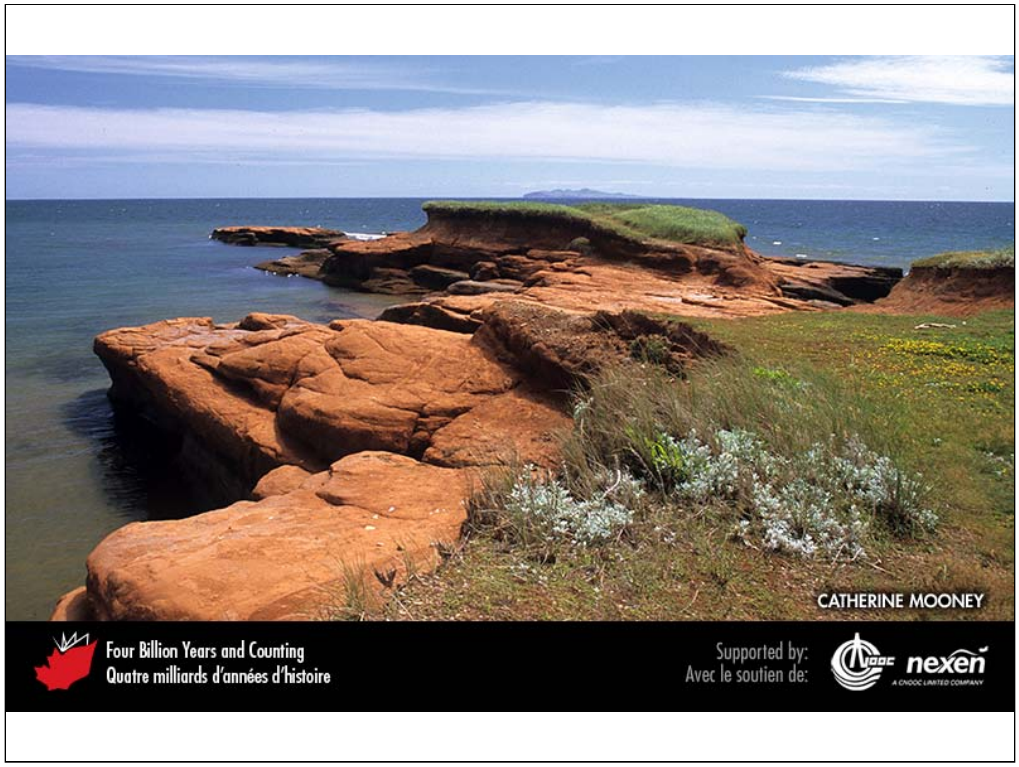
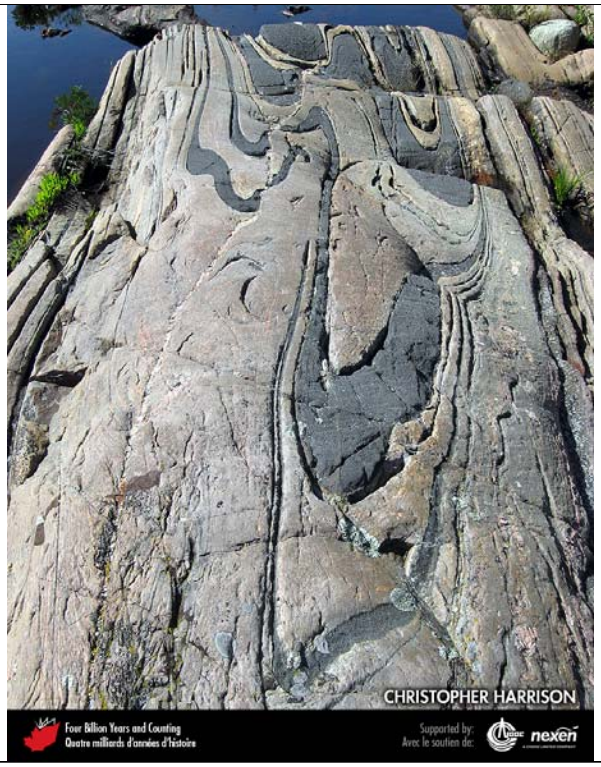
CHAPTER 20
Part 1 of 3



Coastal exposure of sandstones on the Magdalen Islands, Quebec. These Permian redbeds were deposited in the interior of the supercontinent Pangea. CATHERINE MOONEY.

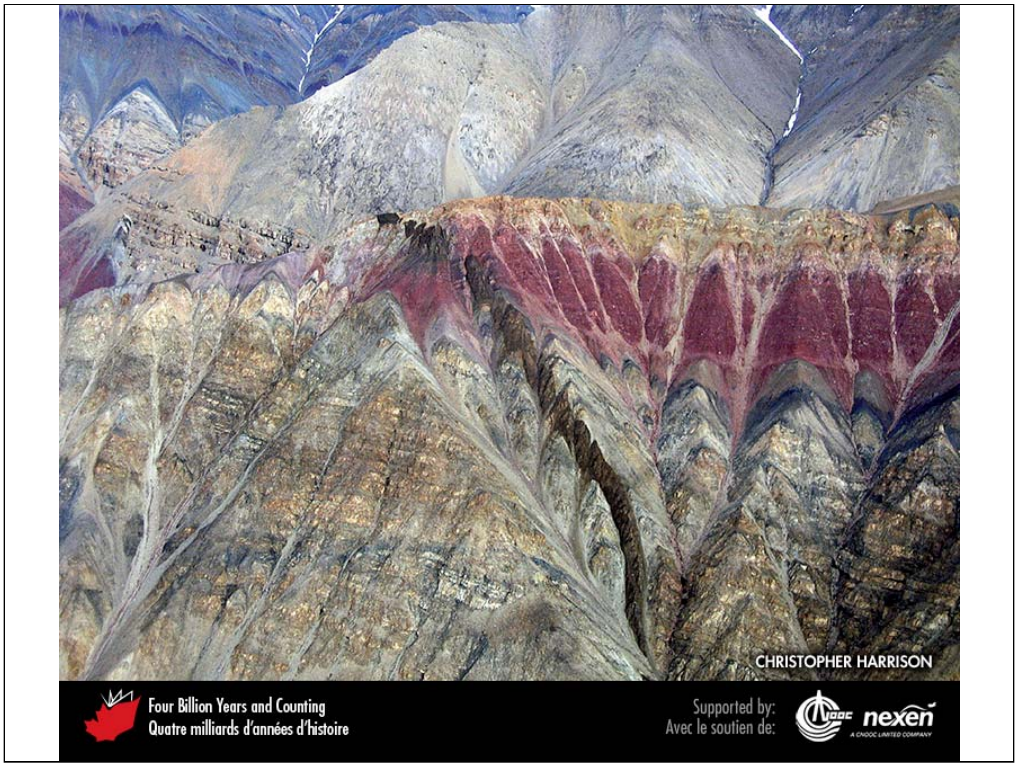
Weathered Archean komatiite, about 2,700 million years old, from the Rae Craton on Baffin Island, Nunavut. The pattern may reflect columnar jointing. MIKE YOUNG.

These well-preserved Paleoproterozoic pillow lavas on central Baffin Island, Nunavut, are 1,970 million years old and likely formed in the Manikewan Ocean prior to the Trans-Hudson Orogeny. The white areas between pillows (not the cross-cutting white veins) represent carbonate that was precipitated in crevices between pillows. DAVID CORRIGAN.

