

*October 10, 2022*

## News and notes

Before going on to a look at the world of the [Neogene Period](#), here are some news items that I thought interesting.

### Thanksgiving Day in Canada



**Credit: [gerry.true](#)**

Here in Canada, it's [Thanksgiving Day](#) today. There is a bit of history to why Canada celebrates Thanksgiving on a different day than the U.S.A., but the short version is that it simply made more sense. As a harvest festival, having Thanksgiving in October reflects that the harvest in Canada is largely complete by the middle of October. Being further south, in much of the U.S.A., the harvest is often not complete until November.

Either way, it's a great way to get together with friends and family so that we can give thanks for our good fortune. My observation is that gratitude is a feature of any emotionally mature person.

### Excellent Article

- Here is an excellent article by Dr. Graham Young of the Manitoba Museum: [The Deep History of the Churchill Quartzite](#).

## Research

- From Eureka Alert: [New Geology articles published online ahead of print in September](#).
- From the American Mineralogist: [New Mineral Names](#).
- Plate tectonics and mineralization: [Oxidation of arcs and mantle wedges by reduction of manganese in pelagic sediments during seafloor subduction](#).
- An Earth-shattering kaboom: [The Chicxulub Impact Produced a Powerful Global Tsunami](#); Phys.org summary [here](#).
- More on Chicxulub, a presentation this past weekend at the [Geological Society of America, Connects 2022](#) conference: [The Chicxulub Mega-Earthquake: Evidence From Colombia, Mexico, and The United States](#); Phys.org summary [here](#).

## Paleontology

- [Reign of Papua New Guinea's megafauna lasted long after humans arrived](#); links to two research papers in the [Journal of Quaternary Science](#) [here](#) and [here](#); from Phys.org.
- Simple answer, yes; [Do multimillion-dollar dinosaur auctions erode trust in science?](#) from Phys.org.
- Lagerstätte: [A kung-fu kick led researchers to the world's oldest complete fish fossils. Here's what they found](#); from Phys.org.
- [A case for an active eukaryotic marine biosphere during the Proterozoic era](#); behind a paywall; lecture on the paper [here](#).
- From the American Geophysical Union: [A Post-Impact Deep Freeze for Dinosaurs](#).
- [A new volute, \*Ericusa ngayawang\* sp. nov. \(Gastropoda: Volutidae\), from the Miocene of South Australia](#).

## Glacial Geology

- [Ancient ice age valleys offer clues to future ice sheet change](#); links to two research articles from [Quaternary Science Reviews](#) are found [here](#) and [here](#); from Phys.org.
- [Abrupt drainage of Lago Greve, a large proglacial lake in Chilean Patagonia, observed by satellite in 2020](#); Eureka alert summary [here](#).
- [Seasonal land-ice-flow variability in the Antarctic Peninsula](#); Eureka alert summary [here](#).
- From the European Geosciences Union: [Stratigraphic templates for ice core records of the past 1.5 Myr](#).
- [Clouds drive differences in future surface melt over the Antarctic ice shelves](#).

## Climate Research

- It's complicated: [Complex spatio-temporal structure of the Holocene Thermal Maximum](#); Phys.org summary [here](#).

- It's really complicated: [Trigger Mechanisms of Gas Hydrate Decomposition, Methane Emissions, and Glacier Breakups in Polar Regions as a Result of Tectonic Wave Deformation](#).
- Concerns: [The wild weather of La Niña could wipe out vast stretches of Australia's beaches and sand dunes](#).
- [The Contribution of Climate Change to Increasing Extreme Ocean Warming Around Japan](#); Phys.org summary [here](#).
- Opinion: [Climate change and the threat to civilization](#); for an alternate view on civilizational collapse [see this article](#).

