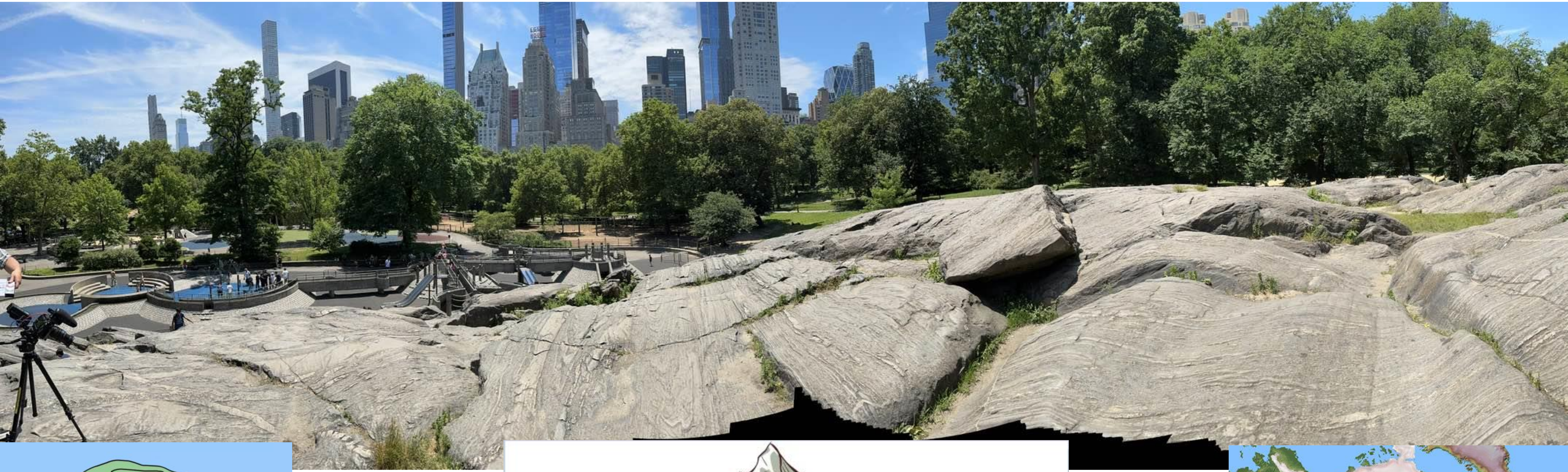
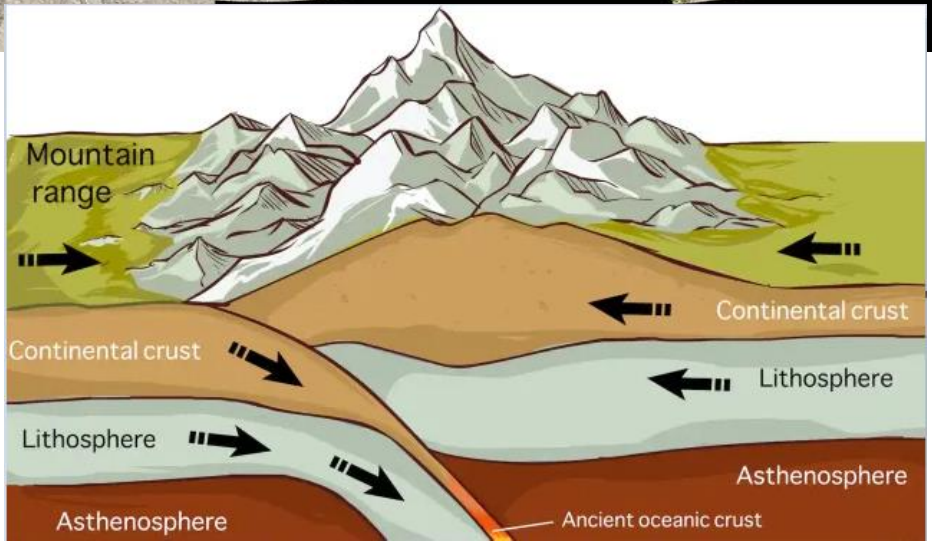
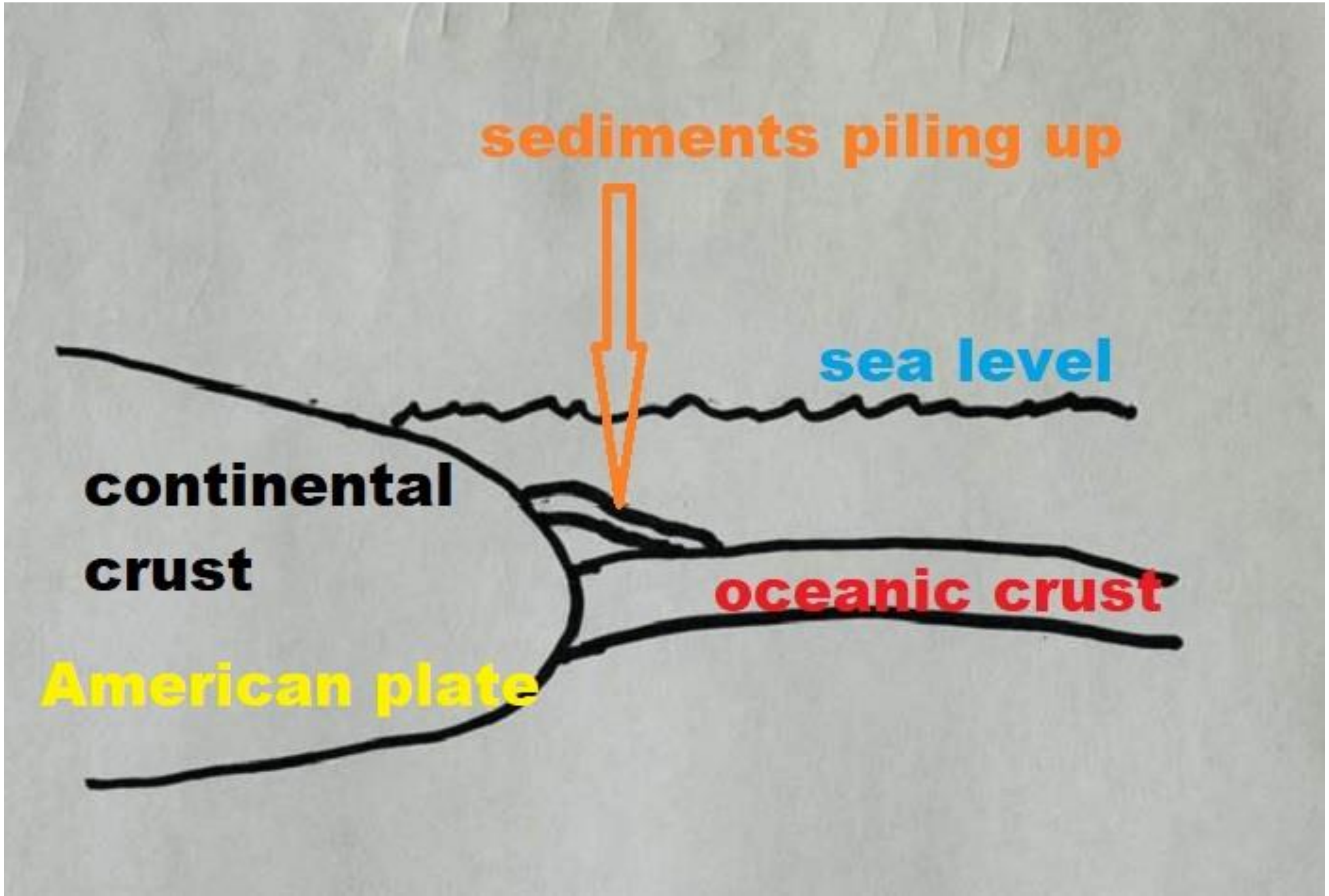
Brief Geological History of NYC