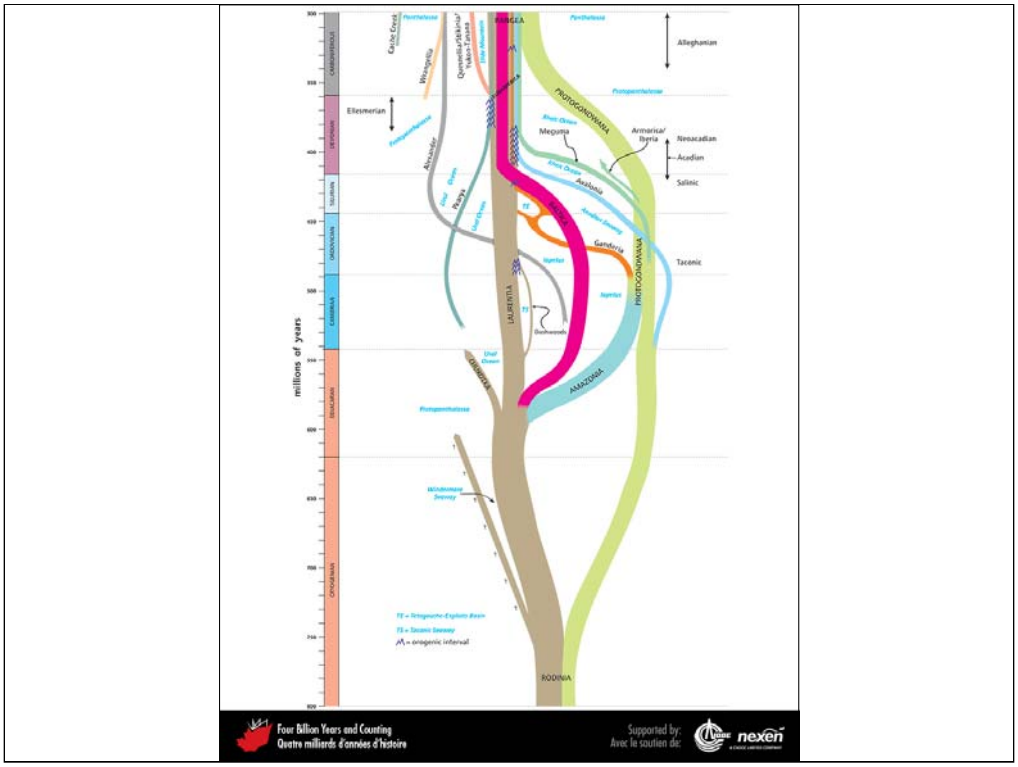


Gneiss and metamorphosed mafic dykes exposed on Franklin Island, off Georgian Bay's east shore. These rocks were deformed at great depth beneath the Grenvillian Mountains over 1,000 million years ago. They reveal what parts of the continental crust might be like today at depths of a few tens of kilometres below the surface. CHRISTOPHER HARRISON.

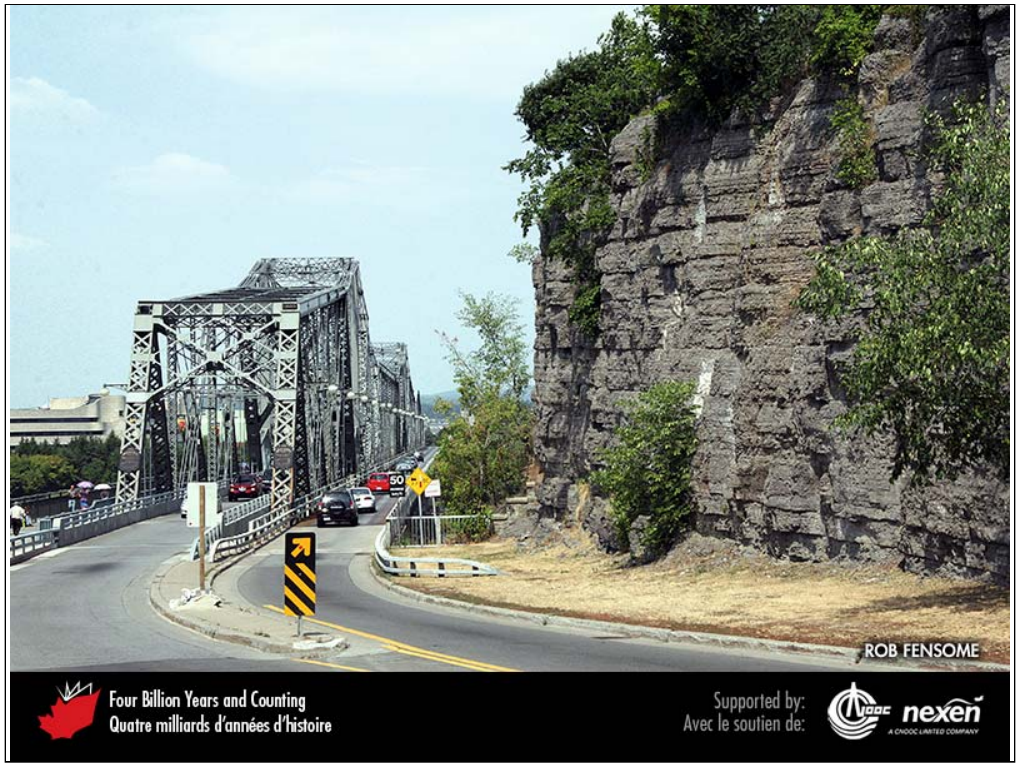
The strata in the upper left half of this photo, taken from Lake Louise ski hill, Alberta, are Cambrian sandstones. Unconformably beneath these are less well-exposed Neoproterozoic deep-sea deposits of the Windermere Seaway. The grey rocks at centre and immediately beneath the well-bedded Cambrian strata represent a submarine canyon and can be seen to thin toward the distance. BILL ARNOTT.



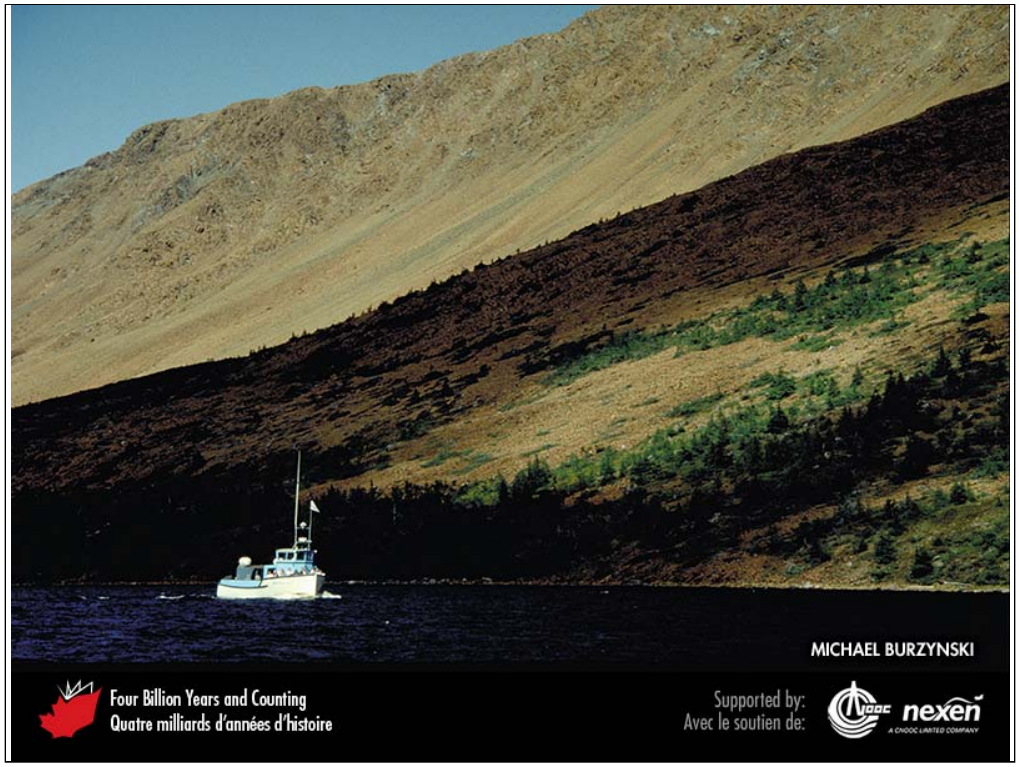
Aerial view of early Cambrian sandstones and overlying Carboniferous redbeds east of Hare Fiord on Ellesmere Island, Nunavut. These strata have been intruded by a Cretaceous mafic dyke (the dark band running obliquely down the cliff). CHRISTOPHER HARRISON.



