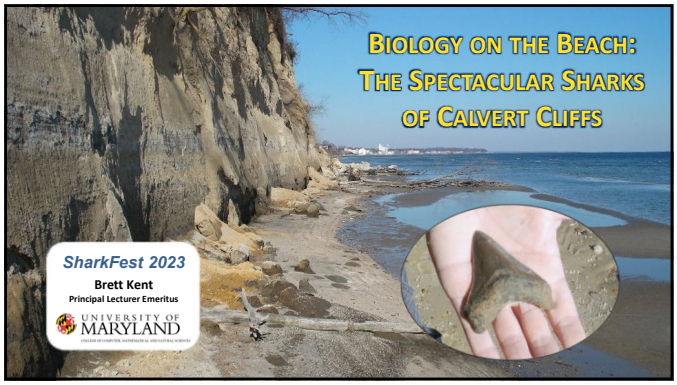

Maryland Miocene

- Elevated global temperatures
- Incomplete polar icesheets
- Global sea level rise

Karen Nelson/Kent AIFD

http://ocean2.unl.edu

Maryland Miocene

- 2 trends in sharks
  - Faunal modernization
  - Gigantism

www.thelayreal.com

Karen Nelson/Kent AIFD

Faunal Modernization

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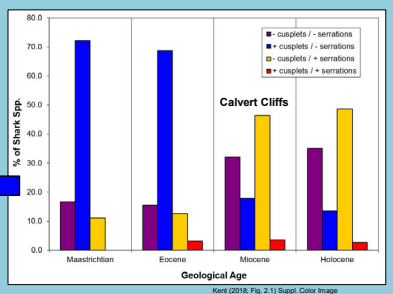
www.thoughtco.com

~300 MY

www.thedscaforum.com

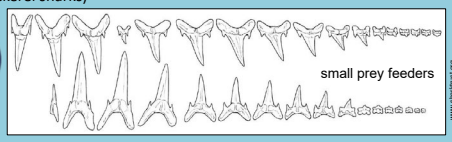


Kent (2018; Fig. 2.1) Suppl. Color Image

Faunal Modernization

- Lamniforms (mackerel sharks)

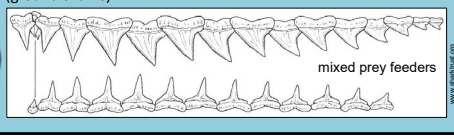
www.hdwallpapers.in



Eugenia Shanklin/ www

- Carcharhiniforms (ground sharks)

www.goscubadivemaui.com



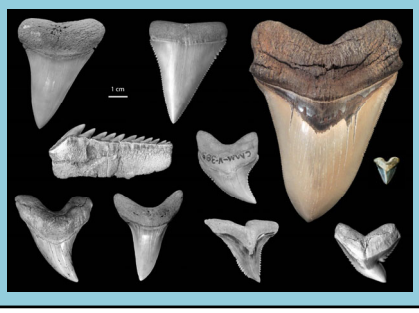
Eugenia Shanklin/ www

Giant Sharks

- Several possible definitions
- Dominated by lamniforms
- Not just oversized versions of modern sharks – reflect differences in lifestyle

Karen Nelson/Kent AIFD

'Meg' (*Otodus megalodon*)



'Meg' (*Otodus megalodon*)

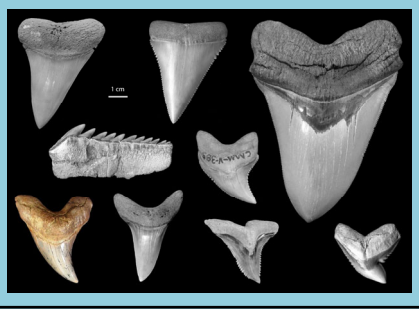
- Early Miocene – Early Pliocene (16–3.6 MYA)
- Subtropical to temperate sediments

Hans Sues
National Museum of Natural History

Gary Staab
Staab Studios

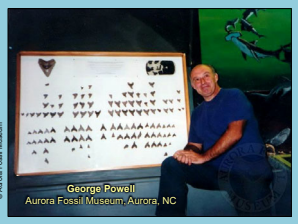
Lucia RM Martino, Smithsonian Institution

False Mako Shark (*Parotodus benedenii*)



False Mako Shark (*Parotodus benedenii*)

- Early Oligocene – Early Pliocene (29-4 MYA)
- Temperate, open ocean sediments



© Aurora Fossil Museum

Early Miocene

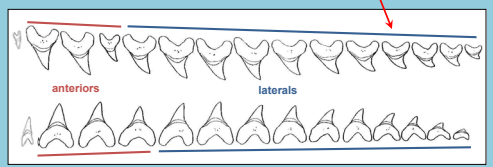
Early Pliocene

© Mark Bennett

False Mako Shark (*Parotodus benedenii*)

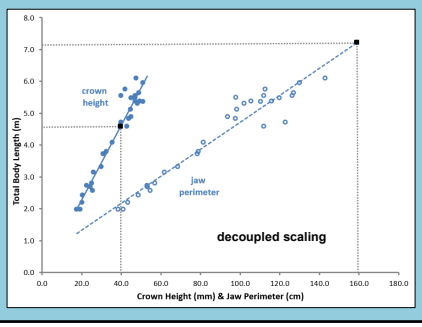
- Associated set of 114 teeth – reconstructed dentition
  - 14 upper jaw files
  - 13 lower jaw files
  - Symphyseals?

