The rise of life in Earth's oceans

Stories from South African rocks and fossils

Claire Browning
Curator Karoo Palaeontology
cbrowning@Iziko.org.za

iziko
museums of
South Africa

Geology

Rocks

+

Biology

Life

=

PALAEONTOLOGY

FOSSILS!

Museum curator

Research

Exhibitions

Lab management

Grow the fossil collection

Support visiting scientists

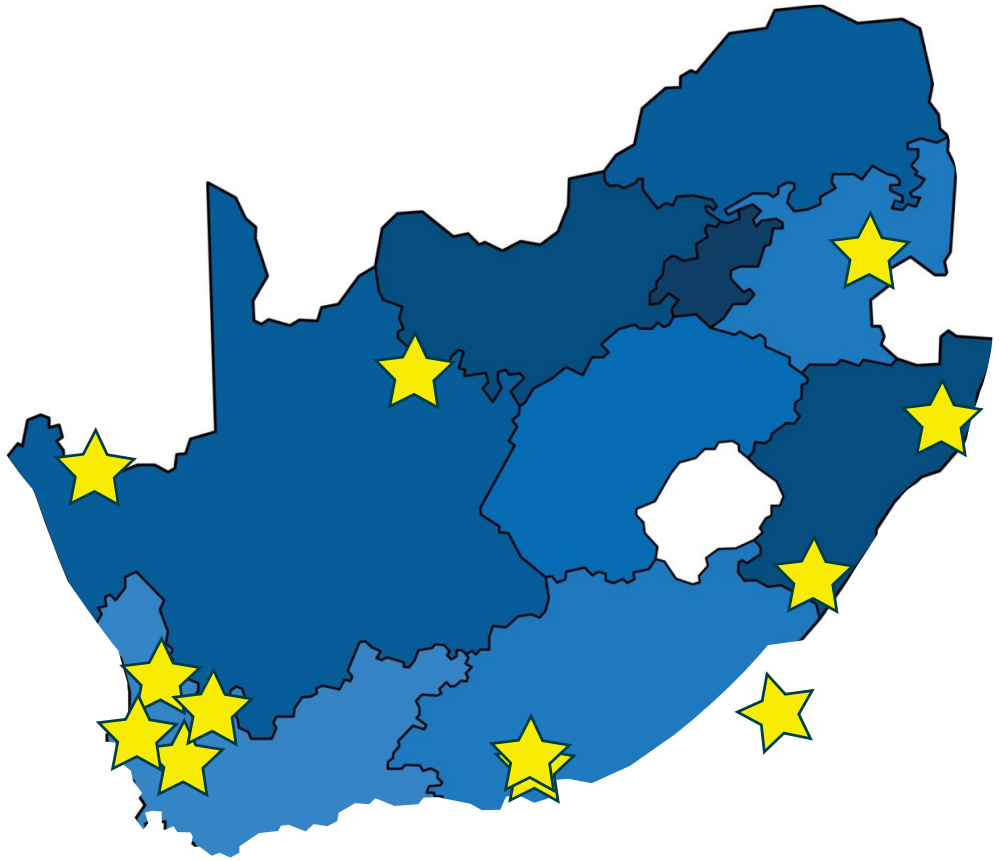
Supervise interns & students

Administration

Support education

Science communication

1 – 10



Microfossils

Marine mammals

Swimming reptiles
Ammonites

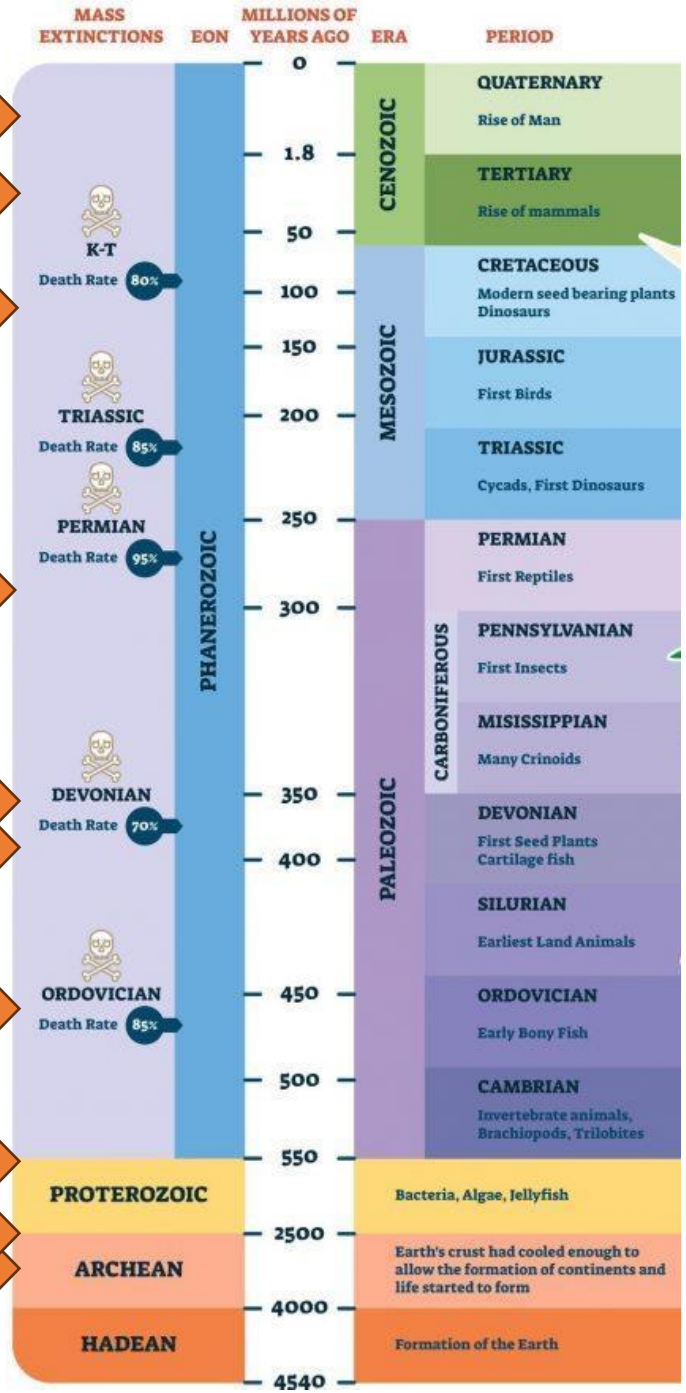
Ecca Seas

Makanda
Bokkeveld

Cedarberg

Nama

Banded iron
Stomatolites



Introduction

- The Earth was not always a hospitable place!
- Before life could evolve, the Earth had to cool, form a crust, and oceans.
- Scientists think that by 4.3 billion years ago (Ga), Earth may have developed conditions suitable to support life.

Origin of Life Theories

- Oldest life form = 3.7 Ga
- Life emerged from a primordial soup (building blocks made on Earth)
- Life was seeded by comets or meteors (building blocks landed on Earth)

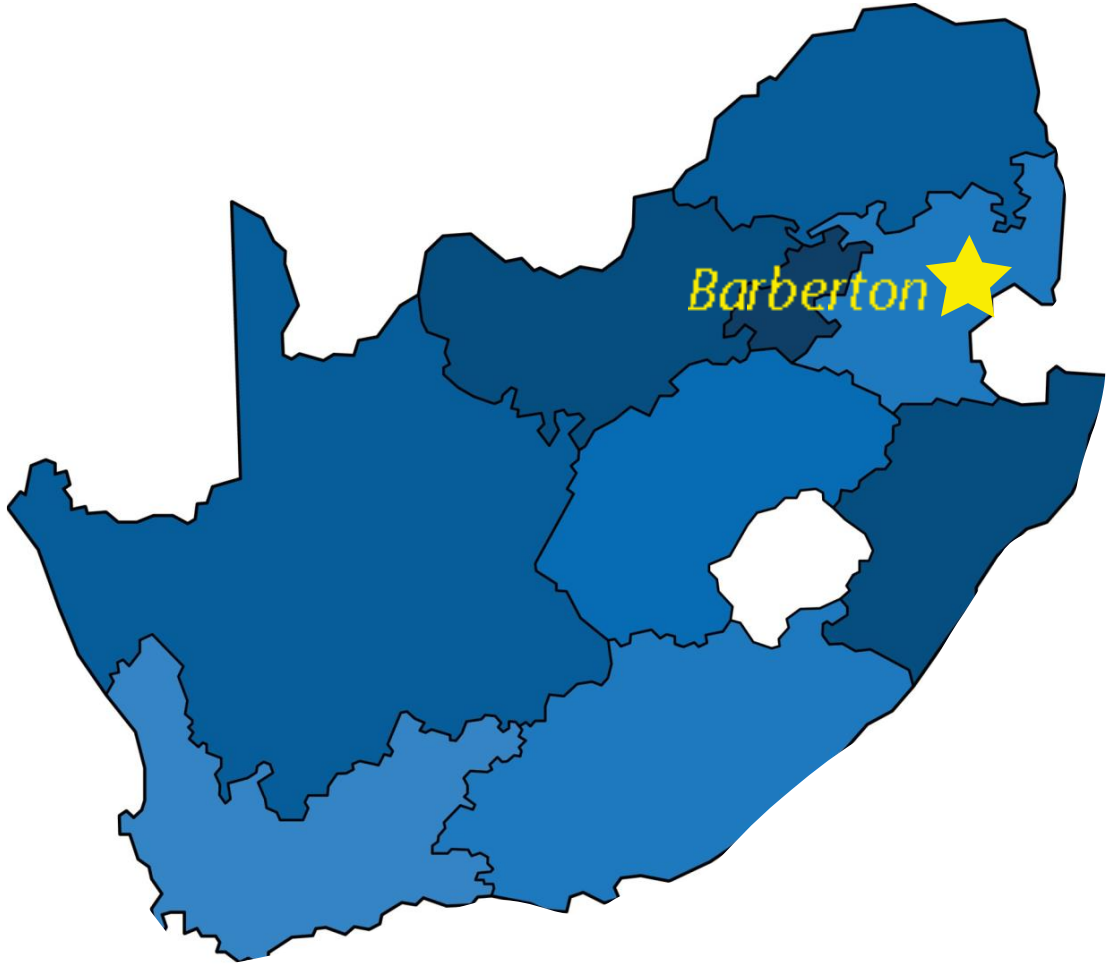
1

Stromatolites

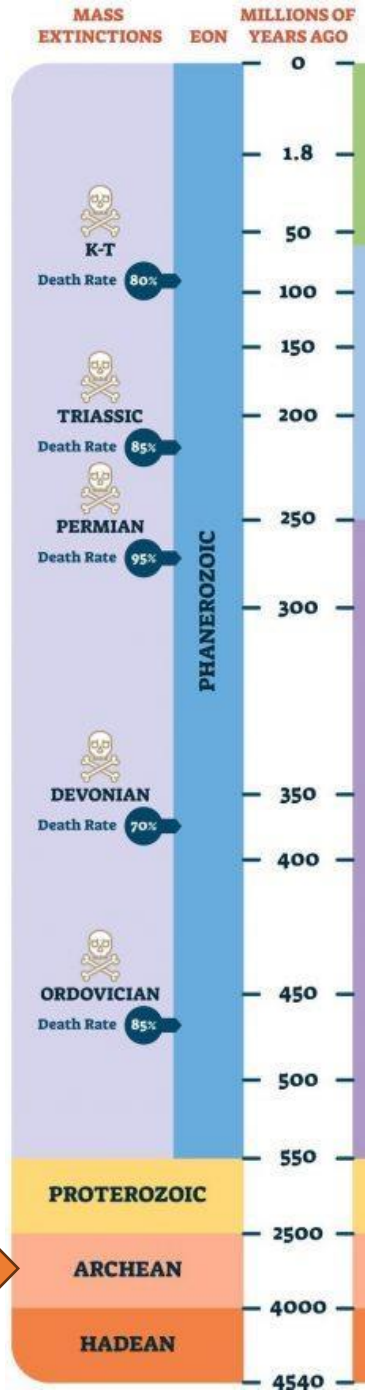
Fossilized microbial mats providing evidence of early life