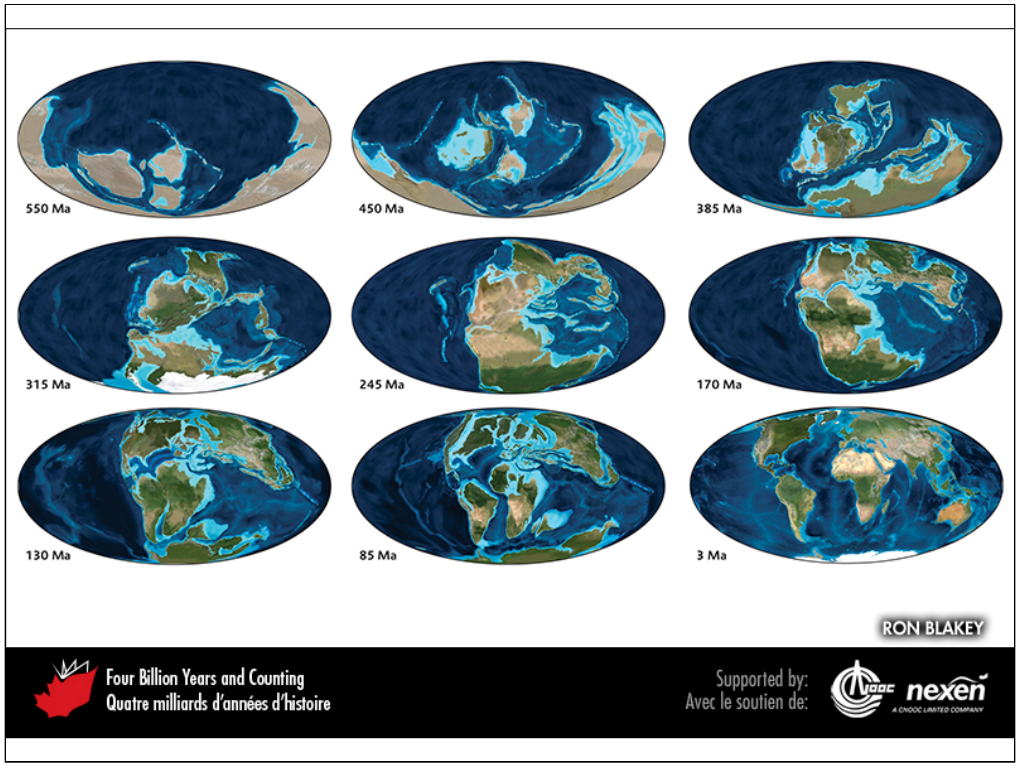
Impressionistic representation of the evolution of continents, oceans, terranes (including microcontinents), orogenies (indicated at right and left), and other major geological features over the interval from 800 to about 300 million years ago. Oceans and seas are in blue lettering; otherwise colours are mainly for clarity and aesthetics. The main focus is on events that relate to the evolution of Canada. It is impossible to accurately represent all events that have occurred during this interval in two dimensions, but this figure provides a sense of how events are related through time and across Canada.



Flat-lying Ordovician limestone beds near the Alexandra Bridge in Ottawa, Ontario. ROB FENSOME.

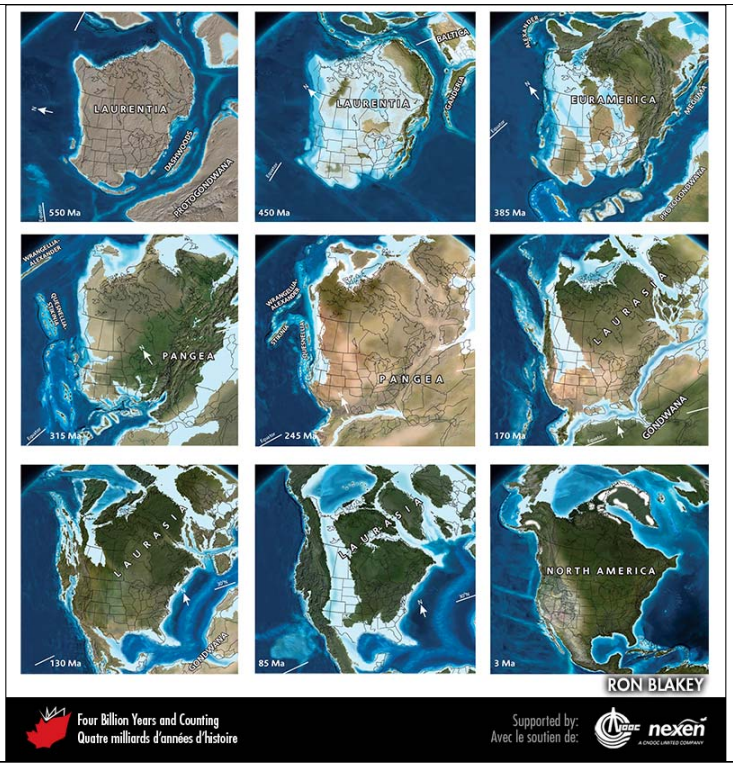


The brown rocks on these slopes near Trout River Pond, Gros Morne National Park of Canada, Newfoundland, are part of the Bay of Islands ophiolite, which was thrust up from the mantle during the Taconic Orogeny, about 480 million years ago. MICHAEL BURZYNSKI.

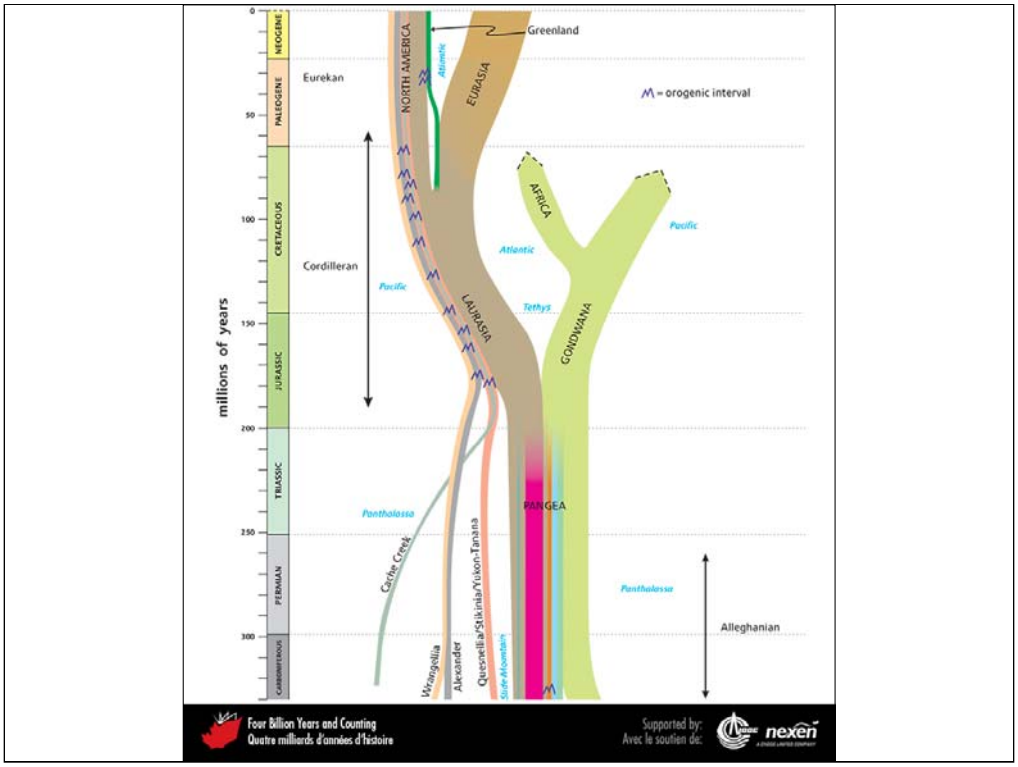


Global paleogeographic reconstructions for selected times from the late Neoproterozoic to almost the present day. Ma = millions of years ago. RON BLAKEY.

Unconformity between Silurian and Carboniferous rocks at Quinn Point, Jacquet River, New Brunswick. The Silurian rocks were tilted during the Acadian Orogeny about 420 to 390 million years ago. ROB FENSOME.



Paleogeographic reconstructions of what was to become North America for selected times (ages in millions of years at top left of each map) from the late Neoproterozoic to almost the present time. Ma = millions of years ago. RON BLAKEY.