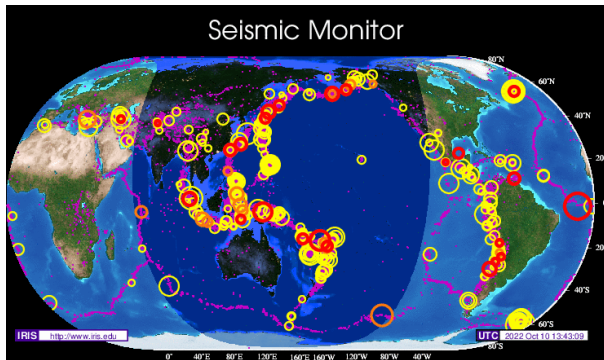
## Mining and Energy

- [Chile permanently closes mining areas connected to giant sinkhole](#).
- [US coal prices climb past \\$200 as global energy crunch boosts demand](#).
- [The American EV boom is about to begin. Does the US have the power to charge it?](#) The simple answer is no; related [Flooded Electric Vehicles Spontaneously Catch On Fire In Florida After Hurricane](#).
- What causes lithium ion batteries to degrade? [Lithiation Pathway Mechanism of Si-C Composite Anode Revealed by the Role of Nanopore using In Situ Lithiation](#); Mining.com summary [here](#).
- Concerns: [The magnificent Lake Eyre Basin is threatened by 831 oil and gas wells, and more are planned](#).
- Opinion: [David Yager: Why 'The World Should be Worried' About Oil Supplies](#).
- [Indigenous People Not Properly Consulted on Emissions Cap](#); I am guessing that the [duty to consult](#) was not convenient in this case.
- [Canada Weekly Rig Count Up 2 for Week Ending October 07, 2022](#).
- [Oil Posts Biggest Weekly Gain Since March on Supply Fears](#).
- [Residential and commercial natural gas prices reach multiyear highs in 2022](#).
- [Why Saudi Arabia Rebuffed Biden's Pleas For More Oil](#); maybe current production is already maxed out?
- Sedimentology research for oil exploration: [Characterization of complex fluvial-deltaic deposits in Northeast India using Poisson impedance inversion and non-parametric statistical technique](#).

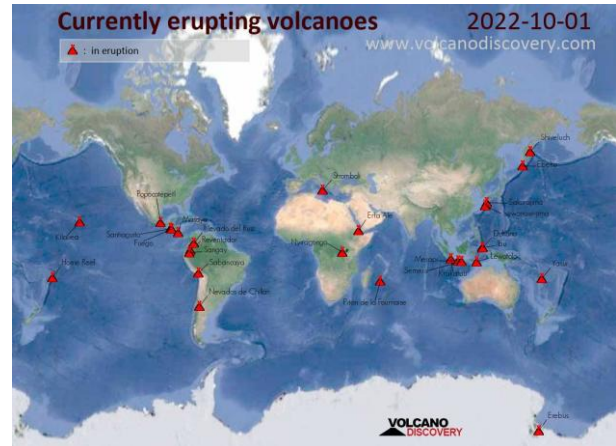
## Environmental Geology and Hydrogeology

- Treatment technologies: [Eco-friendly and solar light-active Ti-Fe<sub>2</sub>O<sub>3</sub> ellipsoidal capsules' nanostructure for removal of herbicides and organic dyes](#).
- From Eureka Alert: [Slurping up groundwater](#).

## Volcanoes, Earthquakes and Geohazards



[Seismic Monitor Link](#)



[Currently Erupting Volcanoes](#)

- Researching a volcano: [Combining hydro-acoustic sources and bathymetric differences to track the vent evolution of the Mayotte eruption, Mozambique Channel.](#)
- Researching magma and lava: [Extracting the geochemical characteristics of magmas in different global tectono-magmatic settings using sparse modeling.](#)
- From Phys.org: [Mauna Loa summit closed until further notice due to 'heightened unrest'.](#)
- From the United States Geological Survey (USGS), dendrochronology and earthquakes: [Redwood Tree Stumps Offer Clues to Past Earthquakes.](#)
- Earthquake prediction: [Case-Control Study on a Decade of Ground-Based Magnetometers in California Reveals Modest Signal 24–72 hr Prior to Earthquakes;](#) Phys.org summary [here](#).
- Active fault database: [The Active Faults of Eurasia Database \(AFEAD\): the ontology and design behind the continental-scale dataset.](#)
- Earthquakes and helium releases: [Earthquakes control the impulsive nature of crustal helium degassing to the atmosphere.](#)
- Geohazard research: [Dynamic risk framework for cascading compounding climate-geological hazards: A perspective on coastal communities in subduction zones.](#)

## Upcoming Events



IUGS 60TH ANNIVERSARY EVENT

**THE FIRST 100 IUGS GEOLOGICAL HERITAGE SITES**

Limited places. More information and registration at: [www.geoparkea.eus/iugs-globalgeosites](http://www.geoparkea.eus/iugs-globalgeosites)

October 25 - 28 th  
Zumaia  
Basque Coast UGGP  
Spain

Save the dates!