© G. W. Powell

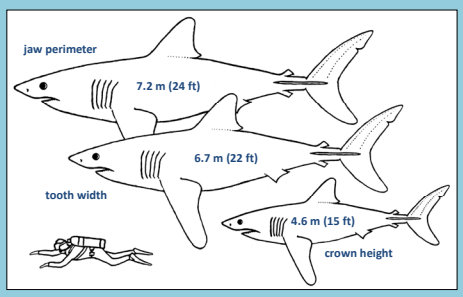


Modified from Kent & Powell (1999) *Mosasaur*

False Mako Shark (*Parotodus benedenii*)

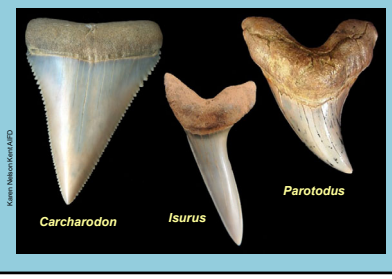


False Mako Shark (*Parotodus benedenii*)



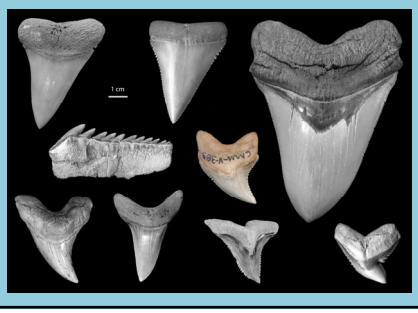
False Mako Shark (*Parotodus benedenii*)

- Tooth morphology & feeding damage



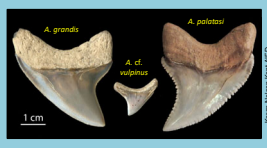
Karen Nelson Kent AFD

Giant Thresher Sharks (*Alopias* spp.)



Giant Thresher Sharks (*Alopias* spp.)

www.projectawareuk.org



Karen Nelson Kent AFD

www.fine-art.co.uk

David Ward
Natural History Museum, London

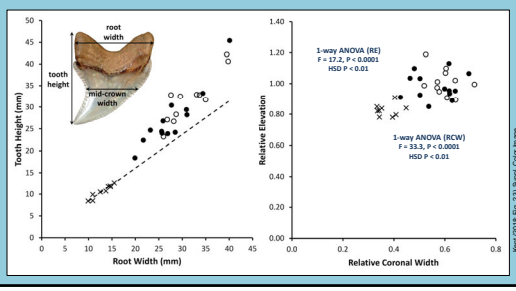
Giant Thresher Sharks (*Alopias* spp.)

- Late Oligocene – Middle Miocene (28-15 MYA)
- Open ocean sediments

Kent & Yeast (2018) Supp. Color Image

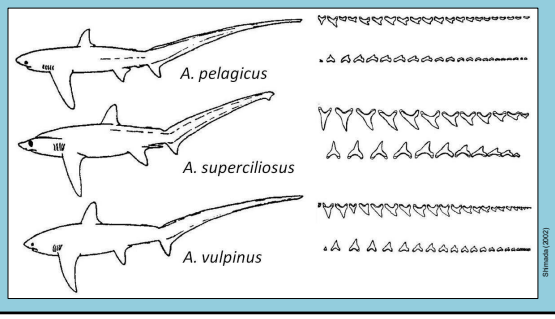
Giant Thresher Sharks (*Alopias* spp.)

- Very different tooth morphology – taller and more blade-like

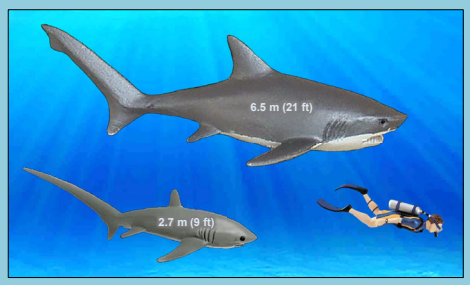


Kent (2018, Fig. 23) Suppl. Color Image

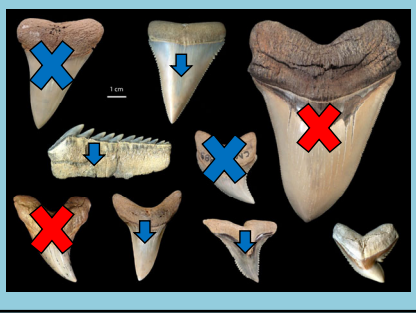
Giant Thresher Sharks (*Alopias* spp.)