Impressionistic representation of the evolution of continents, oceans, terranes (including microcontinents), orogenies (indicated at right and left), and other major geological features over the interval from 330 million years ago to the present. Oceans and seas are in blue lettering; otherwise colours are mainly for clarity and aesthetics. The main focus is on events that relate to the evolution of Canada. It is impossible to accurately represent all events that have occurred during this interval in two dimensions, but this figure provides a sense of how events are related through time and across Canada.

Folded early Cretaceous sandstone with interbeds of coal at the Cardinal River Mine, north of Cadomin, Alberta. These folds are evidence of the deformation that produced the thrust-and-fold belt of the Canadian Rocky Mountains during later Cretaceous to Paleocene time. The horizontal lines are the old pit roads. GODFREY NOWLAN.

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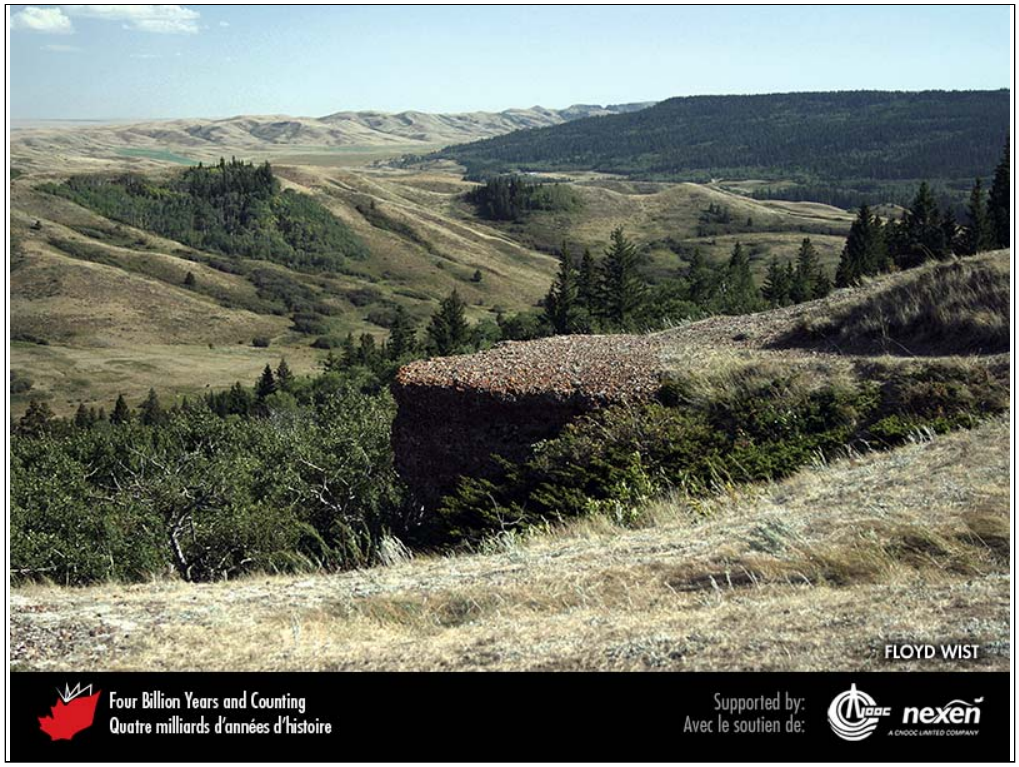
Balancing Rock is a pillar of North Mountain Basalt on Long Island, Nova Scotia. The North Mountain Basalt is part of an episode of late Triassic magmatic activity that presaged the breakup of Pangea and the opening of the Atlantic Ocean. ROB FENSOME.

The black bands in this cliff east of Thompson Glacier on Axel Heiberg Island, Nunavut, are early Cretaceous mafic sills. Here they intrude between late Triassic sandstone and shale layers. The sills are part of the magmatic activity that heralded the early development of the Arctic Ocean. CHRISTOPHER HARRISON.



Conglomerate of Tertiary age, Cypress Hills, southwestern Saskatchewan. FLOYD WIST.

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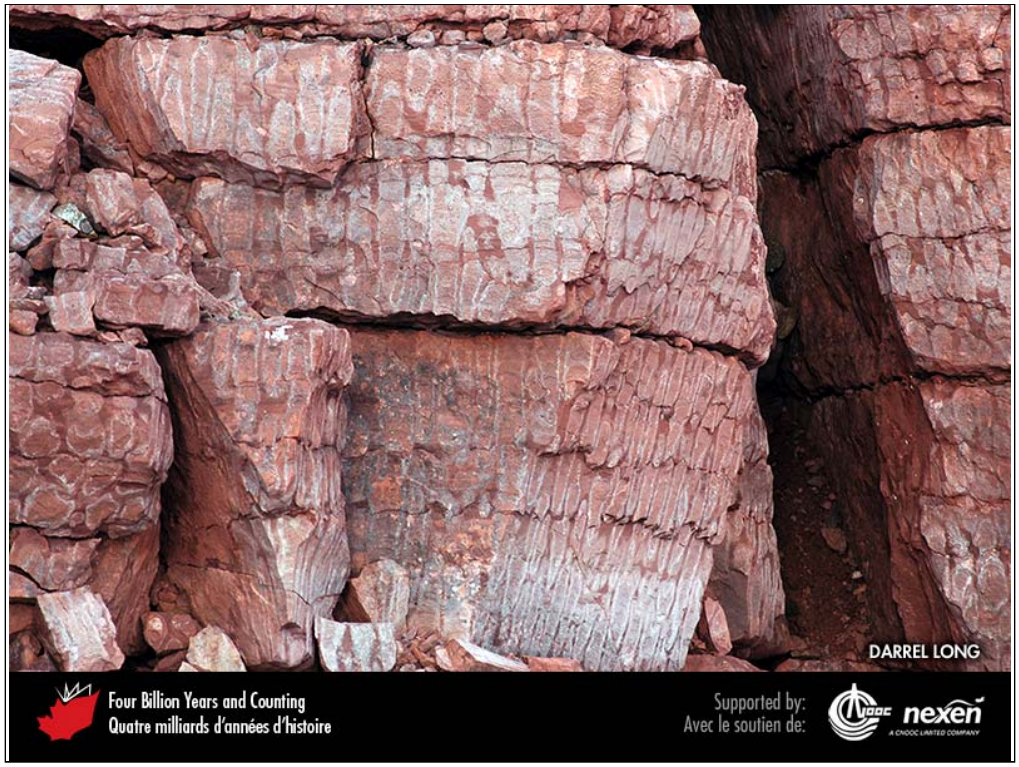
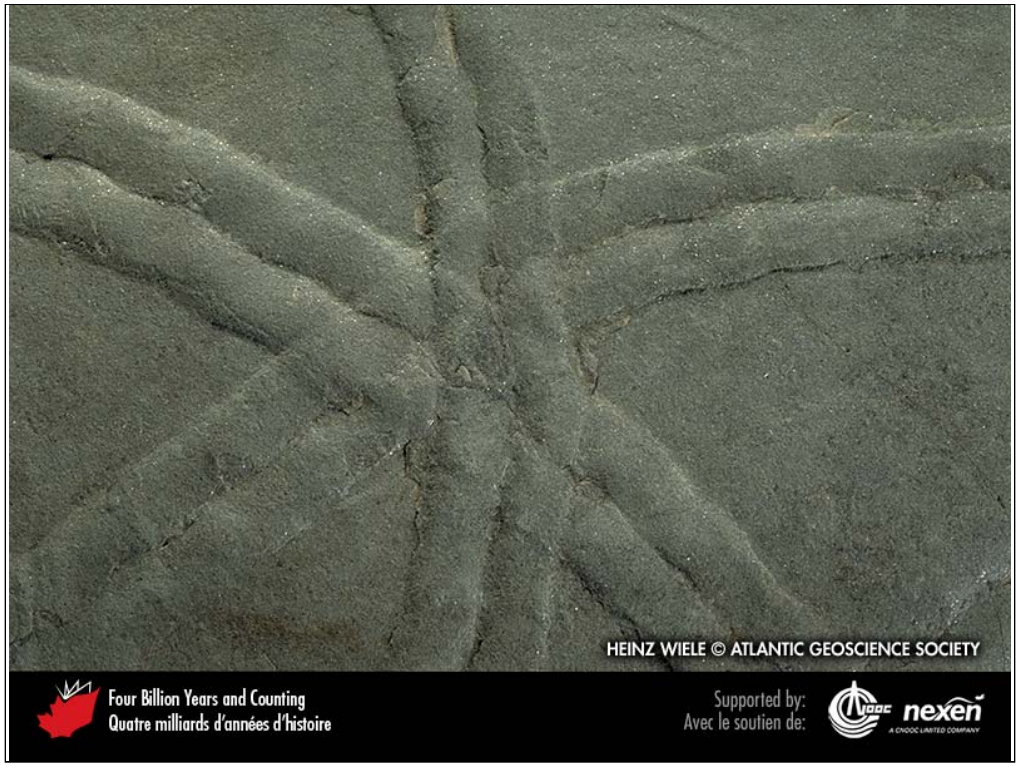
Glacial erosion produced a lot of sediment, material that came to be deposited widely as till. This landscape in southeastern Alberta is formed of hummocky till deposited by the Laurentide Ice Sheet. ROB FENSOME.



