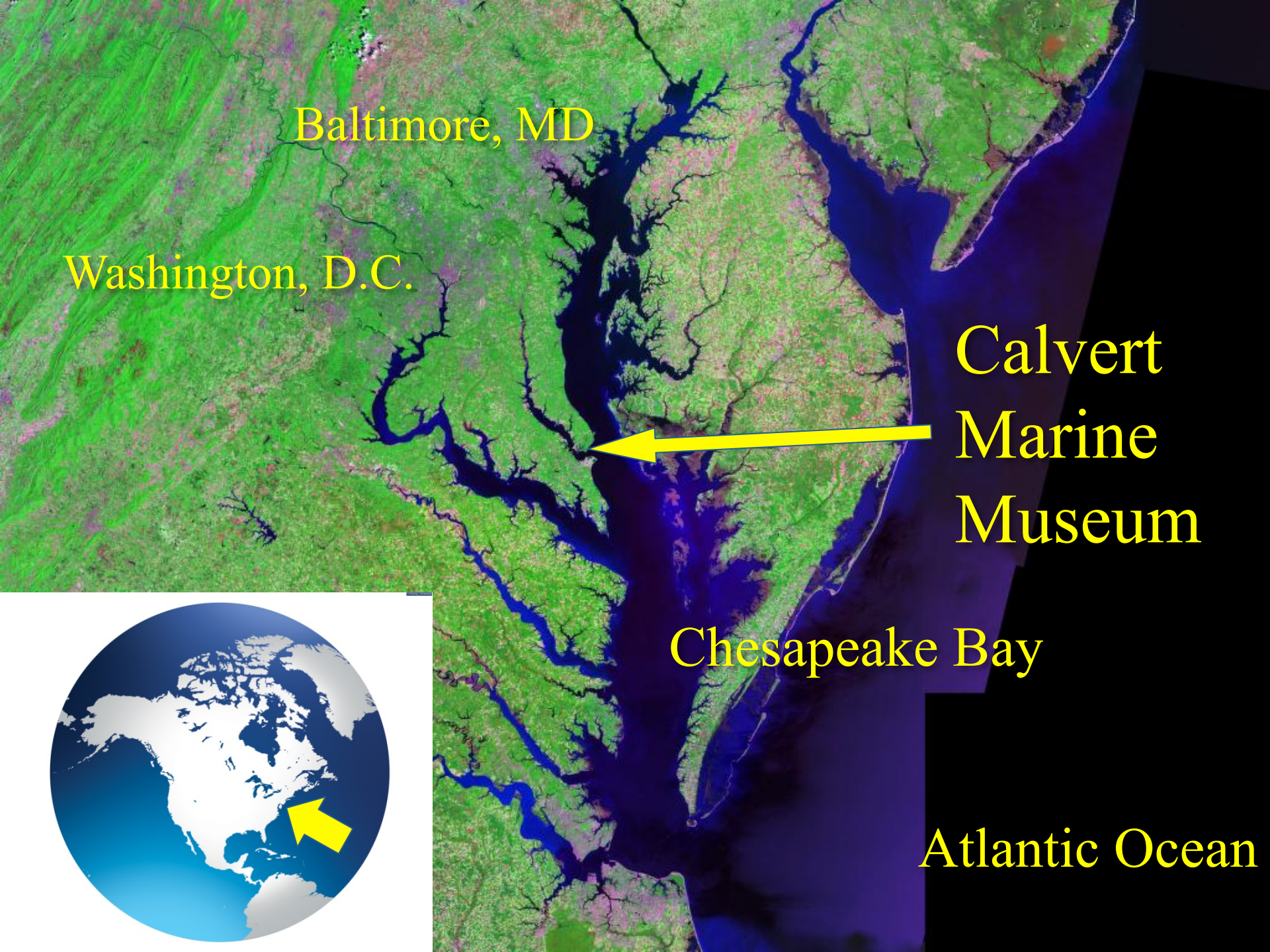


Engagement with the Public and Avocational Paleontologists at the Calvert Marine Museum



**CALVERT
MARINE
MUSEUM**





Baltimore, MD

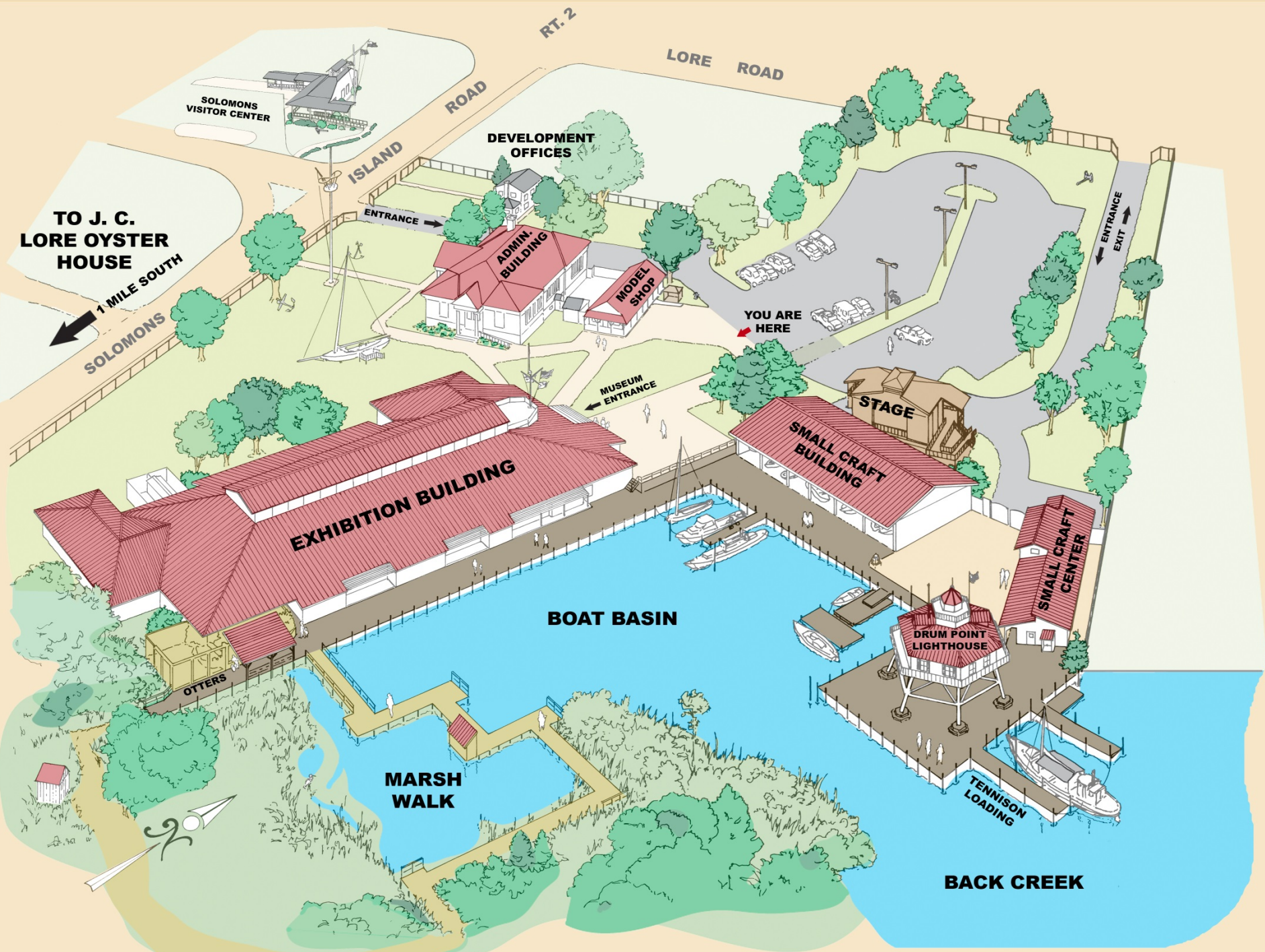
Washington, D.C.

Calvert
Marine
Museum

Chesapeake Bay

Atlantic Ocean





RT. 2

LORE ROAD

SOLOMONS
VISITOR CENTER

ISLAND
ROAD

TO J. C.
LORE OYSTER
HOUSE
1 MILE SOUTH
SOLOMONS

DEVELOPMENT
OFFICES

ENTRANCE

ADMIN.
BUILDING

MODEL
SHOP

YOU ARE
HERE

MUSEUM
ENTRANCE

STAGE

SMALL CRAFT
BUILDING

SMALL CRAFT
CENTER

DRUM POINT
LIGHTHOUSE

TENNISON
LOADING

BOAT BASIN

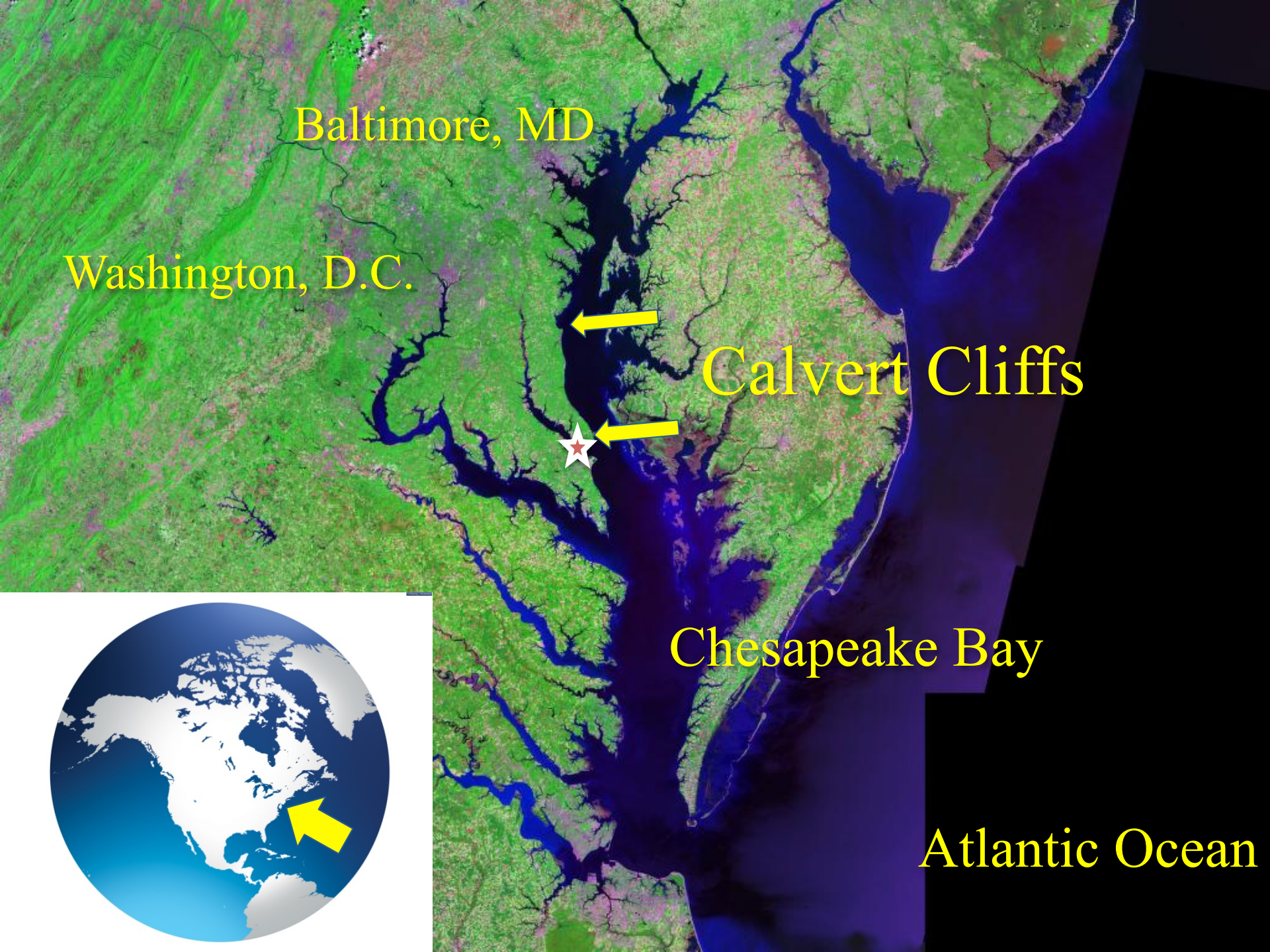
MARSH
WALK

BACK CREEK









Baltimore, MD

Washington, D.C.

