Engagement with the Public and Avocational Paleontologists at the Calvert Marine Museum
Echinoderms
Bryozoa
Coral
Barnacles
Mollusks
Echinoderms
Carcharocles megalodon
Giant White Shark
Photo of Paleo in Discovery Room

A woman and a young boy are exploring a rocky wall with seashells embedded in it. The woman is wearing a striped shirt and sunglasses, while the boy is wearing a green hoodie and jeans. They seem to be looking at something on the wall, possibly fossils or rock samples.
Miocene – this way
WHERE TO FIND FOSSILS

1) Bay Front Park (formerly known as Brownie’s Beach) is located on MD Rt. 261 at the northern end of Calvert County, immediately south of the town of Chesapeake Beach. Limited parking is available. Open year round—fee charged during summer season. Tel: 301-856-8398 or 410-257-2230.

2) Breezy Point Beach is located at the end of Breezy Point Road just off MD Rt. 261. There is a fee to gain access to the beach from April to October. Tel: 410-535-0259 (only from April 15-October 15).

3) Matoaka Cottages/Beach Cabins is located just east of St. Leonard off of Calvert Beach Road. There is a daily beach access fee. Open year round. Tel: (410) 586-6269.

4) Flag Ponds Nature Park provides access (on a seasonal basis) to its beach. There is a daily beach access fee. Tel: 410-586-1477 (direct line) 410-536-5327 (reservations, groups).

5) Calvert Cliffs State Park is located five miles north of Solomons on MD Rt. 4. It has nature trails through a wooded park leading to the beach. The beach is a two mile hike from where you park your vehicle. Open year round. Tel: 301-743-7613.
A Field Guide to the Fossils of Calvert County Maryland

A brief introduction to the geological history of the area, with descriptions of the common (and not so common) fossils found here.

March 2000
Pre-Release Version

Fossil Shark Teeth of the Maryland Miocene

Calvert Marine Museum Fossil Club
Solomons, MD
www.calvertmarinemuseum.com
EXHIBITS

Paleontology

Stay up to date current findings and topics by following the Fossil Club Facebook page and Wordpress blog.

Fossil Identification Guide

Bones | Shells | Teeth

BONES

BASKING SHARK VERTEBRA
Cetorhinus Shark Vertebrate

GRAY SHARK VERTEBRA
Carcharhinus Shark Vertebrate

GIANT WHITE SHARK VERTEBRA
Carcharoclea megalodon (aka Carcharodon megalodon) Shark Vertebrate
Sandy Roberts Earth Sciences Scholarship
Features

- Miocene Marlin Skull
- Modified Mako Teeth
- Polynesian Shark Tooth Sledgehammer
- Bayside History Museum

Inside

- Echphora – Barnacle Home
- Canary Island Megs
- Fossil Club at PRAD
- Stratford Hall Whale Prep
- Pathological Meg Tooth
- 3-D Scanning
- Prints on the Beach
- Bugs at the Beach
- Reptiles at County Fair
- Potomac Coprolites
- Paleo Beer?
- Raku Shark Teeth
- Fish Skeleton as Earrings
- Dino Gasoline
- Field Trips and more...

Miocene Atlantic Blue Marlin Skull

This lovely partial skull was found by Bill Palmer along Calvert Cliffs. It consists of most of the neurocranium of a Miocene Atlantic blue marlin; very similar to the living Atlantic blue marlin (Makaira nigricans, shown below, from: http://fishonbluemailin.com/blue-marlin-makaira-nigricans/). Blue marlin are large and very fast-swimming open-ocean predators that use their bill (rostrum) to knife their way through schools of fish, to which they return to consume the stunned or dead individuals. Their scientific name “Makaira” means “short sword” or “dagger”. Skulls like this are exceedingly rare and I look forward to comparing it to the skulls of extant marlin. Hands by M. Baughman. Photo by S. Godfrey. ☀

See page 2...