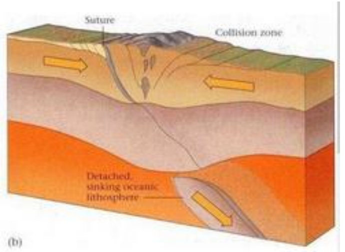




Brief Geological History of NYC

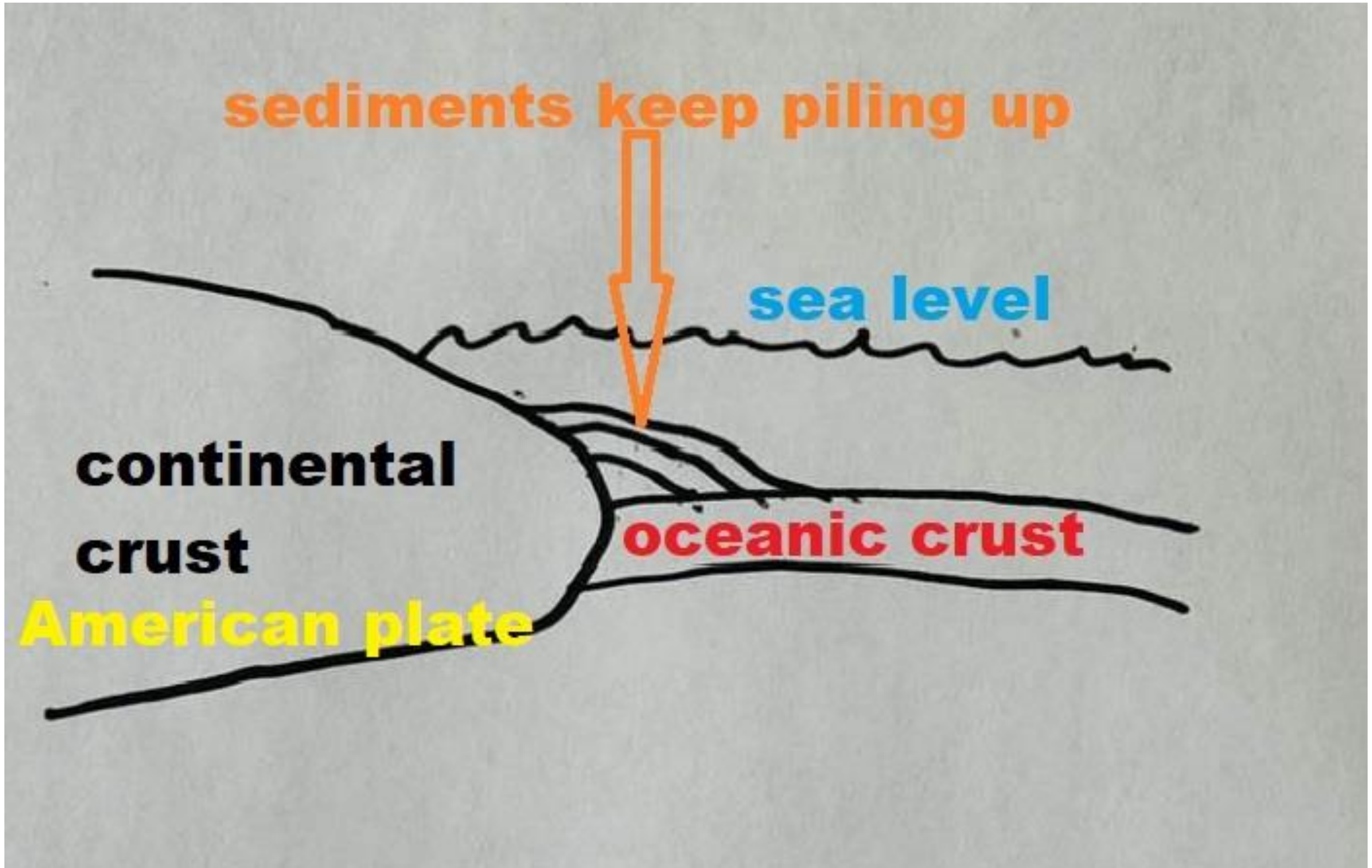
About 400 million years ago (Eon = Phanerozoic, Era = Paleozoic, Period = Devonian), this region was a passive continental margin where layers of sediment started to pile up.

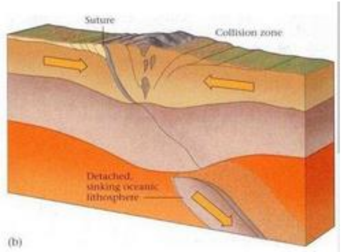




Brief Geological History of NYC

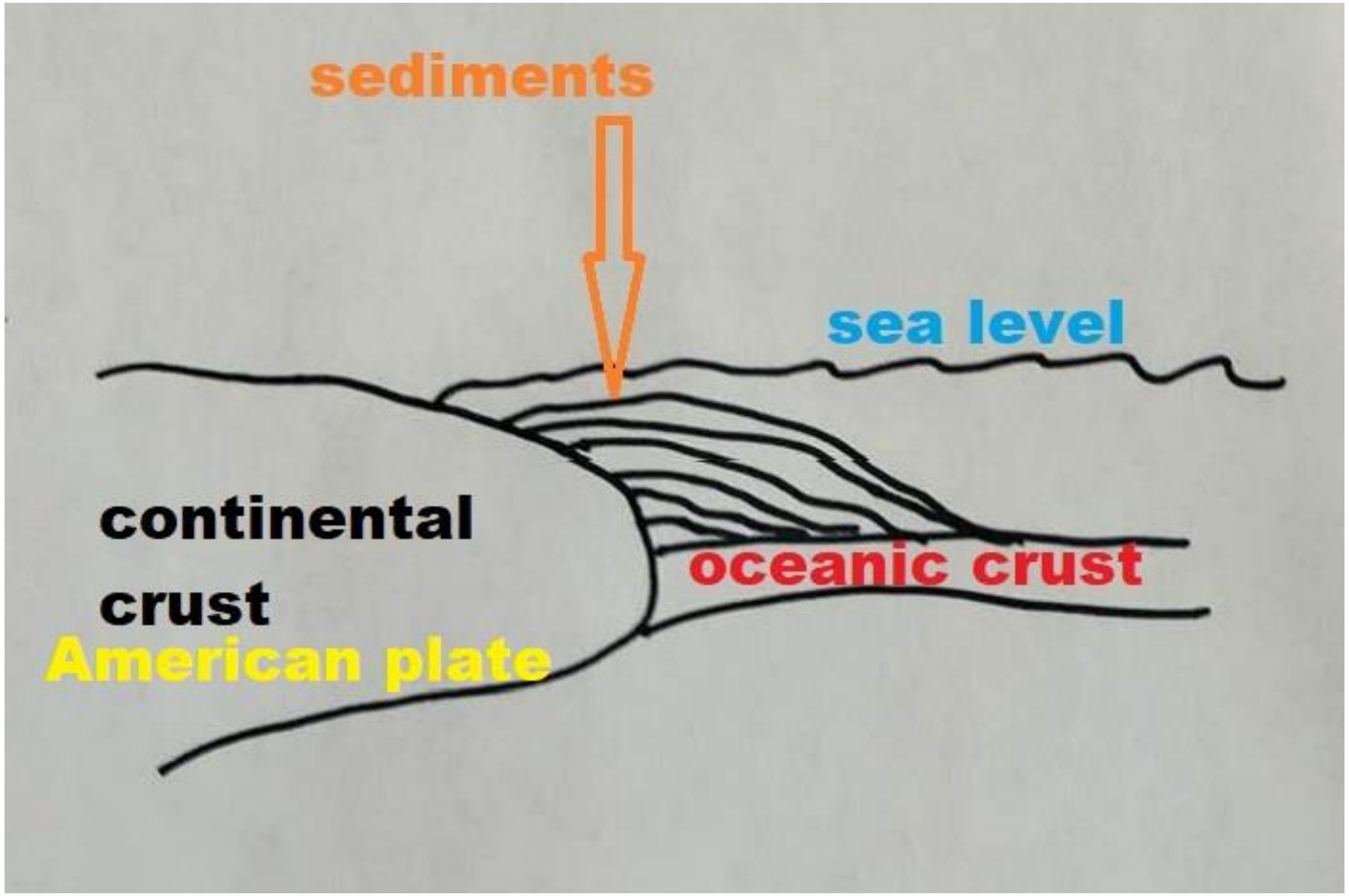
For more than 100 million years ago to about 300 million years ago (Eon = Phanerozoic, Era = Paleozoic, Period = Pennsylvanian), this shallow sea floor of the coast of the American continent kept acquiring a thick sedimentary sequence from eroded rocks from the American plate.

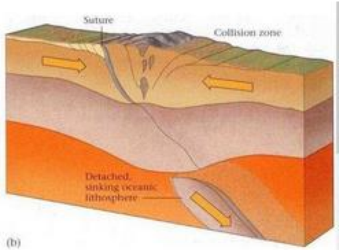




Brief Geological History of NYC

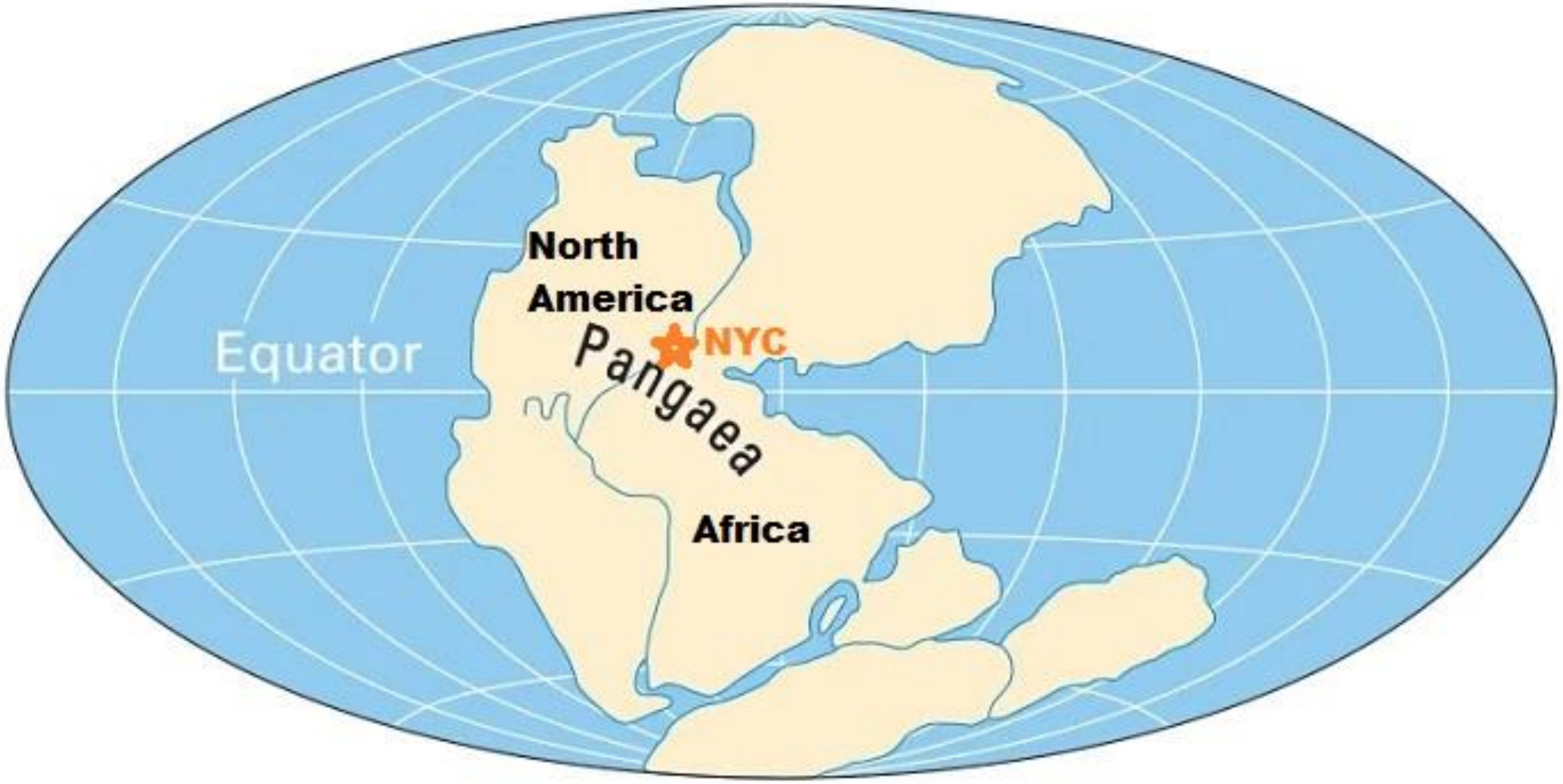
While this sedimentary sequence kept growing the formation of the supercontinent of Pangea started 250 million years ago (Eon = Phanerozoic, Era = Paleozoic, Period = Permian). The continent of Africa from the East was on its way to collide with the American continent moving from the West.



