

Neogene Sediments and Fossils Sitia to Toplou



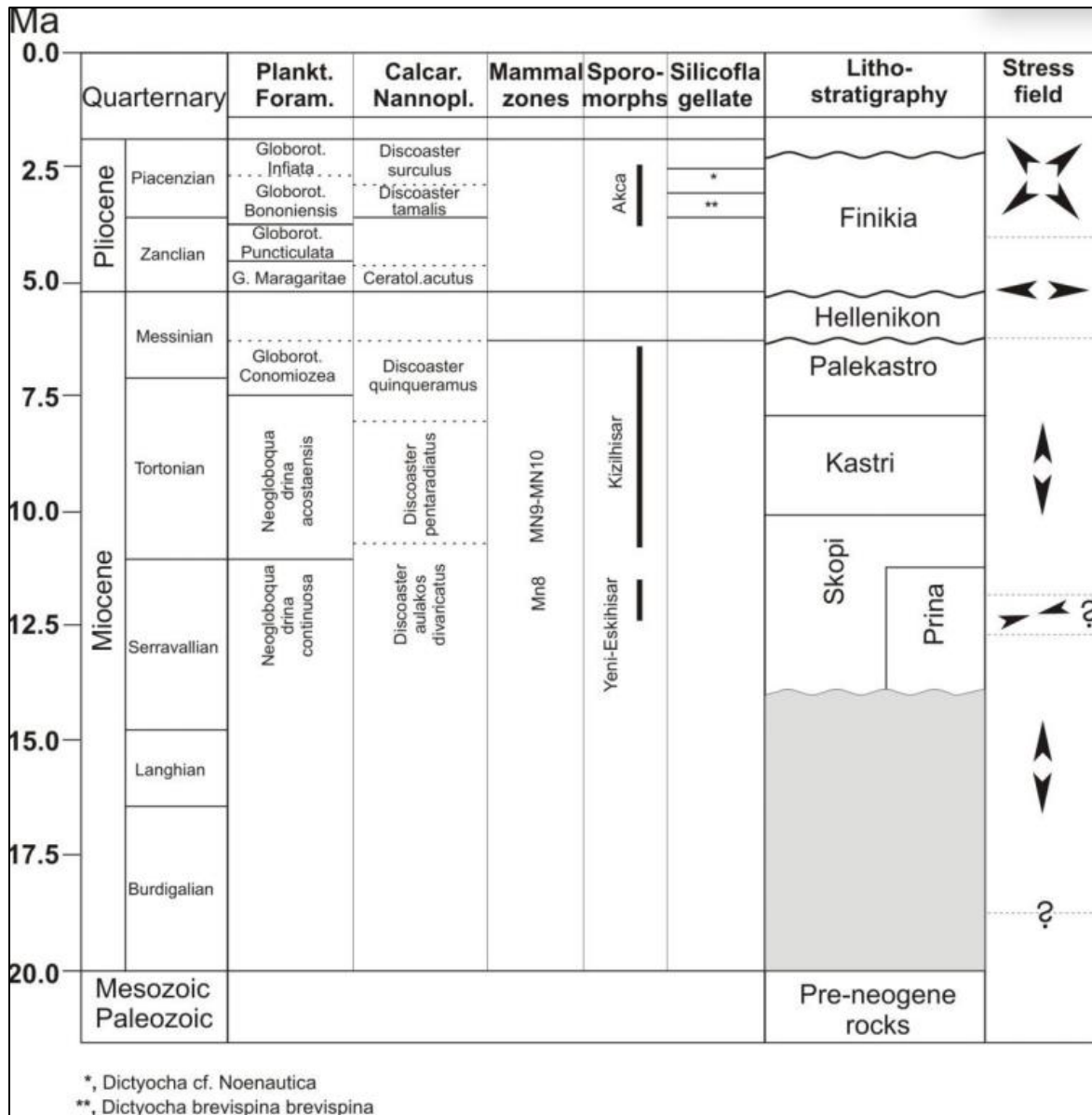
View of the Toplou Monastery – photographed from the entrance to the Moni Toplou Gorge. Conglomerates of the Skopi Formation rim the gorge.