Image from: http://cmmm.gsm.edu/tah-kousu/blog/lessons/americian-indians-and-their-environment/
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- Modified Mako Teeth
- Polynesian Shark Tooth Sledgehammer
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Ongoing public lecture series in paleontology

Sponsored by the Clarissa and Lincoln Dryden Endowment for Paleontology

The Calvert Marine Museum Fossil Club presents

The Rise and Fall of the Neogene Giant Sharks

Saturday, September 28th

Presented by Dr. Bretton Kent
University of Maryland, College Park

Lecture begins at 2:30 in the auditorium
Free and open to the public

This talk is sponsored by the Clarissa and Lincoln Dryden Endowment for Paleontology at the Calvert Marine Museum.

www.calvertmarinemuseum.com
The Gem, Lapidary, and Mineral Society of Montgomery County, MD

Long Beach Community Association, Calvert Cliffs, MD
75% of all vertebrate specimens were collected and donated by amateurs.
• Displays that are visually appealing
• Where to collect fossils
• Help identify their finds
• Fossil Club: newsletter/blog/field trips
• Volunteers/interns
• Accept donations
• Extend our reach
• Mutually beneficial and enriching...
Citizens of Calvert County, Maryland and the Board of Calvert County Commissioners

The Clarissa and Lincoln Dryden Endowment for Paleontology at the Calvert Marine Museum
<table>
<thead>
<tr>
<th>Shark Type</th>
<th>Number of Teeth</th>
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<tbody>
<tr>
<td>Angel Sharks - <em>Squatina suberrata</em></td>
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<tr>
<td>Bumble Sharks - <em>Echinothrix blakei</em></td>
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<tr>
<td>Saw Sharks - <em>Hexanchus gigas</em></td>
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<tr>
<td>Saw Sharks - <em>Notorinchus primigenius</em></td>
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<tr>
<td>Shortnose White Sharks - <em>Carcharodon carcharias</em></td>
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<tr>
<td>Tent White Sharks - <em>Carcharodon carcharias</em></td>
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<tr>
<td>Requiem Sharks - <em>Carcharhinus spp.</em></td>
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<td>Leopard Sharks - <em>Sphyra tawii</em></td>
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<tr>
<td>Tawney Sharks - <em>Negaprion brevirostris</em></td>
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<tr>
<td>Blacktip Sharks - <em>Carcharoides altimus</em></td>
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<td>Isurus Sharks - <em>Isurus desori</em></td>
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<tr>
<td>Isurus Sharks - <em>Isurus hastalis</em></td>
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<td>Isurus Sharks - <em>Isurus oxyrinchus</em></td>
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<td>Scleridae - <em>Prionace glauca</em></td>
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<td>Squalus - <em>Prionace glauca</em></td>
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<tr>
<td>Smaller Sharks - <em>Prionace glauca</em></td>
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<tr>
<td>Snaggletooth Sharks - <em>Hemipristis spp.</em></td>
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<tr>
<td>Tiger Sharks - <em>Galeocerdo cuvier</em></td>
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<tr>
<td>Giant White Sharks - <em>Carcharodon carcharias</em></td>
<td></td>
</tr>
</tbody>
</table>

**Total # of Teeth Identified: 22,560**

Visaggi and Godfrey, 2010
Squalodon sp.
Photo by Paul Murdoch at Willows Beach
**Squalodon calvertensis** Kellogg, 1923

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Squalodon sp.
Squalodon sp.

Olfactory Bulb Recess
Meherrinia isoni
Pliocene

Geisler, Godfrey and Lambert, 2012
Archaeocete Whale
Common minke whale or northern minke whale
(*Balaenoptera acutorostrata*)
Archaeocete Whale

Minke Whale

Dorsal Nasal Meatus

Nasal air passage

Eye Socket

Nasal air passage

Turbinates
Kyle Matthew and Lizzy Jenny
Model Airplane News
Miocene 16mya
Geologic Cross-Section of Calvert Cliffs, Maryland

St Marys Formation

Choptank Formation

Calvert Formation

PP, Plum Point Member of the Calvert Formation
CT, Choptank Formation
SM, St. Marys Formation
pSM, Post St. Marys Formation