Maggie Newman

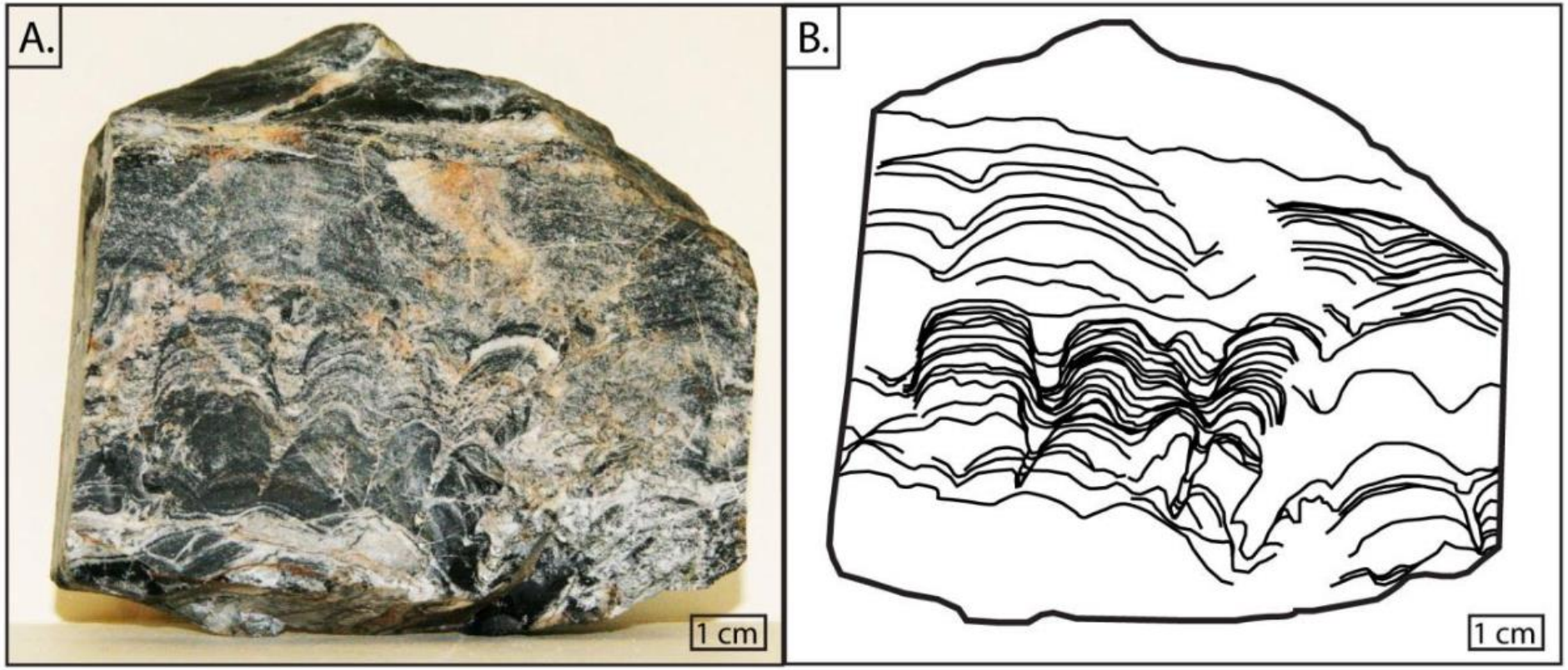
1 Barberton (~3.4 Ga)



Stromatolites



1 Barberton stromatolites (~3.4 Ga)



Shircliff, 2014

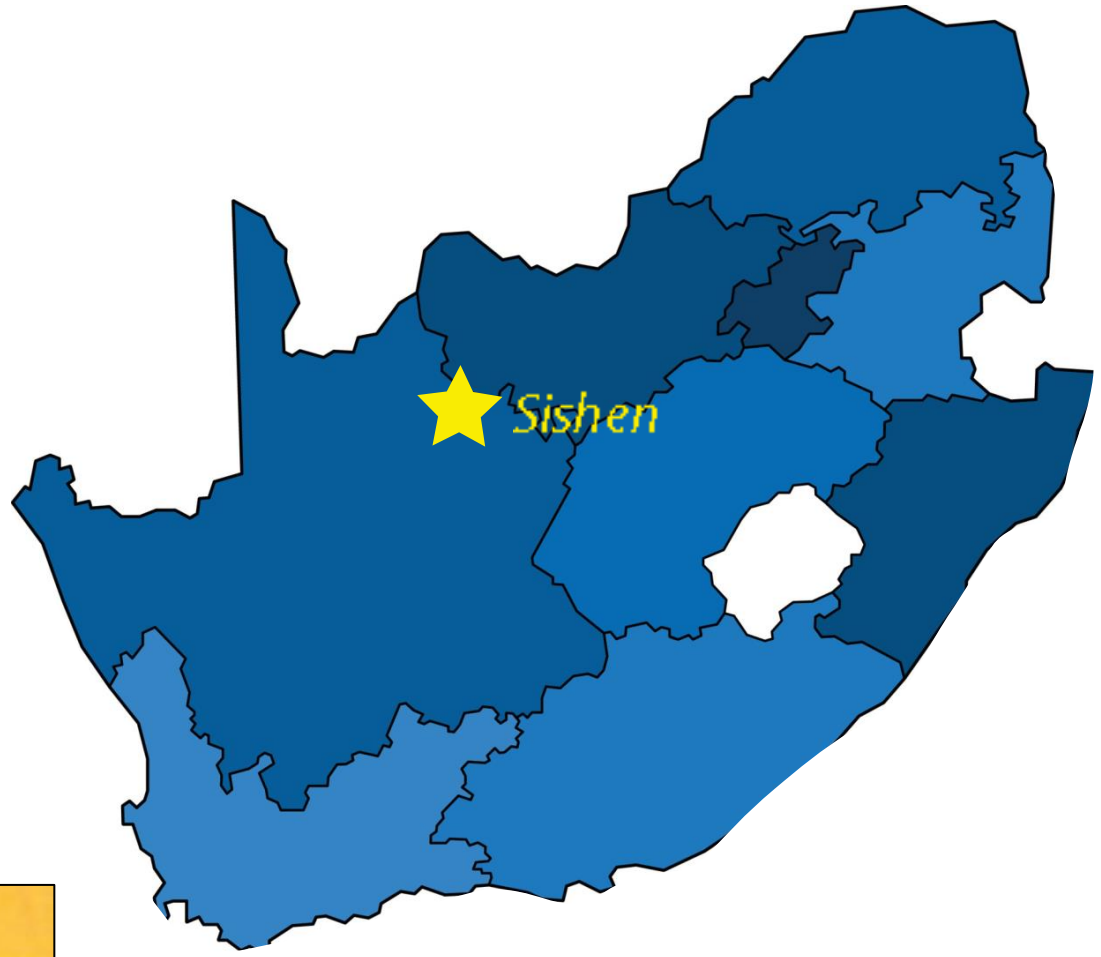
When Photosynthesis made the Earth rust!

2

- Cyanobacteria (Pioneers of oxygenic photosynthesis)
- The Great Oxygenation Event (Accumulation of atmospheric oxygen and its impact on early life)

