University of Southampton

Ocean and Earth Science
Degrees to change the planet

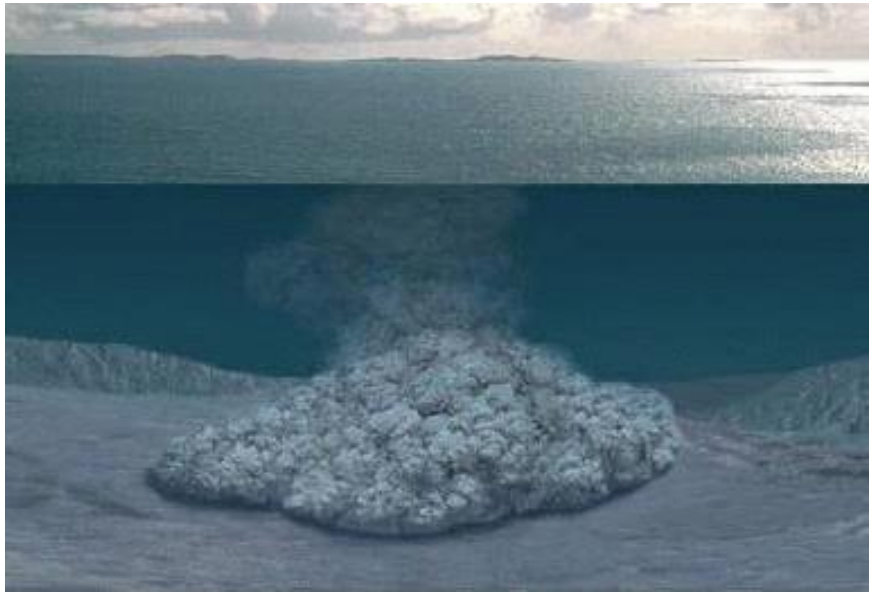
FOUNDING
MEMBER OF THE
RUSSELL
GROUP

Dr Esther Sumner

University of Southampton

Associate Professor in Sedimentology

Admissions Tutor for Geology and Environmental Geoscience undergraduate degrees



Seafloor avalanche

Seafloor internet cable

Ocean microplastics

Students studying sedimentary rocks, Dorset

Students studying a fault zone, Spain fieldclass

Research

Modern and ancient seafloor avalanches.

Geohazards, pollutant transport.

Reconstructing climate and tectonics.

Teaching

Earth materials

Sediment in the Environment

Advanced fieldskills – Spain.