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Post-Alpine Formations East of Sitia

The post-Alpine rocks were formed after the main mountain building phase when land already existed, either in areas that were temporarily shallow marine or continental. At eastern Crete these rocks were formed during the Miocene, Pliocene and Pleistocene.



The Neogene rocks of Sitia area (Modified from Meulenkamp et al. 1979 and Fassoulas 2001)

The Pleistocene rocks (Quaternary) of the Sita National Park appear mostly along the coast and were formed 1.5 million to 50.000 years ago. The sediments were deposited in shallow marine environments and are made up of sandstone and conglomerates with calcite matrix and display fossil fragments such as echinoderms, gastropods and bivalves. Mammal fossils such as hippopotamus and deer have also been found.

Aghia Fotia



Location of outcrops



Fossil finds at Aghia Fotia Beach

In Aghia Fotia outcrops of grey clays and yellowish sands belonging to the Achladhia Formation (Tortonium) extend seaward towards the beach (N 35° 11.72; E 26° 09.02). The path to the beach runs along the top surface of limestone beds and along a sloping outcrop of grey marl where many fossils can be found.



Outcrop at the beach of Agia Fotia looking north. 2: light brown Heterogestina limestone, 3: light grey marl, 4: light yellow marly carbonate sands.



Outcrop at the beach of Agia Fotia looking south. 1: brown calcarenite, 2: light brown Heterogestina limestone, 3: light grey marl.



1: brown calcarenite



1: Closeup of the brown calcarenite



2: Light brown *Heterogestina* limestone.



2: Closeup of previous picture. Foraminifers (*Heterogestina*) make up a large part of this bed.



2: *Pecten* are also abundant and also gastropods.



2: Bivalve, probably a type of oyster, within the *Heterogestina* limestone beds. The teeth of a savannah pig (*Microstonyx*) are reported to have been found above these beds.



3: Light grey marl. The marl is reported to contain several genera of bivalves.