60 IUGS unesco ELISKADI BASQUE COUNTRY Geoparkea

[Link](#)

October 10, 2022

## The World of the Neogene Period

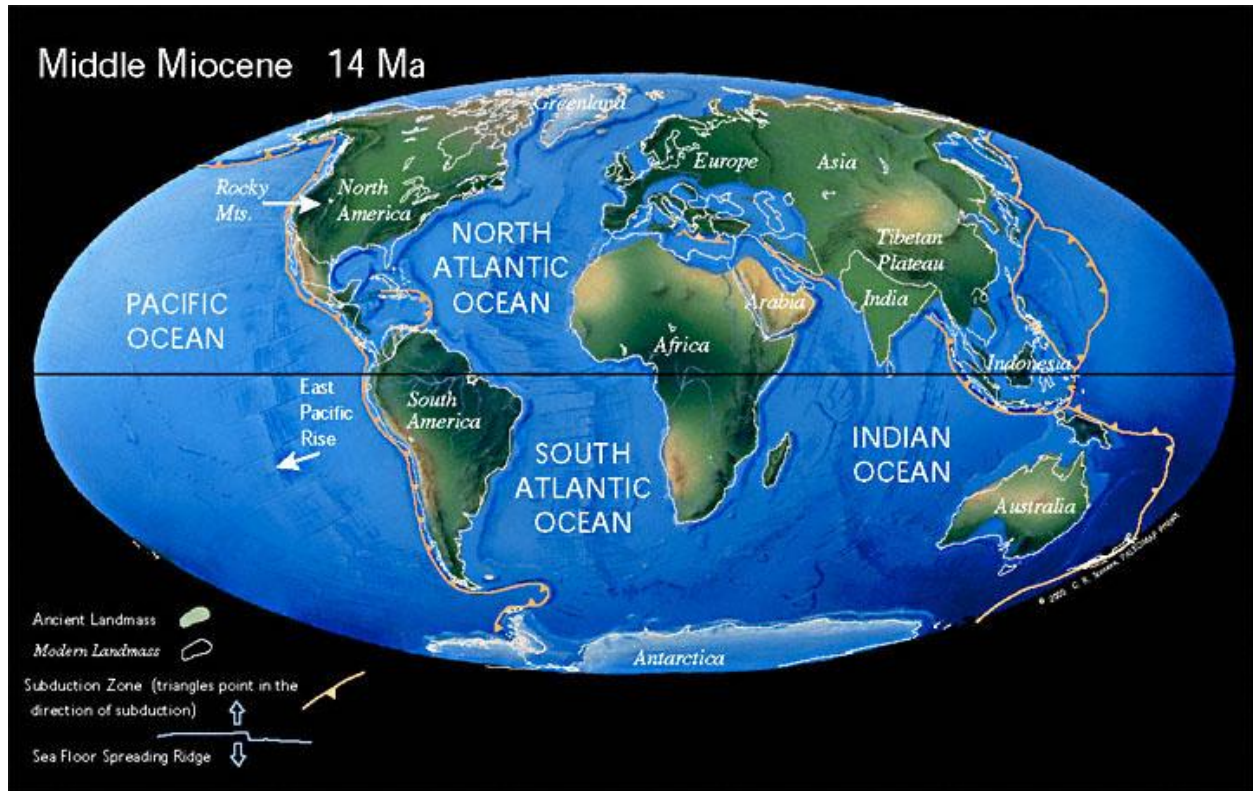


Figure 1 - The world of the Neogene, 14 Mya

**Credit:** "Plate tectonic maps and Continental drift animations by C. R. Scotese, PALEOMAP Project ([www.scotese.com](http://www.scotese.com))"

The [Neogene Period](#) lasted from 23.03 million years ago (Mya) to 2.58 Mya and is the middle period in the [Cenozoic Era](#). It is preceded by the [Paleogene Period](#) and is followed by the [Quaternary Period](#).

There are two epochs in the Neogene:

- The [Pliocene](#), 2.58 to 5.33 Mya, and
- The [Miocene](#), 5.33 to 23.03 Mya..