Maggie Newman

2 Banded Iron (~ 2.5 Ga)



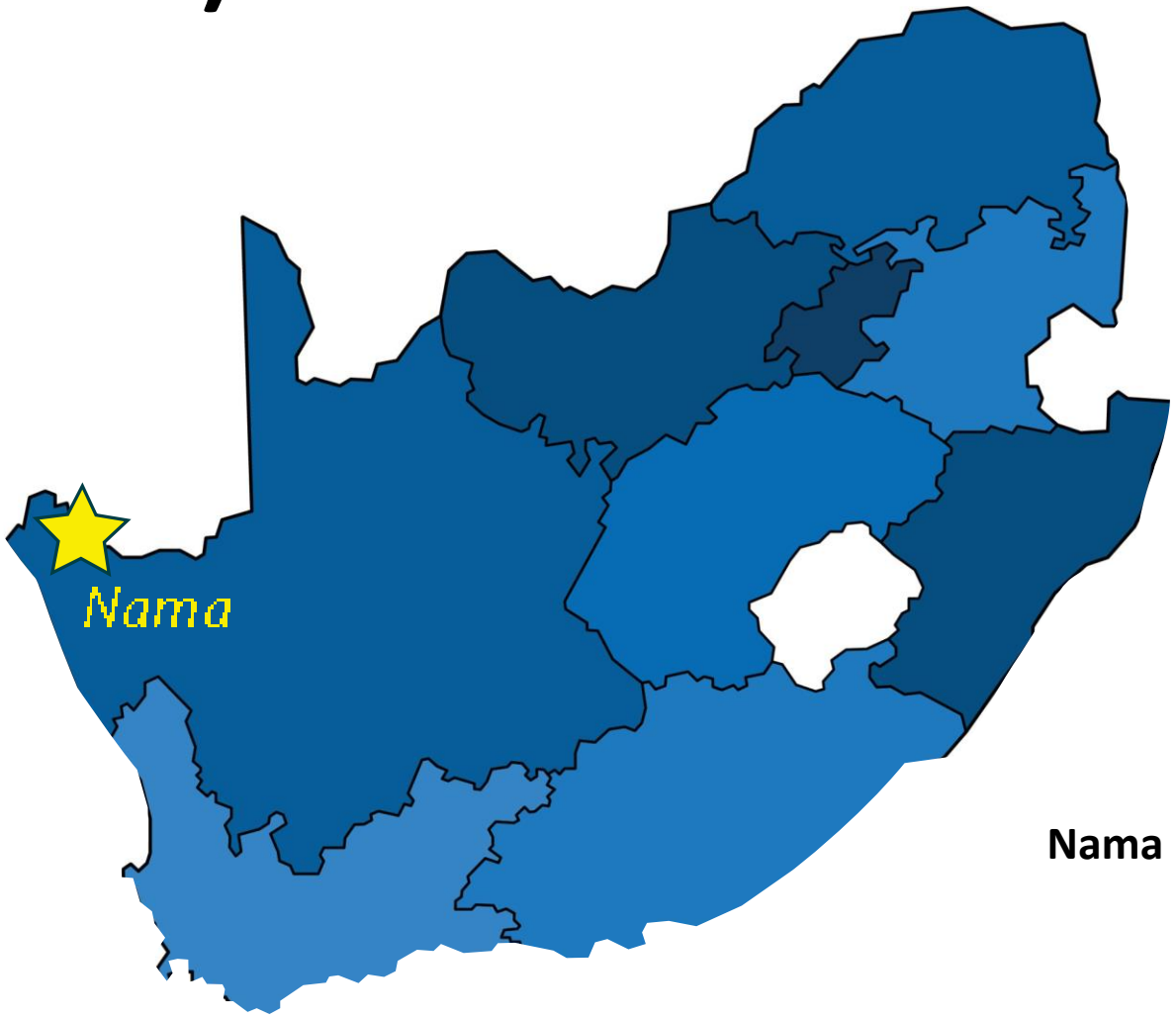
The weird and wonderful Ediacaran

3

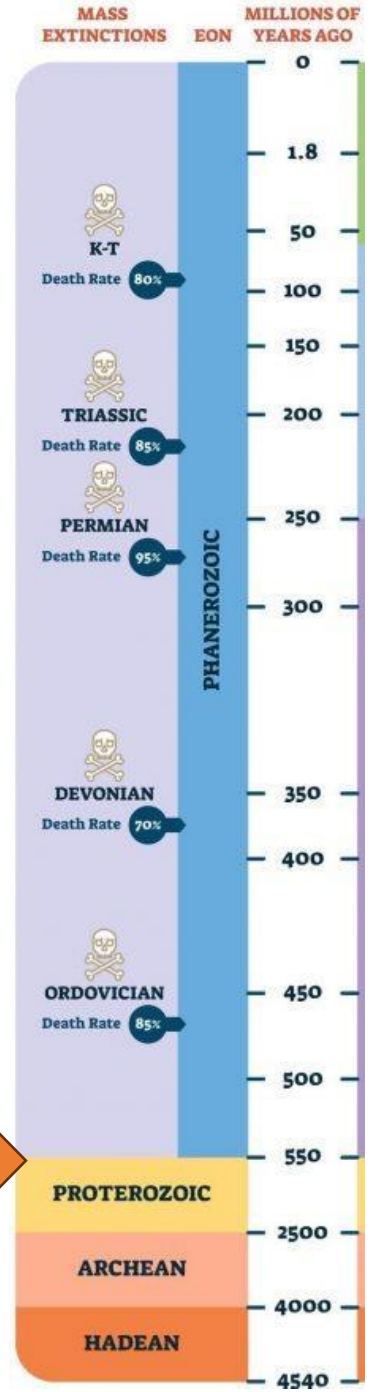
- Complex Multicellular Organisms
  - Appearance during the Ediacaran Period (635-541 million years ago)
- Controversies and Classification
  - Challenges in categorizing and understanding their relationships to modern organisms

Maggie Newman

3 Nama fossils (~ 550 Ma)



Nama



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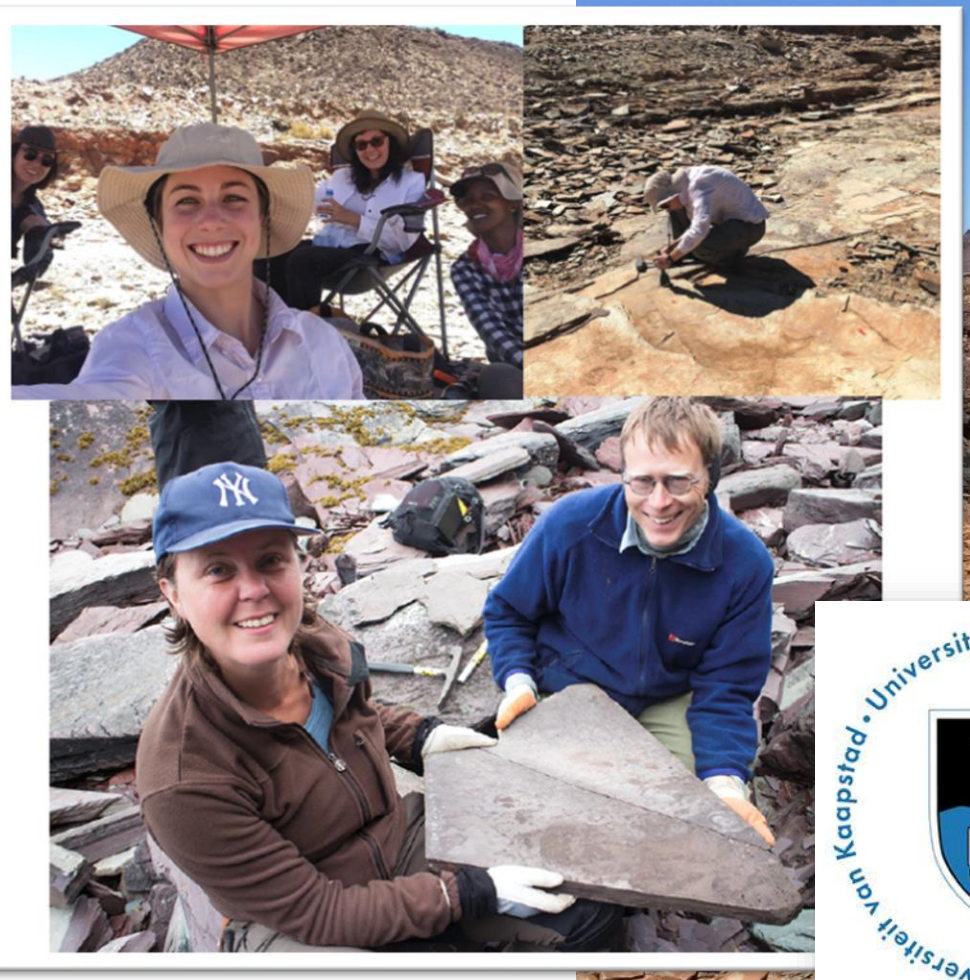
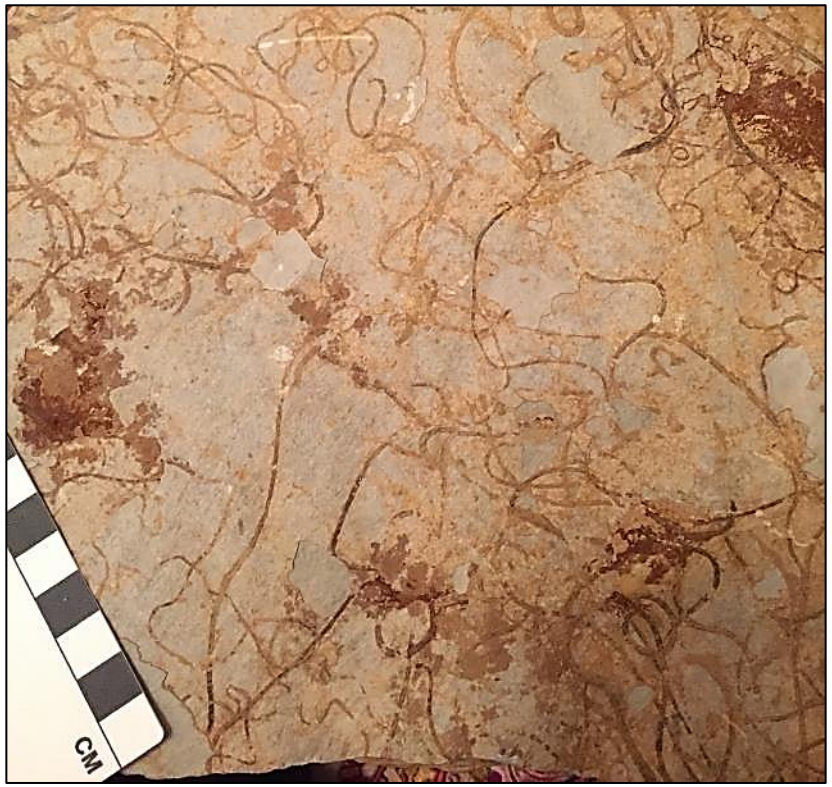
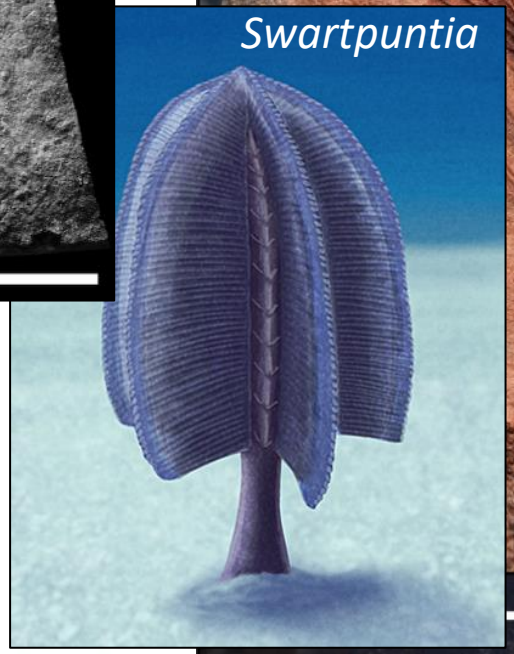