Calvert Cliffs

Chesapeake Bay

Atlantic Ocean

Randle Cliff



Bryozoans



Coral



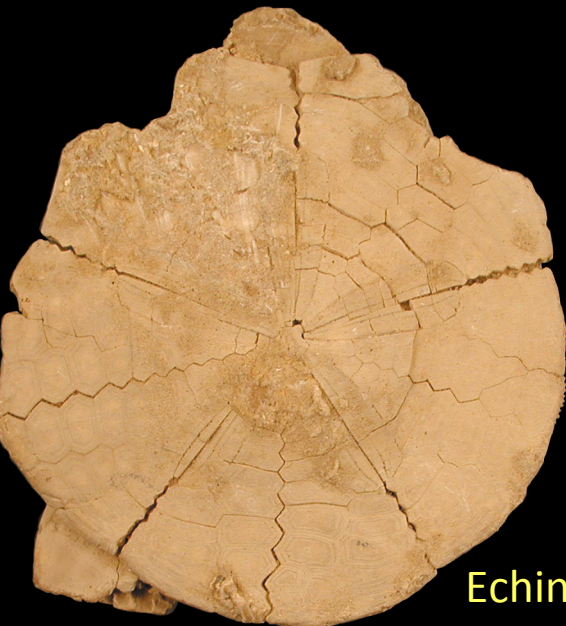
Barnacles



Mollusks



Echinoderms



Carcharocles megalodon
Giant White Shark







← Miocene – this way





CALVERT MARINE MUSEUM

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Visitor Information

What To See and Do

EXHIBITS

All the Exhibits

Discovery Room

Skates & Rays

Estuarine Biology

- River Otters

- Eco Invaders

- Behind the Scenes

Maritime History

- Virtual Exhibits

- Articles

Paleontology

- Fossil Identification

- Where to Find Fossils

- Fossil Field

- The Ecphora

- Fossil Club

- Articles/Books/Library

- Paleontology Collection

Gallery Guide

MARSH WALK

LIGHTHOUSES

LORE OYSTER HOUSE

SMALL CRAFT AT CMM

WOOD CARVING SHOP

LIBRARY / ARCHIVES

RIVER CRUISES

Concerts and Events

Education Programs

Membership

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Museum Store



PO Box 97
14200 Solomons Island Road
Solomons, MD 20688

EXHIBITS

Paleontology

Where to Find Fossils

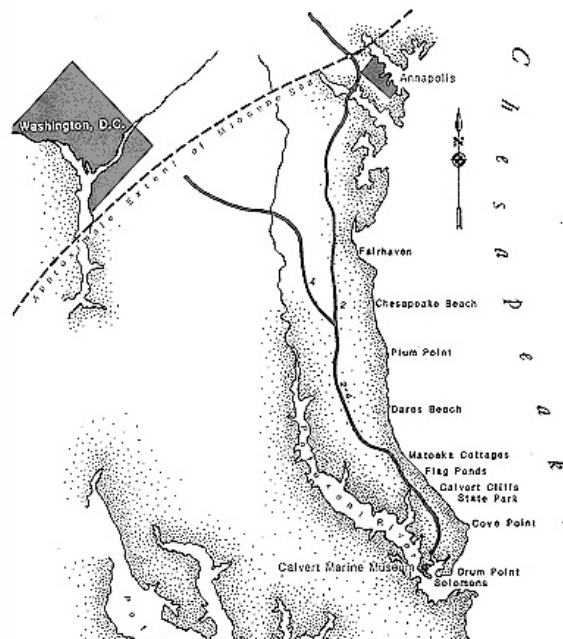
1) Bay Front Park (formerly known as Brownie's Beach) is located on MD Rt. 261 at the northern end of Calvert County, immediately south of the town of Chesapeake Beach. Limited parking is available. Open year round – fee charged during summer season. Tel: 301-855-8398 or 410-257-2230.

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) 586-0269.

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) 410-535-5327 (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.



Paleontology Quick Links

Fossil Identification
Guide



Where to Find Fossils



Fossil Field
Experience



Newsletter
The Ecphora



Fossil Club



Articles, Books, and
Library



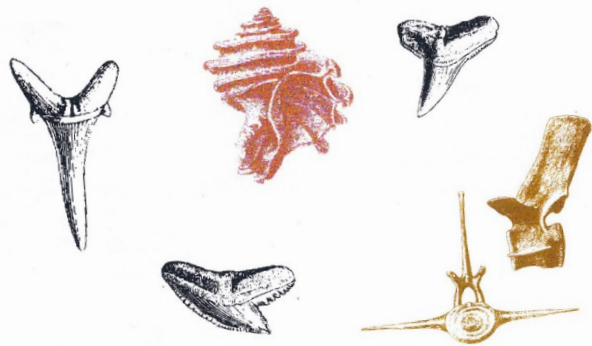
Gallery Guide



Paleontology
Collection



A Field Guide to the Fossils of Calvert County Maryland

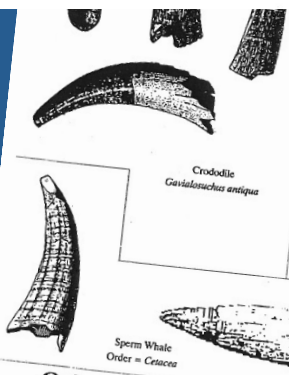
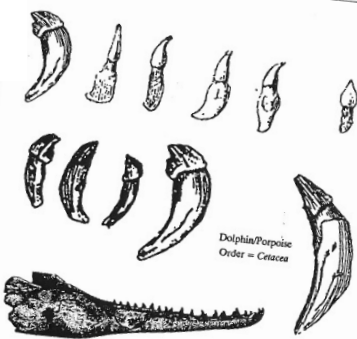
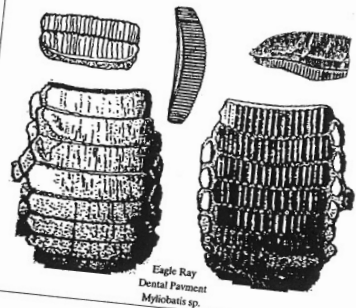
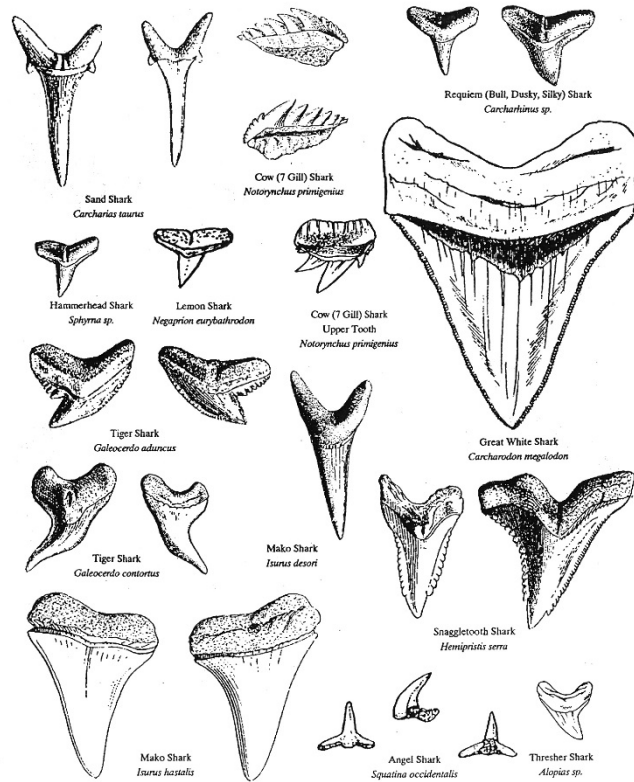


A brief introduction to the geological history of the area, with descriptions of the common (and not so common) fossils found here.

March 2000
Pre-Release Version

Note: This document is meant to serve as a back-up source of information to visitors, and to answer common questions that may be raised after a trip to the area. It is not meant to replace the excellent documents available either through the Calvert Marine Museum or the Maryland Geological Survey.

Fossil Shark Teeth of the Maryland Miocene

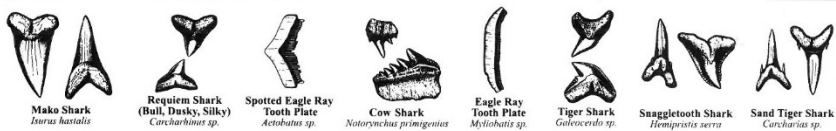


Other Fossil Teeth of the Maryland Miocene



Calvert Marine Museum Fossil Club Solomons, MD

www.calvertmarinemuseum.com





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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



10 cm

BASKING SHARK VERTEBRA

Cetorhinus

Shark Vertebrate



10 cm

GRAY SHARK VERTEBRA

Carcharhinus

Shark Vertebrate



GIANT WHITE SHARK VERTEBRA

Carcharocles megalodon
(aka *Carcharodon megalodon*)
Shark Vertebrate



10 cm

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Guide



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Collection





Sandy Roberts Earth Sciences Scholarship





Fossil Club Newsletter

The ECPHORA



The Newsletter of the Calvert Marine Museum Fossil Club

Volume 28 • Number 4 December 2013

Features

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

Inside

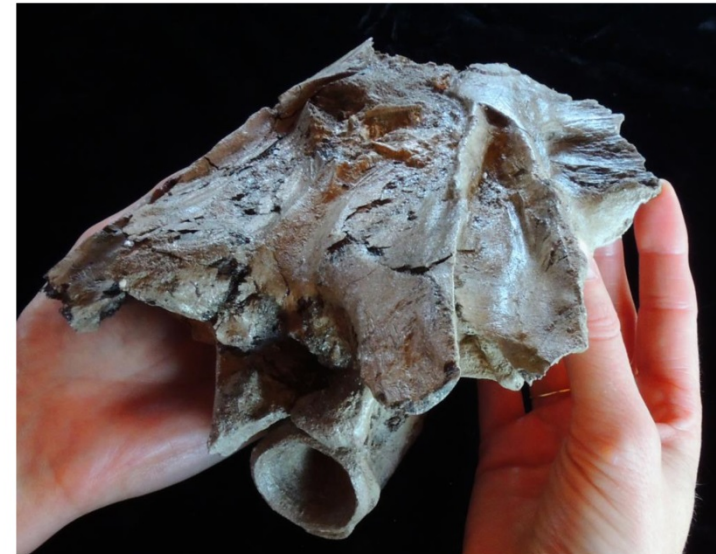
- *Ecphora* – Barnacle Home
- Canary Island Megs
- Fossil Club at PRAD
- Stratford Hall Whale Prep
- Pathological Meg Tooth
- 3-D Scanning
- Prints on the Beach
- Bugs at the Beach
- Reptiles at County Fair
- Potomac Coprolites
- Paleo Beer?
- Raku Shark Teeth
- Fish Skeleton as Earrings
- Dino Gasoline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



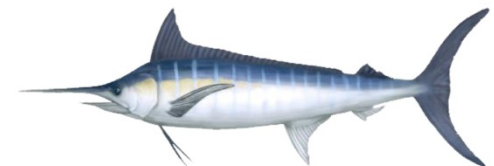
See page 2...

Image from: <http://chnm.gmu.edu/tah-loudoun/blog/lessons/american-indians-and-their-environment/>

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://fishonbluemarlin.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. ☼



CALVERT MARINE MUSEUM

www.calvertmarinemuseum.com

Bill Palmer



The ECPHORA



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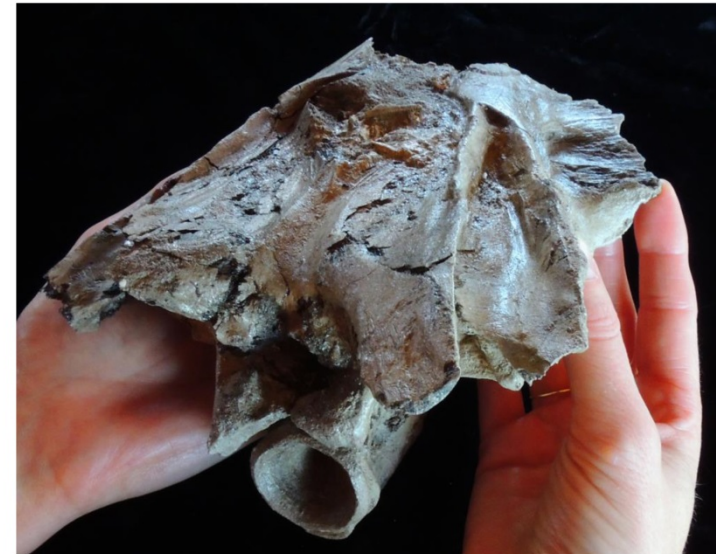
- *Ecphora* – Barnacle Home
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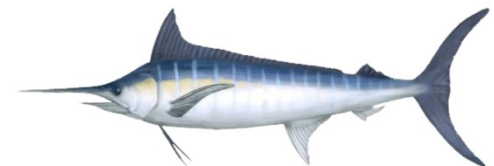
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CALVERT MARINE MUSEUM