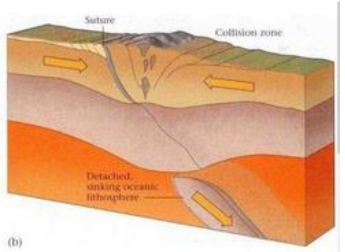


Brief Geological History of NYC

The collision of all continents to form the supercontinent of Pangea was completed about 225 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Triassic). The continent of Africa from the East was on its way to collide with the American continent moving from the West.

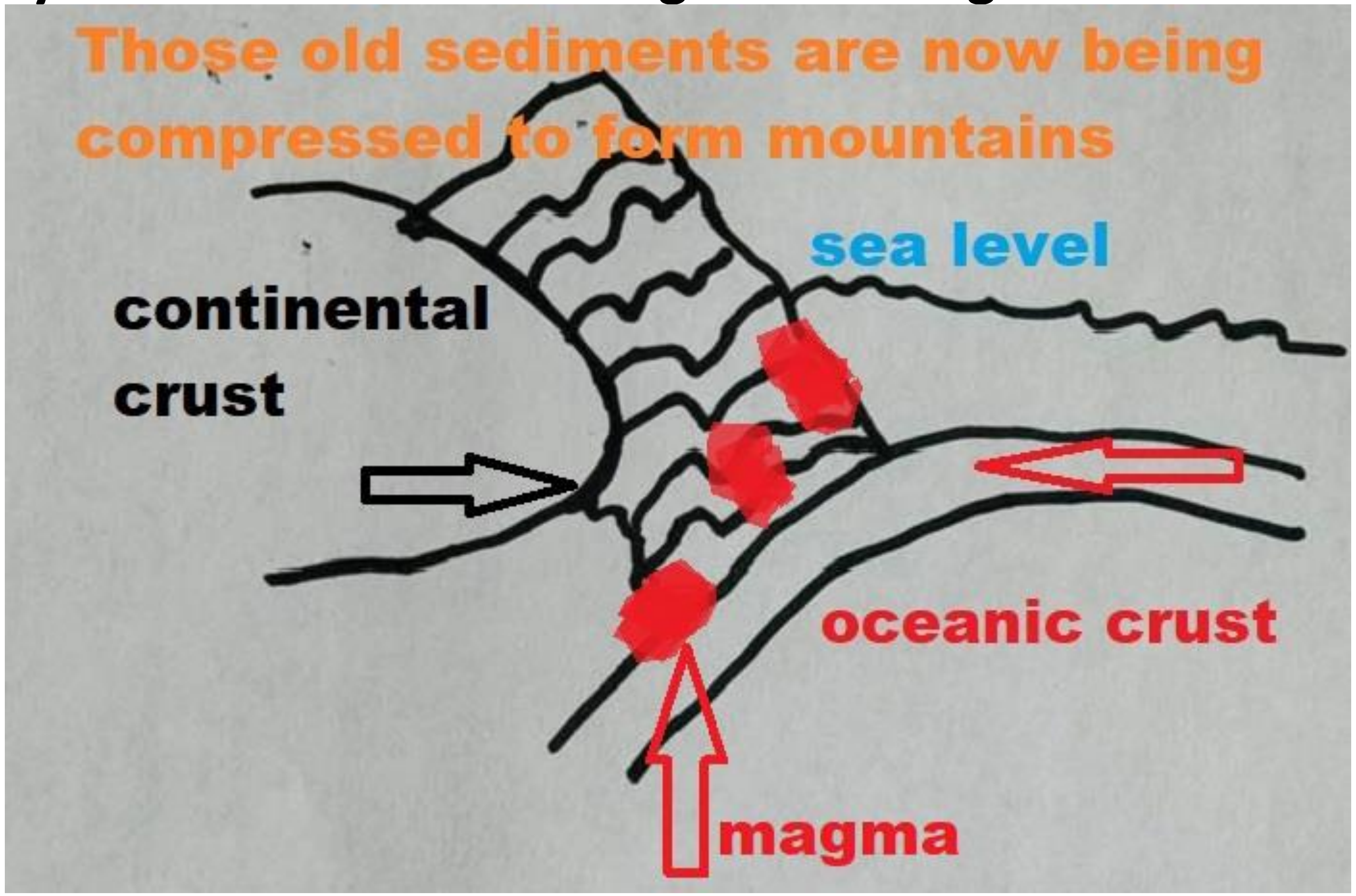


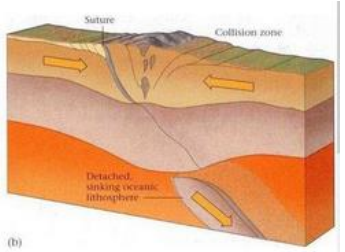
225 Million Years Ago



Brief Geological History of NYC

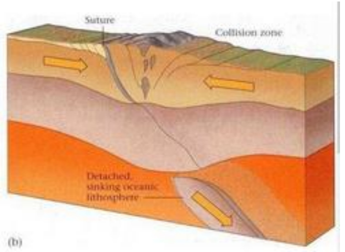
225 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Triassic). This convergent plate boundary because of the collision of America and Africa became a zone of compression and from those old sediments a mountain range as tall as the Himalayas formed on what today is NYC. In this subduction zone the heat, magma and active fluids penetrated the sedimentary layers of the mountain range deforming and metamorphosing them.





Brief Geological History of NYC

225 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Triassic). Folding of the rocks in Central Park caused by the formation of the supercontinent Pangea. Metamorphic rock Manhattan Schist.