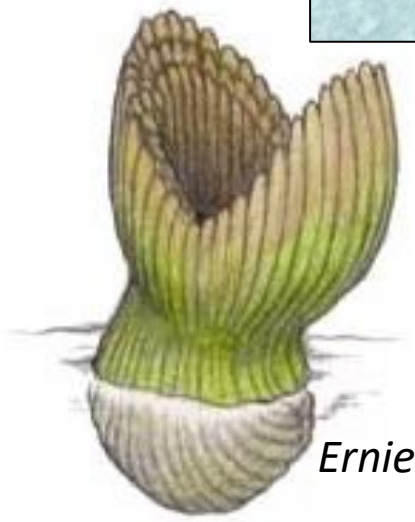
3

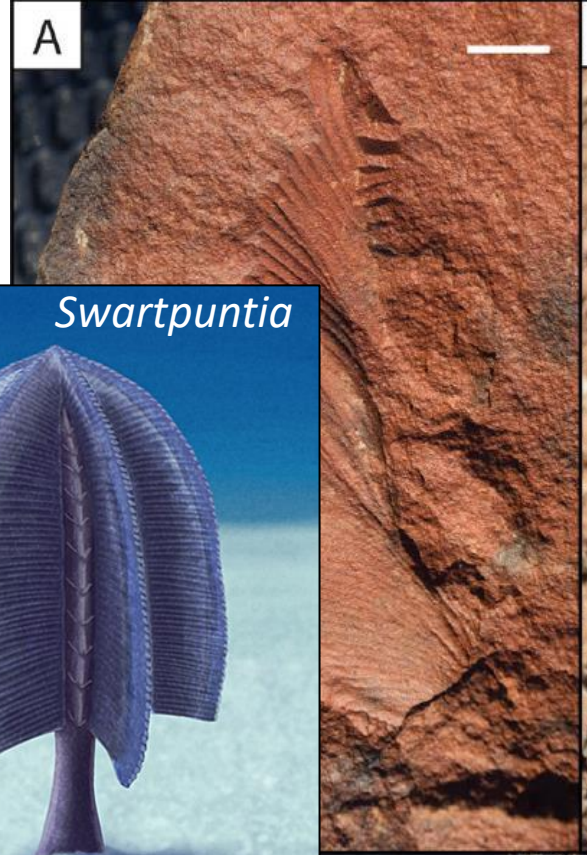
Scratch circles



Vendotaenids







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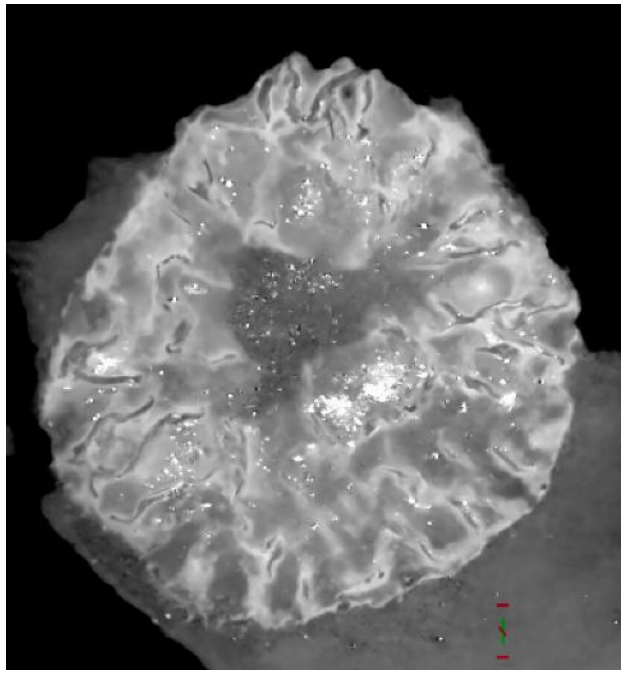
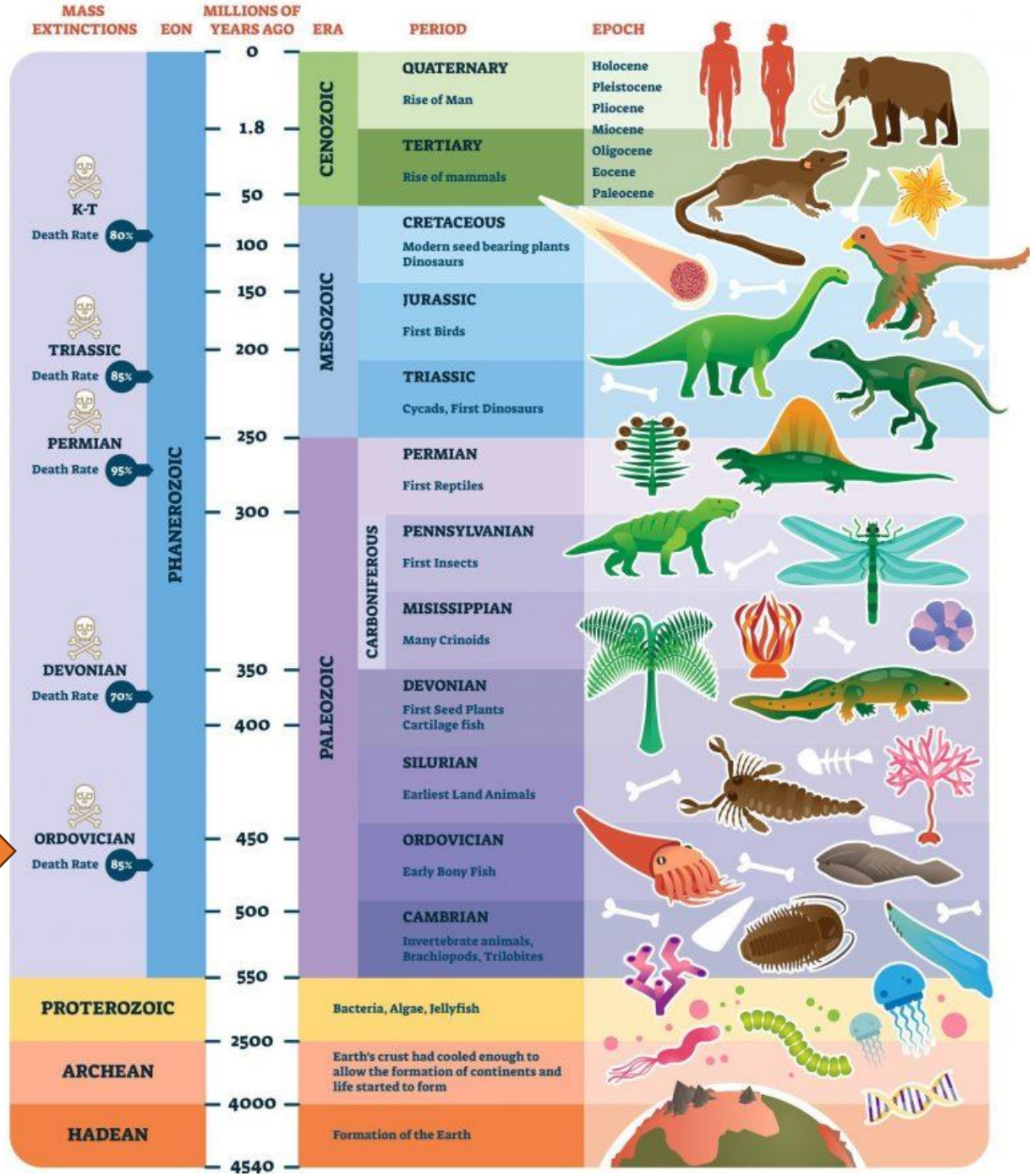


CAF Central Analytical Facilities
STELLENBOSCH UNIVERSITY

PROUDLY SOUTH AFRICAN

4

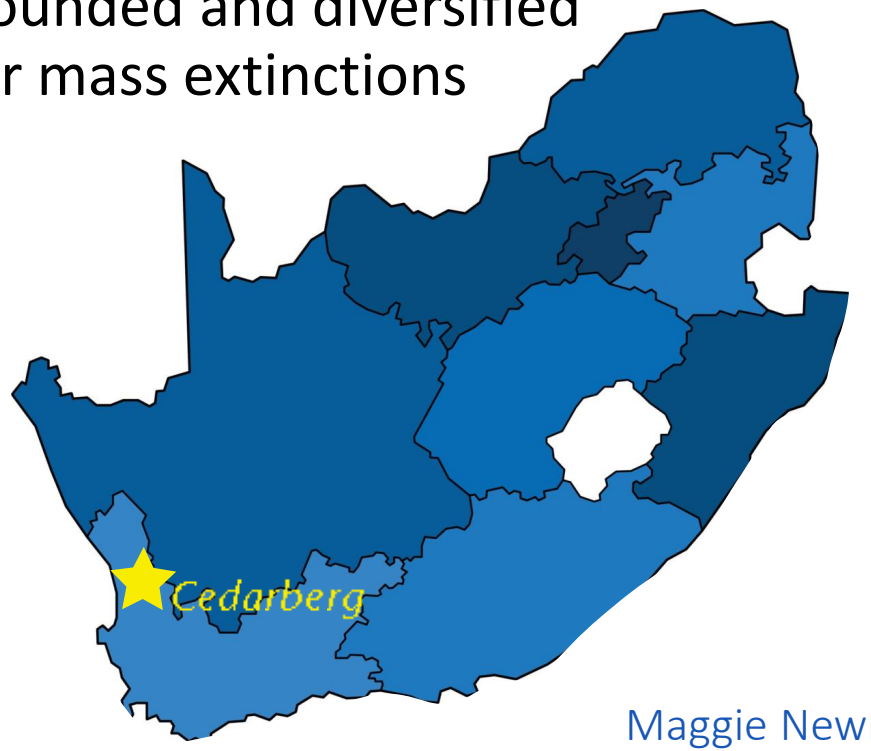
Cedarberg


MASS EXTINCTIONS
EON
MILLIONS OF YEARS AGO
ERA
PERIOD
EPOCH
0
1.8
50
100
150
200
250
300
350
400
450
500
550
2500
4000
4540
PHANEROZOIC
CENOZOIC
QUATERNARY
Rise of Man
Holocene
Pleistocene
Pliocene
TERTIARY
Rise of mammals
Miocene
Oligocene
Eocene
Paleocene
MESOZOIC
CRETACEOUS
Modern seed bearing plants
Dinosaurs
JURASSIC
First Birds
TRIASSIC
Cycads, First Dinosaurs
PALEOZOIC
PERMIAN
First Reptiles
CARBONIFEROUS
PENNSYLVANIAN
First Insects
MISISSIPPIAN
Many Crinoids
DEVONIAN
First Seed Plants
Cartilage fish
SILURIAN
Earliest Land Animals
ORDOVICIAN
Early Bony Fish
CAMBRIAN
Invertebrate animals,
Brachiopods, Trilobites
K-T
Death Rate 80%
TRIASSIC
Death Rate 85%
PERMIAN
Death Rate 95%
DEVONIAN
Death Rate 70%
ORDOVICIAN
Death Rate 85%
PROTEROZOIC
Bacteria, Algae, Jellyfish
ARCHEAN
Earth's crust had cooled enough to allow the formation of continents and life started to form
HADEAN
Formation of the Earth