Geohazards

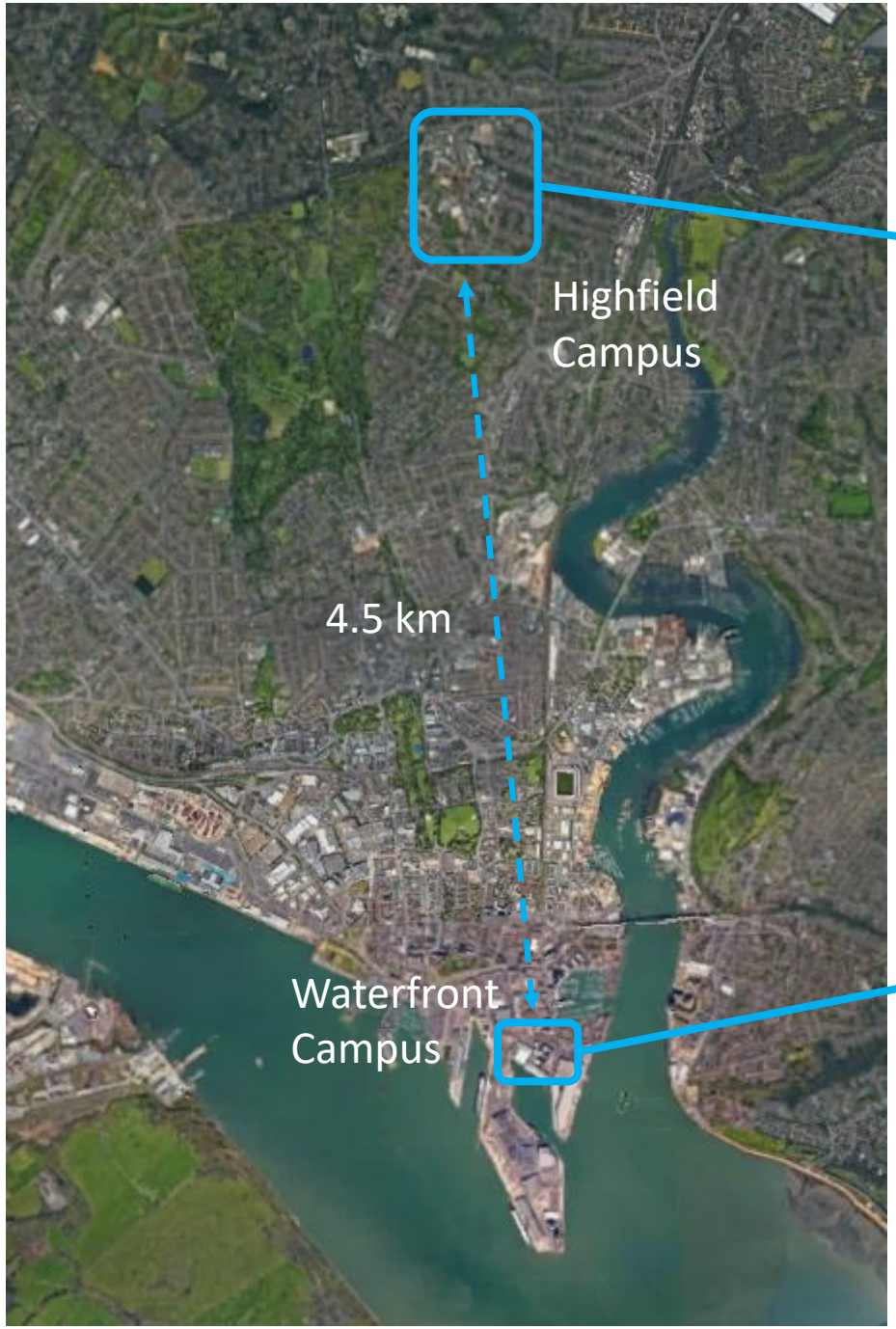
In this session:

1. Degrees in the School of Ocean and Earth Science

2. Activity - ‘From Mass Extinctions to Mass Spectrometers’

3. Question and Answer Session

1. Degrees in the School of Ocean and Earth Science

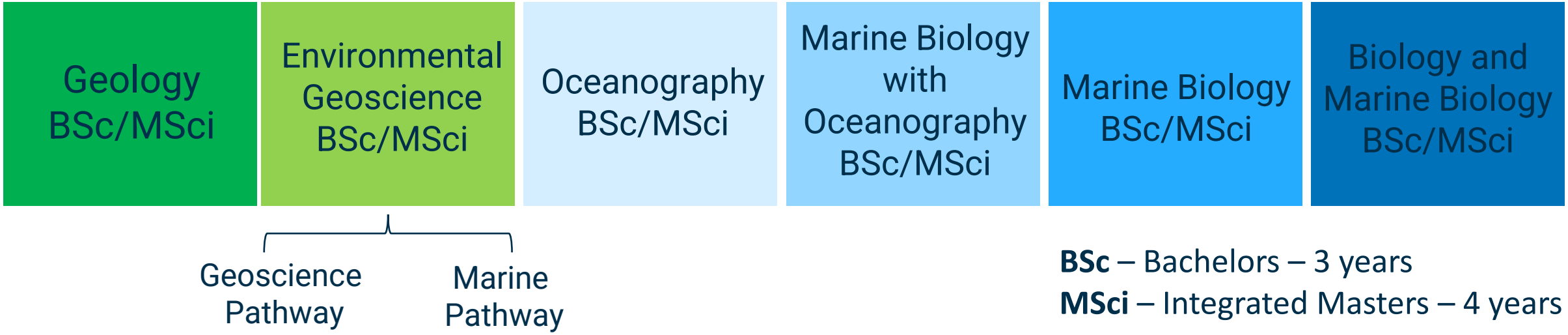


Highfield Campus

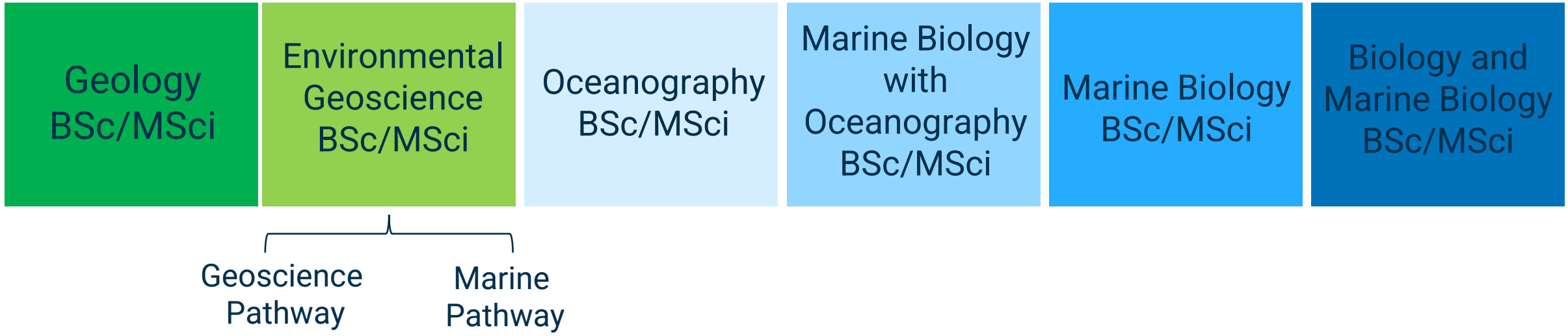
Waterfront Campus – National Oceanography Centre

Degrees in the School of Ocean and Earth Science

University of Southampton



BSc – Bachelors – 3 years
MSci – Integrated Masters – 4 years



Geology – focuses on the physical earth system

Environmental Geoscience – focuses on human interactions with the earth and/or ocean system

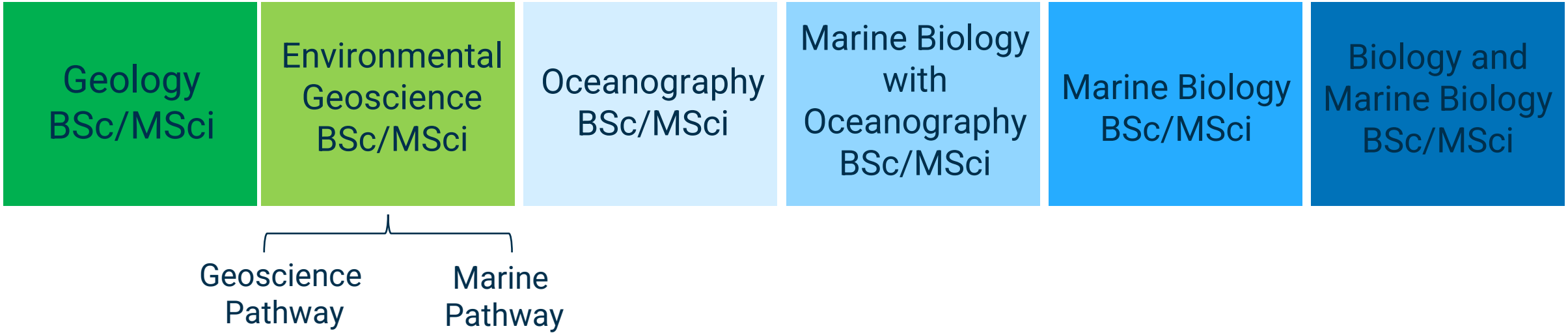
Oceanography – focuses on physical, chemical and biological processes in the oceans

Marine Biology – focuses on biological processes in the oceans

Biology with Marine Biology – focuses on biological processes on the earth and in the oceans

Degrees in the School of Ocean and Earth Science

University of Southampton



The 4-year MSci gives students the opportunity to:

- Study the subject in greater depth
- Study a wider range of topics to an advanced level
- Conduct an Advanced Independent Research Project

Degrees in the School of Ocean and Earth Science

University of Southampton

- Geology BSc/MSci
- Environmental Geoscience BSc/MSci
  - Geoscience Pathway
  - Marine Pathway
- Oceanography BSc/MSci
- Marine Biology with Oceanography BSc/MSci
- Marine Biology BSc/MSci
- Biology and Marine Biology BSc/MSci