www.calvertmarinemuseum.com



The Calvert Marine Museum Fossil Club presents

Ongoing public
lecture series in
paleontology

Sponsored by the
Clarissa and Lincoln
Dryden Endowment
For Paleontology

The Rise and Fall of the Neogene Giant Sharks

**Saturday,
September 28th**



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



← Scan here to
learn more about
the Fossil Club

*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



Pam Platt

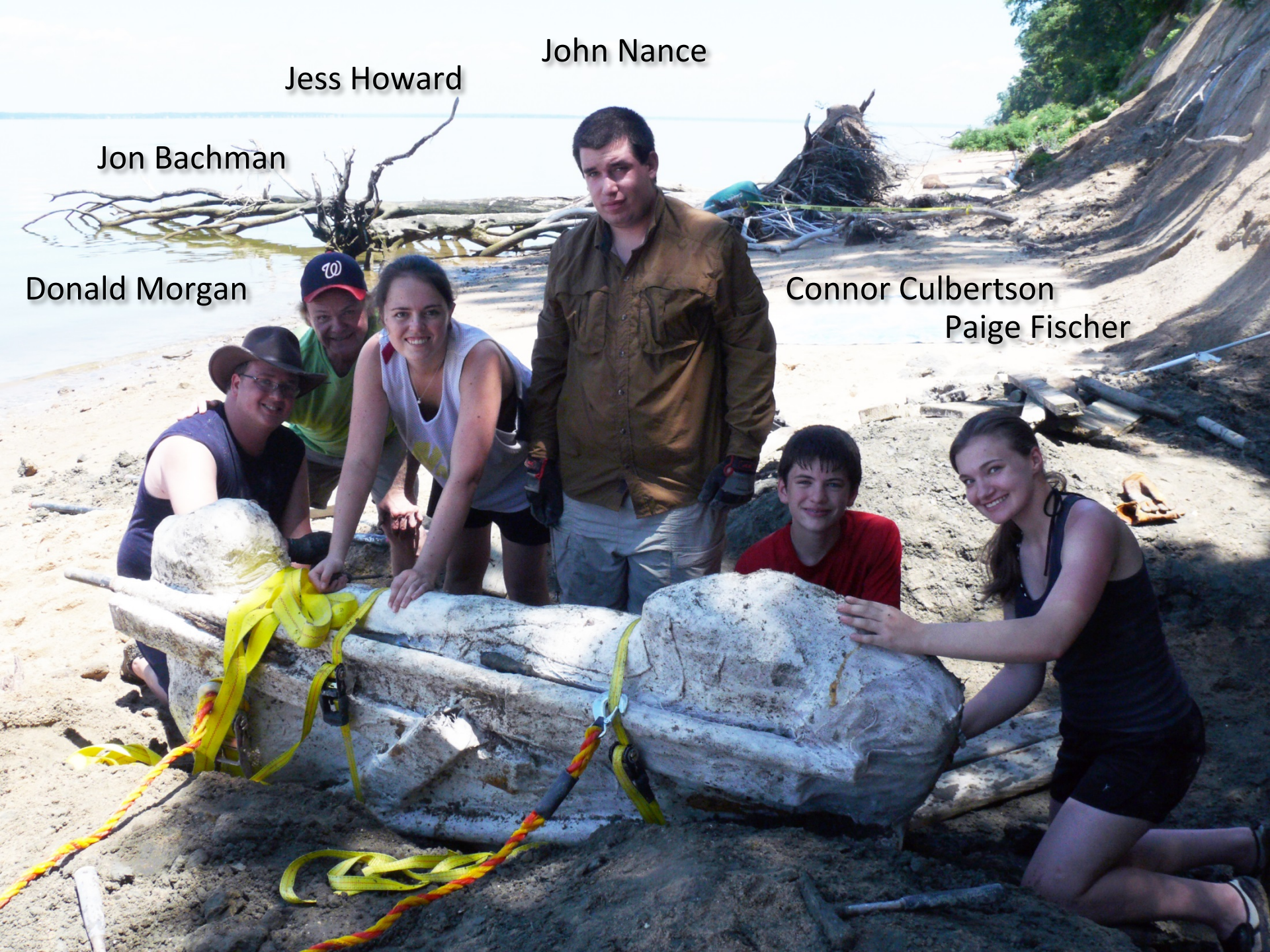


Christa Conant





Dick Hu



John Nance

Jess Howard

Jon Bachman

Donald Morgan

Connor Culbertson

Paige Fischer

Ron Ison



Aaron Alford



Jason Osborne

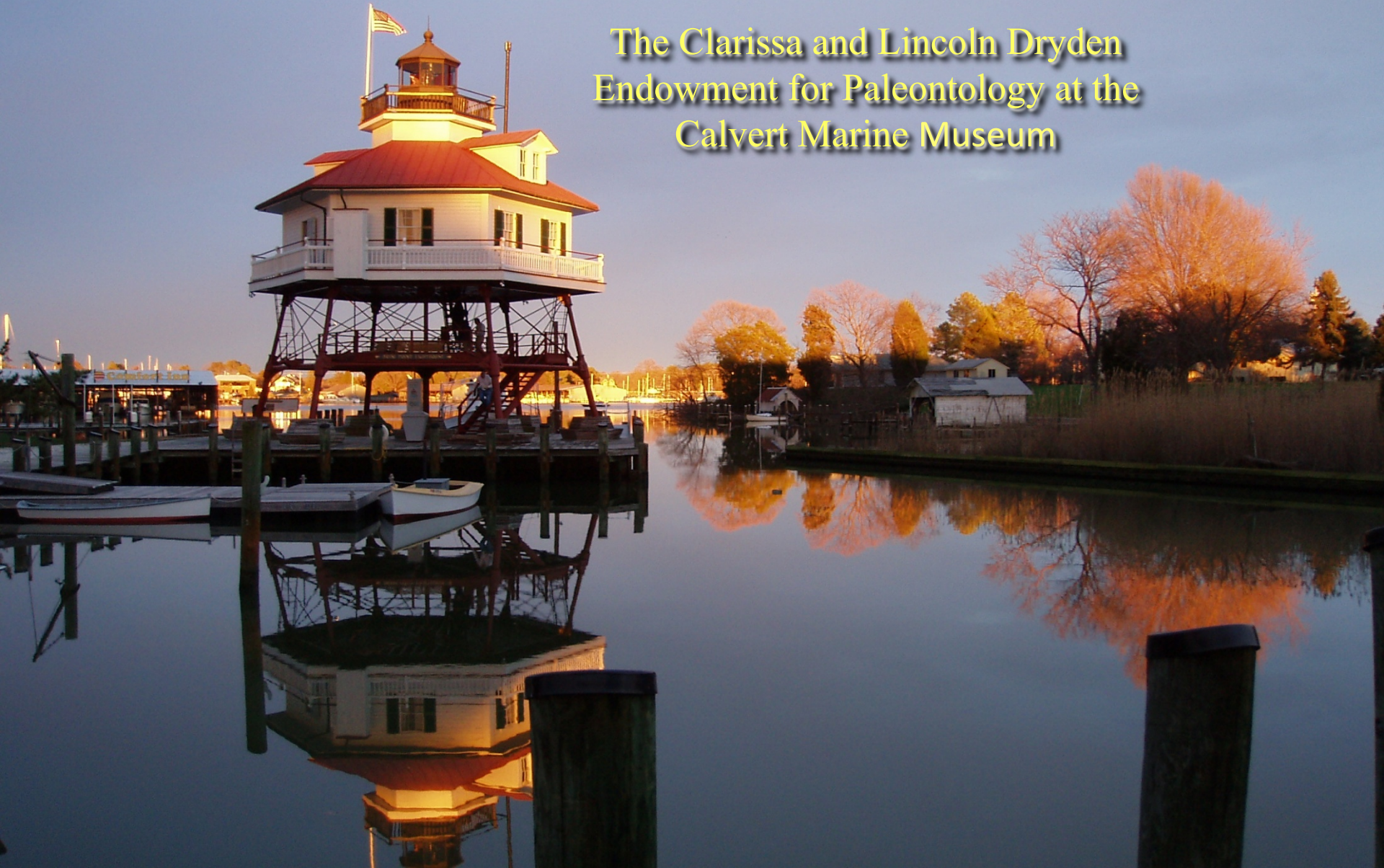
75% of all vertebrate
specimens were
collected and
donated by amateurs.



- 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





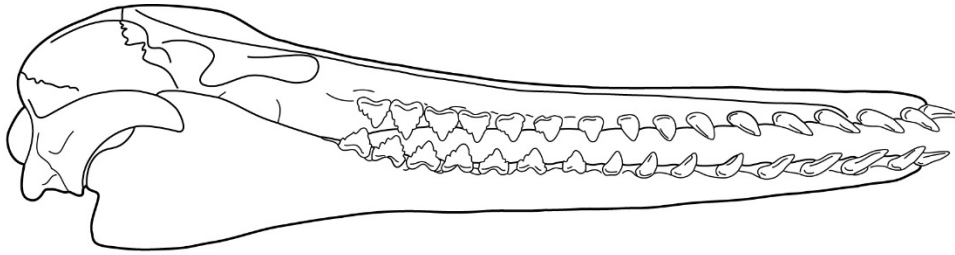
Total # of Teeth Identified: 22,560



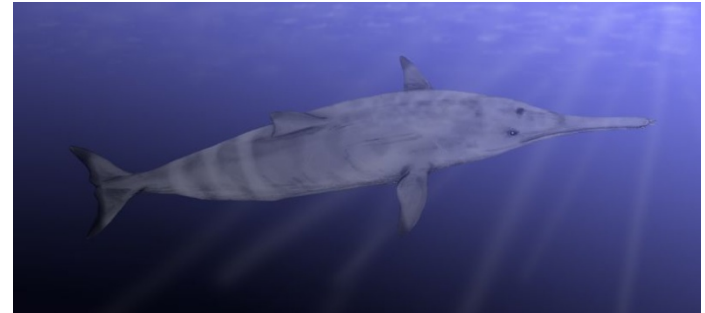
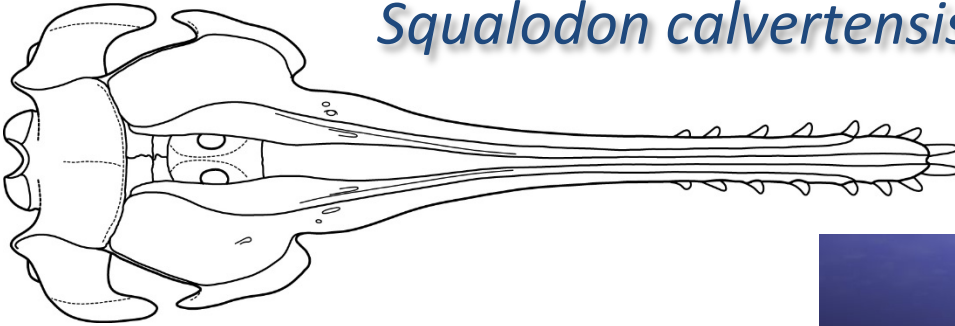


Squalodon sp.