Stromatolites in red dolostone within a small Mesoproterozoic basin on northern Somerset Island, Nunavut. Stromatolites resulted from the activity of microbes and are widespread in Proterozoic sedimentary rocks prior to the evolution of grazing animals. The red colour here is due to oxidation during diagenesis of small amounts of iron in the dolostone. DARREL LONG.

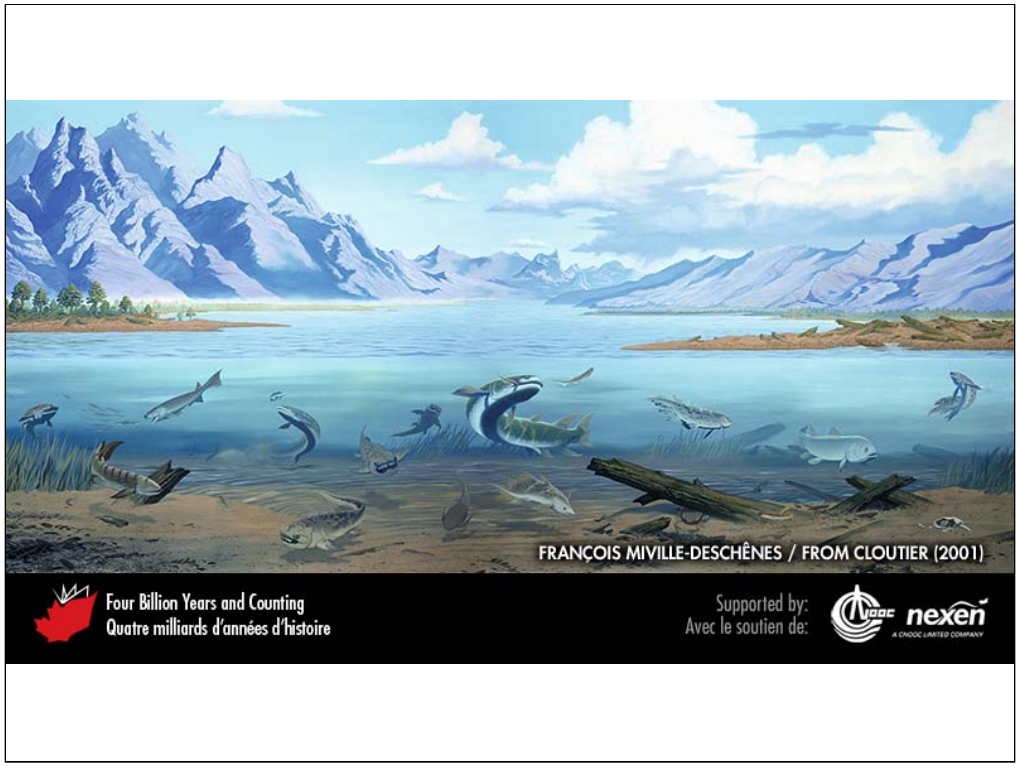


Psammichnites gigas, an early Cambrian trace fossil from Hanford Brook, New Brunswick. The explosion of life from 580 to 530 million years ago, saw not only a spectacular rise in the variety of animal body fossils but also a burgeoning of trace fossils. HEINZ WIELE, COURTESY OF THE ATLANTIC GEOSCIENCE SOCIETY; SPECIMEN COURTESY OF THE NEW BRUNSWICK MUSEUM.

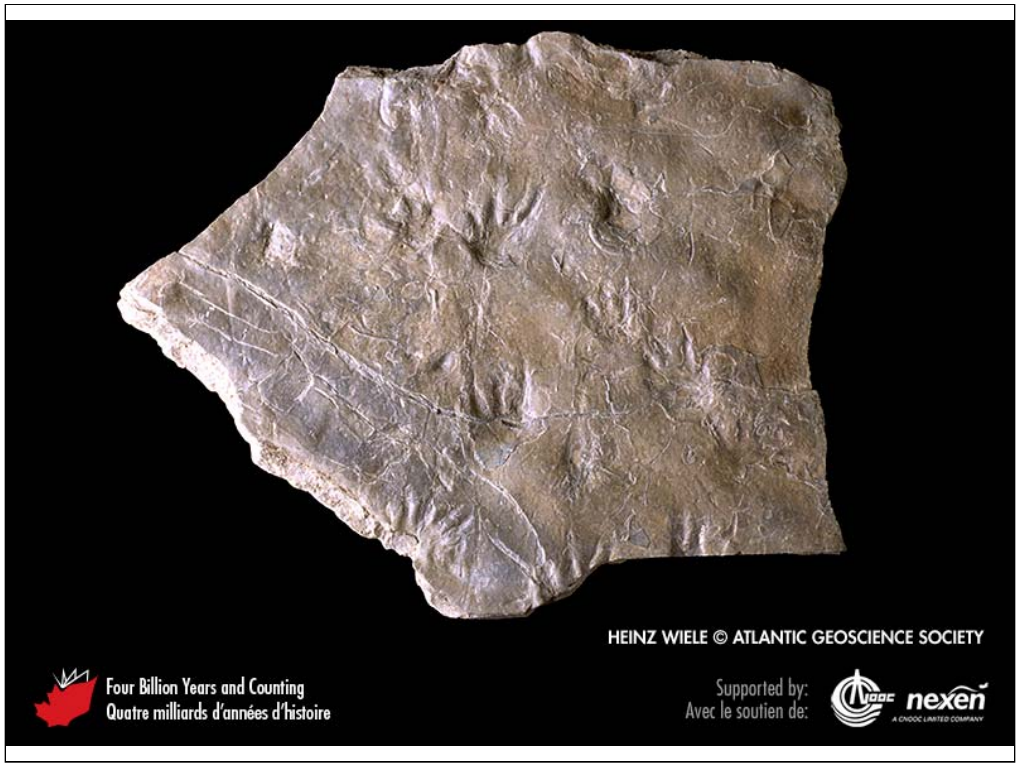
Partially intact filtration structure of a shrimp-like crustacean from early Cambrian rocks in the Northwest Territories. The specimen is about two-tenths of a millimetre long. It reflects the increasing complexity and diversity of life at the time. NICK BUTTERFIELD.

Abundant fossils are exposed on this early Silurian bedding surface from Anticosti Island, Quebec. During the Ordovician and Silurian, invertebrates proliferated in the oceans, where almost all life was then located. ROB FENSOME, SPECIMEN COURTESY OF NATURAL RESOURCES CANADA AND PAUL COPPER.

A specimen of the arthropod *Belinurus* from middle Carboniferous rocks near Parrsboro, Nova Scotia. ANDREW MACRAE.



In this Devonian estuary scene, the underwater fauna is dominated by fish, based on fossils found at Miguasha, on Chaleur Bay in Quebec. The waters of the estuary have as their backdrop the eroding Acadian Mountains, part of the Appalachian Orogen. FROM CLOUTIER (2001), USED WITH PERMISSION; PAINTING BY FRANÇOIS MIVILLE-DESCHÊNES.



Early Carboniferous amphibian footprints at Blue Beach, Nova Scotia. HEINZ WIELE, COURTESY OF THE ATLANTIC GEOSCIENCE SOCIETY; SPECIMEN COURTESY OF GORDON OAKEY.

