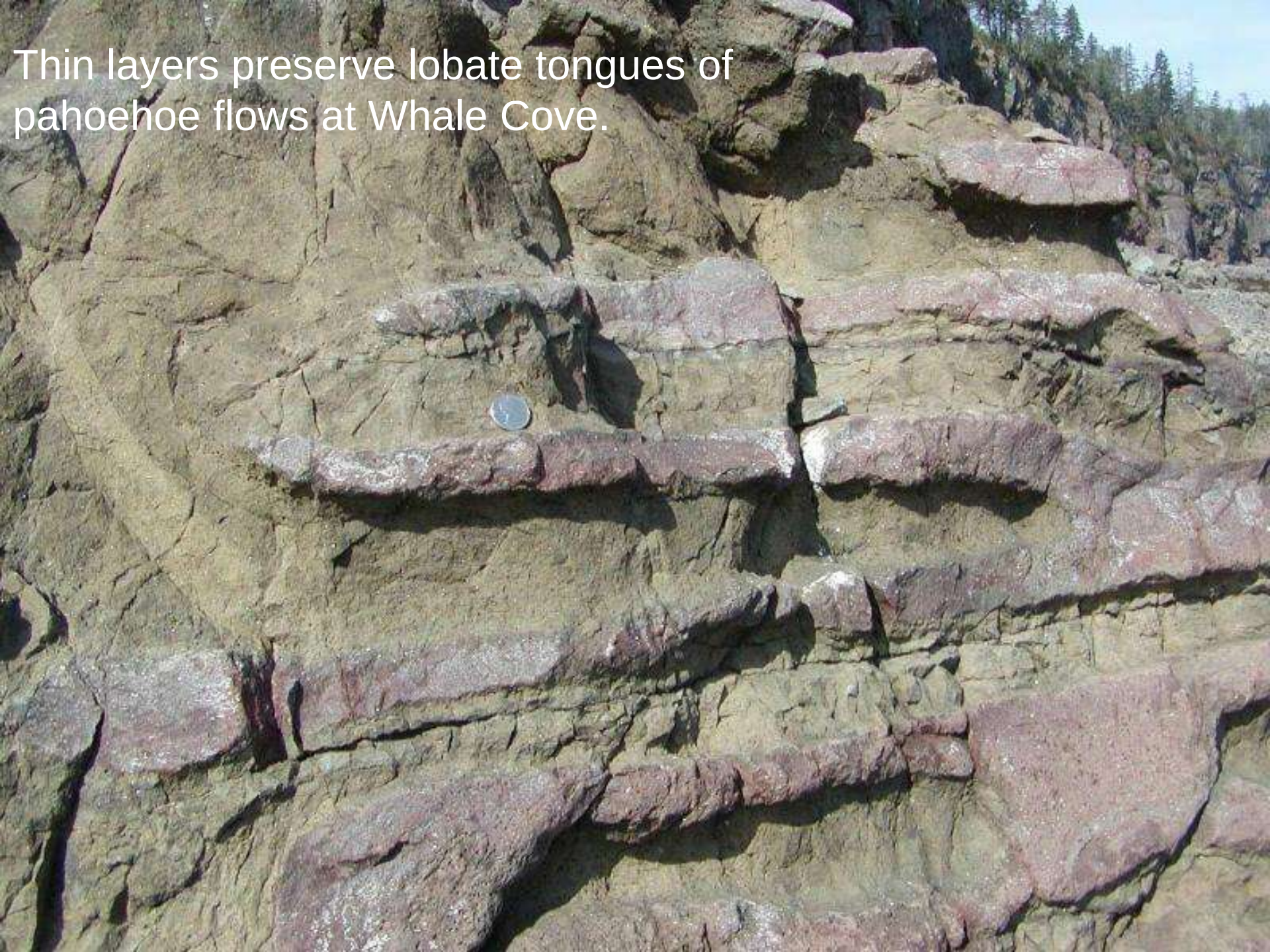
Seven Days Work, a 60-m cliff of thin amygdaloidal flows of the middle unit

Seven Days Work member occurs in other places, such as Seal Cove and Deep Cove. Same rocks at Jack Tars Cove (Cave).