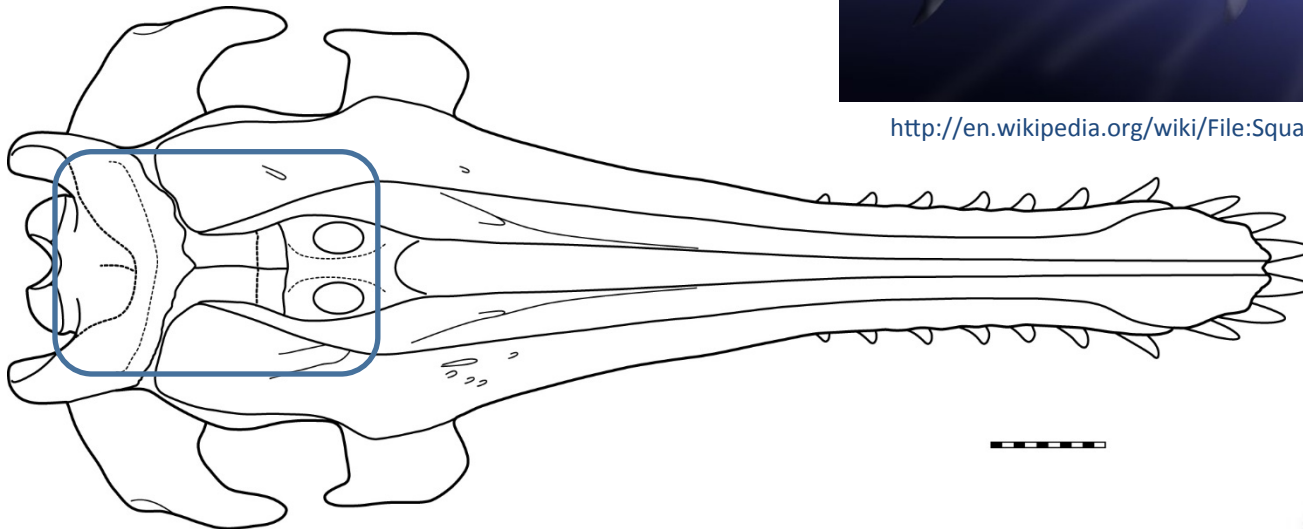
Photo by Paul Murdoch at Willows Beach



Squalodon calvertensis Kellogg, 1923



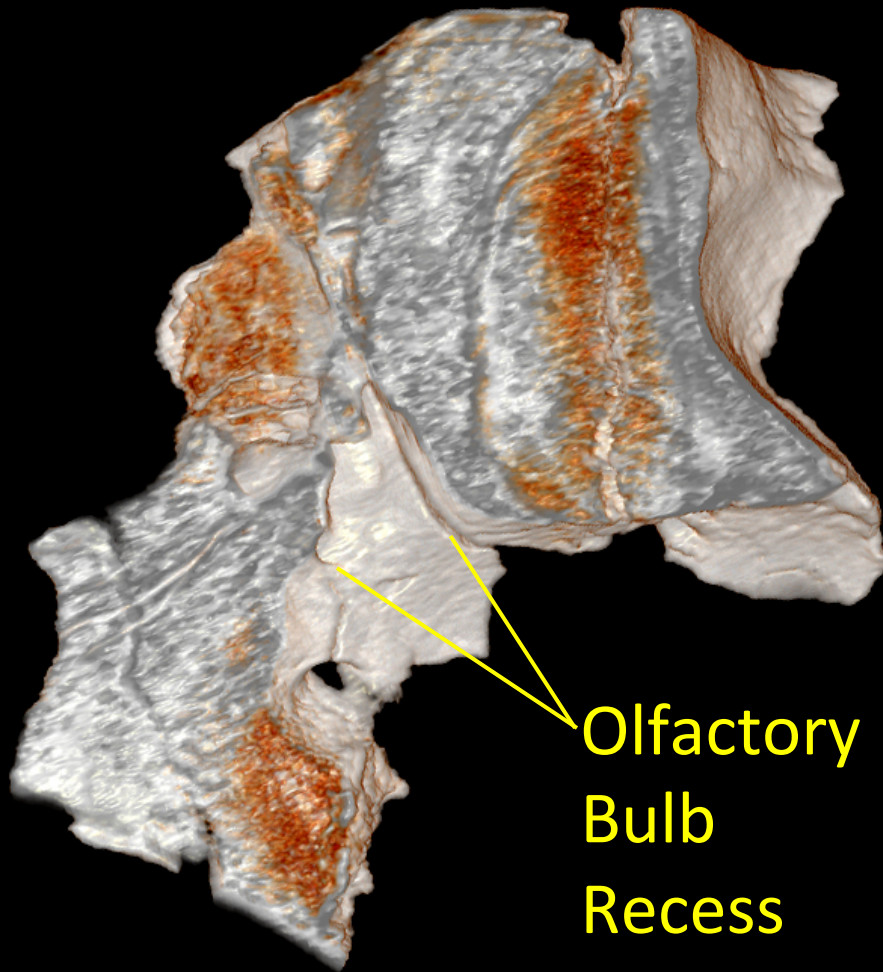
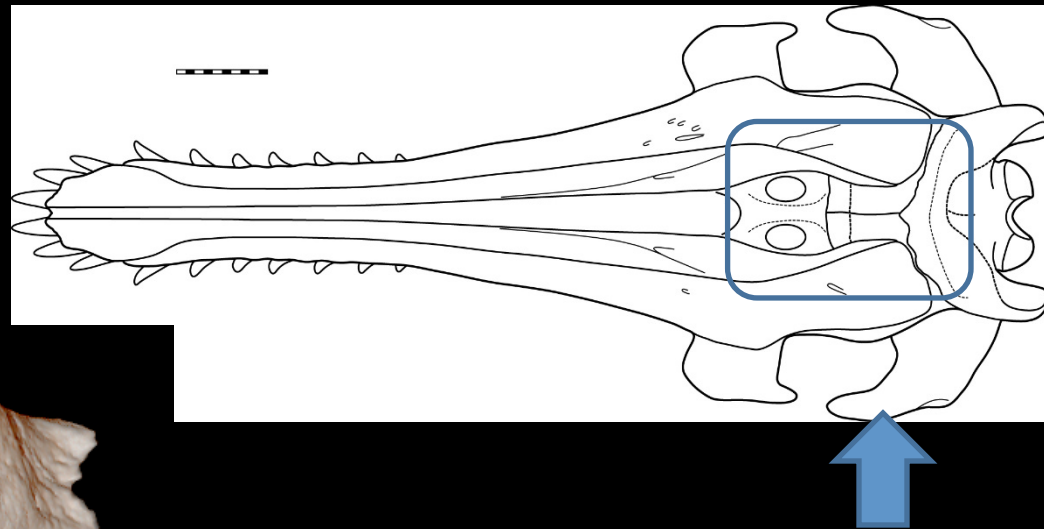
http://en.wikipedia.org/wiki/File:Squalodon_BW.jpg



Squalodon sp.



Squalodon sp.

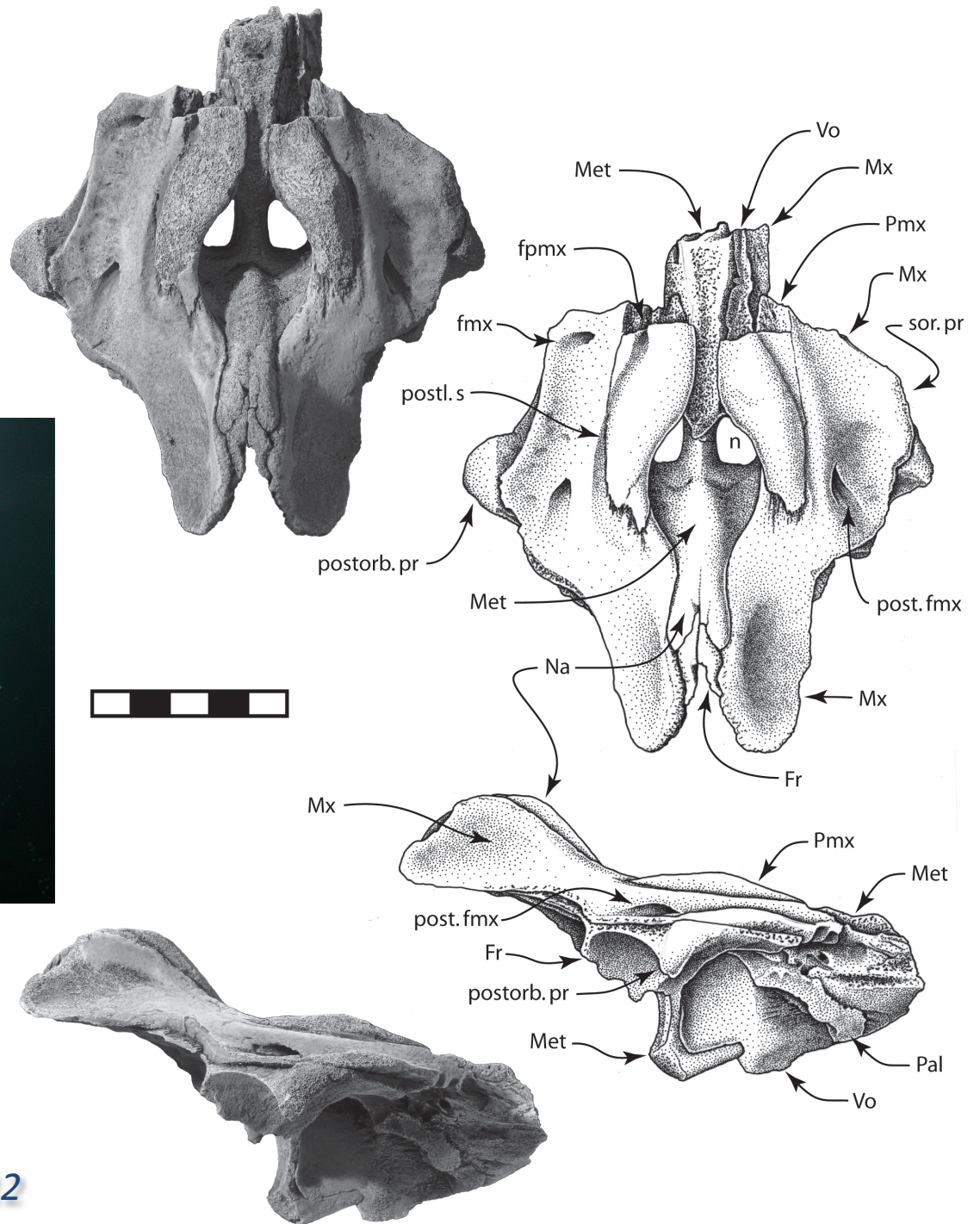
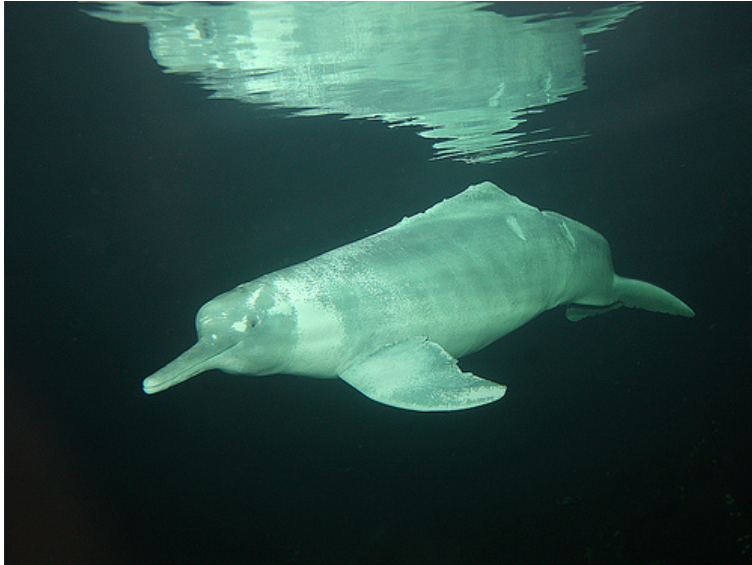