The Neogene Period was when much of the modern world evolved into its present form. Many of the fossils from the period are clearly directly ancestral to modern organisms, although there are many that went extinct in the meantime. The earliest fossil examples of the genus [Homo](#), the hominid [Homo habilis](#), appeared near the end of the period.

Austrian palaeontologist [Moritz Hörnes](#) was the [first to use the term Neogene](#) in 1853. There has been some disagreement on whether or not the Neogene should include the Quaternary

Period. Marine geologists especially are in favour of this whereas Quaternary geologists oppose it. Beginning in 2004, numerous geologists made proposals to the [International Commission on Stratigraphy](#) to reform the division of the Cenozoic Era. The current compromise has been to keep the three fold division of the Cenozoic Era (Paleogene, Neogene, and Quaternary) with what was formerly the last age of the Pliocene Epoch, the [Gelasian](#), added to the beginning of the [Pleistocene Epoch](#) of the Quaternary.

### Paleogeography and Climate

By the beginning of the Miocene, the world took on the general shape we are familiar with today. The major continents were roughly in the same locations they are in today except that the Atlantic Ocean was smaller and the Pacific Ocean was larger. However, while similar, there were some significant changes to the layout of the continents and sea levels. These in turn led to changes in the Earth's climate.

Overall, the general pattern of the [climate during the Neogene](#) was one of a gradual cooling. The cause of the [cooling](#) was complicated, but there is no doubt that the cooling occurred. Among the changes that led to the cooling are the rise of the Himalayan Mountains and the creation of the Isthmus of Panama.