Giant Thresher Sharks (*Alopias* spp.)



Fall of the Giant Sharks

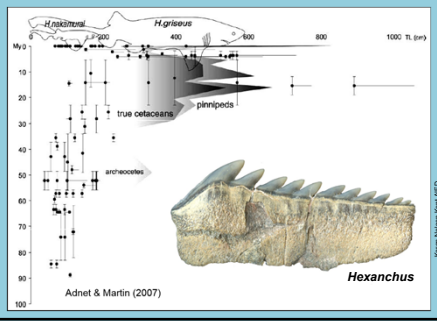


genus extinct

lineage extinct

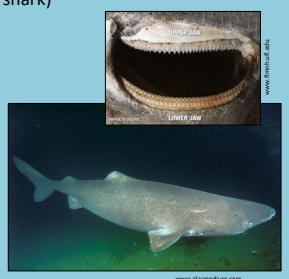
reduced Holocene size

Fall of the Giant Sharks

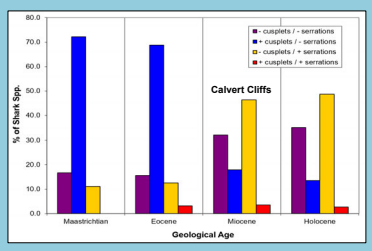


Fall of the Giant Sharks

- *Somniosus microcephalus* (Greenland shark)
  - 6.4 m (21 ft) – possibly 7.3 m (24 ft)
- *Orcinus orca* (killer whale)
  - 8 m (26 ft)



Miocene Shark Communities (Reprise)



Calvert Cliffs Diversity

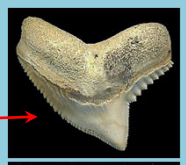
- How many elasmobranch species are present?
  - Data from Kent (2018)

	Calvert Cliffs	Holocene	Change
total	**51**	**46**	**-10%**
giant sharks	14	4	-71%
small sharks	25	24	-4%
rays	12	18	+50%

- Based on completeness estimates for other 'scrap' faunas possibly 60-90 spp. in Calvert Cliffs

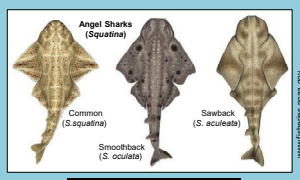
Calvert Cliffs Diversity (since Kent, 2018)

- Additional species
  - *Ginglymostoma* cf. *delfortriei* (nurse shark)
  - *Pachyscyllium* sp. (cat shark)
  - *Megascyliorhinus miocenicus* (no common name)
  - *Galeocerdo mayumbensis* (tiger shark)
  - *Megalolamna paradoxodon* (no common name)
- Probable additional species
  - *Isistius* sp. (cookiecutter shark)
  - *Triakis* sp. (hound shark)
  - *Paragaleus* sp. (weasel shark)
  - *Rostroraja* sp. (skate)
  - *Gymnura* sp. (butterfly ray)



Calvert Cliffs Diversity (Cryptic Species)

- Genera with possible Miocene cryptic spp. (molecular data)
  - *Squatina* (angel sharks)
  - *Alopias* (thresher sharks)
  - *Mustelus* (smooth-hound sharks)
  - *Carcharhinus* (gray sharks)
  - *Negaprion* (lemon sharks)
  - *Rhizoprionodon* (sharpnose sharks)
  - *Sphyrna* (hammerhead sharks)
  - *Raja* & related genera (skates)
  - *Dasyatis* & related genera (stingrays)



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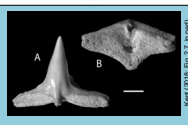
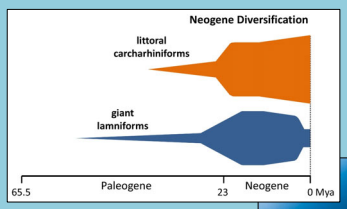
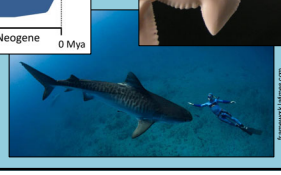


Kent (2018, Fig. 2-7, in part)

The Modern Shark Fauna



en.wikipedia.org



frameworks.latimes.com

Special Thanks…

- Karen Nelson Kent
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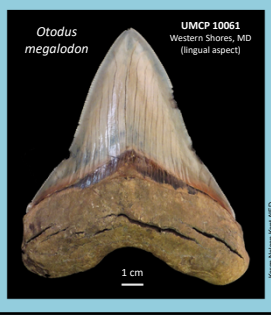
- Geerat Vermeij
- Victor Perez
- George Powell
- Mark Bennett
- Peter Picard
- Aaron Alford
- Jason Osborne
- Brittany Franckowiak
- Henry Hays
- Walt Johns
- Mike Ellwood
- Doug Donald †
- UMD Fossil Elasmobranch Group



Karen Nelson Kent, AMTD