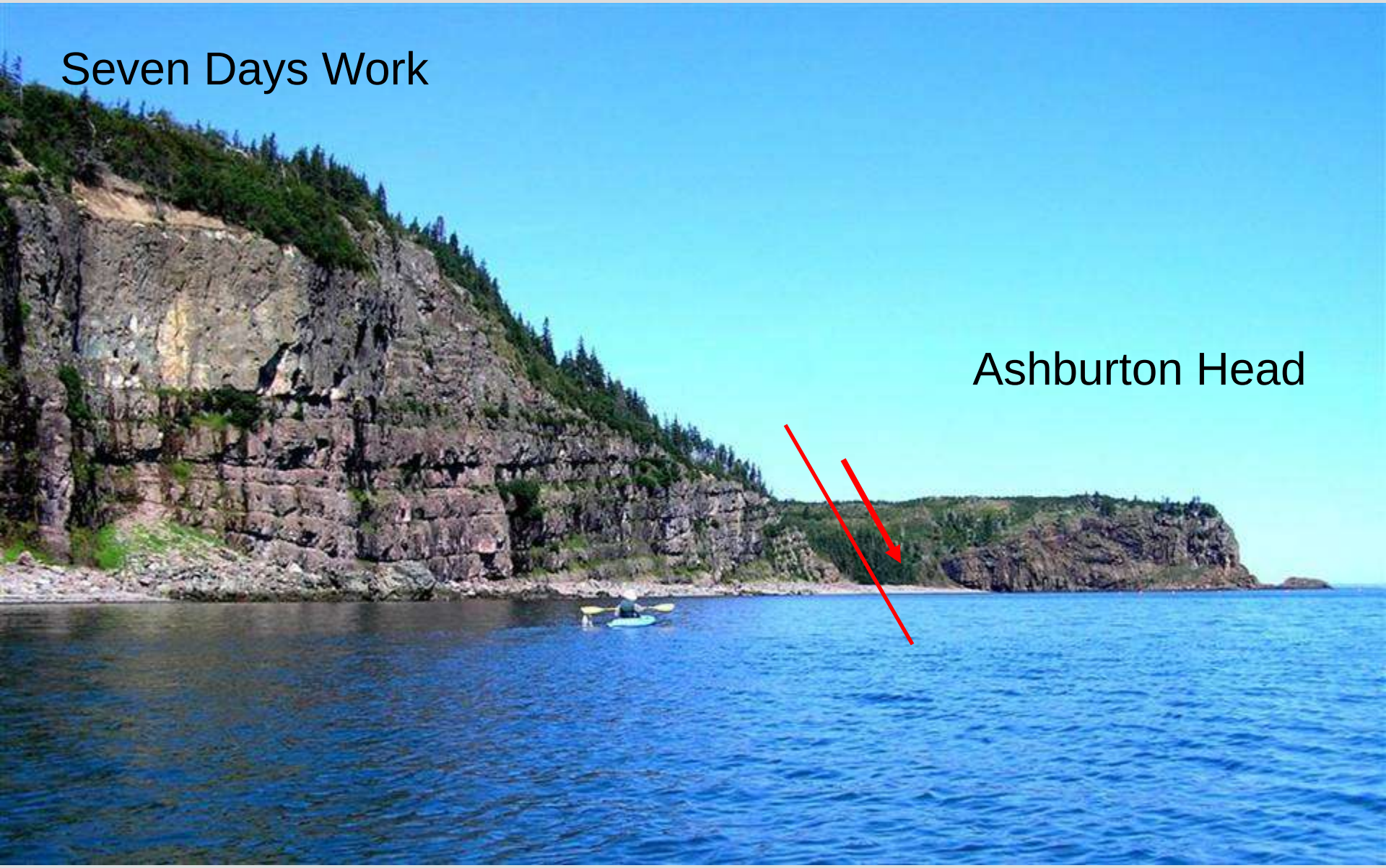
The lavas that form most of Grand Manan are the type called *pahoehoe*, which is smooth, ropy, glassy lava that flows easily. This is a common type in Hawaii.