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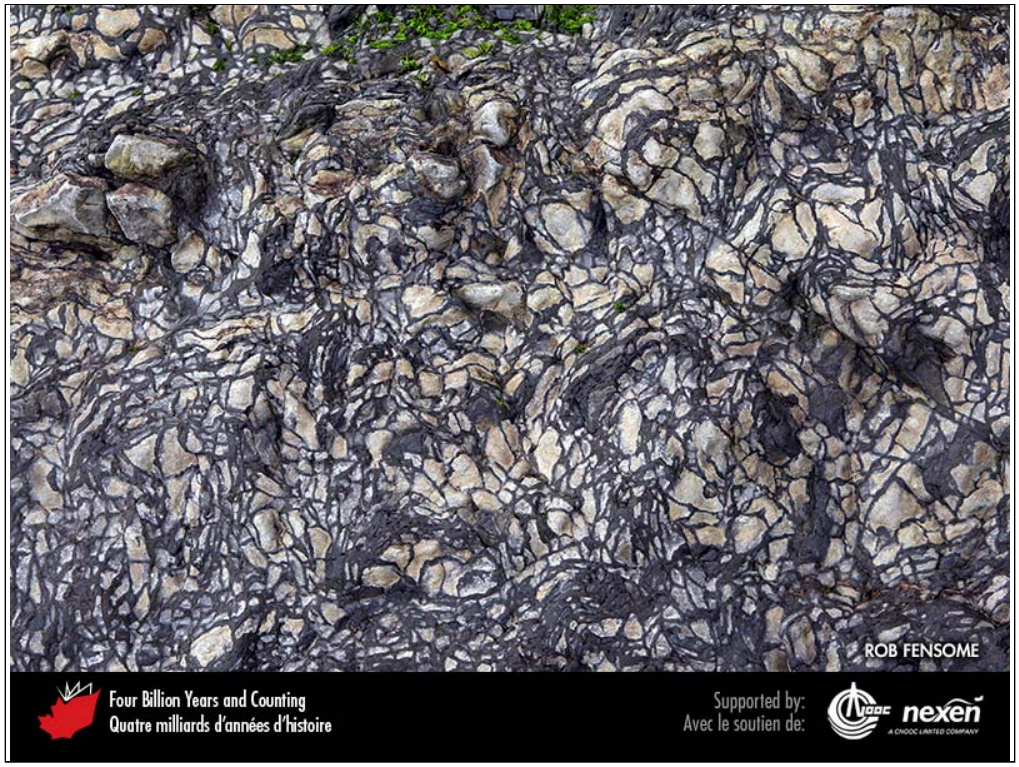
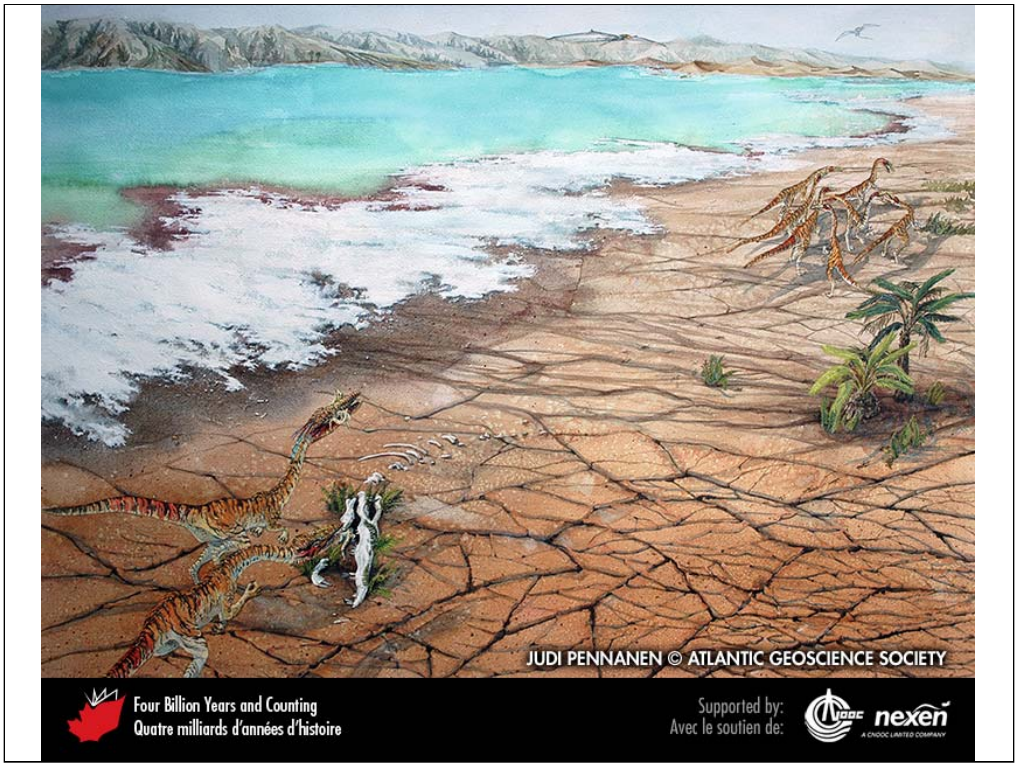


This strange looking middle Carboniferous rock from Parrsboro, Nova Scotia, may be a paleosol. Before life moved onto land, the Earth's surface was largely either bare or loose rubble, as on Mars today. Plants and, later, animals provided the organic component and the mechanisms needed to produce soil and, hence, fertile land. ROB FENSOME.



In this latest Triassic scene based in part on fossil finds around the Bay of Fundy in Nova Scotia, a pair of *Coelophysis* dinosaurs pause by a phytosaur skeleton as the main pack forges ahead. Early pterosaurs soar overhead. The mud-cracked surface and evaporite deposits (white) bordering the lake testify to a hot, dry climate. But the remains of the phytosaur, an animal that lived in wetter environments, testifies to fluctuating climatic conditions in the region during the late Triassic. PAINTING BY JUDI PENNANEN, COURTESY OF THE ATLANTIC GEOSCIENCE SOCIETY.

March fly from Eocene lake deposits at Quilchena, British Columbia. Although they originated in the Devonian, insects have achieved incredible diversity over the past 100 million years by co-evolving with flowering plants. RON LONG.