THE UNIVERSITY of ADELAIDE

Universiteit Utrecht

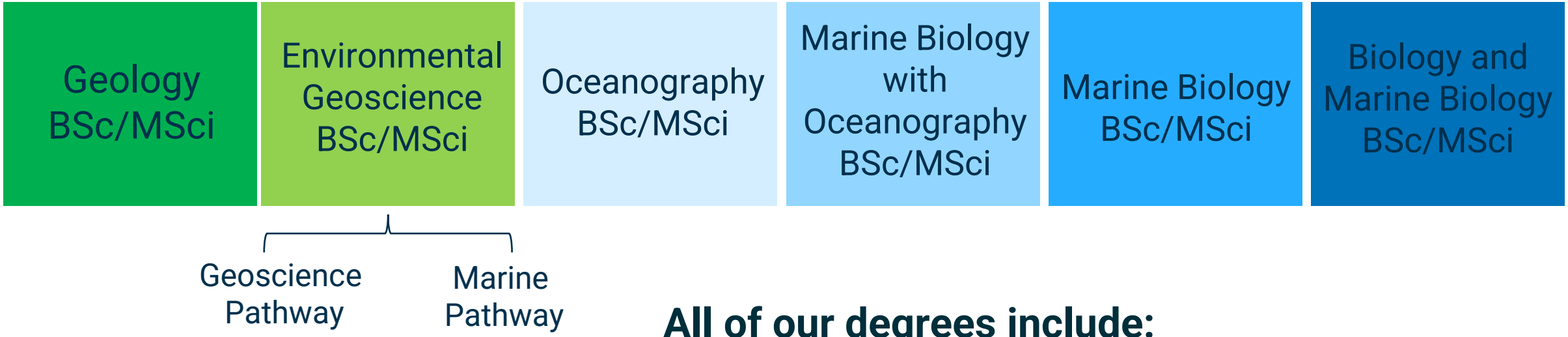
UNIVERSITAS BERGENSIS

PENNSTATE 1855

Students on the MSci have the opportunity to spend a semester studying abroad at a partner institution.

Degrees in the School of Ocean and Earth Science

University of Southampton

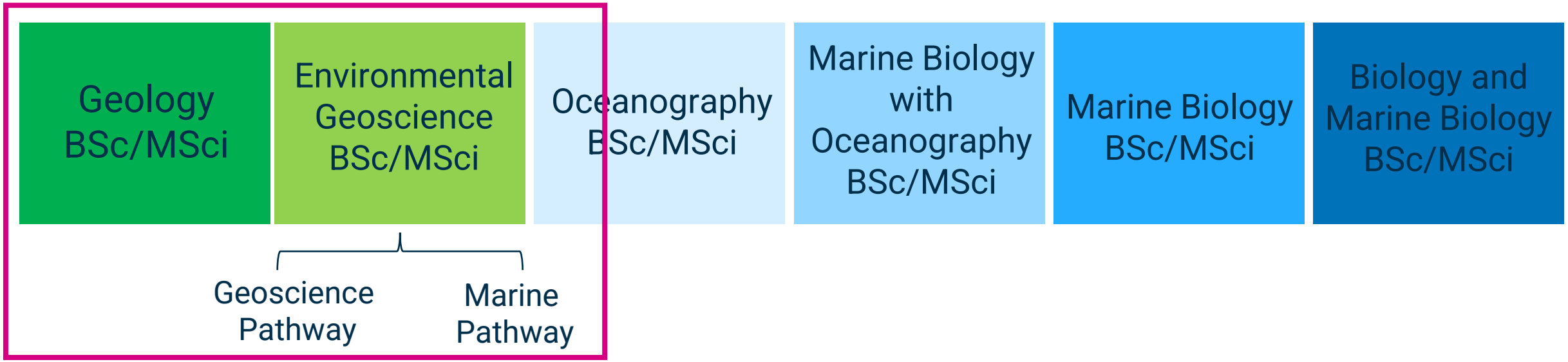


All of our degrees include:

- Analysing data and writing scientific reports
- Lots of practical experience
- Independent research
- An extensive fieldwork program

Degrees in the School of Ocean and Earth Science

University of Southampton



Our Geoscience Degrees

University of Southampton

Geology focuses on the physical earth system.

Environmental Geoscience focuses on human interactions with the earth system.