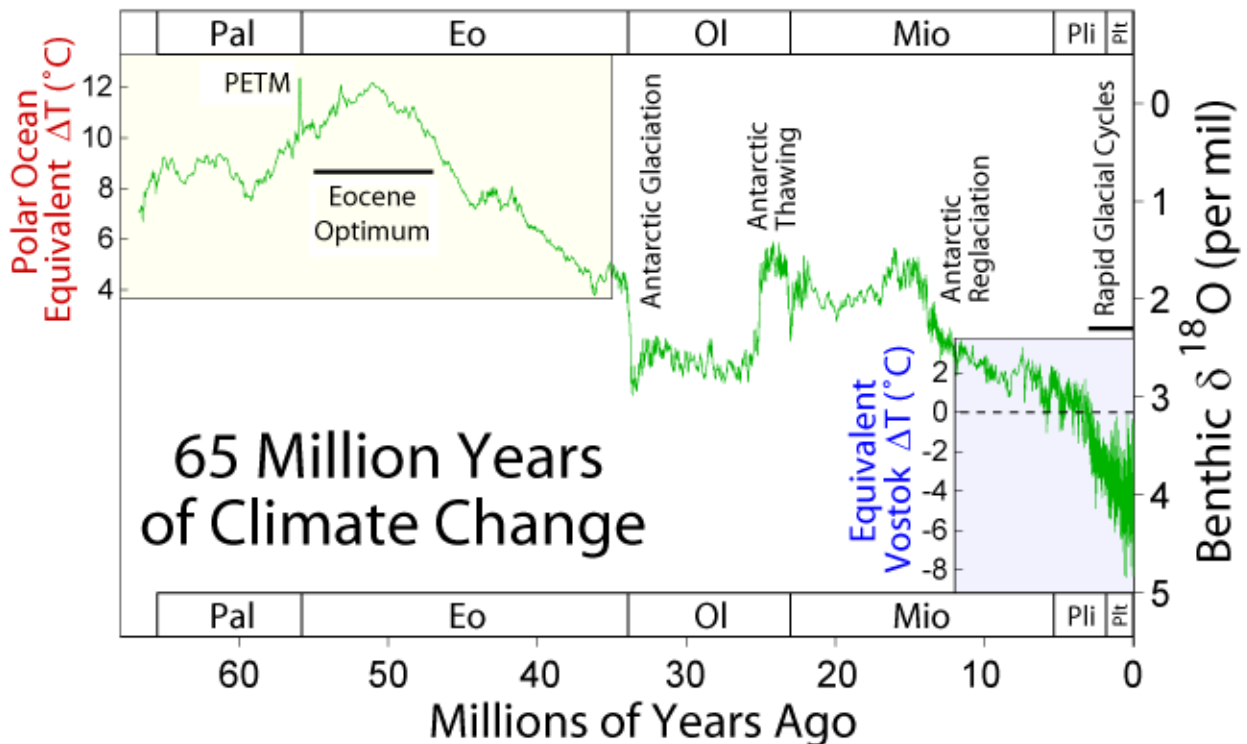


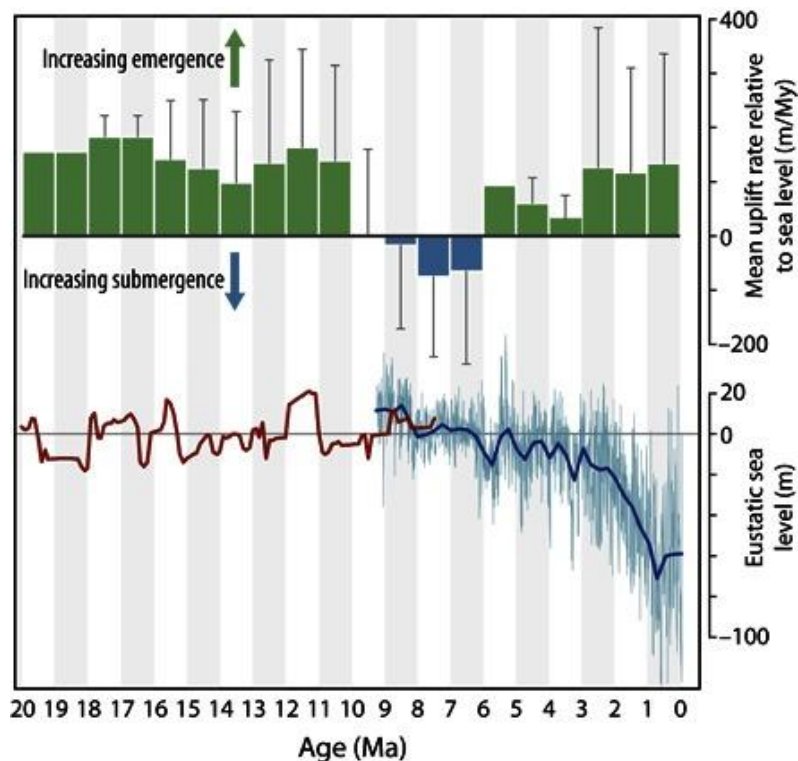
Figure 2 - 65 Million Years of Climate Change

Credit: [Robert A. Rohde](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

In Asia, the Indian subcontinent moved into Asia and raised the Tibetan Plateau and the Himalayan Mountains. [The rise of the Himalayas](#) was not without worldwide consequences. Among other things, it [may have led](#) to the strong monsoons that are now a [significant part of India's climate](#). The rise of the mountains also interrupted the climate of Central Asia, creating a giant rain shadow we now call the Gobi Desert. Windblown dust from the desert led to the deposit of massive [loess](#) deposits in [China](#). The role of the rise of the Himalayas in the reduction of carbon dioxide concentrations during the Neogene [is still not well fully understood](#); it looks complicated.

Another earth changing events was the linking of North and South America via the Isthmus of Panama near the end of the Pliocene, [approximately 2.8 Mya](#). Subduction of the [Pacific](#) and [Farallon](#) plates beneath the [Caribbean](#) and [South American](#) plates led to the creation of a [volcanic arc](#) and this created the Isthmus of Panama. A consequence of the rise of the Isthmus of Panama was to [alter the flow of ocean currents](#). The equatorial current that formerly ran around the world and flowed between North and South America became diverted to the current flow of the [Gulf Stream](#).

[Eustatic sea levels](#) also changed during the Neogene, generally falling and exposing more land. The causes of this sea level change are also complicated, but they seem to be due the various other tectonic changes that happened during the Neogene.



**Figure 3 - Eustatic Sea Level Change**  
**Credit:** Figure 1 in [O'Dea et al, 2016](#)

Besides the [orogenies](#) that led to the rise of the Himalayas and the Isthmus of Panama, other mountain building episodes during the Neogene included:

- The [Alpine Orogeny](#) in Europe and Western Asia, that began during the [Eocene](#) and was largely complete by the end of the Miocene, although tectonic activity in this area, especially along the [Mediterranean Ridge](#) continues till this day.
- The [Kaikoura Orogeny](#) in New Zealand that began in the Late [Oligocene](#) and continued through the Neogene until this day.
- The formation of the Isthmus of Panama noted above is a part of the larger [Andean Orogeny](#) in South America that began during the [Jurassic](#) Period and continues till this day.