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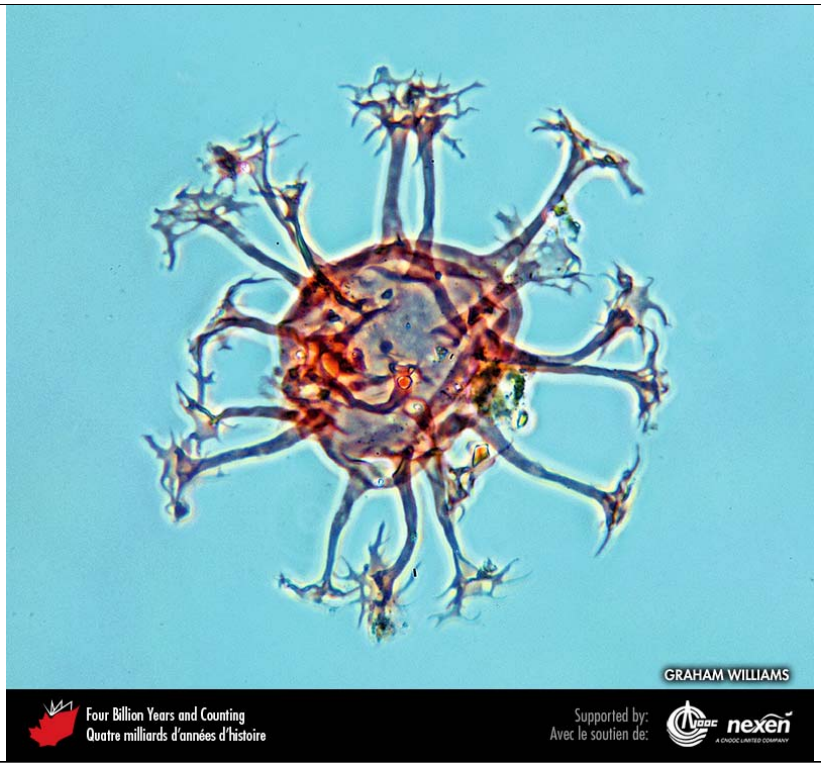
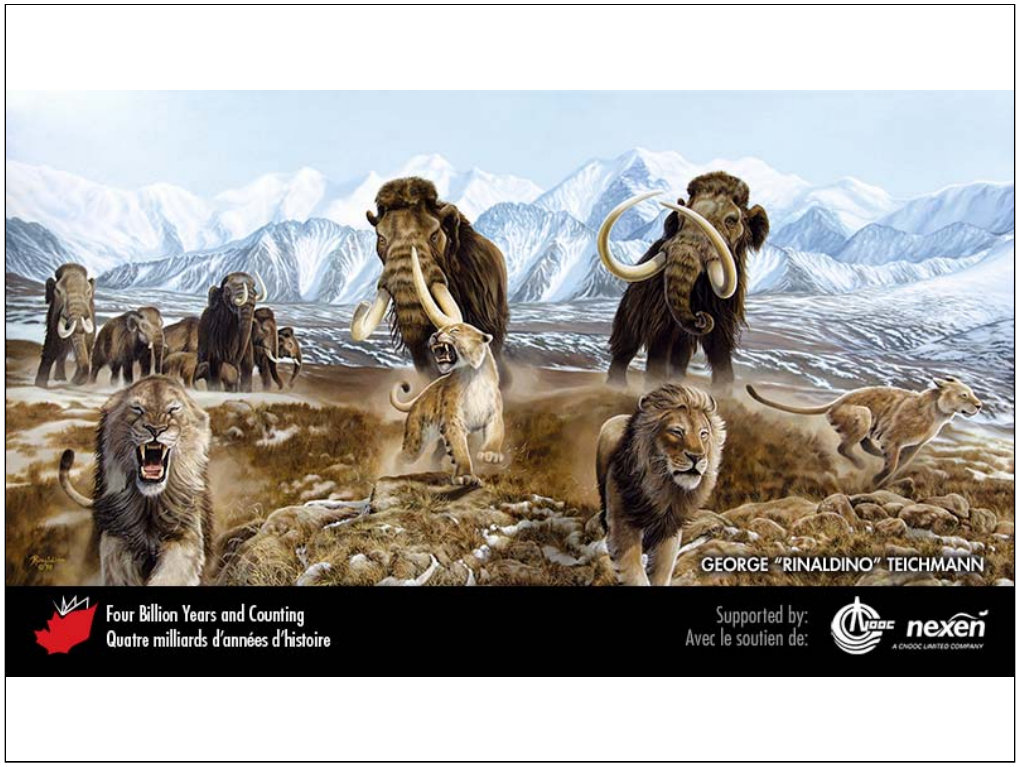
A skeleton of *Chasmosaurus*, a ceratopsian dinosaur from Alberta, now on display at the Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta. Some of the finest late Cretaceous dinosaurs have been discovered in rocks of the western Canadian Prairies. COURTESY OF THE ROYAL TYRRELL MUSEUM OF PALAEONTOLOGY.

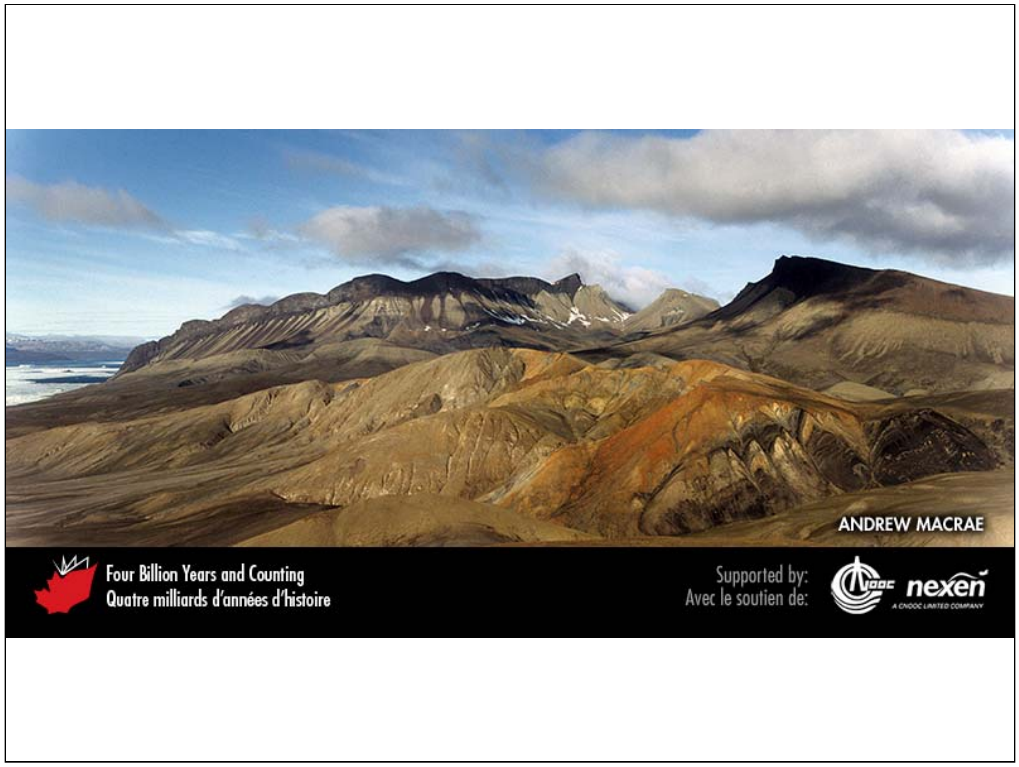


Stained specimen of the dinoflagellate *Oligosphaeridium* from late Cretaceous rocks of a shallow core hole in Baffin Bay. Plankton, such as coccolithophores, diatoms, dinoflagellates, and planktonic foraminifera, evolved during the early Mesozoic. GRAHAM WILLIAMS.

Specimen of the fruit of an elm tree preserved in Eocene lake deposits at Quilchena, British Columbia. Flowering plants (angiosperms) evolved in the early Cretaceous and have since developed a dominant role in land-based ecosystems. ROLF MATHEWES.



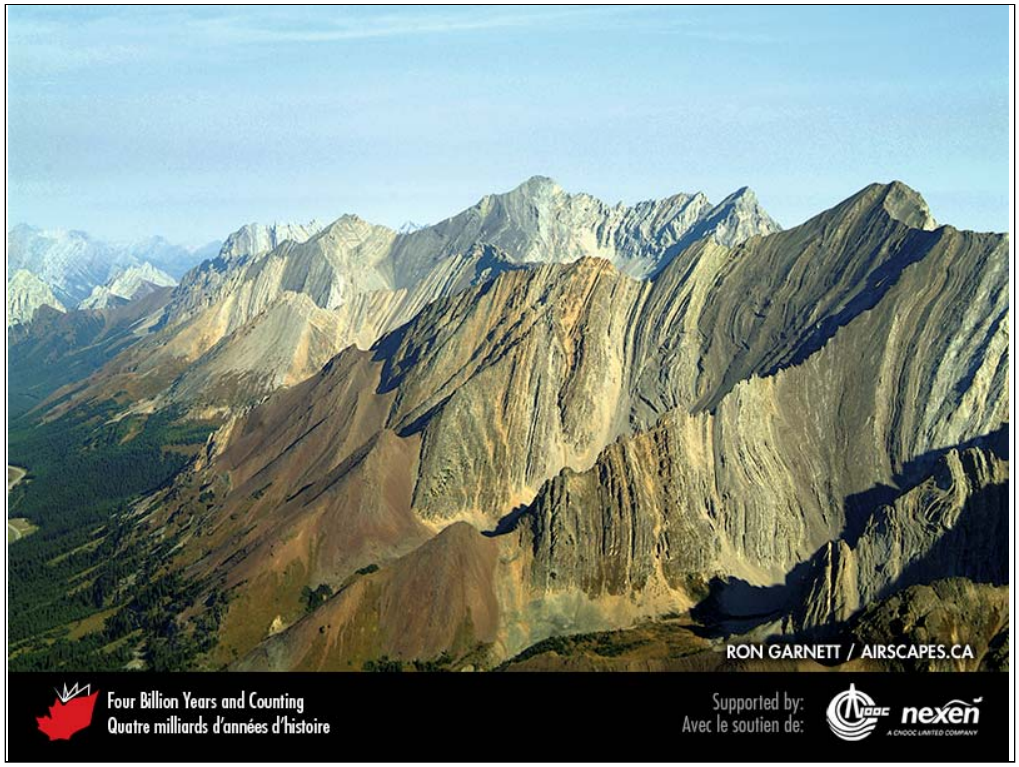
In this Quaternary Beringian scene, cave lions retreat from a herd of mammoth. *SHAMEFUL RETREAT* BY GEORGE "RINALDINO" TEICHMANN, COPYRIGHT 1998.