Olfactory
Bulb
Recess



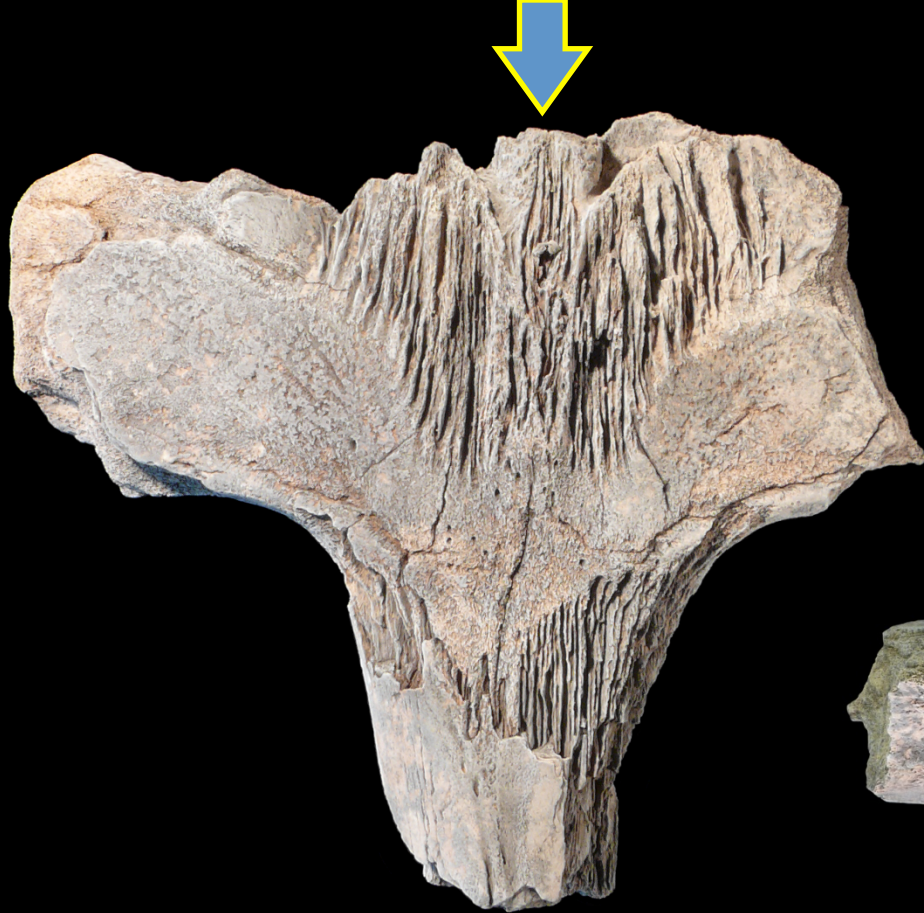
Meherrinia isoni

Pliocene

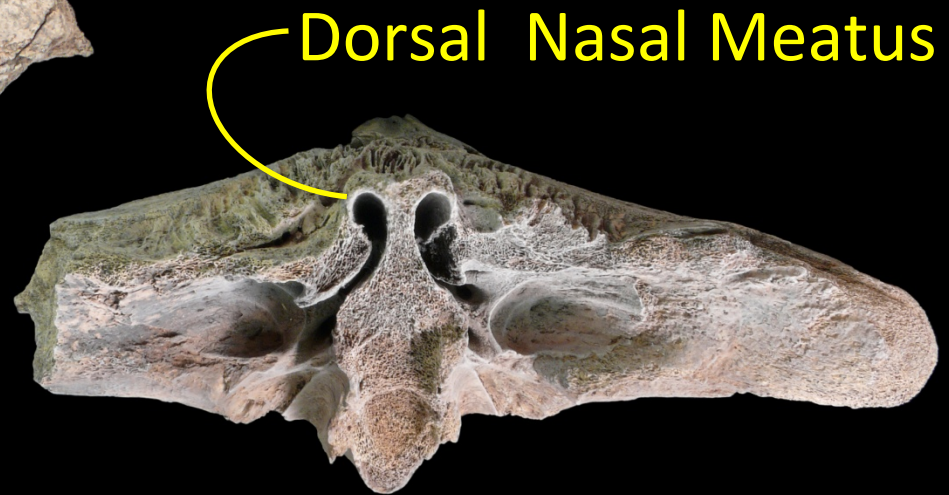


Archaeocete Whale

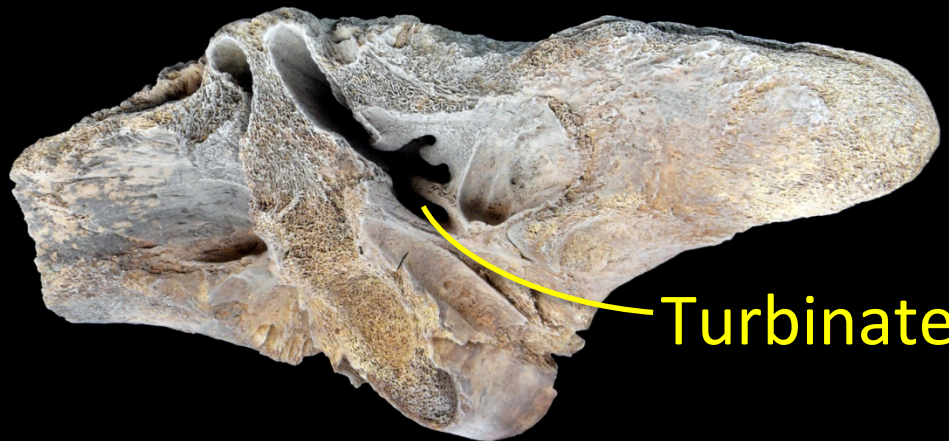




Virginia Archaeocete
Whale

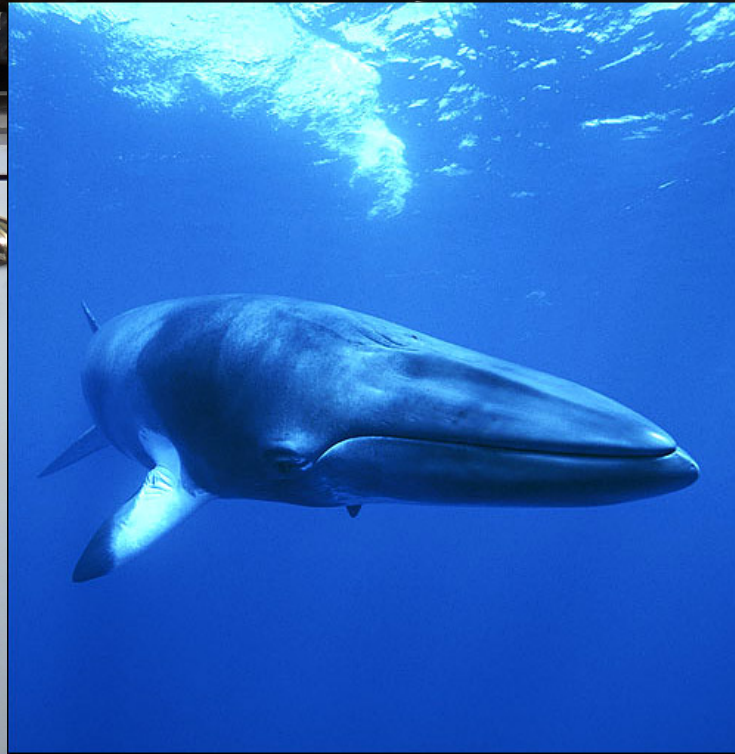


Dorsal Nasal Meatus



Turbinates

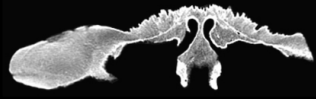
Common minke whale or northern minke whale (*Balaenoptera acutorostrata*)