“Flow tongues” of pahoehoe flow like soft paste

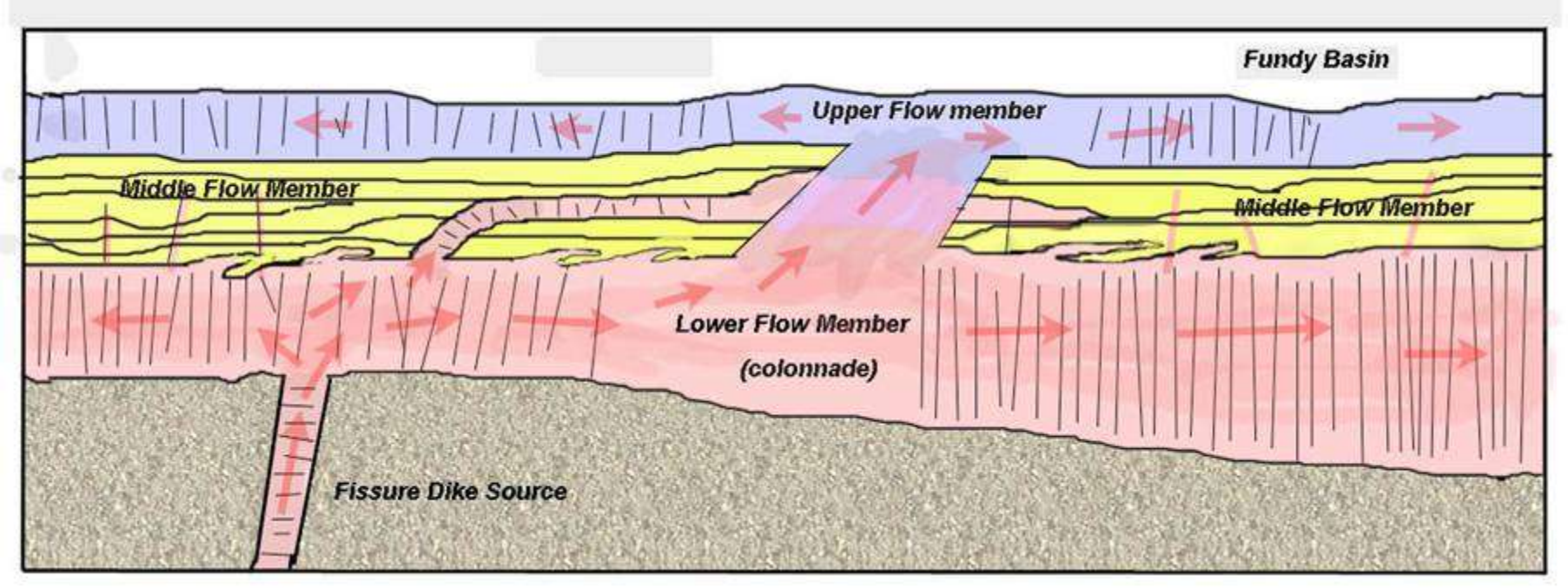

Thin layers preserve lobate tongues of pahoehoe flows at Whale Cove.


Lava tubes were formed from liquid lava flowing inside or beneath more solid flows, here at Seven Days Work.

Minerals on display in the Grand Manan Museum, many from the Seven Days Work lava flows.