Brief Geological History of NYC

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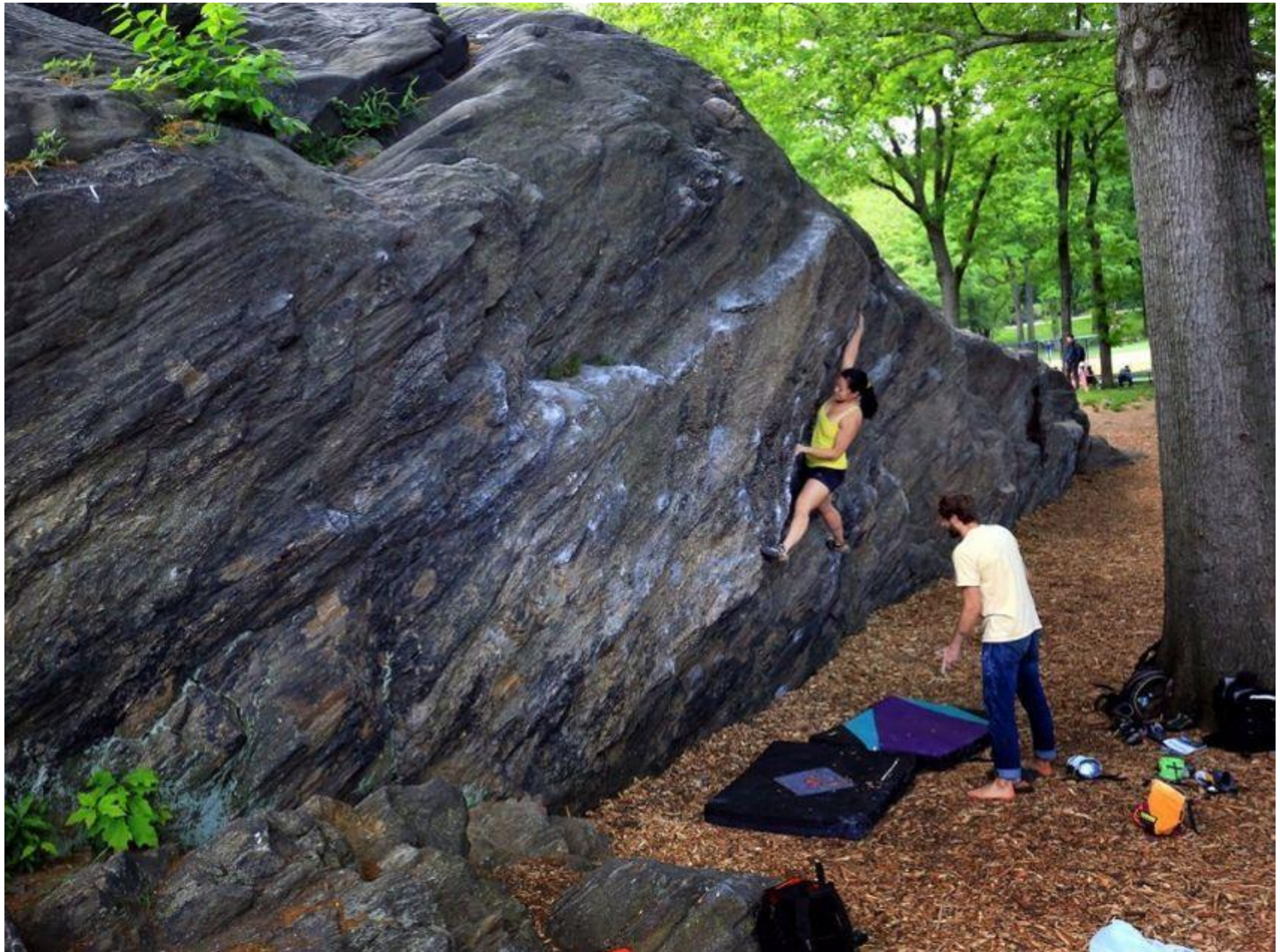
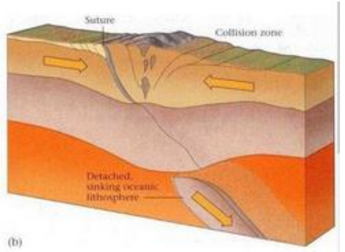
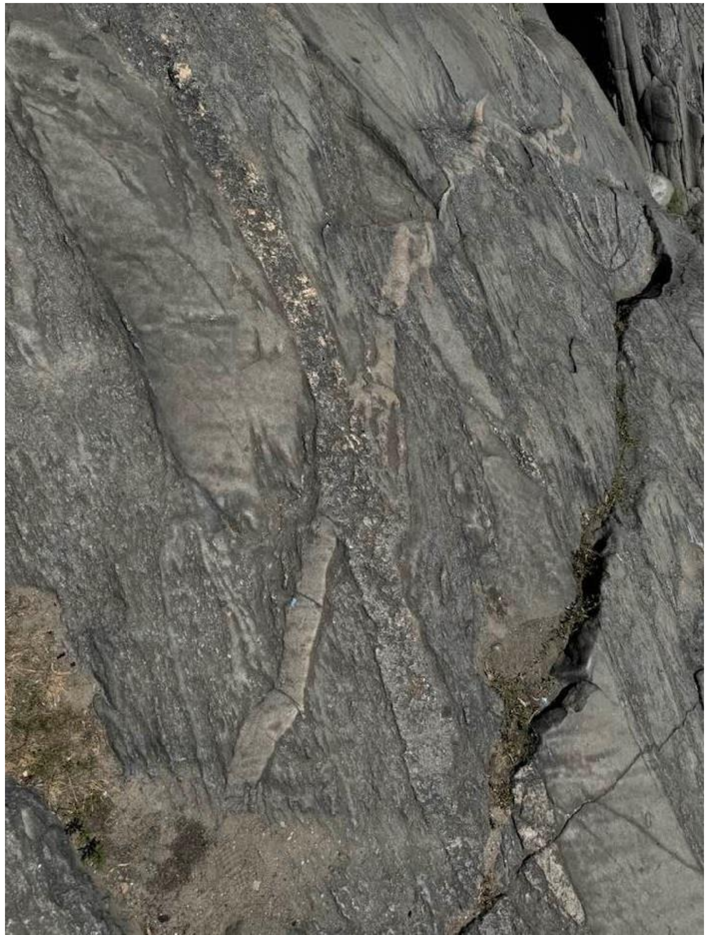
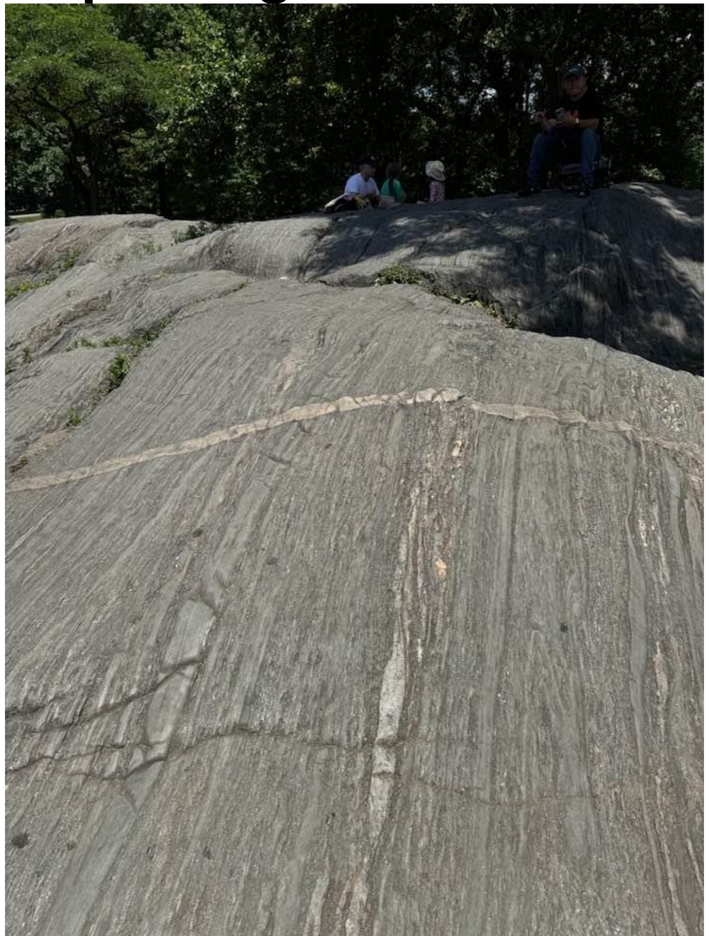




Brief Geological History of NYC

225 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Triassic). Remnants of igneous intrusions seen in Central Park. These intrusion were made by magma that travelled its way when the convergent plate boundary formed by the collision of America and Africa. In this subduction zone the heat, magma and active fluids penetrated the sedimentary layers of the mountain range deforming and metamorphosing them.

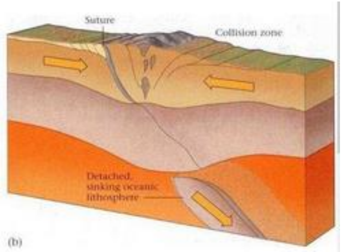




Brief Geological History of NYC

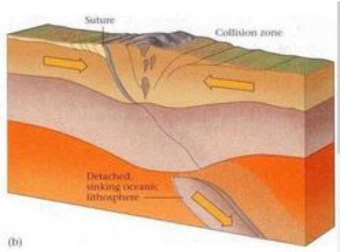
At about 150 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Jurassic).
The continents started to separate moving away from each other.

150 Million Years Ago



Brief Geological History of NYC

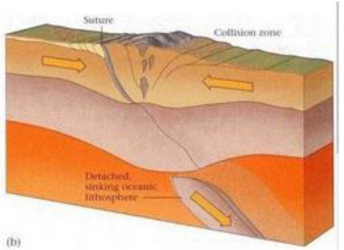
At about 100 million years ago (Eon = Phanerozoic, Era = Mesozoic, Period = Cretaceous).
The continents kept moving away from each other towards their present locations.



Brief Geological History of NYC

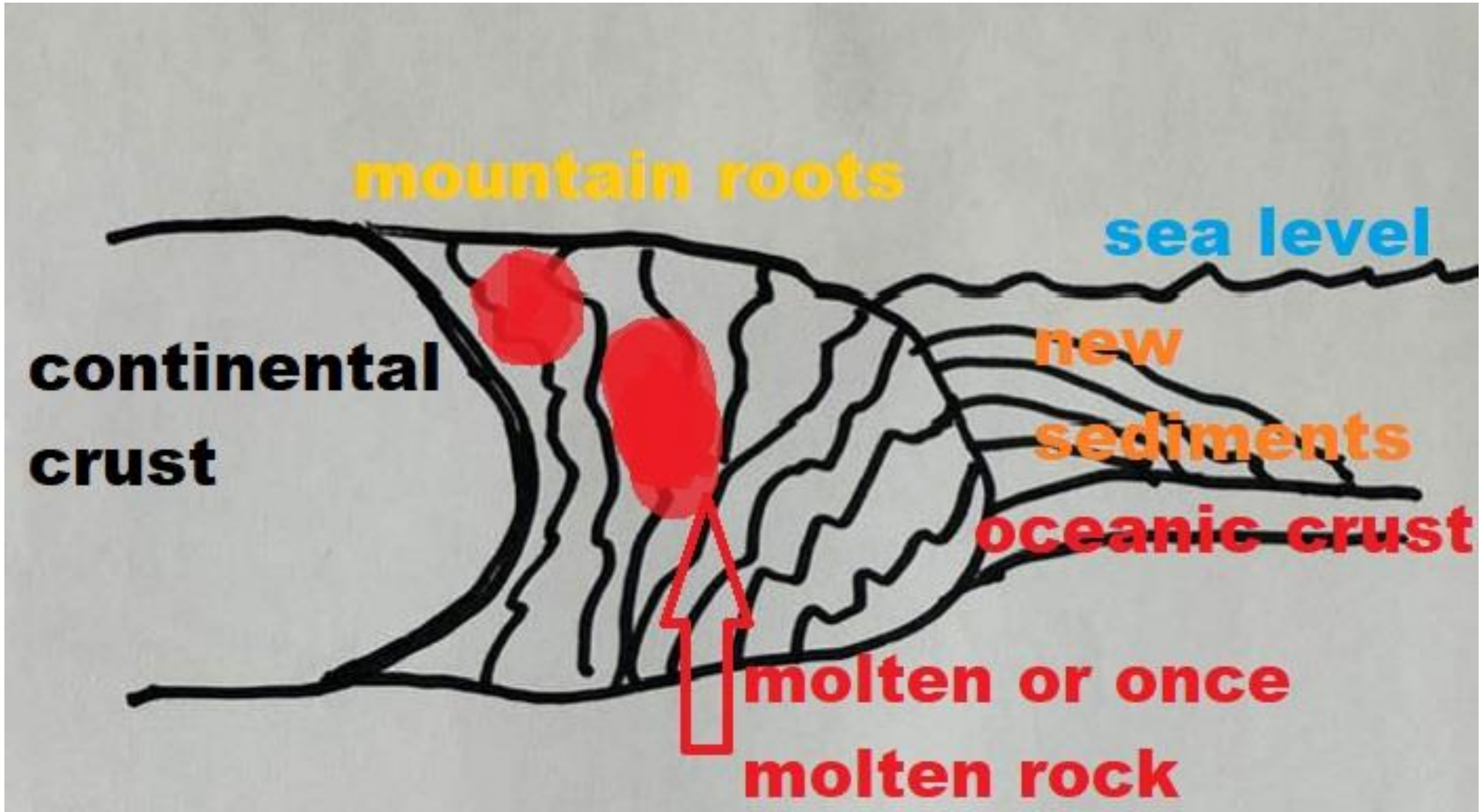
This is how the Earth looks today. (Eon = Phanerozoic, Era = Cenozoic, Period = Quaternary). The continents kept moving away from each other towards their present locations.