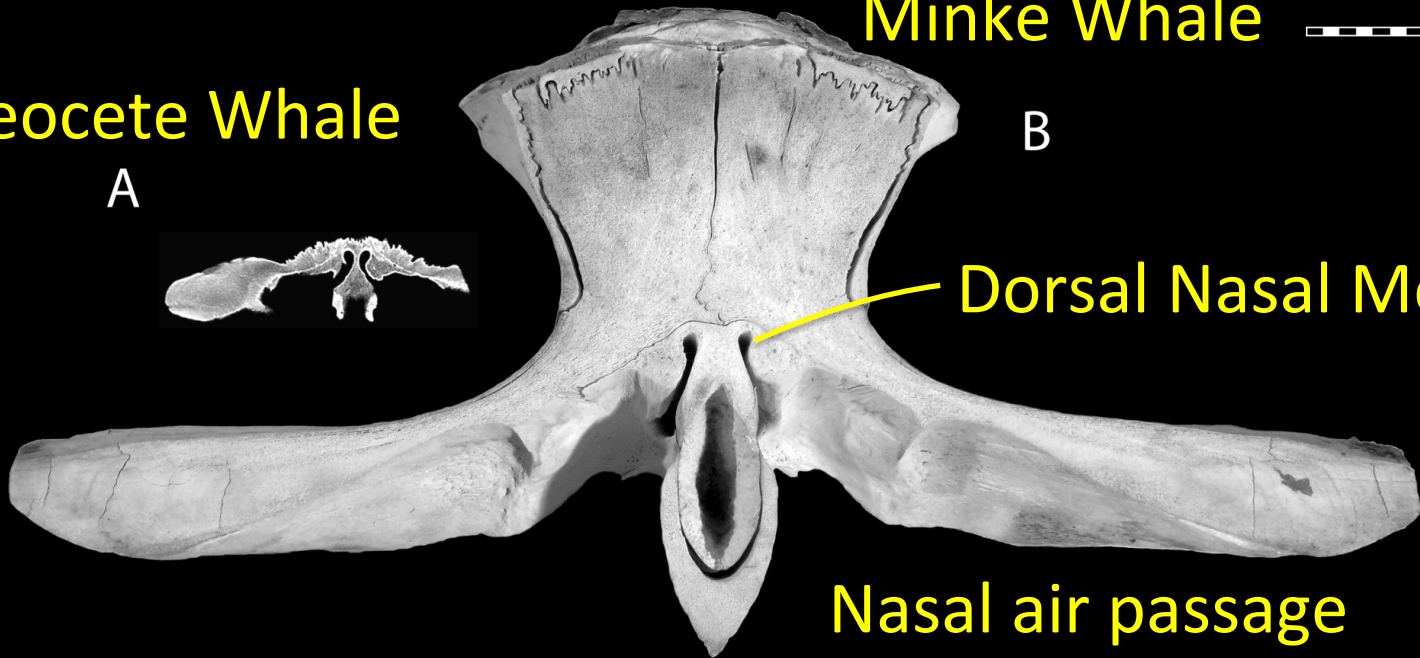
Minke Whale 

Archaeocete Whale

A



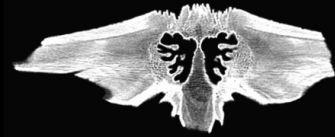
B



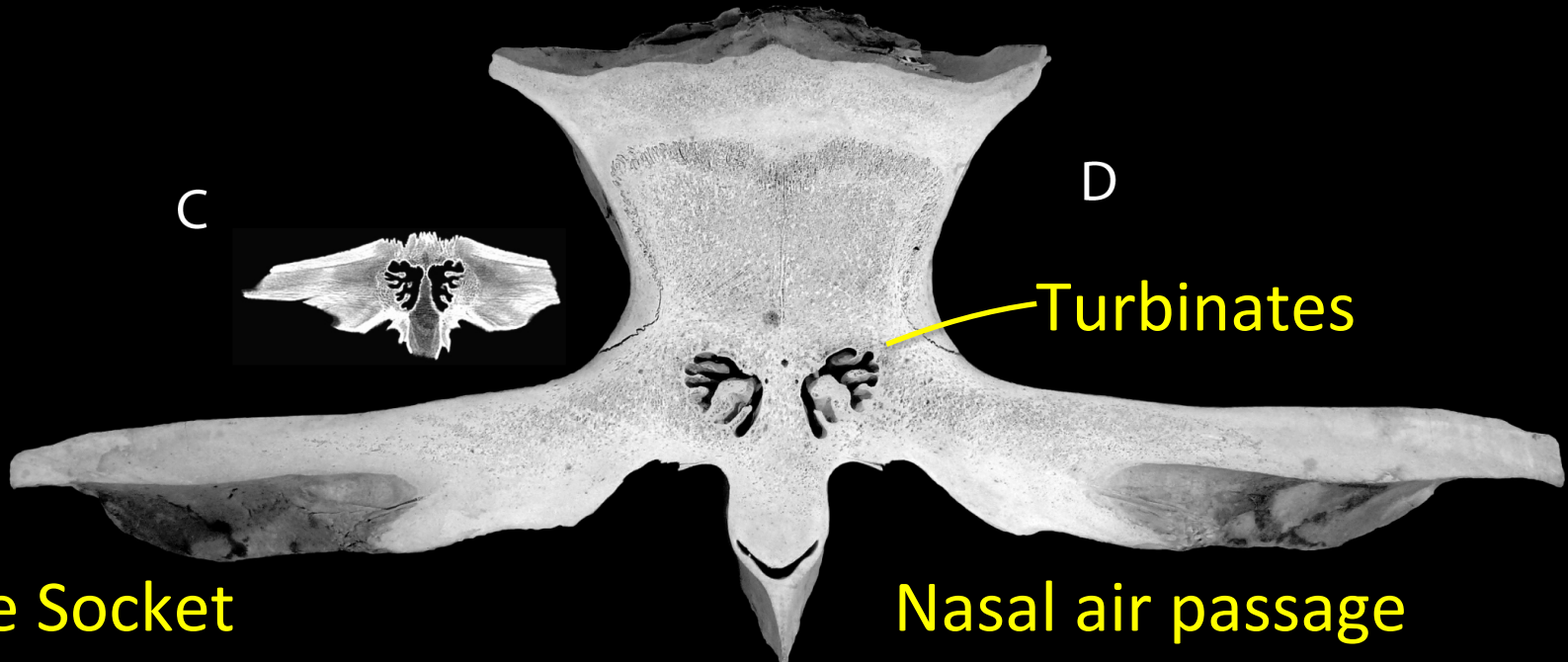
Dorsal Nasal Meatus

Nasal air passage

C



D



Turbinates

Eye Socket

Nasal air passage

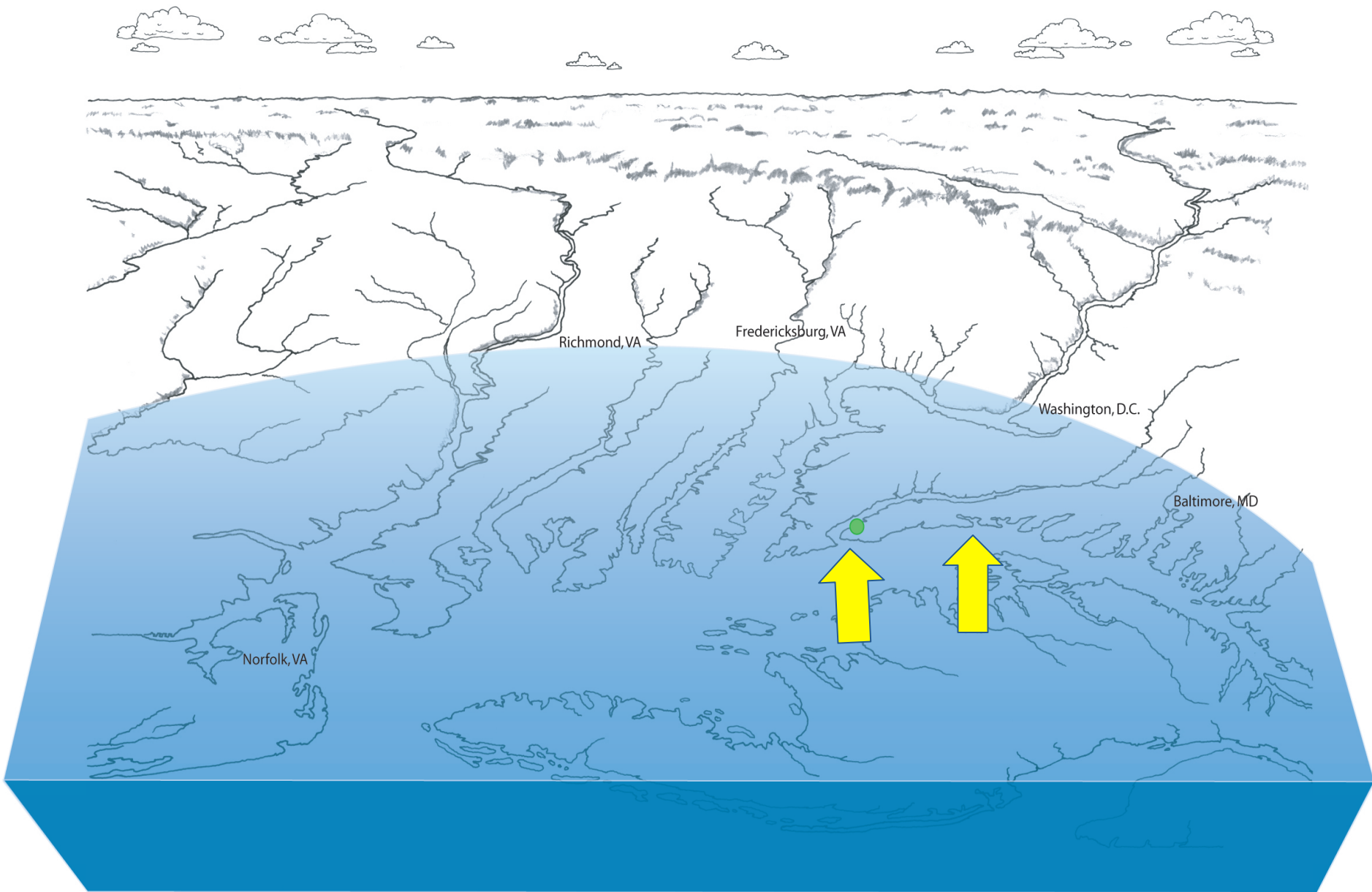


Kyle Matthew and Lizzy Jenny
Model Airplane News



Chip Reid
CBS







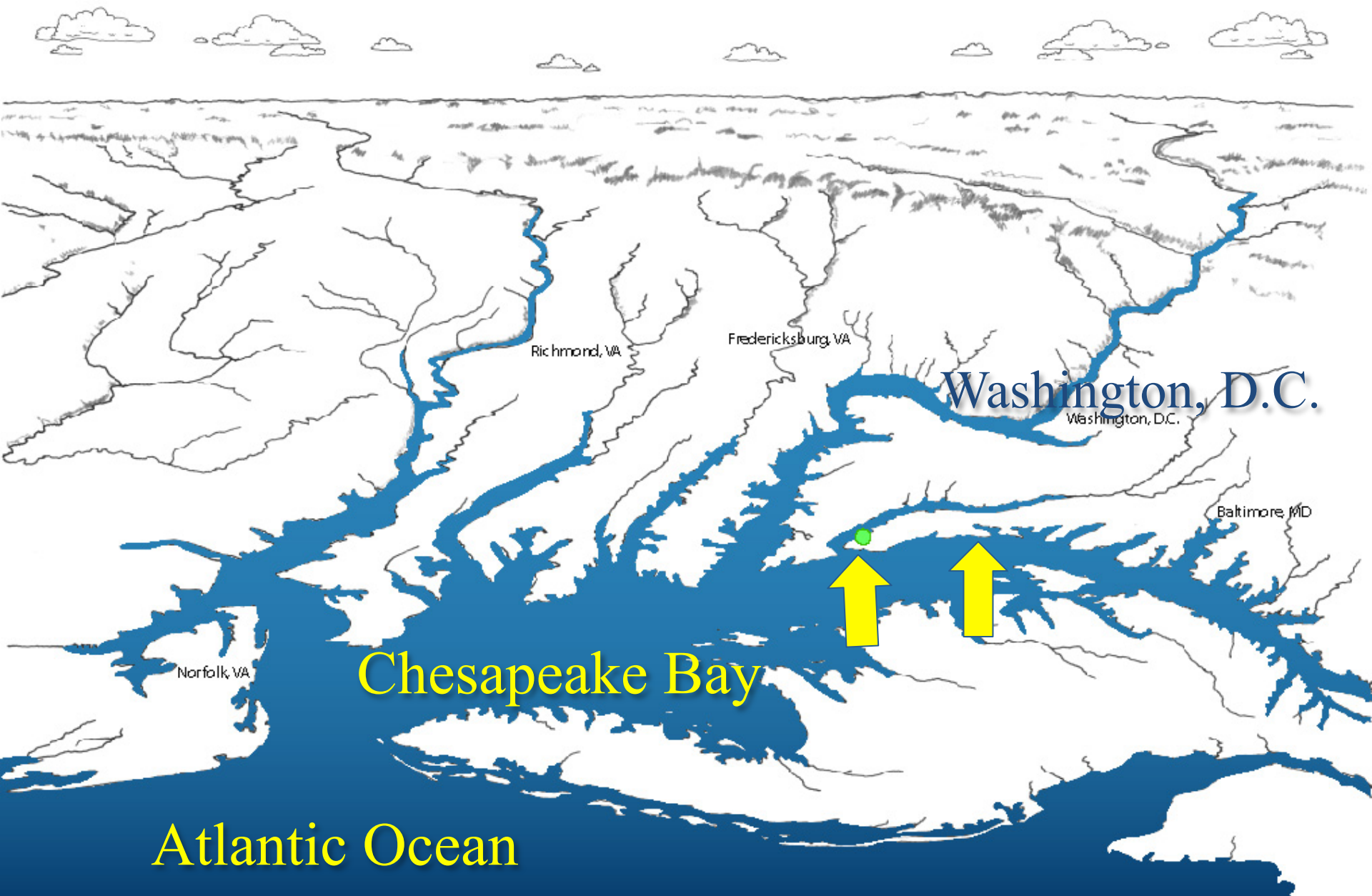
CALVERT MARINE MUSEUM



DISCOVERY ROOM ACTIVITY BOOK

Miocene 16mya





Richmond, VA

Fredericksburg, VA

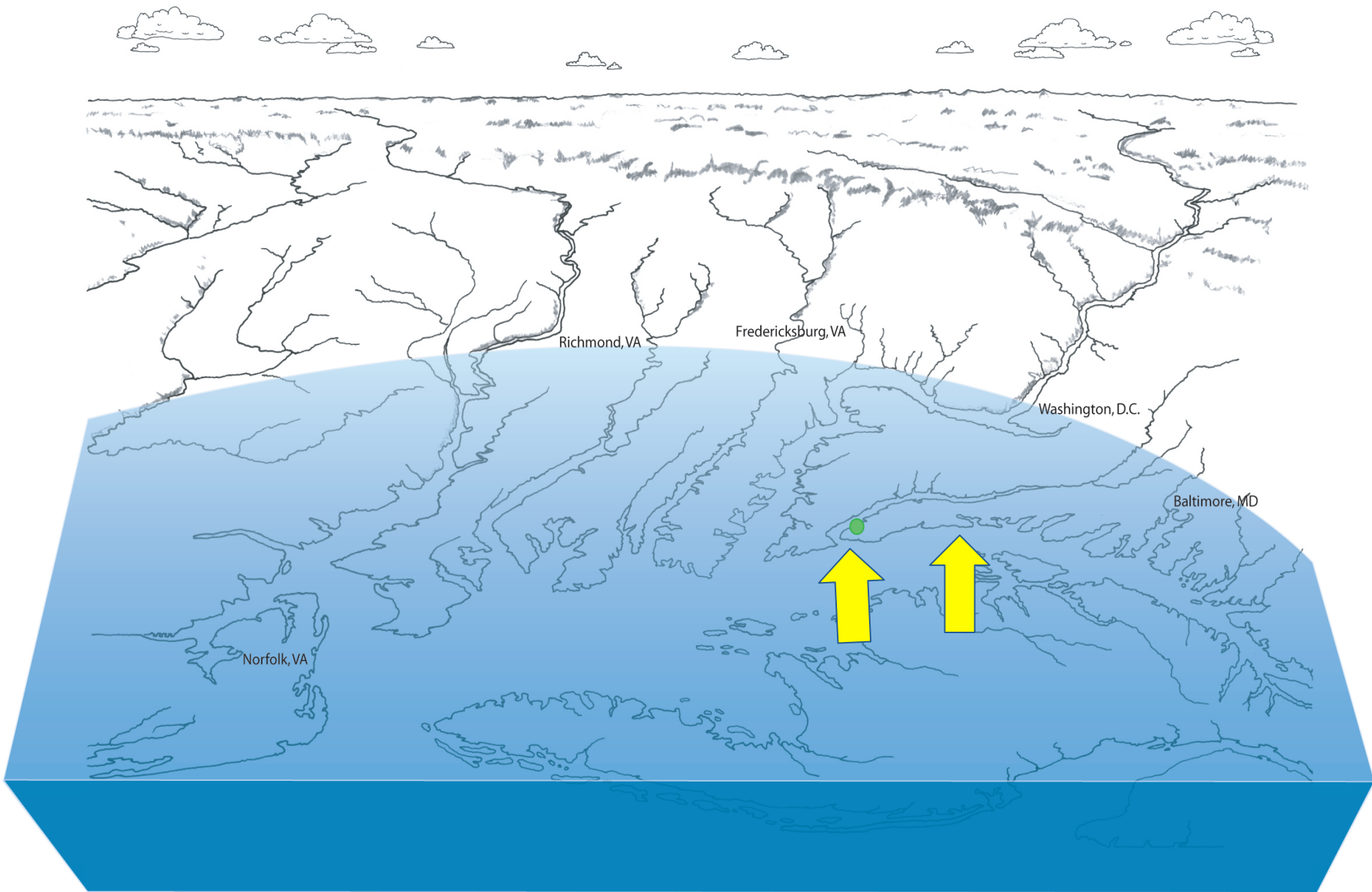
Washington, D.C.
Washington, D.C.