Seven Days Work
Ashburton Head

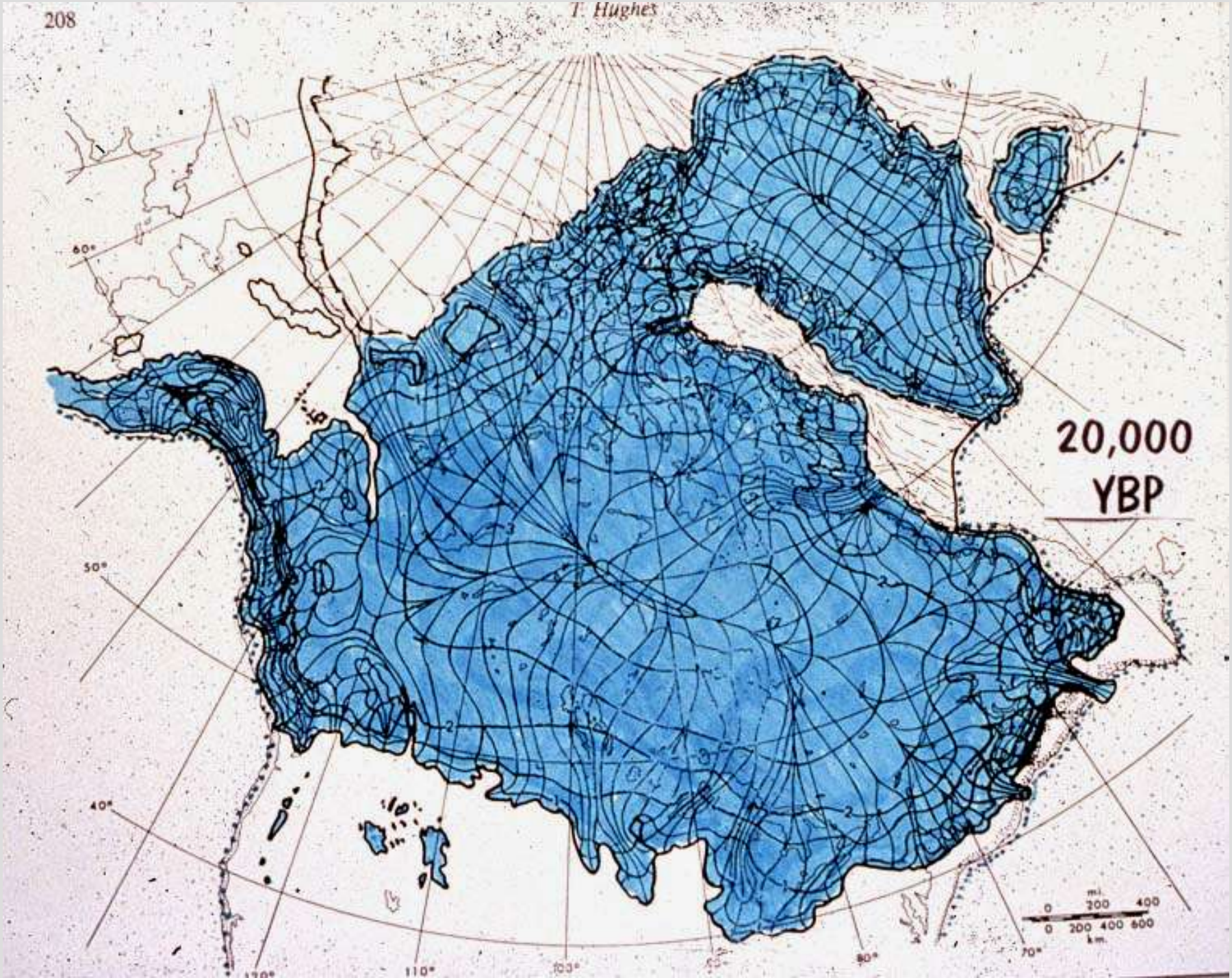
Ashburton Head is a columnar basalt section made of the upper or third member, at least 90 m thick.