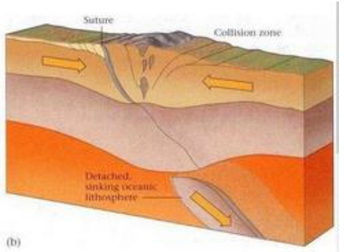
Earth Today



Brief Geological History of NYC

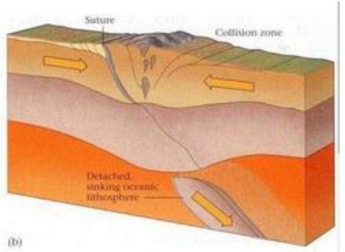
Gradually these tall mountains started to erode away for over 150 million years all the way to roots of these mountains that are exposed at the surface in many parts of the city. These are igneous and metamorphic rocks are the remnants of those mountains formed by the collision of Pangea. (Eon = Phanerozoic, Era = Cenozoic, Period = Quaternary).





Brief Geological History of NYC

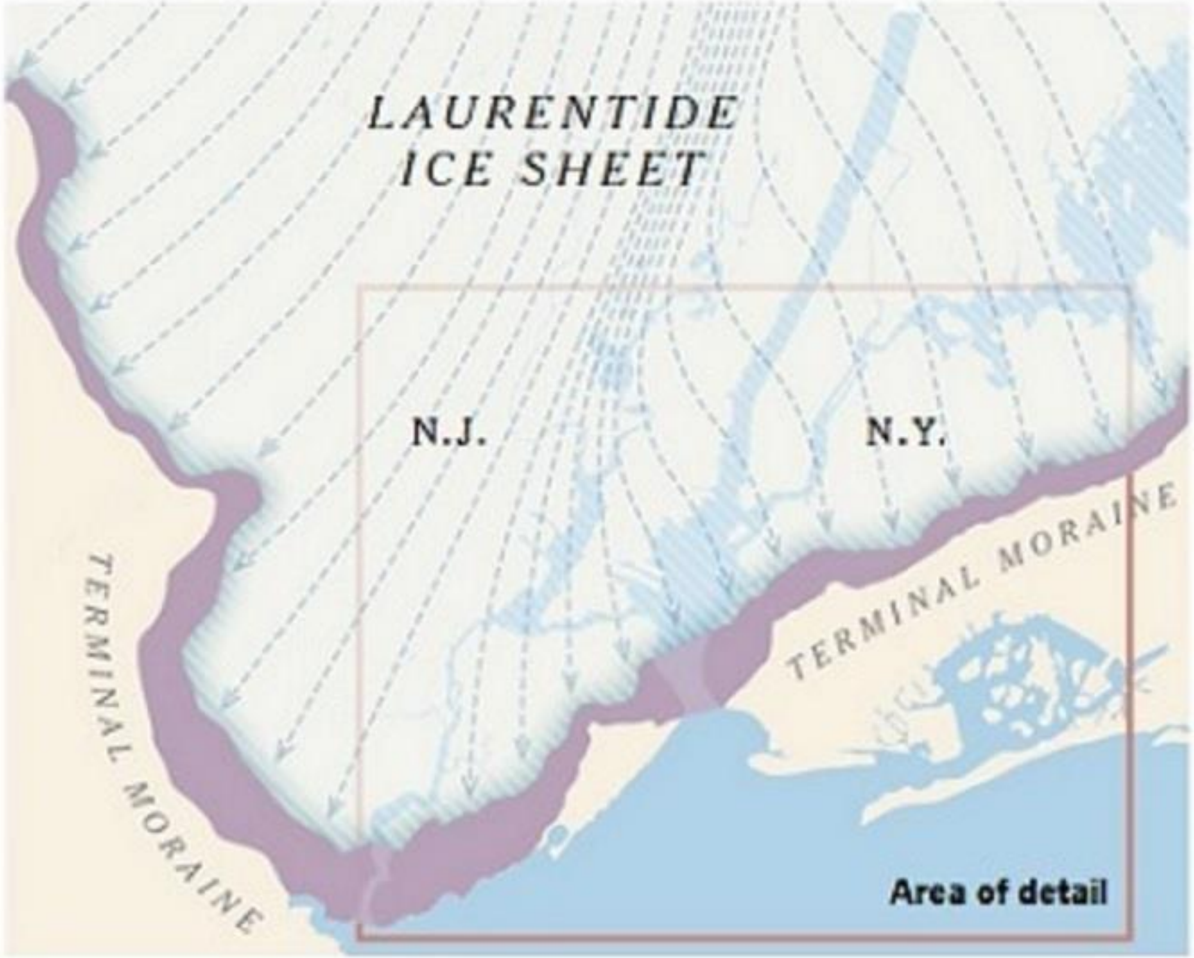
Today in Central Park we can observe the roots of these mountains that formed during the collision of the supercontinent Pangea. After 150 million years of erosion these roots are exposed in many parts of the city. These are igneous and metamorphic rocks are the remnants of those mountains formed by the collision of Pangea. (Eon = Phanerozoic, Era = Cenozoic, Period = Quaternary).



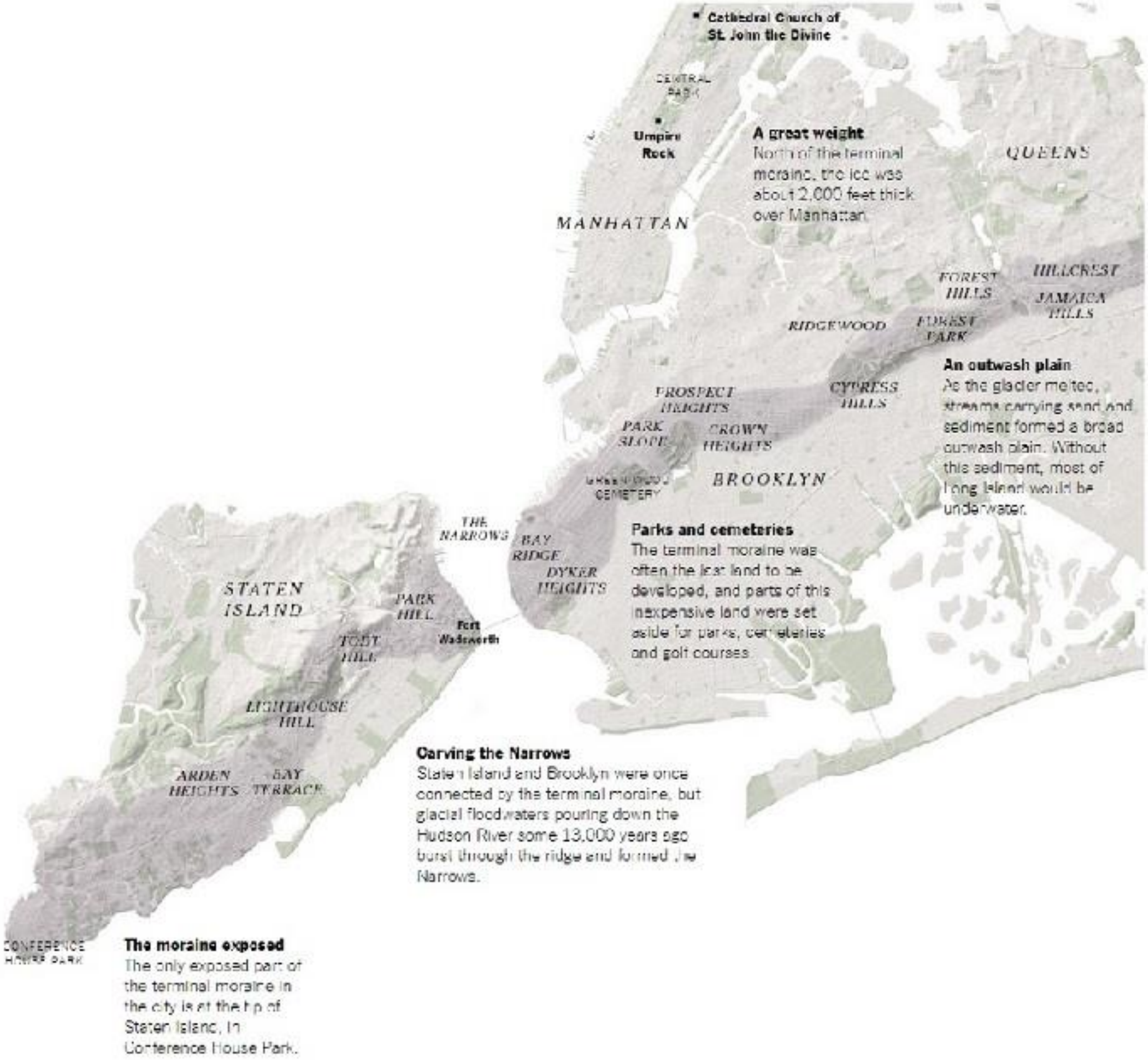
Brief Geological History of NYC

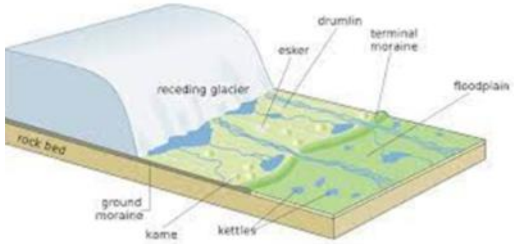
The Wisconsin Ice Sheet, the last of many glacial advances that started at about 90,000 years ago (Eon = Phanerozoic, Era = Cenozoic, Period = Quaternary) and which stretched down from eastern Canada and advanced as far south as New York City.