Baltimore, MD

Norfolk, VA

Chesapeake Bay

Atlantic Ocean

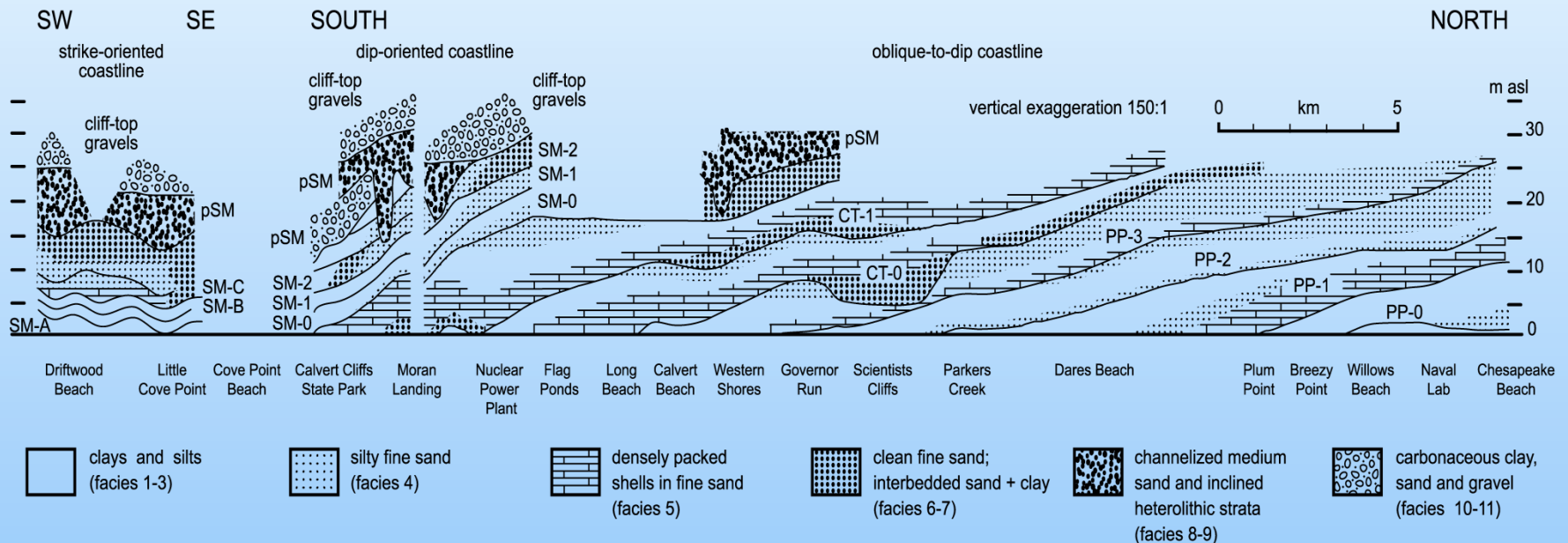


Geologic Cross-Section of Calvert Cliffs, Maryland

St Marys Formation

Choptank Formation

Calvert Formation



PP, Plum Point Member of the Calvert Formation

CT, Choptank Formation

SM, St. Marys Formation

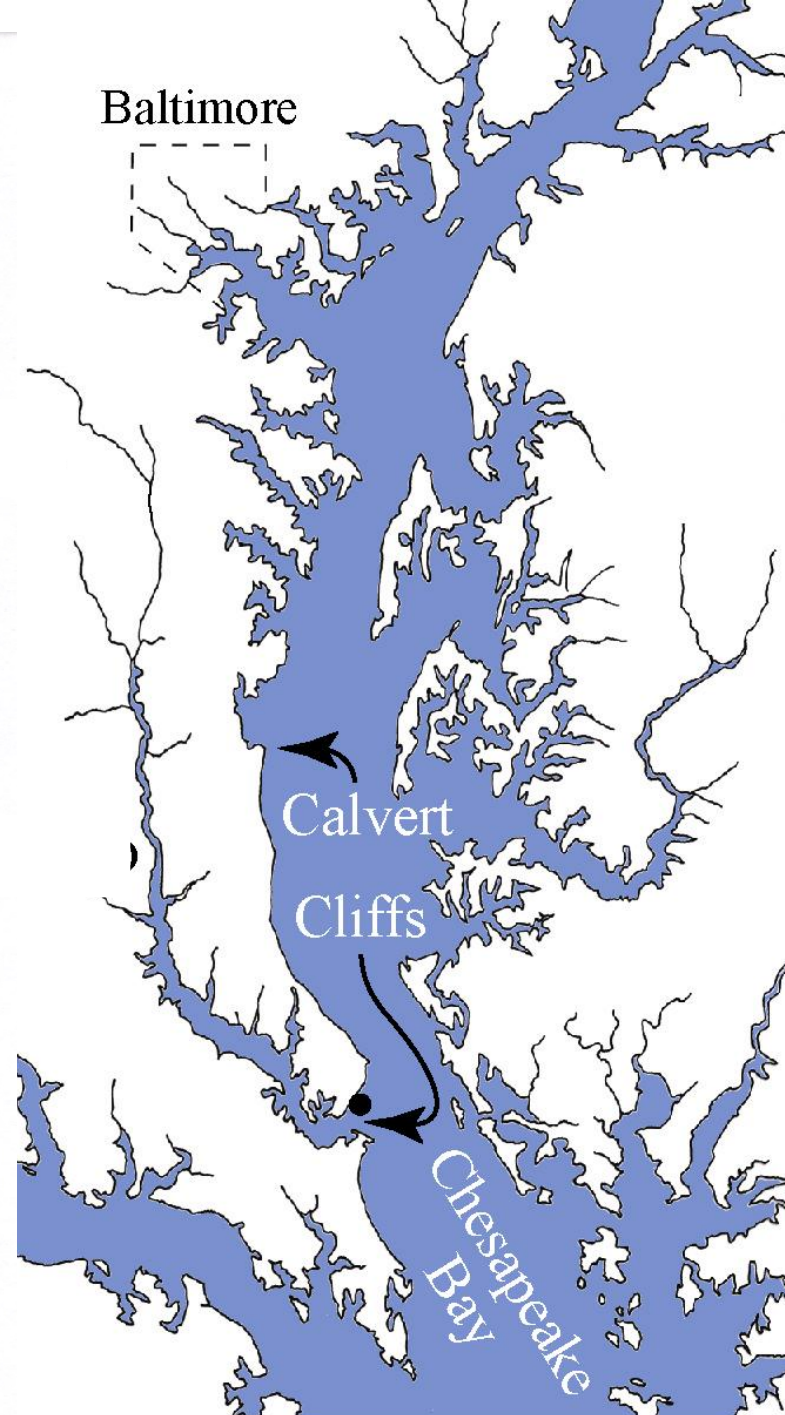
pSM, Post St. Marys Formation

Adapted from Kidwell (1997)

Miocene Fossils



Ma	EPOCH		STAGE	FORMATION	MEMBER	BED	
3.4	PLIOCENE	UPPER	Piacenzian	Chowan River			
				Yorktown	Moore House		
					Morgarts Beach		
					Rushmere		
			5.2	Zanclean	Sunken Meadow		
6.7	MIOCENE	UPPER	Messinian				
Eastover			Cobham Bay				
			Claremont Manor				
Tortonian							
St. Mary's			Windmill Point	24			
			Little Cove Point	21-23			
			Conoy	20			
14.2			MIDDLE	Serravallian			
					Choptank	Boston Cliffs	19
						St. Leonard	18
	Drumcliff	17					
16.3	Langhian	Calvert Beach	14-16				
21.5	LOWER	Burdigalian	Calvert	Plum Point	4-13		
				Fairhaven	2-3		
		Aquitanian					
23.3	OLIGOCENE			Old Church			



Western Shores



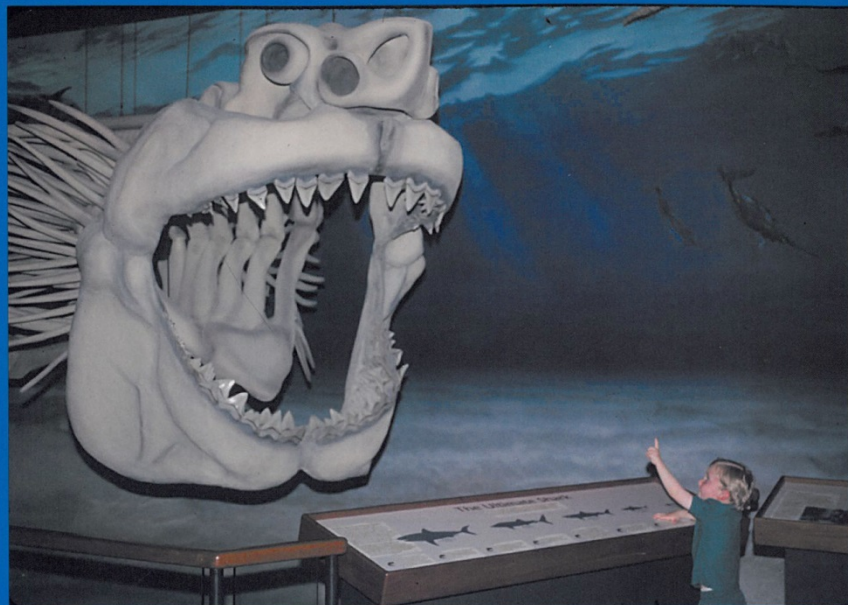


Chesapeake Ranch Estates





- 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



**CALVERT
MARINE
MUSEUM**

CALVERT MARINE MUSEUM

P. O. Box 97

SOLOMONS, MARYLAND 20688

(410) 326-2042 • FAX (410) 326-6691

MARYLAND RELAY FOR IMPAIRED HEARING OR SPEECH:

STATEWIDE TOLL FREE 1-800-735-2258

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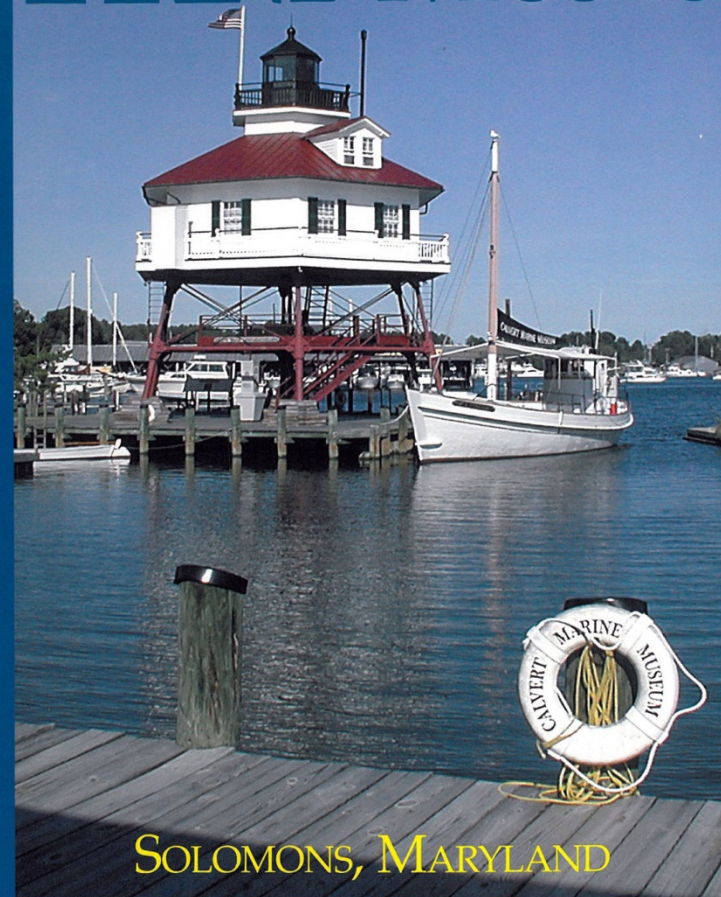
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American Association
of Museums

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WITH DISABILITIES UPON REASONABLE NOTICE.

ISBN 0-941647-16-1



CALVERT MARINE MUSEUM



SOLOMONS, MARYLAND

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.



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

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



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 antiqua*, skulks through a salt marsh bordered by bald cypress. Adjacent to the warm and shallow ocean waters of the Atlantic, forests of oak, pine, walnut, and bald cypress covered much of Maryland.



Fossils like this skull and skeleton of the long-snouted Miocene dolphin, *Eurhinodelphis bossi*, are prepared in the museum's fossil preparation lab.

Common Miocene invertebrate fossils from Calvert Cliffs.

Snail *Turritella plebeia*



Coral *Astrhelia palamata*

Sand Dollar *Abertella aberti*



Ark Shell *Dallarca idonea*

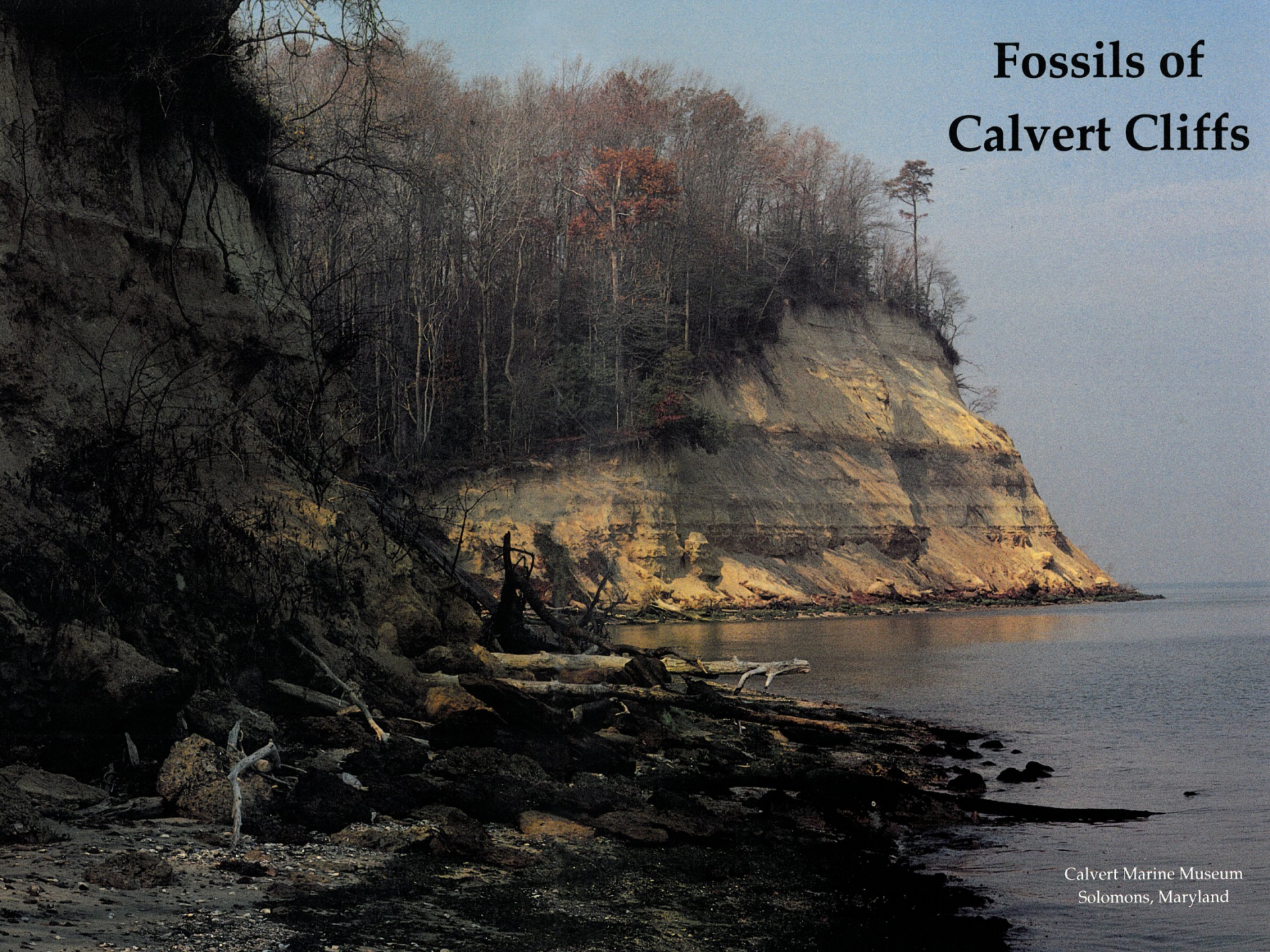


Scallop *Chesapecten nefrens*

Snail *Epchora gardnerae*



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 teeth 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 tooth-aches for them! Shark teeth are not set firmly in the jaws, 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 to take 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.