### Subdivisions of the Neogene

Table 1 shows the subdivisions of the Neogene Period.

Period	Epoch	Ages	Mya
<a href="#">Neogene</a> 23.03 to 2.58 Mya	<a href="#">Pliocene</a> 5.33 to 2.58 Mya	<a href="#">Piacenzian</a> 3.60 to 2.58 Mya, <a href="#">Zanclean</a> 5.33 to 3.60 Mya	<b>5.33</b>
		<a href="#">Messinian</a> 7.246 to 5.333 Mya	<b>7.246</b>
	<a href="#">Miocene</a> 23.03 to 5.33 Mya	<a href="#">Tortonian</a> 11.63 to 7.246 Mya	<b>11.63</b>
		<a href="#">Serravallian</a> 13.82 to 11.63 Mya	<b>13.82</b>
		<a href="#">Langhian</a> 15.97 to 13.82 Mya	<b>15.97</b>
		<a href="#">Burdigalian</a> 20.44 to 15.97 Mya	<b>20.44</b>
		<a href="#">Aquitania</a> 23.03 to 20.44 Mya	<b>23.03</b>

**Table 1 - Neogene Subdivisions**  
Based upon the [Subcommission on Neogene Stratigraphy](#)

There are two epochs in the Neogene, the Pliocene and the Miocene, let's look at the further subdivisions of the two epochs.

## The Pliocene Epoch



**Figure 4 - Monte San Nicola, Sicily, Italy, arrow shows the top of the Pliocene**  
**Credit: [Subcommission on Neogene Stratigraphy](#)**

### *Piacenzian Age*

Lasting from 3.60 to 2.58 Mya, [Piacenzian Age](#) is the last age in the both the Pliocene Epoch and the Neogene Period. The top of the Piacenzian is also the bottom of the [Gelasian](#) Age of the Pleistocene Epoch, Quaternary Period. The marker for the beginning of the Gelasian is a [magnetostratigraphic boundary](#), in this case the base of the Matuyama (C2r) [chronozone](#), [isotopic stage](#) 103. Matuyama (C2r) chronozone coincides with a geomagnetic reversal (i.e. reversal of the Earth's magnetic poles), the [Gauss–Matuyama Reversal](#). Above the Matuyama (C2r) chronozone, [Discoaster pentaradiatus](#) and [Discoaster surculus](#), marine algae with calcareous exoskeletons, go extinct. The [Global Boundary Stratotype Section and Point](#) (GSSP) for the [bottom of the Gelasian](#) is at Monte San Nicola, Sicily, Italy near the city of [Gela](#).

The base of the Piacenzian is also defined by a geomagnetic chronozone, in this case magnetic chronozone C2An which is also the base of the Gauss chronozone. The base is also marked by the extinction of [forams](#) [Globorotalia margaritae](#) and [Pulleniatina primalis](#). The [GSSP for the Piacenzian](#) Stage is at Punta Piccola on Sicily, Italy.

Swiss geologist [Karl Mayer-Eymar](#) named the Piacenzian Age in 1858 after the Sicilian city of [Piacenza](#).

### ***Zanclean Age***

Below the Piacenzian, the [Zanclean Age](#) is the lowest age of the Pliocene Epoch lasting from 5.33 to 3.60 Mya. The base of the Zanclean coincides with magnetic chronozone Cr3 and is close to the extinction of calcareous nanoplankton species [Triquetrorhabdulus rugosus](#) and the first appearance of nanoplankton [Ceratolithus acutus](#). The [GSSP for the Zanclean](#) is close to the ruins of the ancient city of [Heraclea Minoa](#) on [Sicily, Italy](#).

In 1868, Italian geologist [Giuseppe Seguenza](#) named the Zanclean after the [Zancle](#), the ancient name for [Messina](#), Sicily.