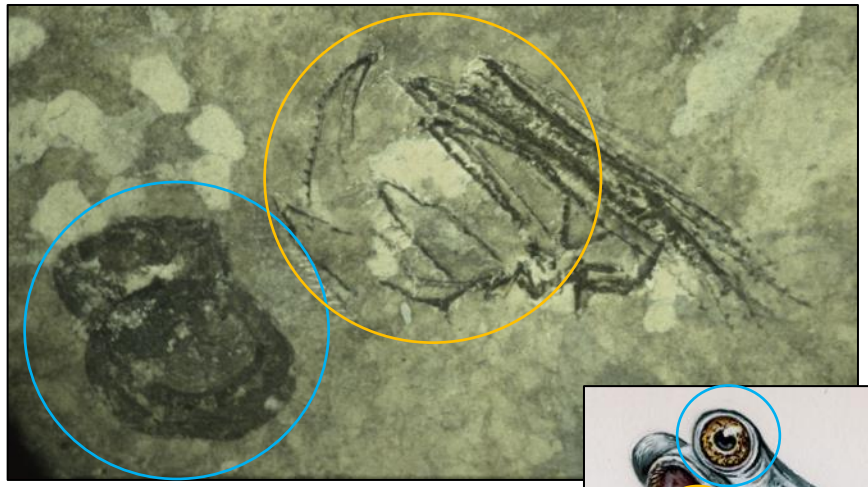
Ordovician Survivors

4

How surviving organisms rebounded and diversified after mass extinctions

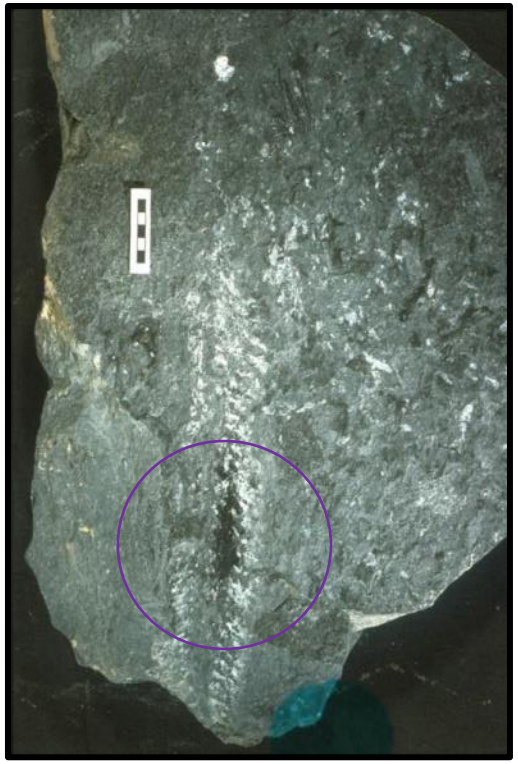


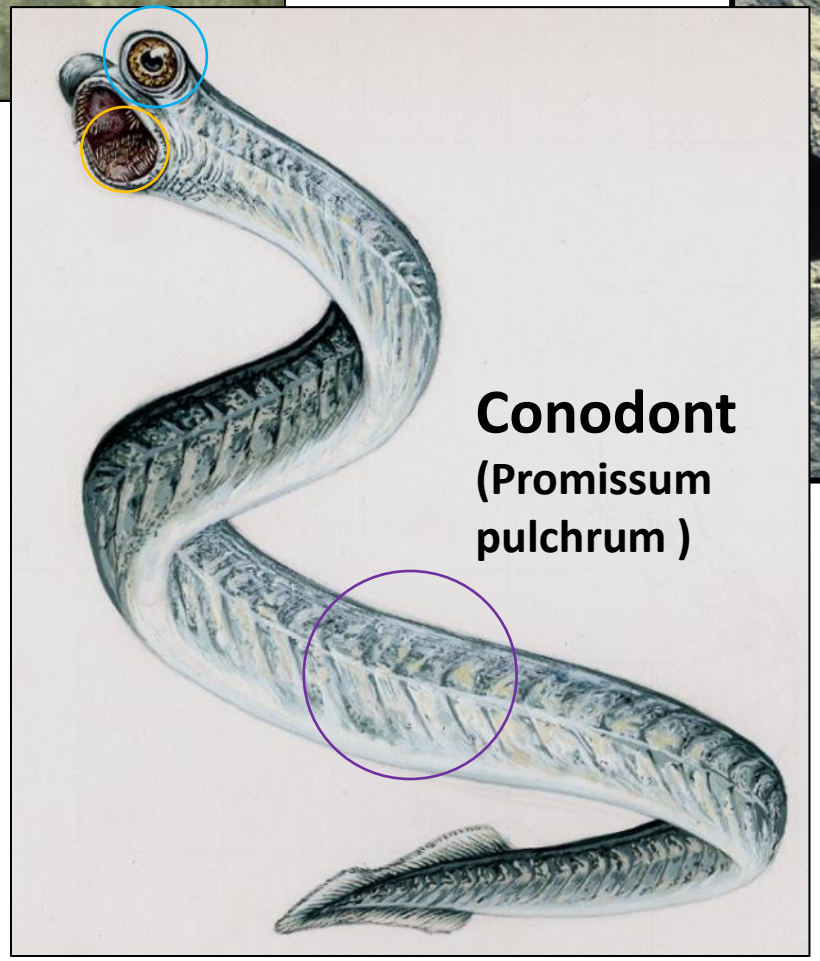
Maggie Newman



4

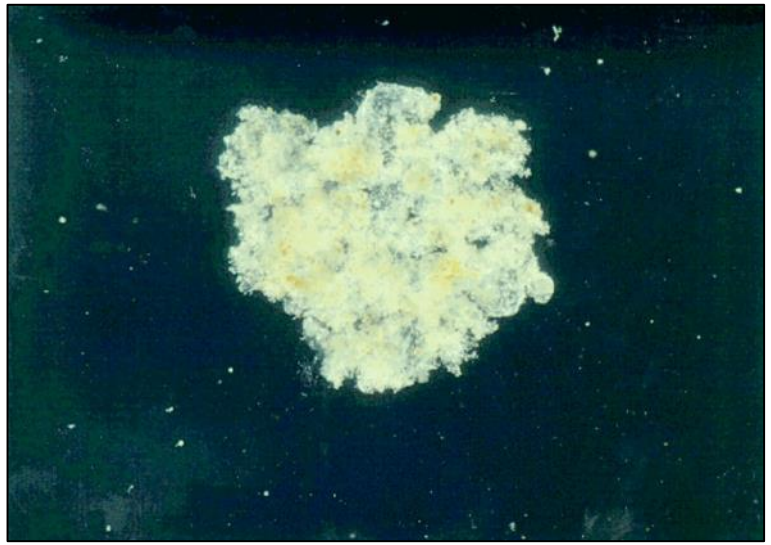
Eurypterid





Conodont
(Promissum pulchrum)

4



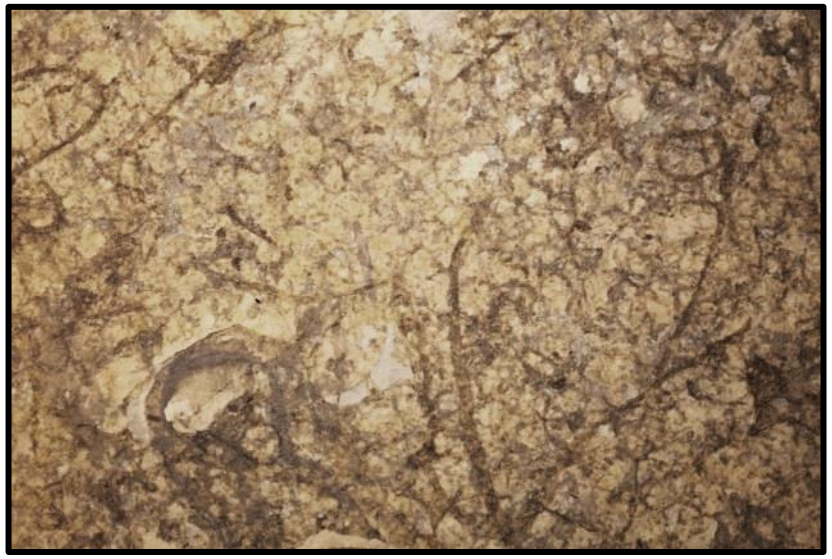
Marine snow!

Land snow!