Adapted from Kidwell (1997)
Miocene Fossils
<table>
<thead>
<tr>
<th>Ma</th>
<th>EPOCH</th>
<th>STAGE</th>
<th>FORMATION</th>
<th>MEMBER</th>
<th>BED</th>
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<td>Serravallian</td>
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<td>St. Mary's</td>
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<td></td>
<td>Zancian</td>
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<td>Upper</td>
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<td>Chowan River</td>
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Chesapeake Ranch Estates
• Volunteer Coordinator
• Fossil Club
• Fossil Club newsletter
• Freely identify fossils for anyone
• Public events where the fossil club exhibits
• Paleo Volunteers in prep lab, collections, and collecting specimens
Treasure from the Cliffs
Exploring Paleontology of Southern Maryland

The paleontology gallery offers visitors a glimpse of prehistoric marine and terrestrial critters that lived in southern Maryland during the Miocene epoch – that portion of geologic time which lasted from about 23.8 million years ago until 5.3 million years ago. A full 40 million years separates the Miocene creatures from the last of the dinosaurs which became extinct 65 million years ago.

The fossils in our exhibit come from the cliffs along the Chesapeake Bay and the Patuxent River. The sediments, which form the cliffs, accumulated on the bottom of a vast inland arm of the Atlantic Ocean. During periods of Miocene global warming, the Atlantic Ocean extended west to the present-day location of Washington, D.C. During global cool spells, when ice would accumulate over the South Pole, the ocean would retreat to the east, leaving southern Maryland and its continental shelf high and dry. The layer-cake appearance of the sediments is therefore a result of changes in the depth of the Atlantic Ocean over this area. Sandy sediments generally indicate relatively shallow near-shore deposits, whereas clayey sediments reflect deeper water environments farther from shore or within embayments protected from wave action.

A partial dolphin skull is removed from the cliffs by a member of the Department of Paleontology.

Calvert Cliffs extend approximately 35 miles along the western shore of the Chesapeake Bay, Calvert County, Maryland.

A word of warning! Digging in the cliffs is dangerous and is prohibited on all state and federal lands. On private land, permission must be obtained from the owners before digging. If you see a skull, bone, or unusual fossil in the cliffs, please report it to the Calvert Marine Museum (410-326-2042). The museum appreciates getting this information and, if justified by the importance of the find, will make every effort to obtain the necessary permission and have trained personnel collect the specimen, giving full credit to the finder.

The Diversity of Fossils from the Maryland Miocene

Of the more than 600 species that have been identified from the cliffs, a large majority of the fossils are marine organisms, such as corals, mollusks, sharks, bony fish, turtles, and a variety of dolphins and whales. Yet, in spite of this remarkable diversity, they represent only a small portion of the total number of species that must have been living in this area. It is the hard parts of animals – shells, bones, and teeth – that are most likely to be preserved as fossils. Worms and other soft-bodied animals fossilize only under exceptional circumstances and have never been collected from the cliffs. Although fragmentary remains of some of the larger terrestrial animals have been collected – extinct mastodons, rhinos, and camels – the fossils of small terrestrial mammals, insects, amphibians, lizards, and snakes are yet to be found.

Forty drawers provide examples of the fossilized remains of the more common Miocene vertebrate and invertebrate species, some of which you might have in your collection.

Mollusk shells – clams, oysters, scallops, snails and their kin – are so densely packed in several conspicuous beds along the cliffs that most of the shell material on the beach is Miocene in age. It is little wonder that over 400 species of mollusks have been identified by paleontologists. Only about 11 percent of these species are living today.

Of the vertebrate fossils, the most complete skeletons are those of some of the marine mammals. The variety of skulls and skeletons collected by museums from the cliffs for over a century demonstrates that these deposits preserve one of the world’s most diverse assemblages of extinct whales and dolphins. Among the over 30 extinct kinds found thus far are the remains of sperm whales, shark-tooth whales, both long and short beaked dolphins, and at least eight species of primitive baleen (filter-feeding) whales.