Brief Geological History of NYC



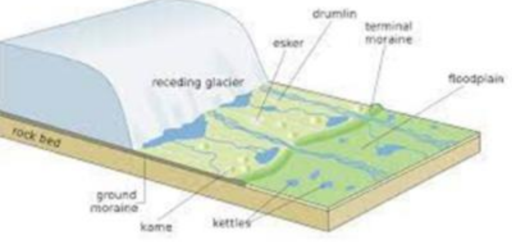
The edge of an ice sheet
During the last ice age, ice sheets covered most of Canada and many northern states. The Laurentide ice sheet ended in a sheer cliff across what is now New York City.


Cathedral Church of
St. John the Divine
CENTRAL PARK
Umpire Rock
MANHATTAN
QUEENS
A great weight
North of the terminal moraine, the ice was about 2,000 feet thick over Manhattan.
FOREST HILLS
HILLCREST
JAMAICA HILLS
RIDGEWOOD
FOREST PARK
An outwash plain
As the glacier melted, streams carrying sand and sediment formed a broad outwash plain. Without this sediment, most of Long Island would be underwater.
CYPRESS HILLS
PROSPECT HEIGHTS
PARK SLOPE
CROWN HEIGHTS
GREEN-WOOD CEMETERY
BROOKLYN
THE NARROWS
BAY RIDGE
DYKER HEIGHTS
Parks and cemeteries
The terminal moraine was often the last land to be developed, and parts of this inexpensive land were set aside for parks, cemeteries and golf courses.
STATEN ISLAND
PARK HILL
Fort Wadsworth
TODT HILL
LIGHTHOUSE HILL
ARDEN HEIGHTS
BAY TERRACE
Carving the Narrows
Staten Island and Brooklyn were once connected by the terminal moraine, but glacial floodwaters pouring down the Hudson River some 13,000 years ago burst through the ridge and formed the Narrows.
CONFERENCE HOUSE PARK
The moraine exposed
The only exposed part of the terminal moraine in the city is at the tip of Staten Island, in Conference House Park.


drumlin
terminal moraine
esker
receding glacier
floodplain
rock bed
ground moraine
kame
kettles

Brief Geological History of NYC

As the glacier melted, a series of great lakes developed behind the natural dams of the Harbor Hill moraine. This morainal dam was breached in the vicinity of the Verrazano Narrows, and the draining rivers carved a chasm through the till that extended downward to bedrock. To this day, the daily in-and-out flow of the tides through the Narrows maintains a water depth of 100 feet, the deepest water along the length of the Hudson River drainage and in the Inner New York Bight



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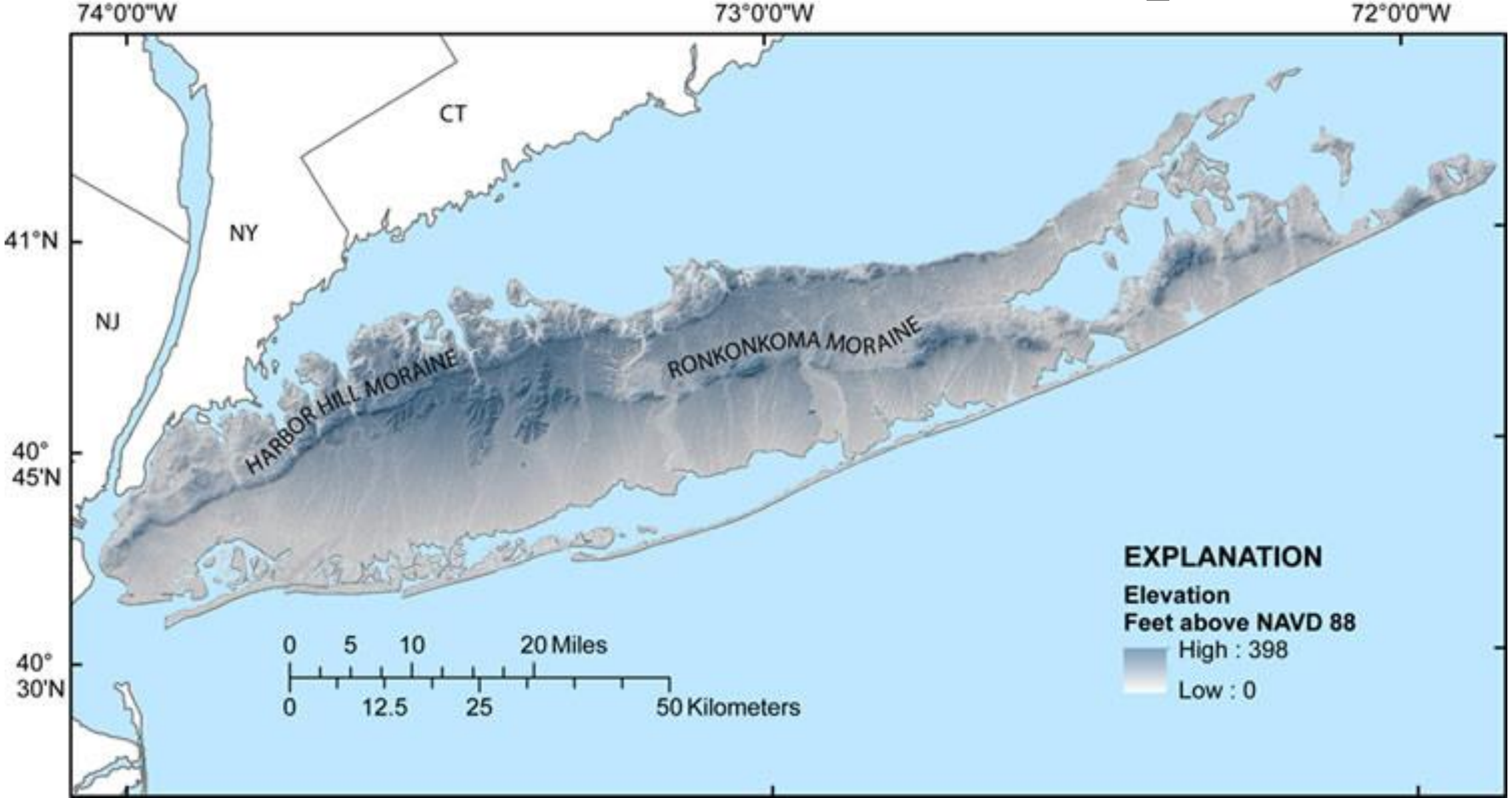
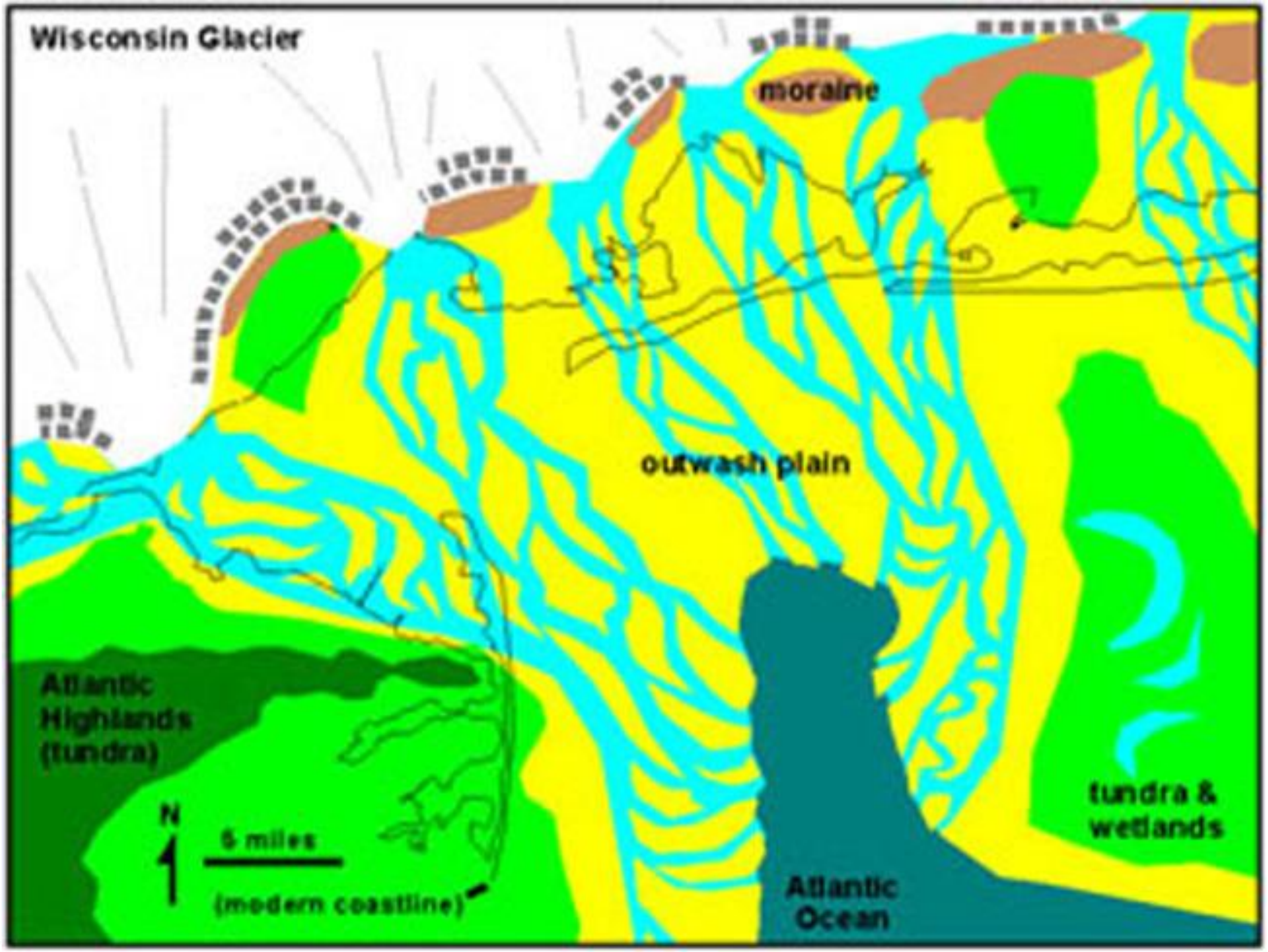
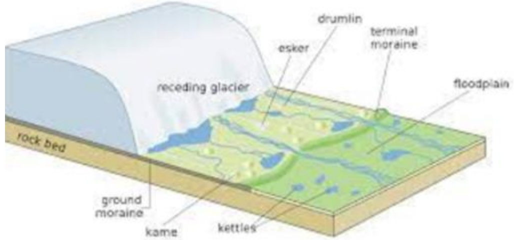


Brief Geological History of NYC

As the glaciers start to melt all that sediment created the outwash plains of Brooklyn and Queens (soft layers upon layers of unconsolidated sediments made of gravel, sand and silt).