4

Small food web

Nematode

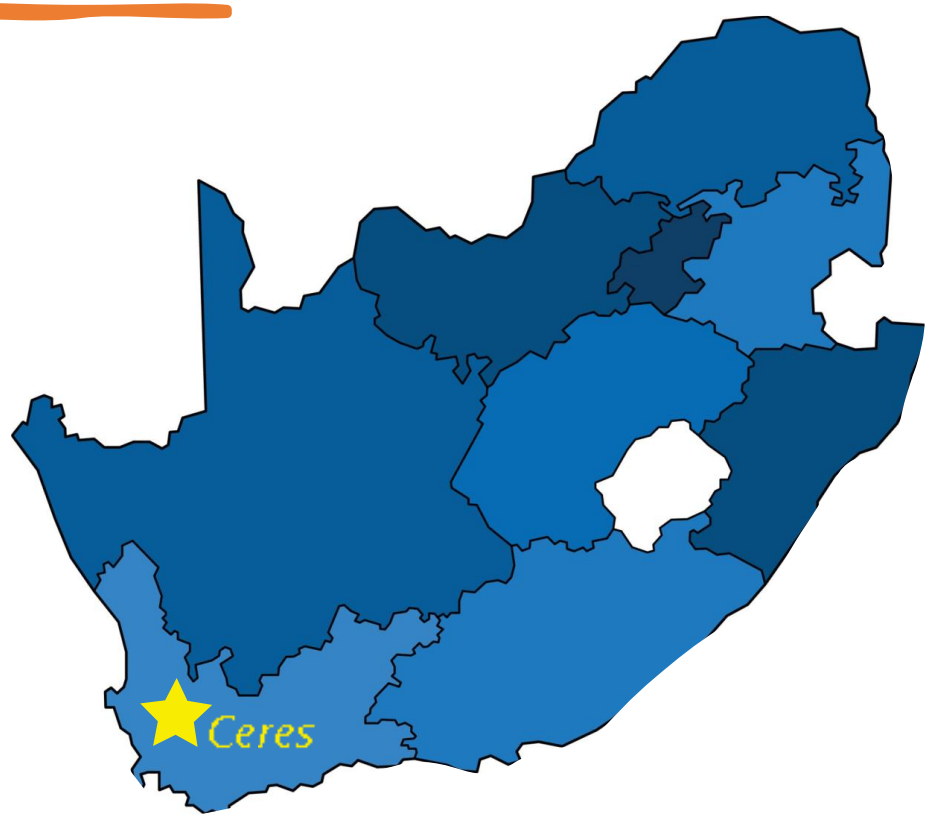


Algae

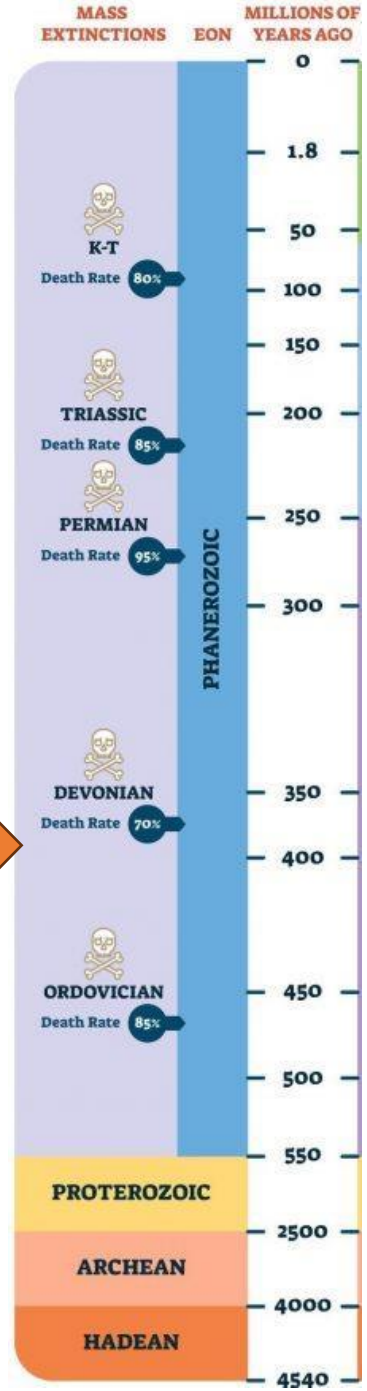
Foraminifera

Mudrock

5 Shelly fossils of the Bokkeveld (~390 Ma)



Bokkeveld



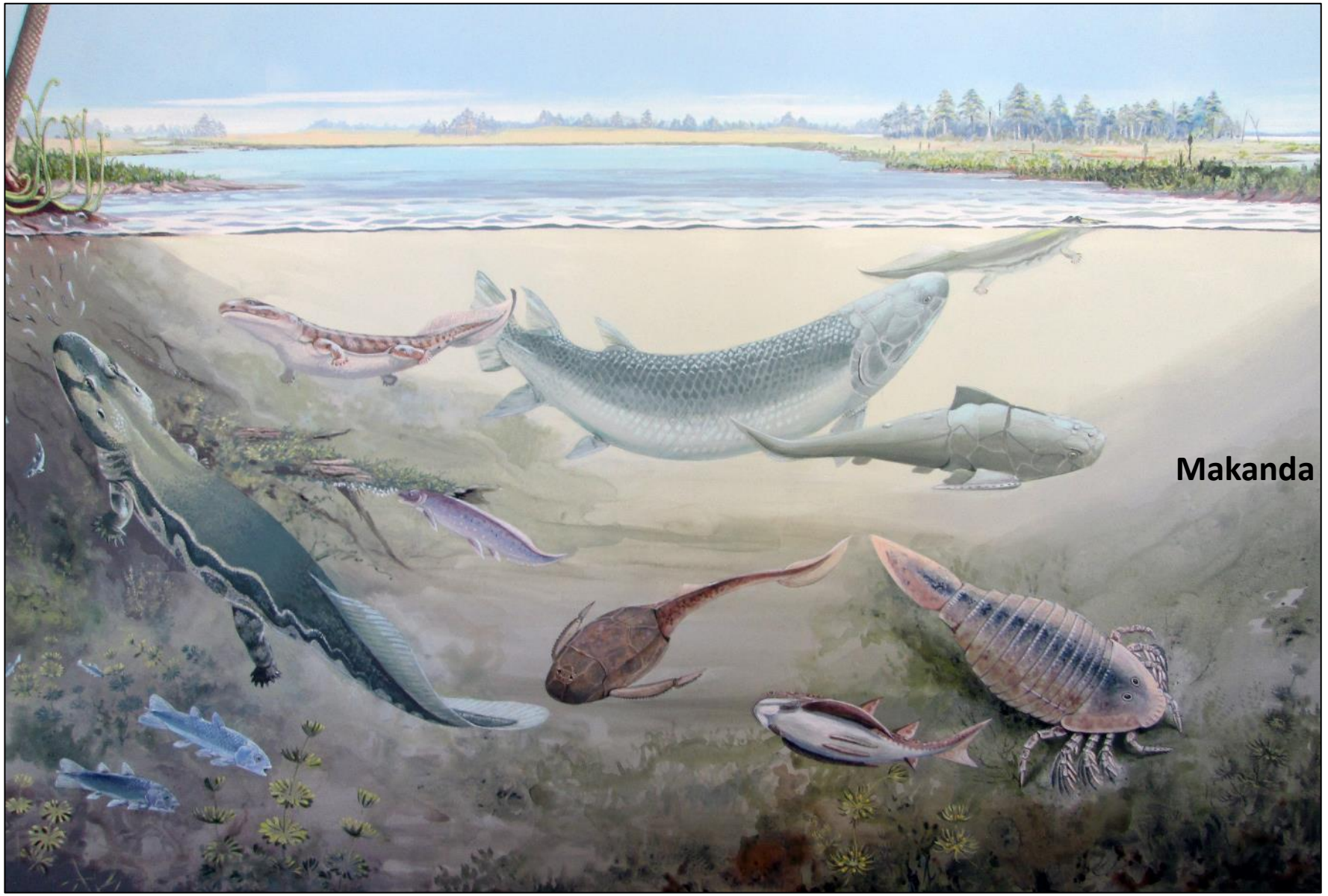
5

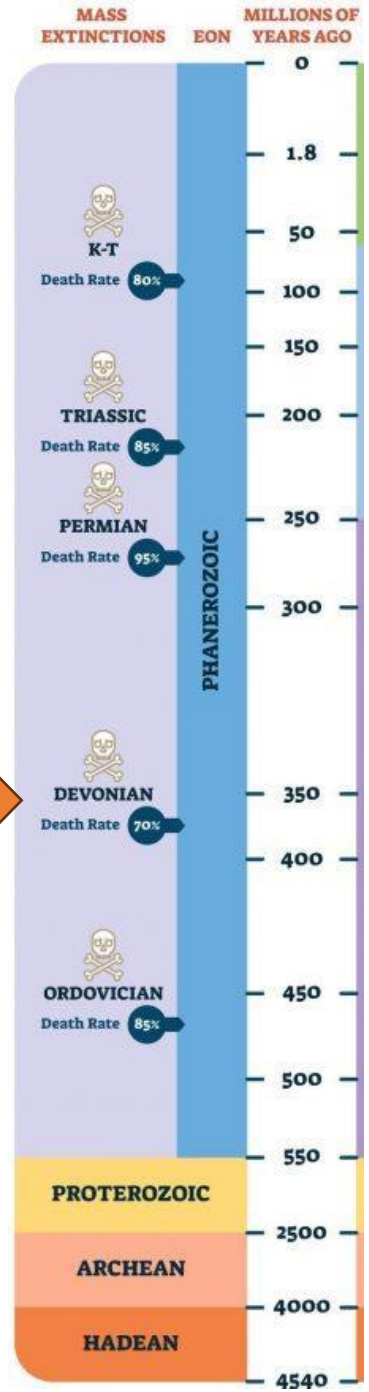
A thriving estuary (~360 Ma)

6

6

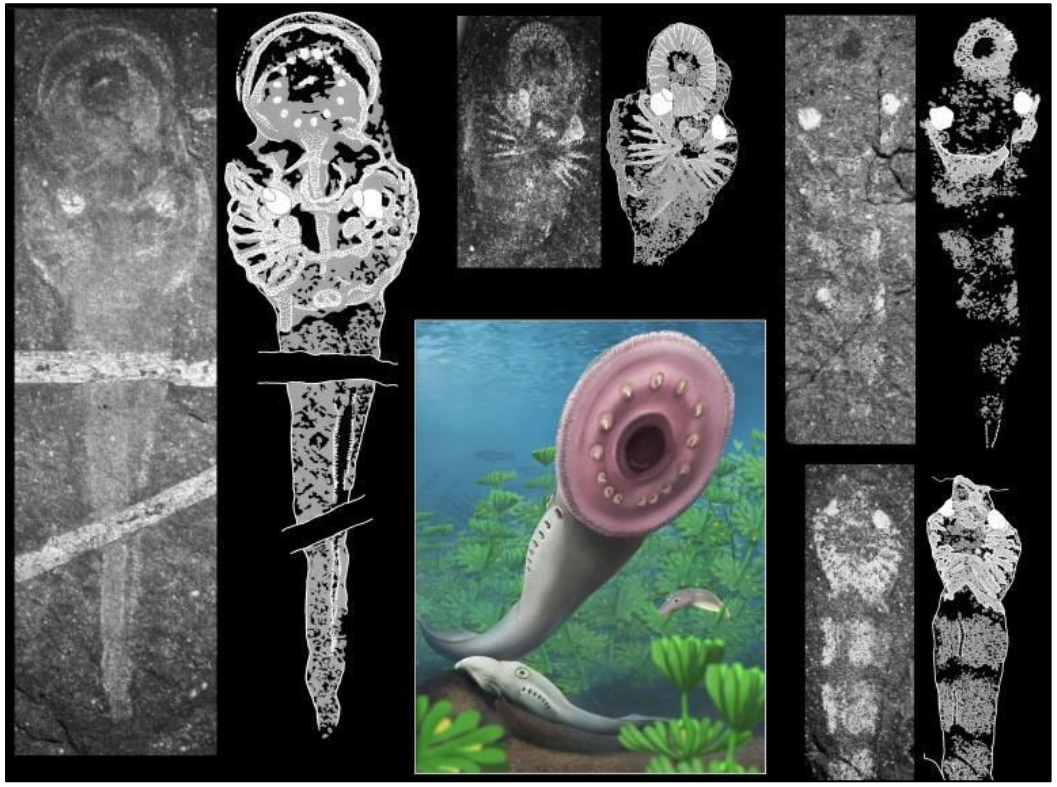
Waterloo farm





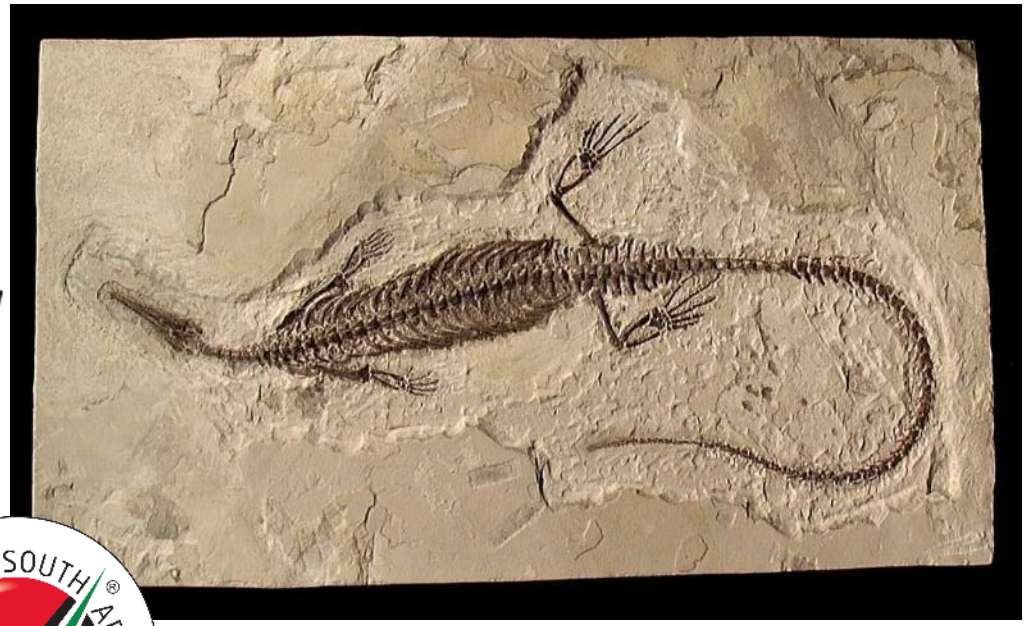
Maggie Newman

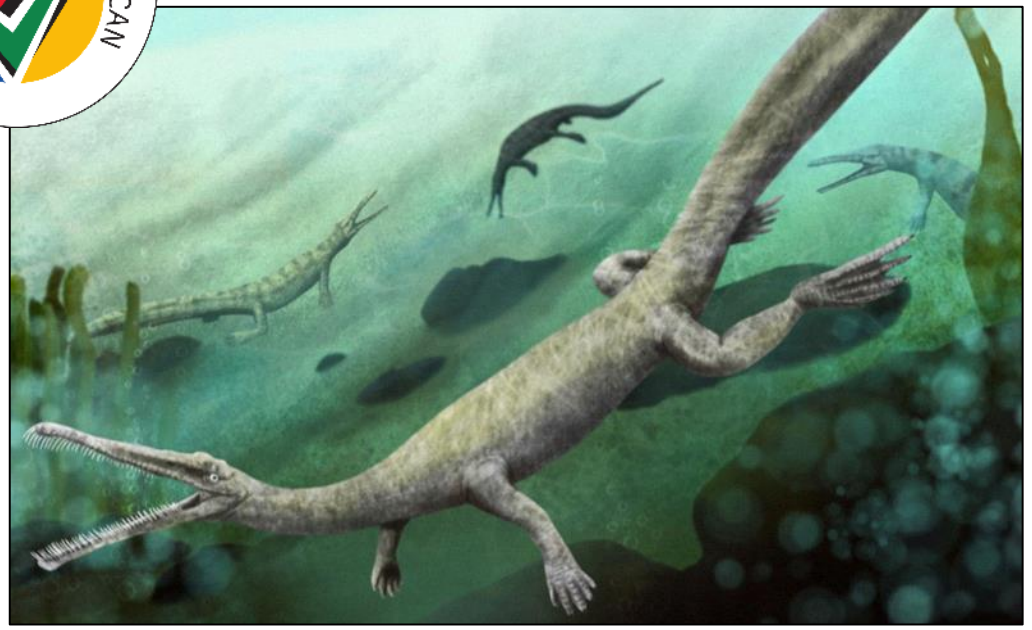
6



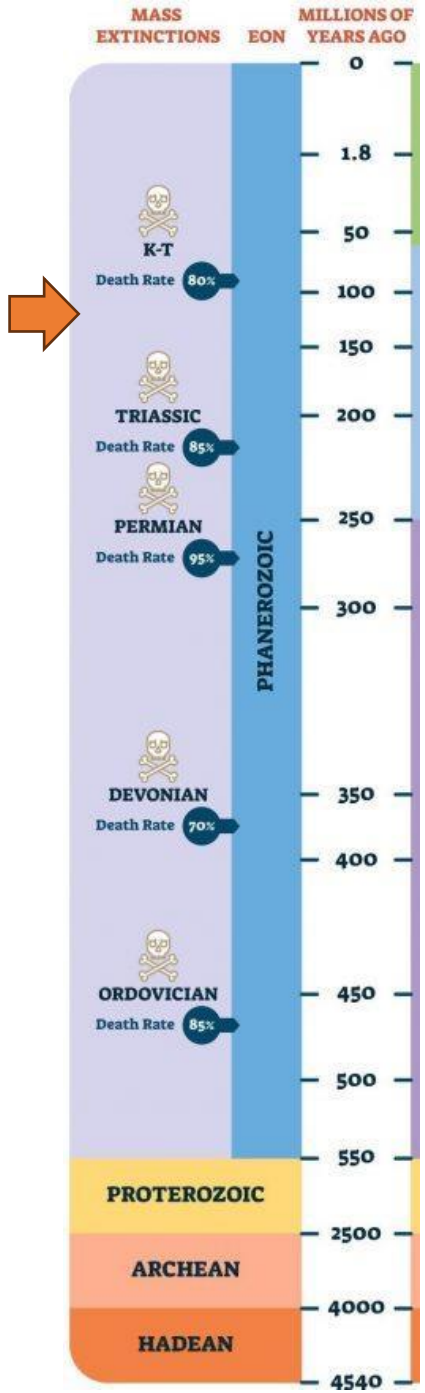
7 The Ecca Sea (~ 280 Ma)