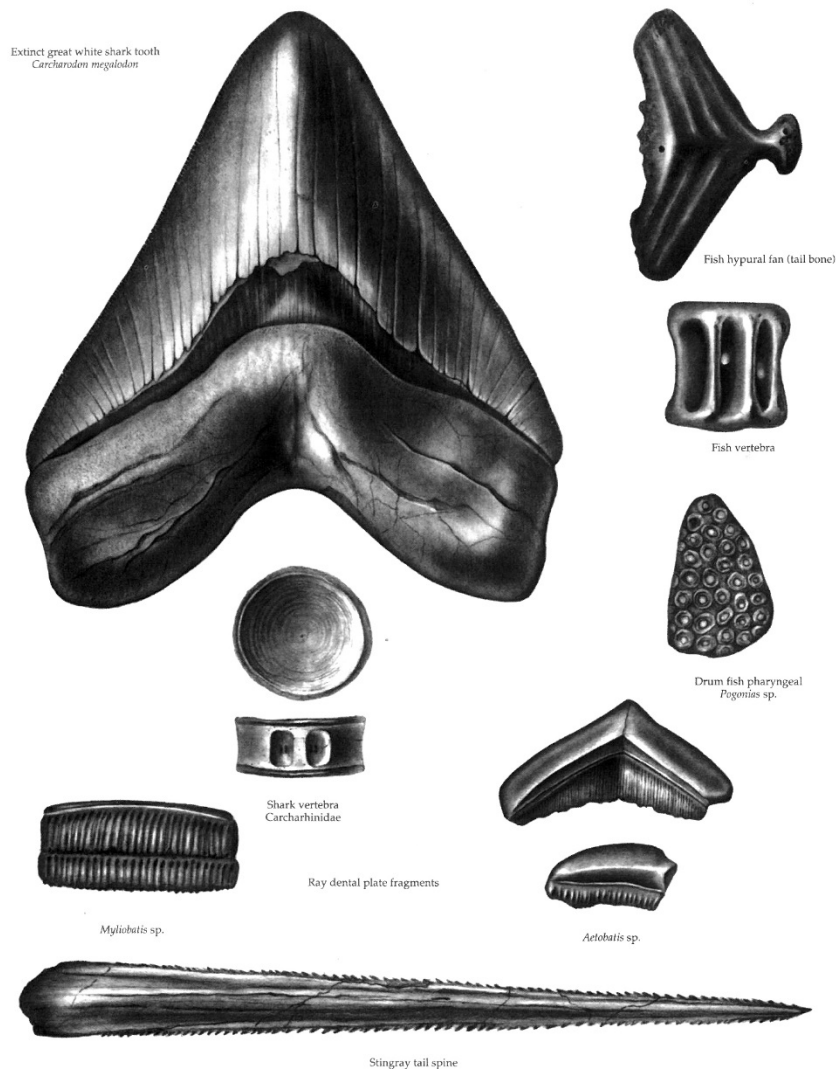
The durability of shark teeth also may be a factor. They are among the hardest of all organic materials and highly resistant to destruction by weather and wave action. Shark teeth are found less frequently in the cliff than on the beach. It may be that those we pick up from the beach are part of an accumulation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

Rays and skates, related to sharks, also lived in the Miocene sea. 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. Skulls have been found, but they are very delicate and among the most difficult fossils to collect.

SHARKS, RAYS and BONY FISH





Steve Grossman

Connor Culbertson



OUTBOARD MOTORING
AMERICA



"Fossil hunting is a sport that has nothing, perhaps, to rival the eyes. Over the next few years, the fossil hunter down the road of his sport is to add to the treasures of human knowledge."



The Ecphora

QUARTERLY NEWSLETTER OF THE CALVERT MARINE MUSEUM FOSSIL CLUB

Volume 1, Number 1
Summer 1985

Editor: Sandy Roberts

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.

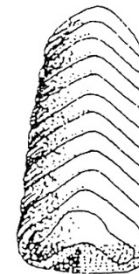
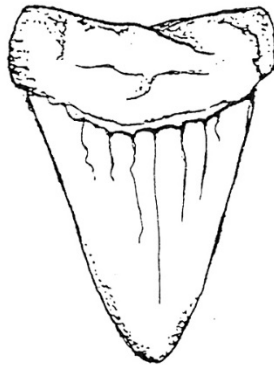
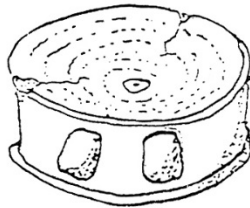
An organizational meeting held April 16, 1981, established the club and we've functioned informally since then under the leadership of Dave Bohaska. Annual dues of \$10 per family, \$3 for students, were initiated in 1985 to cover expenses such as phone, postage, printing,

Fossil Facts

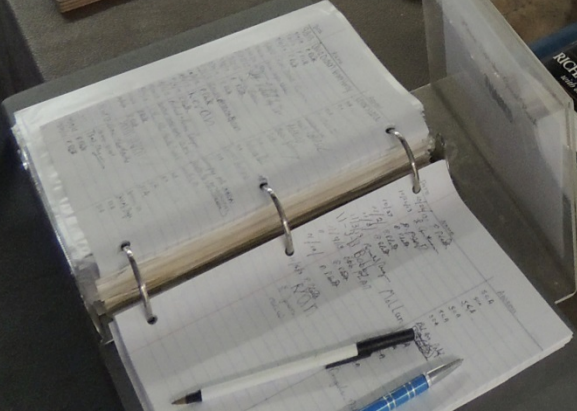
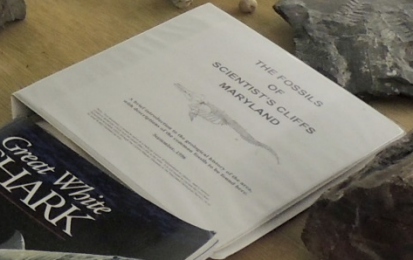
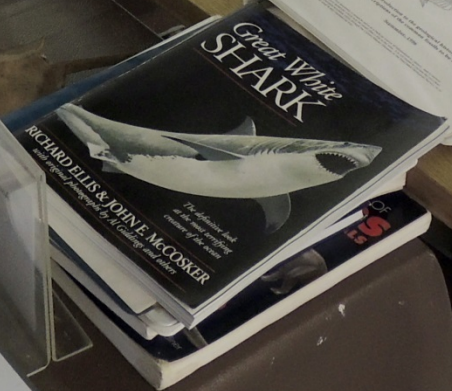
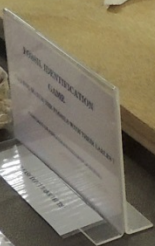
Extracted from the

Bugeye Times

Published by the Calvert Marine Museum



Compiled by the Calvert Marine Museum Fossil Club



EXTINCT DUSKY, OR SANDBAR
SHARK TEETH
(*CARCHARHINUS EDGERTONI*)

FOSSIL SAND TIGER SHARK
(*CARCHARIAS* SP.)

EXTINCT TIGER SHARK TEETH
(*GALEOCERDO ADUNCUS*)

MODERN LEMON SHARK FOSSIL
TEETH
(*NEGAPRION BREVIROSTRIS*)

EXTINCT TIGER SHARK T
(*GALEOCERDO CONTOR*)

SHARK VERTEBRA, OR SPINAL
DISK

FOSSIL TEETH OF DUSKY, OR
GRAY SHARKS
(*CARCHARHINUS* SPP.)

MODERN TIGER SHARK
FOSSIL TEETH
(*GALEOCERDO CUVIER*)

FOSSIL SHARK COPROLITE
(DUNG)

EXTINCT GIANT WHITE SHARK
TEETH
(*CARCHARODON*, OR
CARCAROCLES MEGALODON)

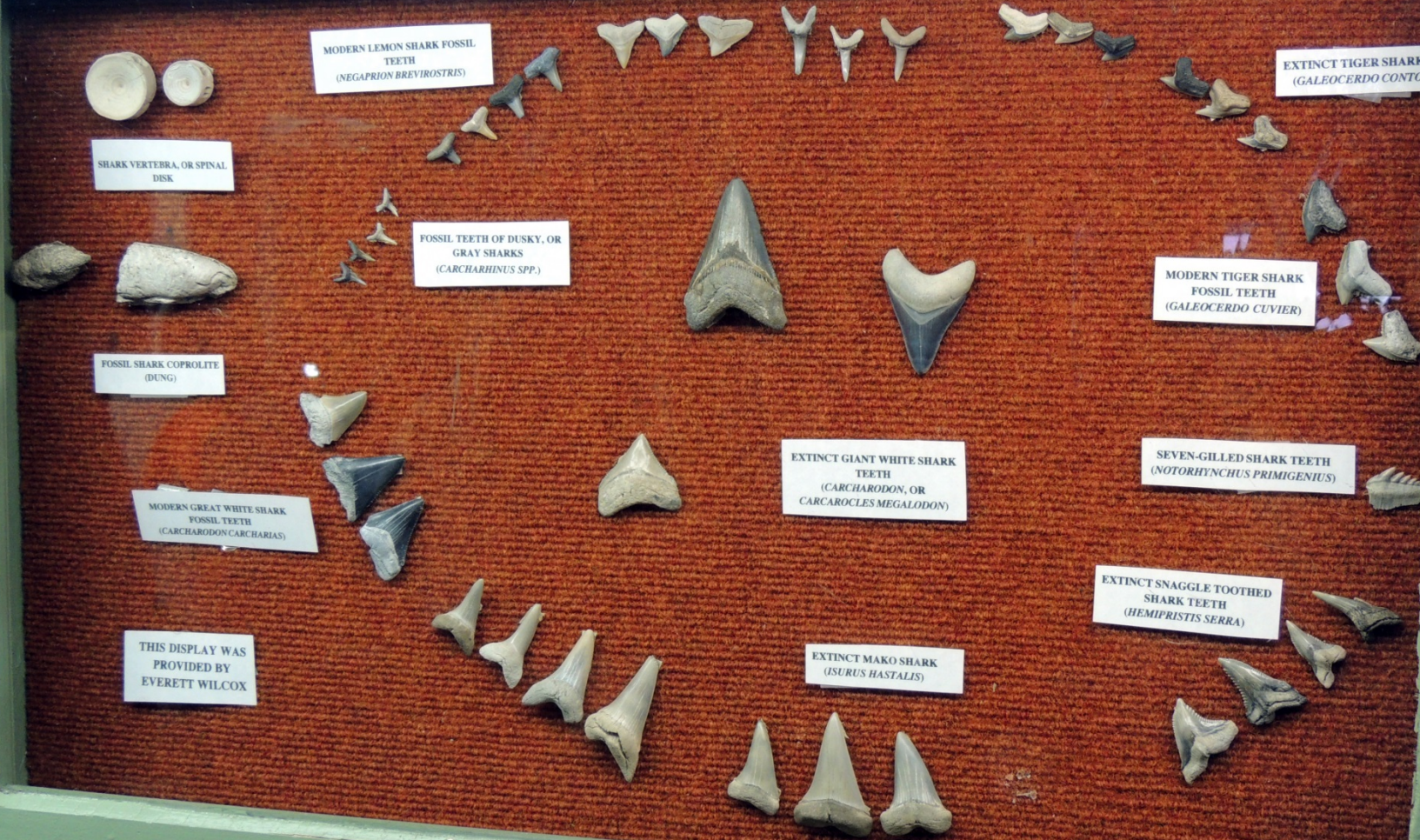
SEVEN-GILLED SHARK TEETH
(*NOTORHYNCHUS PRIMIGENIUS*)

MODERN GREAT WHITE SHARK
FOSSIL TEETH
(*CARCHARODON CARCHARIAS*)

EXTINCT SNAGGLE TOOTHED
SHARK TEETH
(*HEMIPRISTIS SERRA*)

THIS DISPLAY WAS
PROVIDED BY
EVERETT WILCOX

EXTINCT MAKO SHARK
(*ISURUS HASTALIS*)





Paige Fischer



Pam Platt