Aerial view of Split Mountain, western Axel Heiberg Island, Nunavut. Resistant, gently folded Cretaceous basalt flows form cliffs several hundred metres high. Beneath the basalts are early Cretaceous mudstone and sandstone. The hills in the foreground are formed of diapirs of yellowish-grey Carboniferous gypsum and salt, whose injection caused the doming up of the Cretaceous rocks. ANDREW MACRAE.

Mount Garibaldi, British Columbia, was built from eruptions over the past 200 thousand years. The volcano last erupted about 12,000 years ago. Canada's only potentially active volcanoes are all in the far west. PAUL ADAM.

Farwell Canyon, British Columbia, where glacial outwash and glacial lake sediments have been eroded into cliffs and pillars. PAUL ADAM.

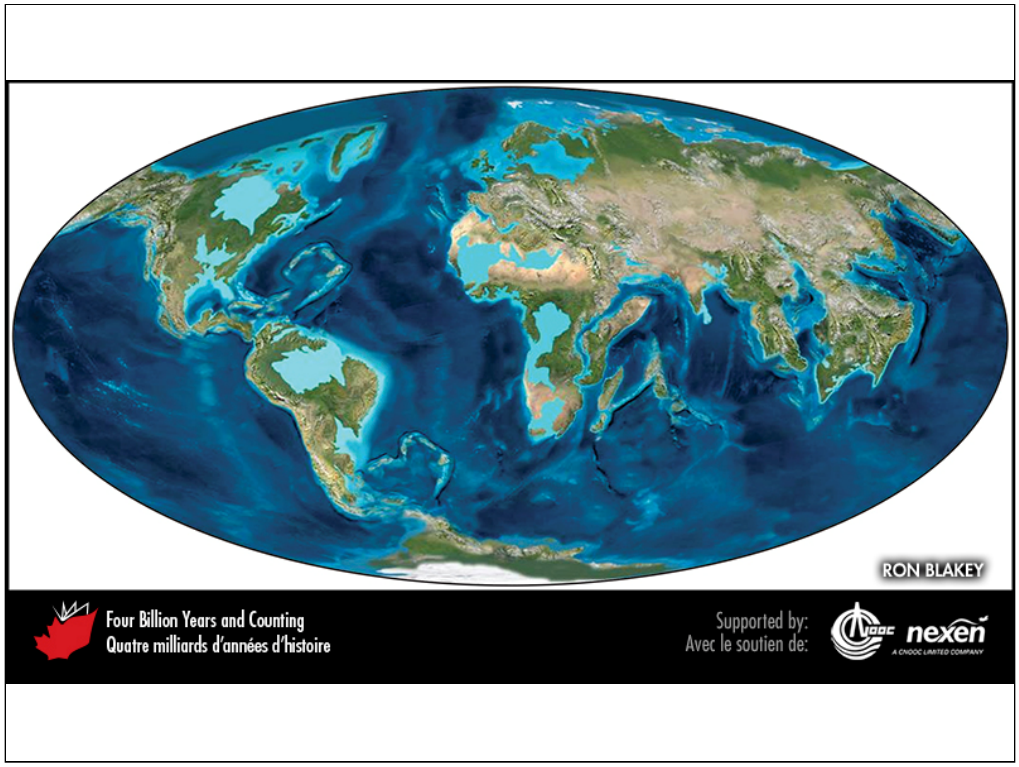


The Rocky Mountains may be Canada's best-known landscape. Part of the range is a UNESCO World Heritage Site. Although they do not reach the heights of the Coast and St. Elias Mountains, the Rocky Mountains attract and inspire many visitors; they were the first recognized and are the best studied of all thrust-and-fold belts. This view is of the Kananaskis Country of Alberta. RON GARNETT / AIRSCAPES.CA.

The Red River meanders across the flat Prairie landscape in this view northward between Letellier and St. Jean Baptiste, Manitoba. GREG BROOKS.

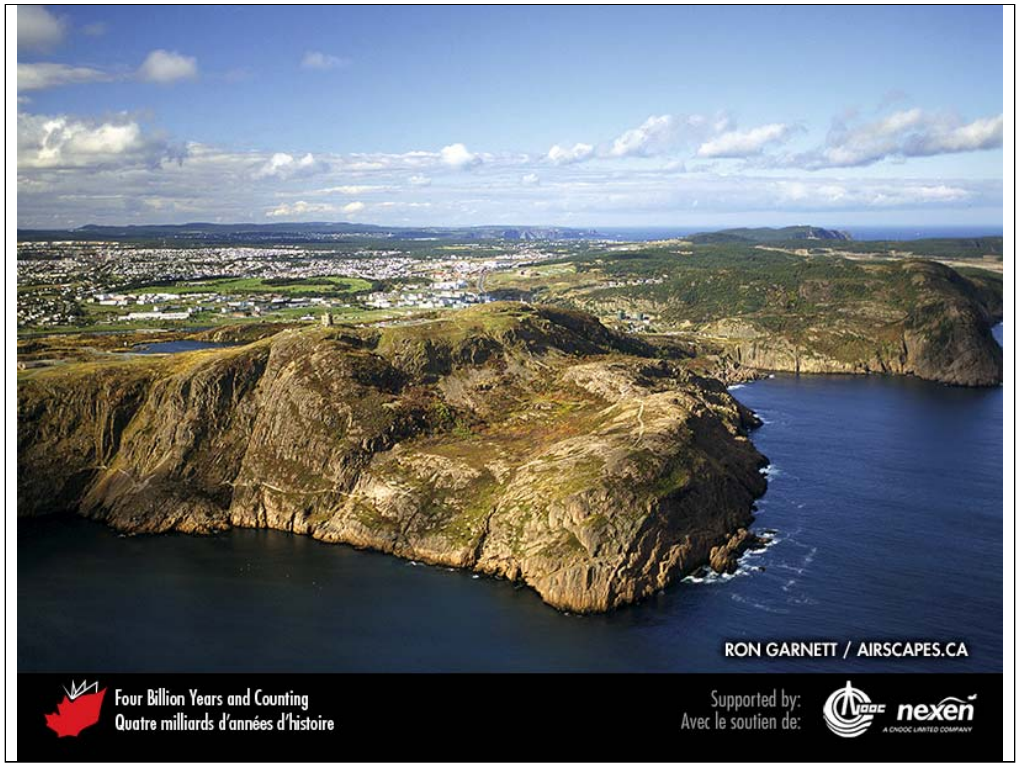
Aerial view of the Canadian Shield at Lefty's Falls on the Grease River, northwest of Stony Rapids, Saskatchewan. RON GARNETT / AIRSCAPES.CA.

Bay of Fundy shoreline at Five Islands, Nova Scotia. Mi'kmaw tradition says that the native god Glooscap created these islands when he threw chunks of sod at a wizard who was mocking his powers; the wizard turned himself into a giant beaver to escape. RON GARNETT / AIRSCAPES.CA.



Global paleogeography 50 million years into the future. The lighter blue areas represent possible coastal or nearshore areas, darker blue represents deeper ocean waters, and black indicates trenches. RON BLAKEY.

This fall scene of Lake Bouchard in La Mauricie National Park of Canada, Quebec, is typical of much of southern Ontario and Quebec. M. MILLS, COPYRIGHT PARKS CANADA.



Aerial view of Signal Hill in St. John's, Newfoundland. The Cabot Tower, at the top of the cliffs at left, is constructed in part from the local Ediacaran rocks that underlie the Avalon Peninsula. The Tower was built in 1898–1900 to mark the 400th anniversary of the landing of John Cabot, so this scene provides a fitting reflection on Canada's intertwined geological and historical heritages. RON GARNETT / AIRSCAPES.CA.