Maggie Newman





8 Swimming reptiles (~135)



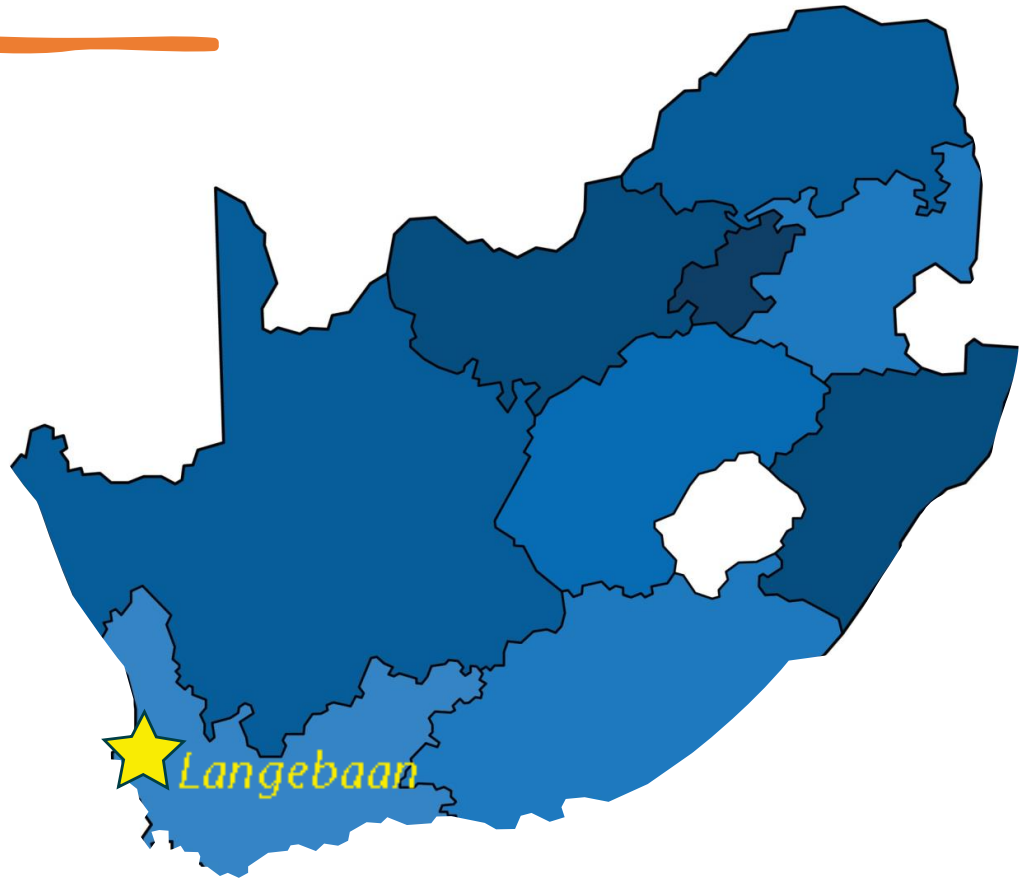
8

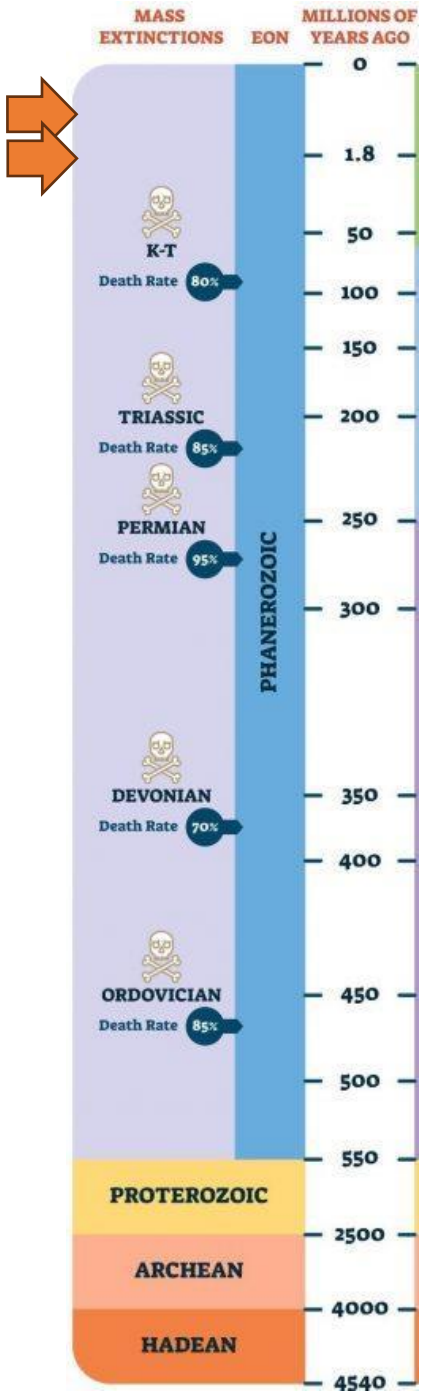
Plesiosaur (*Leptocleidus capensis*)

3 Mosasaur specimens

Ammonites

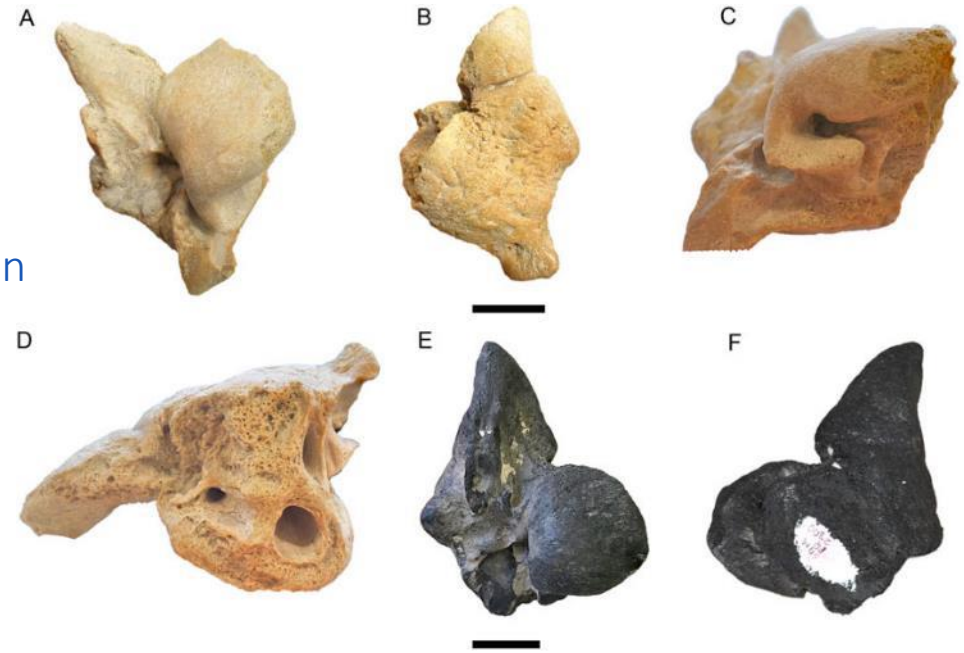
9 Marine mammals etc. (~5 – 0.8 Ma)





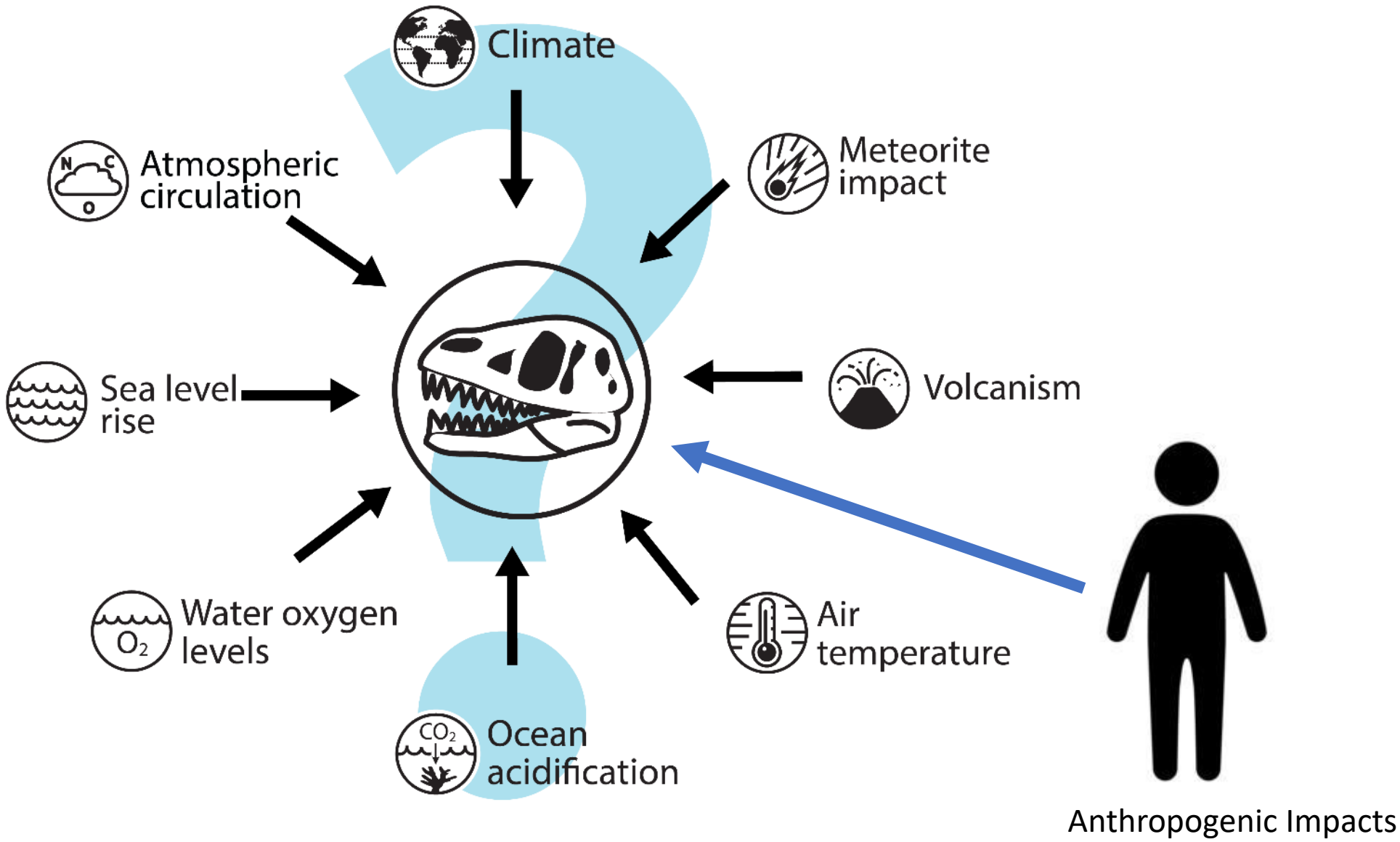
9 West Coast Fossil Park etc.