### **Miocene Epoch**



**Figure 5 - Zanclean / Messinian Boundary, near Heraclea Minoa**  
**Credit: [Subcommission on Neogene Stratigraphy](#)**

### ***Messinian Age***

The [Messinian Age](#) is the final age of the Miocene and it lasted from 7.246 to 5.333 Mya. The top of the Messinian is also the bottom of the Zanclean age, described above. The first appearance of the [Globorotalia conomiozea](#) forams marks the base of the Messinian and is in the middle of magnetic chronozone C3Br.1r. The [GSSP for the Messinian](#) is in Morocco, at the [Oued Akrech](#) stream near the capital Rabat. Karl Mayer-Eymar named the Messinian in 1867 after Messina, Sicily.

### ***Tortonian Age***

The fifth age of the Miocene, below the Messinian, is the [Tortonian Age](#), which lasted from 11.63 to 7.246 Mya. The last common appearance of the nanoplankton [Discoaster kugleri](#) and planktonic foram [Globigerinoides subquadratus](#) marks the base of the Tortonian. The base is also associated with the short normal polarized magnetic chronozone C5r.2n. The [GSSP of the Tortonian](#) is near [Ancona](#), Italy at Monte dei Corvi. Karl Mayer-Eymar (a busy fellow in Neogene geology) named the Tortonian after the city of [Tortona](#), in the Piedmont region of Italy.

[Two large eruptions](#) of the Yellowstone Caldera are dated to the Tortonian Age.

### ***Serravallian Age***

Lasting from 13.82 to 11.63 Mya, and below the Tortonian, is the [Serravallian Age](#). The first occurrence of fossils of the nanoplankton species [Sphenolithus heteromorphus](#) marks the base of the Serravallian. It is located within chronozone C5ABr. The [GSSP for the Serravallian](#) is in Malta at the 'Ras il-Pellegrin' headland in the vicinity of '[Fomm ir-Rih](#)' Bay. the base also coincides with the boundary between the [Globigerina Limestone Formation](#) and the [Blue Clay Formation](#) on Malta. The base of the Serravallian also coincides with the onset of the [Middle Miocene Cooling step and the Mi3b oxygen isotope excursion](#).

The Italian geologist [Lorenzo Pareto](#) named the Serravallian Age in 1865 after the town of [Serravalle Scrivia](#) in northern Italy.

### ***Langhian Age***

Below the Serravallian, the [Langhian Age](#) is the third age in the Miocene. It lasted from 15.97 to 13.82 Mya. The first appearance of foraminifer species [Praeorbulina glomerosa](#) marks the base of the Langhian Age. the base coincides with the top of magnetic chronozone C5Cn.1n. The [Subcommission on Neogene Stratigraphy](#) (SoNS) has not yet established a GSSP for the Langhian Age. Lorenzo Pareto named the age in 1865 after the [Langhe](#) area north of [Ceva](#) in northern Italy.

### ***Burdigalian Age***

The second age in the Miocene, the [Burdigalian Age](#) lasted from 20.44 to 15.97 Mya and is below the Langhian. The first appearance of foram species [Globigerinoides altiapertura](#) and the top of magnetic chronozone C6An mark the base of the Burdigalian. No GSSP for the Burdigalian has been established by the SoNS.

French geologist [Charles Depéret](#) named the Burdigalian in 1892 after the Latin name for the City of Bordeaux, France.

### ***Aquitanian Age***

The first age in the Miocene, the [Aquitanian Age](#) lasted from 23.03 to 20.44 Mya and is below the Burdigalian. The base of the Aquitanian is also the Miocene/Oligocene boundary and is

marked by the first appearance of foram species [\*Paragloborotalia kugleri\*](#), the extinction of calcareous nanoplankton species [\*Reticulofenestra bisecta\*](#) and the base of magnetic chronozone C6Cn.2n . Karl Mayer-Eymar named the Aquitanian in after the [Aquitaine](#) region in France. The [GSSP for the Aquitanian](#) is the [Lemme-Carrosio](#) section near the small village of Carrosio, north of Genoa, Italy.



**Figure 6 - Lemme-Carrosio section (north-west Italy): GSSP of the Oligo-Miocene boundary**  
**Credit: Figure 4 in [Lirer and Iaccarino, 2011](#)**

## Winding Up

That's the quick introduction to the Neogene. Follow upon the links if there is more you want or need to know. The [SNoS website on the Neogene](#) is a good place to start.

## Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.