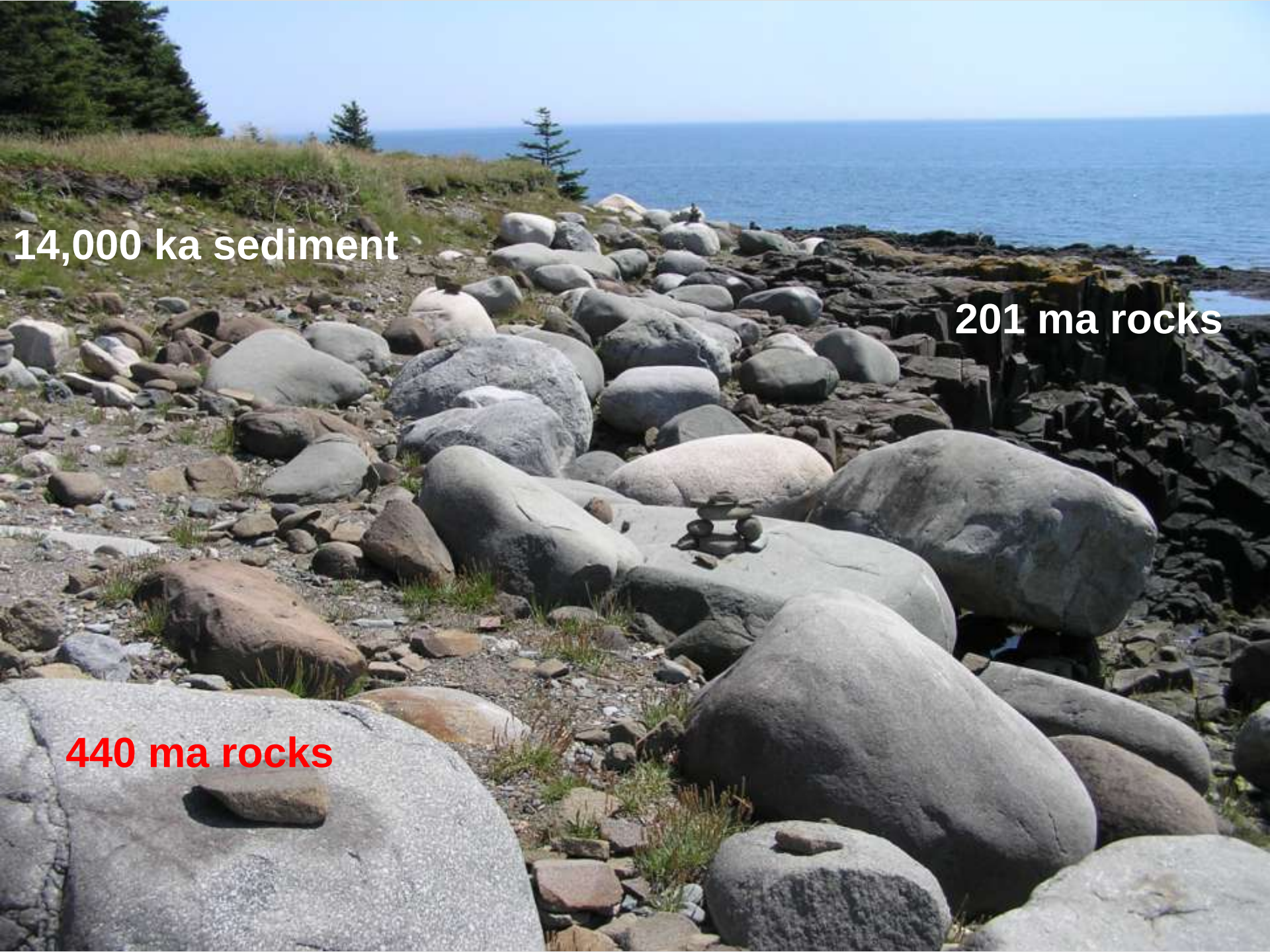


1. Fissures (dikes) fed the thick lower member, which filled the young Fundy Basin (a topographic low area)

2. A series of thin gas-rich vesicular cap flows formed the middle member, created from repeated inflations or surges of magma from the source fissures.

3. A large surge broke through the middle member to form the third or upper member.


20,000
YBP
60°
50°
40°
110°
100°
90°
70°
0 200 400
mi.
0 200 400 600
km.


14,000 ka sediment
201 ma rocks
440 ma rocks