Brief Geological History of NYC

The construction of skyscrapers and subway tunnels is highly dependent on the type of rocks that is underneath the surface and the depth to reach this bedrock. In order to anchor skyscrapers and to dig tunnels we need to have very strong rocks underneath. For this reason in Brooklyn and Queens we don't have skyscrapers and in many parts of these boroughs the subway system has to go above ground because the terrain is made of unconsolidated sediments.

Brief Geological History of NYC

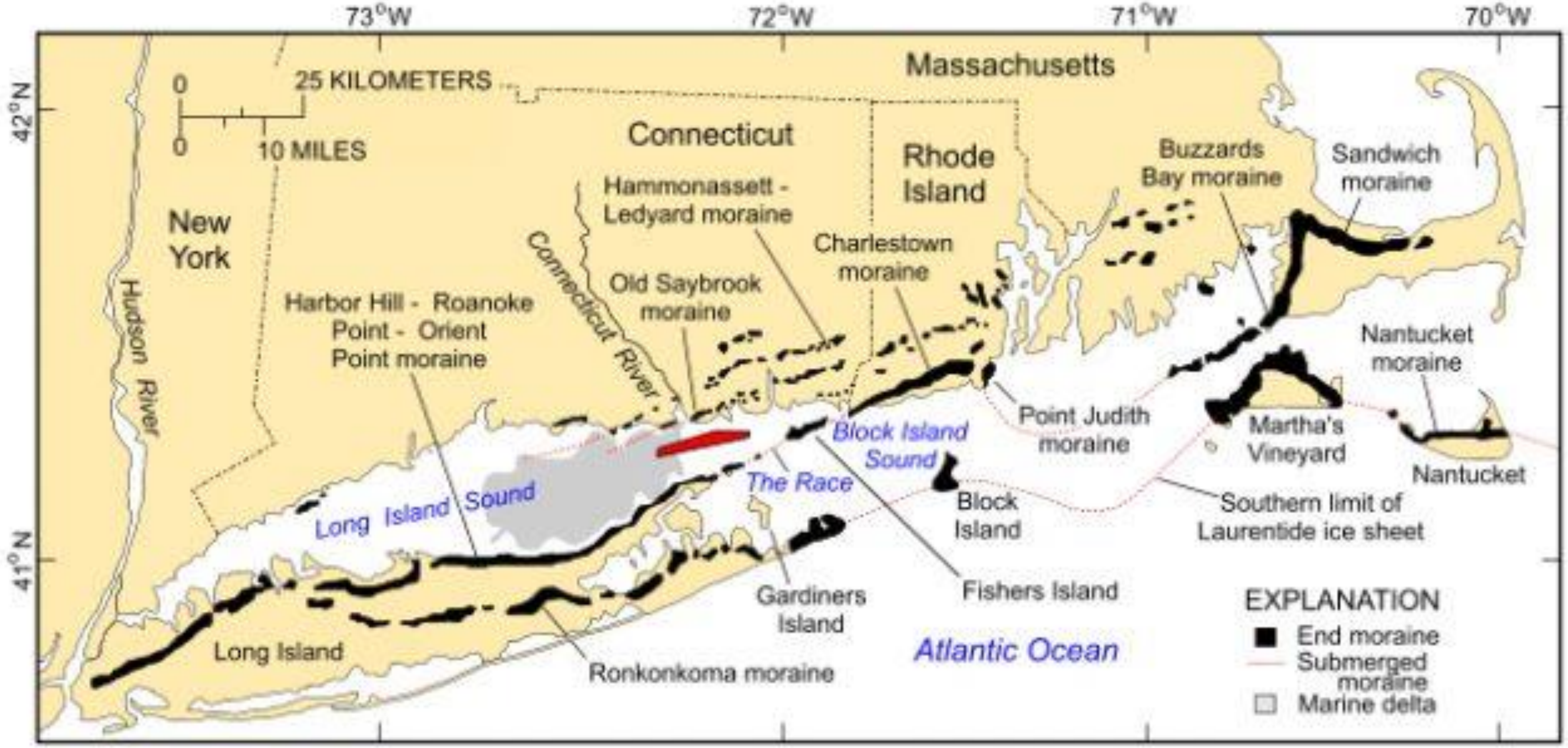
These glaciers left their marks on the city, depositing rock and debris and accounting for the hilly areas that run straight in the northern part of Brooklyn, Queens, Nassau and Suffolk forming the Ronkonkoma Moraine. Striations and grooves are marks that are left on the rocks by the shear weight of the glaciers that press them against the bedrock.

Brief Geological History of NYC

Glacial grooves and striations are sets of parallel channels which have been ground out of rock surfaces by boulders (grooves) and pebbles (striations) lodged in the moving sole of a glacier or ice sheet. The weight and pressure made by the colossal thickness of the glacier left its marks on the bedrock surface especially in Manhattan and the Bronx.

Brief Geological History of NYC

During a period of warmth and retreat the glaciers finally begin their final retreat at about 18,000 years ago. In New York City, the Wisconsin Ice Sheet was about 2,000 feet thick (in the Adirondacks it was over 5,000 feet thick and perhaps as much as 10,000 feet thick in Labrador). A glacial moraine was produced at the end of glacier.

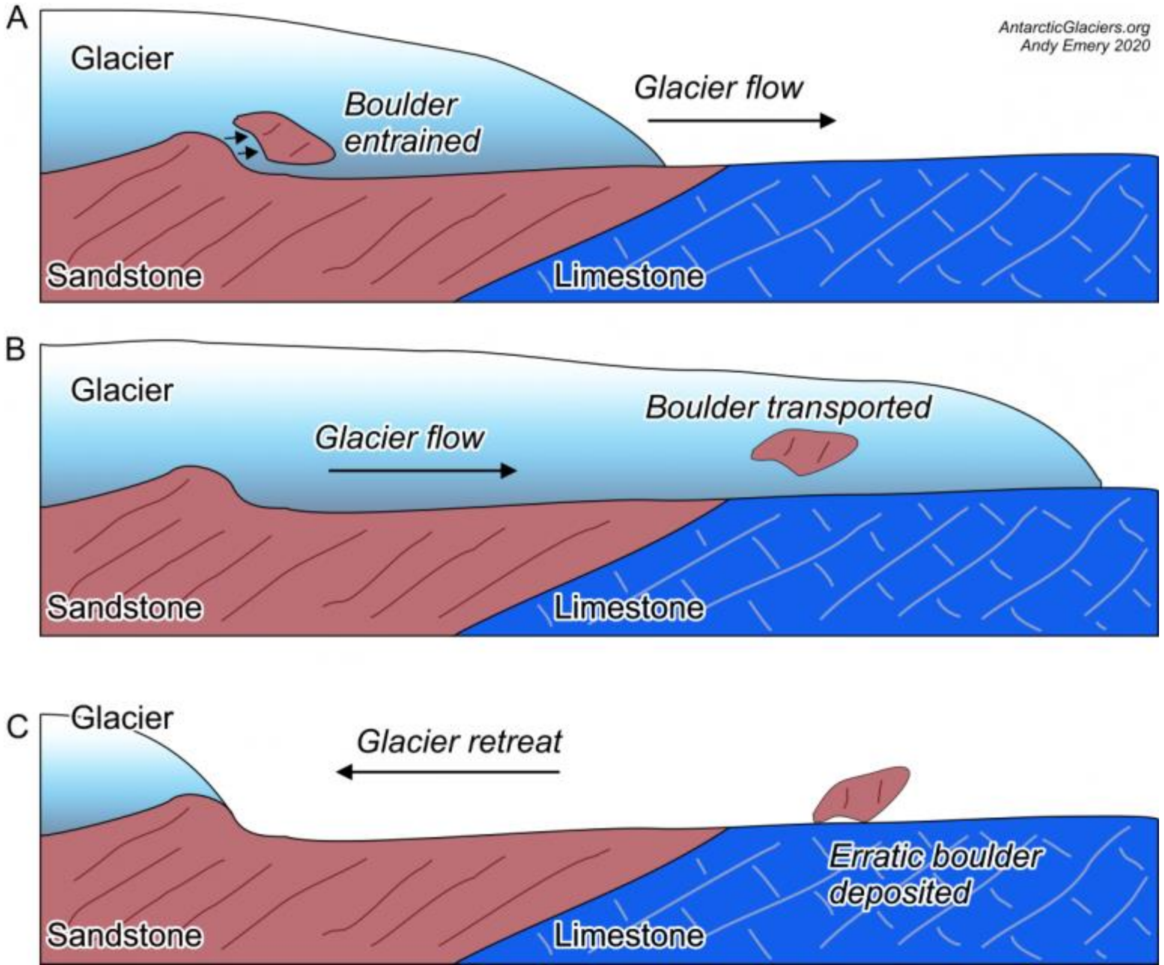


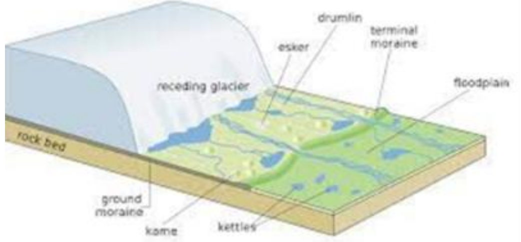
Brief Geological History of NYC

As the glacier moves, it behaves like a bulldozer since it will scrape clean the surface that the glacier traveled on; that is why in many parts of Manhattan and the Bronx the bedrock is at the surface and it is complete cleaned and free of top soil. The terminal moraine is created by all of this detritus moved at the edge of the glacier.