Our Geoscience Degrees

University of Southampton

Geology focus -
Students studying gold-bearing volcanic rocks, Spain fieldclass.

Environmental Geoscience focus -
The environmental impacts of gold mining.

Our Geoscience Degrees

University of Southampton

All of our degrees include:

- An extensive fieldwork program
- Analysing data and writing scientific reports
- Using Geographic Information Systems (GIS)
- Independent Research
- Fundamental topics for understanding the earth, ocean and atmosphere e.g.
  - The composition of the earth, atmosphere and oceans
  - Geochemistry of the earth and oceans
  - Remote sensing techniques
  - Environmental challenges e.g. climate change, sustainable mineral and energy solutions.
- An opportunity to study a practical module in seafloor surveying

Our Geoscience Degrees

University of Southampton

Geology focuses on the physical earth system.

A geology degree suits students with interests in:

- Volcanoes
- Earthquakes and seismology
- Geohazards
- Palaeontology
- Environmental and Engineering geology
- Earth’s resources
- Extensive experience of independent fieldwork combining remote sensing data with traditional geological mapping.

Our Geoscience Degrees

University of Southampton

Environmental Geoscience focuses on human interactions with the earth system.

An Environmental Geoscience degree suits students with interests in:

- Environmental impacts of humans on the earth system.
- Finding solutions to environmental and societal challenges e.g. pollution, climate change, sustainable development.
- Modern earth surface processes and environments.
- Field training in using geophysics to study the subsurface.
- Oceanographic fieldskills.

We offer either a **geoscience pathway**, or a **marine pathway**.

Waterfront Campus at the National Oceanography Centre

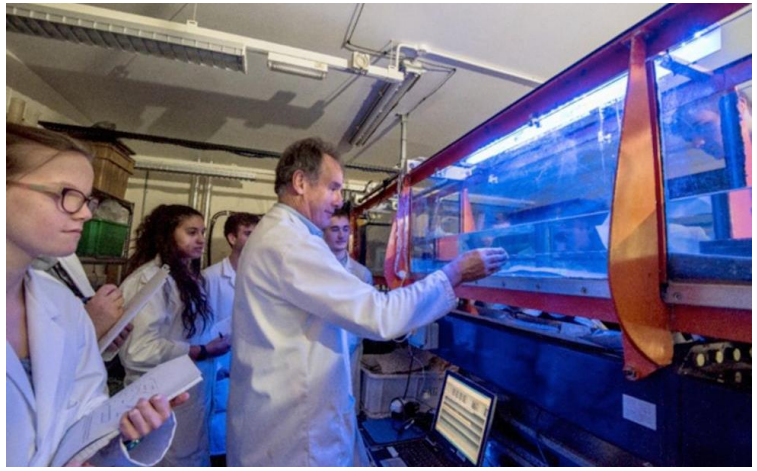
University of Southampton

“A leading European centre for Ocean & Earth Sciences” (The Times)

- Home to the UK’s research vessel fleet
- A community of scientists and students linked by interdisciplinary studies
- World class teaching and research facilities
- Ranked in top 5 in UK for Earth and Ocean Science research **(REF 2021)**