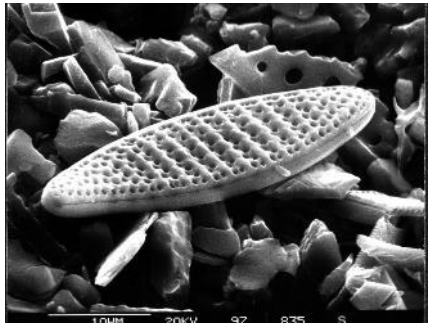
Maggie Newman

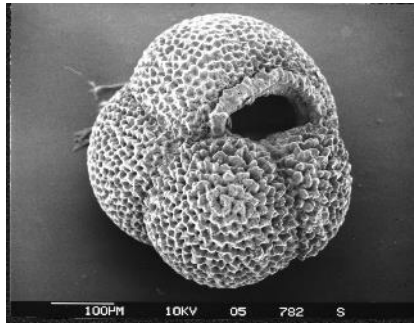


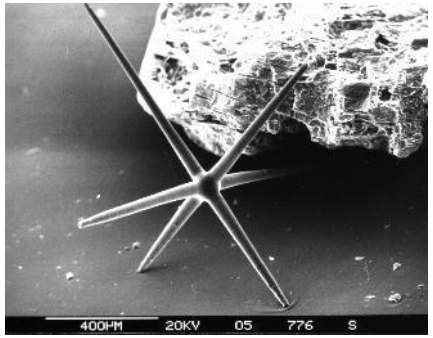
Whales (baleen, blue, right, pygmy right)
Dolphins and a seal (phocid)

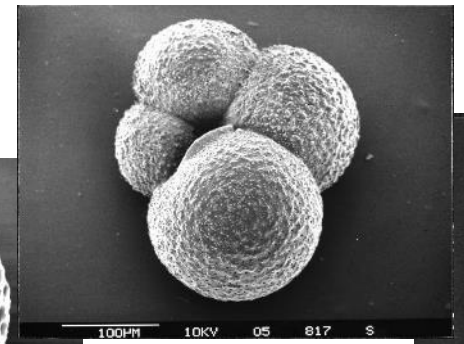
10

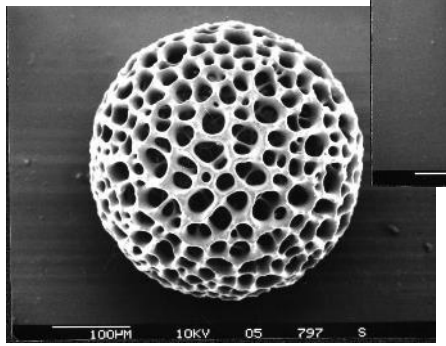

Climate
Atmospheric circulation
Meteorite impact
Sea level rise
Volcanism
Water oxygen levels
Air temperature
Ocean acidification
Anthropogenic Impacts



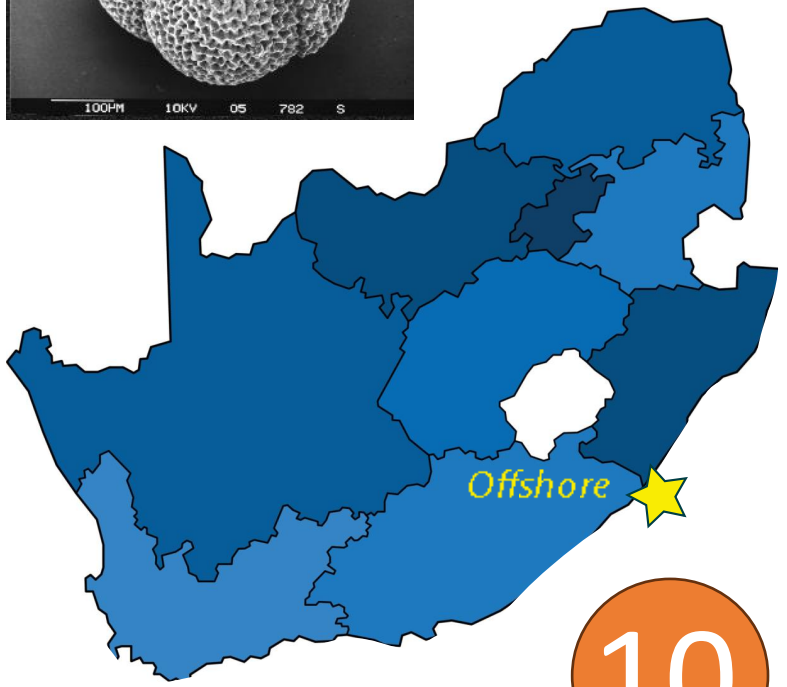








Microfossils



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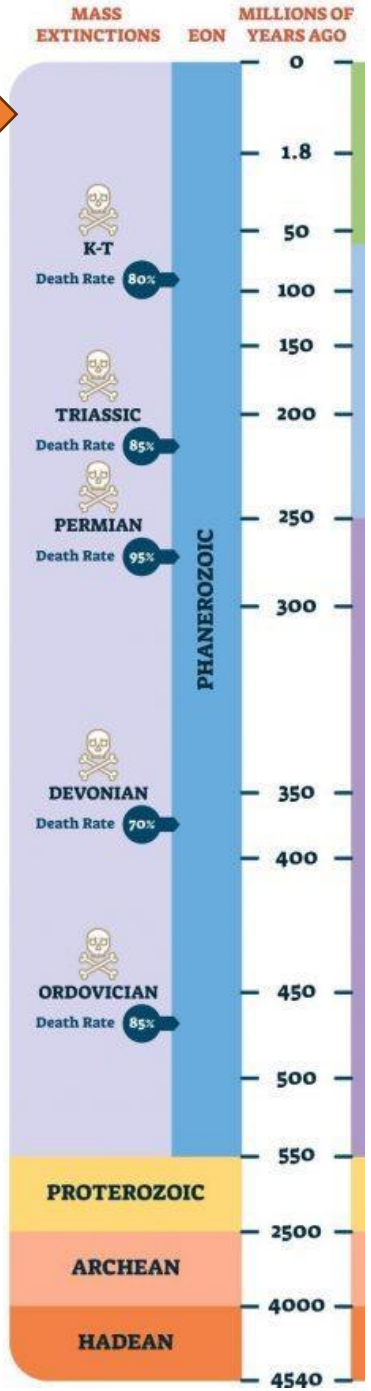

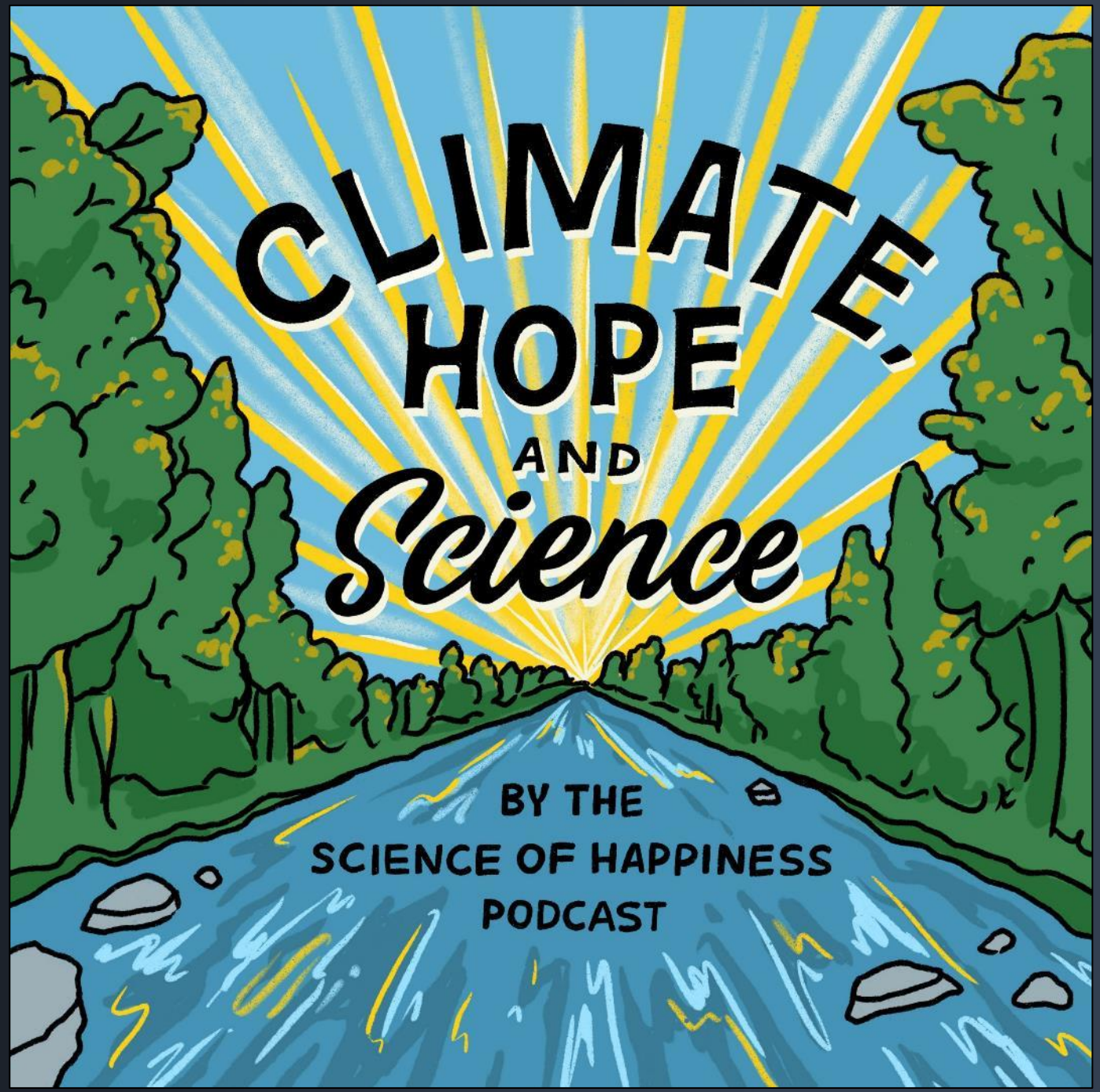

https://greatergood.berkeley.edu/podcasts

Conservation Efforts

Ongoing initiatives to protect marine biodiversity and ecosystems

Research and innovation

Better understanding part and present marine biodiversity and ecosystems

Questions?
Comments?