Brief Geological History of NYC

Glacial erratics, often simply called erratics, or erratic boulders, are rocks that have been transported by ice and deposited elsewhere. The type of rock (lithology) that the glacial erratic is made from is different to the lithology of the bedrock where the erratic is deposited.





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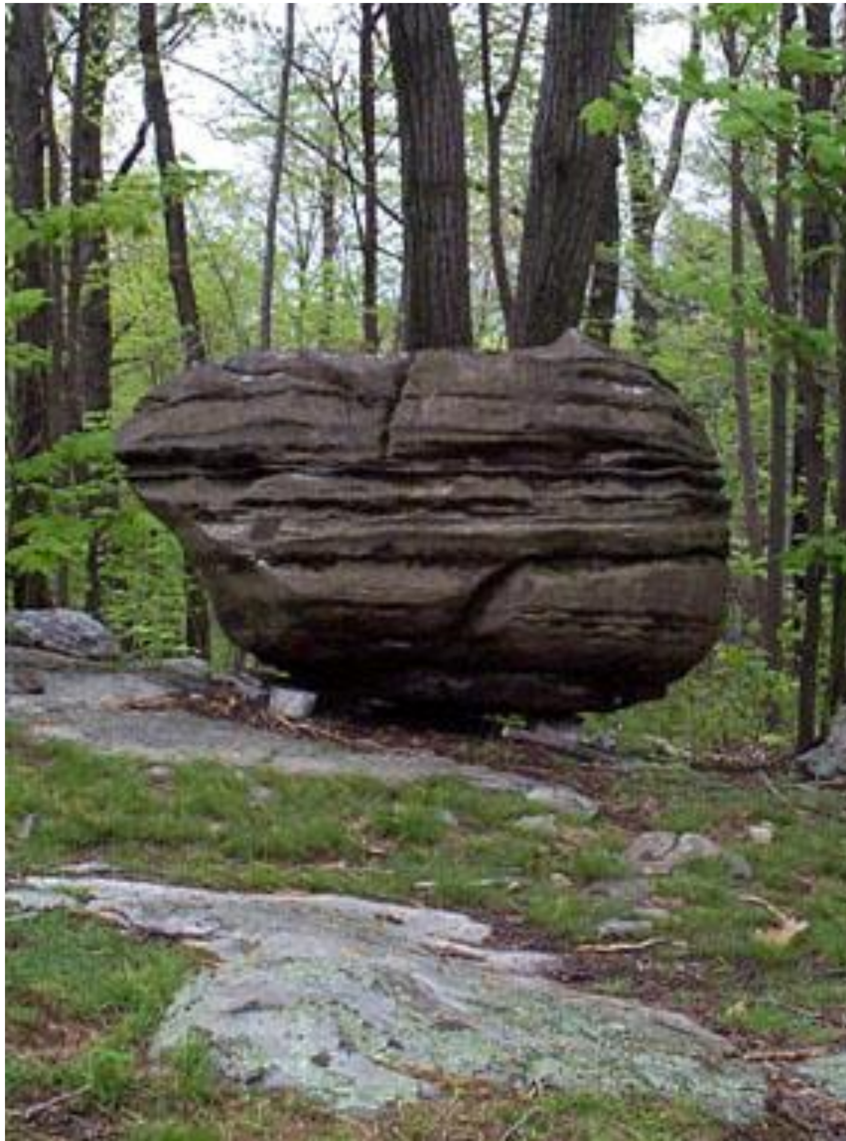
Brief Geological History of NYC

These glacial erratics or erratic boulders, are sandstones, basalts, granites, and pegmatites that are sitting on top of the bedrock in Manhattan, the Manhattan Schist.



Brief Geological History of NYC

This boulder is a pegmatite (igneous rock) sitting right on top of the Manhattan schist (metamorphic rock). The minerals that can be clearly seen on the pegmatite are: feldspar, quartz, and muscovite.

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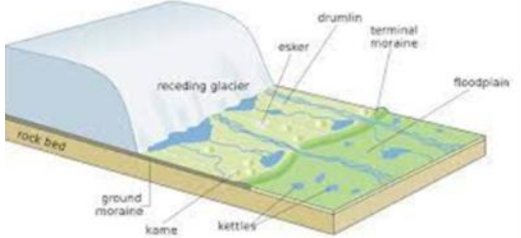
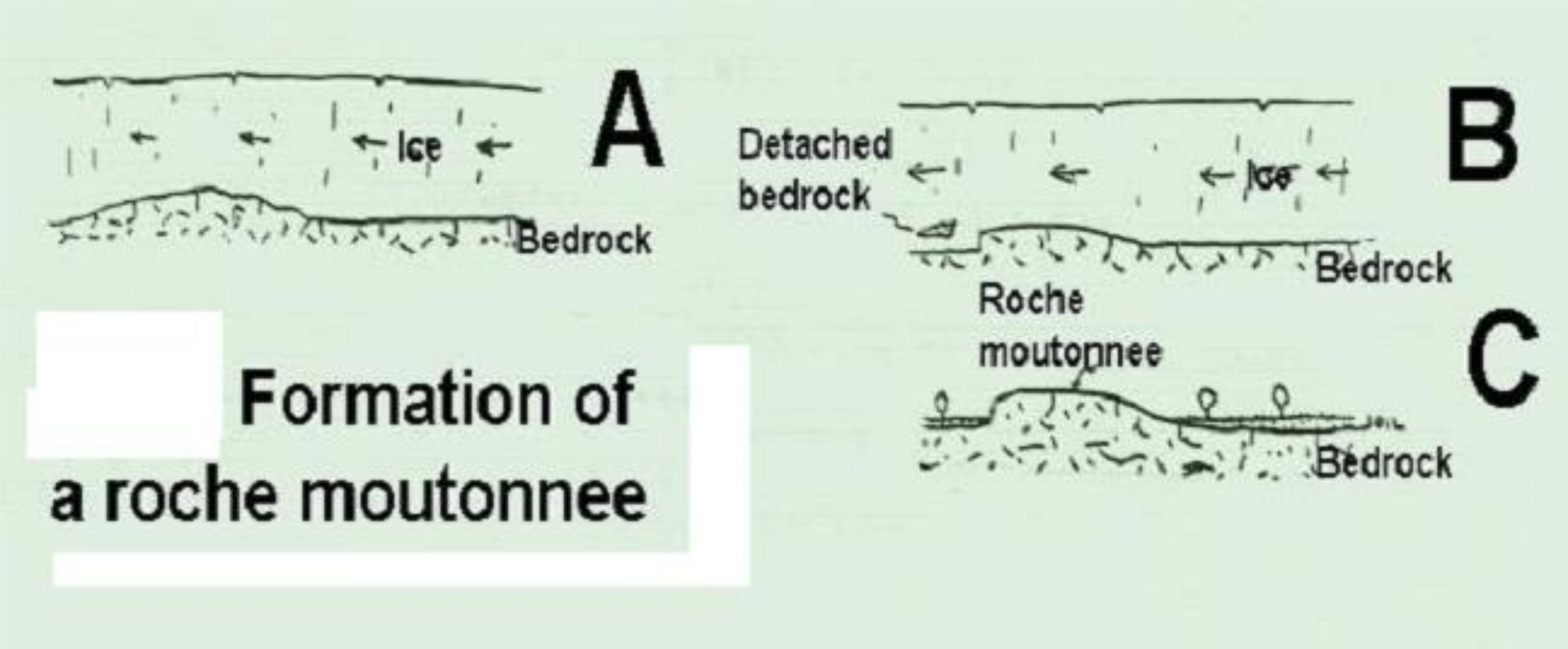
Brief Geological History of NYC

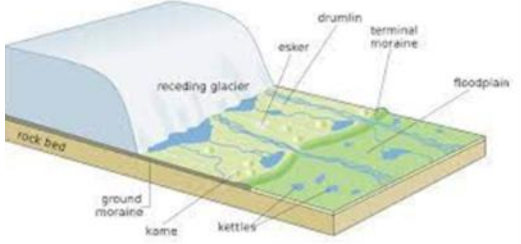
These linear features produced by the glacier: striations and grooves can tell us the direction that the glacier travelled. In this case the direction of travelling can either be NW to SE or SE to NW. Since these lines gives an inconclusive direction of travelling we need another geological feature to tell the exact direction.



Brief Geological History of NYC

A roche moutonnee will tell us the direction of travelling.

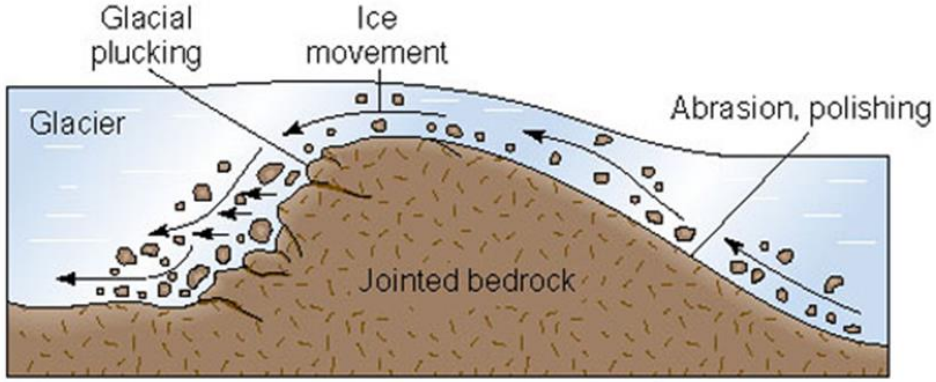




Brief Geological History of NYC

Based on the roche moutonnee we can finally tell that the glacier moved from the NW to the SE.

(a)



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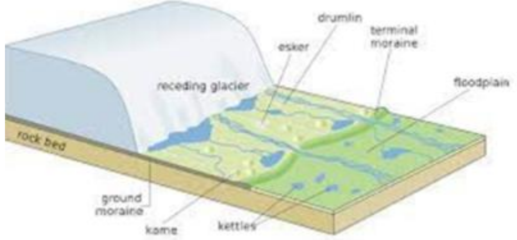

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