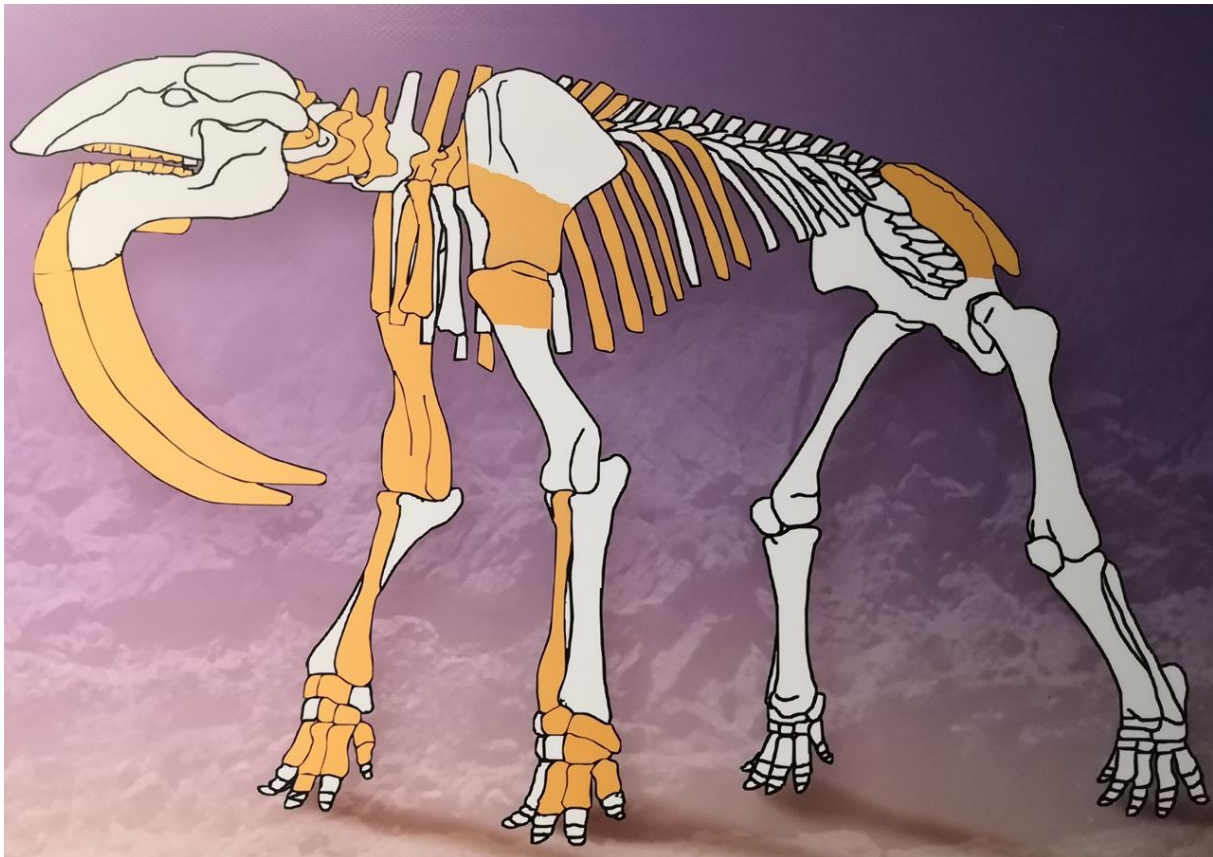


4: light yellow marly carbonate sands

Deinotherium

In addition to the fossils described above, the remains of the famous Deinotherium were found in a slope of the Skopi Formation near Agia Fotia. The Deinotherium fossils are now exhibited in the Natural History Museum of Heraklion (Poulakakis et al. 2005) [Kull].

In Crete, the first fossils of Deinotheriums were found in 2002 in the Gela area of Agia Fotia. The Deinotheriums of Crete were gigantic and existed approx. 8-9 million years ago. During the excavations by the Natural History Museum of Crete, a large portion of the skeleton of a single animal was collected, as well as almost all of its teeth and two tusks, that reveal that it was 4.5-5 meters tall and 6 meters long. The Sitia Deinotherium is thought to be the largest animal that ever lived on Crete and the rest of Greece.



Deinotherium: Yellow excavated fossil bones [Source: Natural History Museum of Heraklion]

Moni Toplou Gorge

West of the village Analoukas the road to Toplou Monastery branches off to the North, leading up through the Neogene Toplou Formation (not to be confused with the Toplou Fm defined by Stampfli). Just west of the monastery lies the entrance to the Toplou Gorge.

Tafoni

Tafoni vary in dimensions from a few centimetres to tens of metres and may appear as single cavities or in cellular arrays. In effect, the humidity drifts in along the coastal zone, due to the wind from the sea, and dissolves – similar to karstic fracturing - the carbonate cement matrix of the rock. This results in continuous removal of harder materials and enlargement of the cavity. Such formations are quite rare, but appear frequently within the Toplou Gorge and its surroundings, where there is Miocene sandstone.



1: To the Toplou Monastery, 2: Tafoni morphology, 3: Former marine terrace with coral reefs,



1: Miocene conglomerates of the Skopi Formation rim the Moni Toplou Gorge along the trail down to the beach. Cavities called Tafoni have been formed by the moist sea air and wind.



1: Conglomerate of the Skopi Formation (Serravallian/ Tortonian)



2: View of the former marine terrace looking Northeast.



3: *Miocene corals cover the marine terrace*



2: *Miocene Corals (possibly Porities)*

References

U. Kull, 2012: Kreta, Sammlung geologischer Führer

2014, Geology of Sitia, Aspiring Geopark

Natural History Museum of Heraklion, <https://www.nhmc.uoc.gr/en/>