Much less frequently encountered are the fossil remains of extinct seals and sea cows.

An artist’s view of the Washington, D.C. area 15 million years ago. Here the extinct subtropical crocodile, Gavialisuchus antiquus, skulks through a salt marsh bordered by willow cypress. Adjacent to the warm and shallow ocean waters of the Atlantic, forests of oak, pine, walnut, and bald cypress covered much of Maryland.

Snail Turitella plebeia
Coral Astrhelia palamata
Sand Dollar Ambergella aberti
Ark Shell Dallarca idonea
Snail Exphora gardnerae
Scallop Chesapeacket nefrens
Fossils of Calvert Cliffs

Calvert Marine Museum
Solomons, Maryland
SHARKS, RAYS and BONY FISH

Shark teeth are the favorite fossils of local beachcombers. They vary in size from barely visible to tooth of the fossil great white shark measuring six inches or more. There are so many that one can almost always find a few at the water’s edge when the bay is calm. Shark vertebrae are also fairly common.

The kinds identified thus far include the hammerhead shark, mako shark, tiger shark, sand shark, cow (seven-gilled) shark, mackerel shark, bull (gray) shark, snaggletooth shark, thresher shark, basking shark, whale shark, and giant fossil great white shark. The shark in the story “Jaws” was a modern white shark, but a smaller animal than the Miocene monsters with six-inch teeth; it is estimated that the largest fossil white sharks reached fifty feet in length and weighed fifty tons! Shark teeth and vertebrae are found in all strata; the largest are believed to come from the Calvert Formation.

Why are so many shark teeth found here? Jeanne D. McLennan in Miocene Sharks Teeth of Calvert County says, “There are several reasons for this abundance. First, sharks have an unlimited supply of teeth. No cavities, permanently missing teeth, or toothaches for them! Shark teeth are not set firmly in the jaw, but in the gums, where they occur in layered rows. If a tooth is lost, it is gone but briefly, for another from the reserve layer moves forward and takes its place. Therefore, one ‘full set’ by no means represents the total tooth production of one shark. Also, recent studies indicate that the young of one common modern shark replace their upper teeth every 7.2 days, and their lower ones every 8.2 days. It is probable that this may have held true in fossil sharks.”

Curiously, tooth replacement can begin even before a shark is born. Recent examination of baby white sharks still in their mother’s uterus revealed tiny teeth that had been shed during the developing young’s gestation period. In an entire lifetime, a shark may produce and shed tens of thousands of teeth.

The durability of shark teeth also may be a factor. They are among the hardest of all organic materials and highly resistant to destruction by weather and wave action. Shark teeth are found less frequently in the cliff than on the beach. It may be that these we pick up from the beach are part of an accumulation that has worked out of the cliffs over a period of many years.

Rays and skates, related to sharks, also lived in the Miocene seas. Fragments of dental plates are common, and occasionally complete plates and tail barbs wash out of the cliffs.

Many kinds of fish in the Chesapeake Bay today had close relatives that lived in the area millions of years ago. Bluefish, weakfish, sturgeon, ocean catfish, tilefish, and black drum were present, as were cod, sailfish, ocean sunfish and other types. Fish remains are plentiful in the cliffs but usually consist of isolated vertebrae, scales and an occasional tooth. Skins have been found, but they are very delicate and among the most difficult fossils to collect.
Brief History of the Fossil Club

Local amateur fossil collectors and museum staff have been fossil collecting together or leading field trips for schools and other organizations since early in the CMM's history. But it was not until 1981 that Norm Riker, a local collector, suggested that a fossil club be formed.

An organizational meeting held April 16, 1981, established the club and we've functioned informally since then under the leadership of Dave Bohaska. Annual dues of $10 per family, $3 for students, were initiated in 1985 to cover expenses such as phone, postage, printing,
Fossil Facts

Extracted from the

*Bugeye Times*

Published by the Calvert Marine Museum

Compiled by the Calvert Marine Museum Fossil Club
Paige Fischer