DISCOVERY

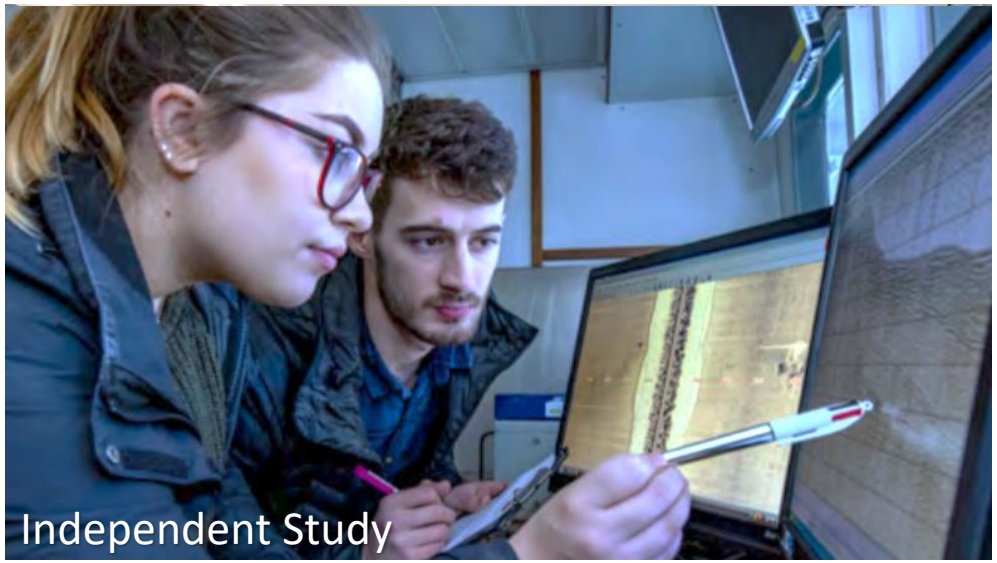
Facilities



Geoscience Degrees

University of Southampton


Taught modules: Lectures and Practical classes


Independent Study


Fieldwork


Independent Research Projects

Fieldwork

Each year:

+ Residential field courses of 1-2 weeks duration in the UK or abroad

+ Onshore and offshore training in state-of-the-art geophysical techniques

Fieldwork Highlights

Advanced mapping skills – Anglesey, Wales

Independent Mapping – UK and Europe

Advanced fieldskills, Spain

Local day field classes – Jurassic Coast

Applied Geophysical Techniques
S Wales

Seafloor surveying, RV Callista

Volcanic and Mantle Processes, Tenerife

Independent Research Projects

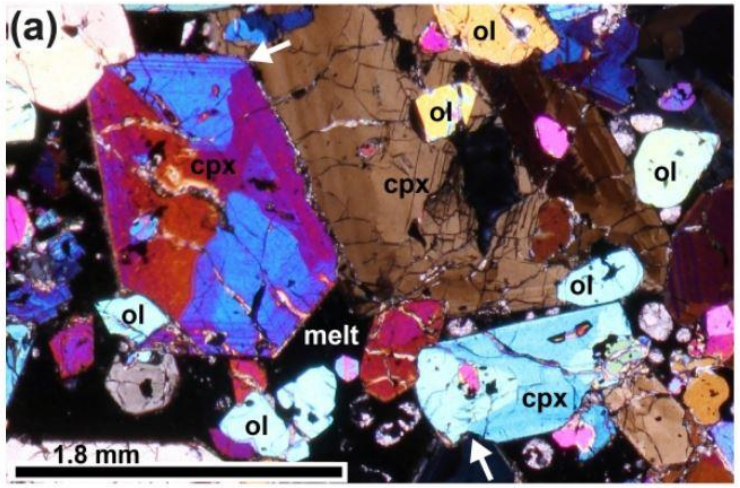
Research projects in years 3 and 4 offer the chance to work in our large range of facilities and laboratories alongside academic staff.

'A diverse and exciting range of project topics' – External examiners

Alumni Profile

Katie – Geology MSci

Working as a tour guide in Iceland.



Nodule under the microscope.

‘For my fourth-year independent research project I re-evaluated models of the magma chamber beneath Tenerife using cumulate mush nodules, which contributed to a scientific paper.’

‘I spent a summer working in Iceland as a geological tour guide’.

‘I’m now studying a PhD at the University of Durham funded by the European Research Council examining the structure and development of magma storage beneath volcanoes in order to better interpret pre-eruptive signals.’

‘I want to pursue a career in volcanic monitoring’

Careers in Geoscience

University of Southampton

There are a shortage of qualified Environmental Geoscientists and Geologists in the UK.

Recent Graduate Destinations

Job Titles include:, Environmental consultant, Geophysicist, Catastrophe modeller, Carbon Coach and Energy Analyst, Data Scientist, Environmental Consultant, Geotechnical Engineer, GIS Technician, Graduate Geologist, Junior Ocean Environmental Scientist, Laboratory Analyst, Logistics Graduate, Marine and Coastal Environmental Consultant, Recruitment Consultant, Remote Sensing Surveyor, Trainee Detective Constable, Data Consultant, Wells Engineer, Hydrographic geophysical Surveyor, Environmental and sustainability coordinator, Graduate Engineering Geologist, Geospatial Graduate, Oil Spill Consultant.

Recent Graduate Destinations

Job Titles include:, Environmental consultant, Geophysicist, Catastrophe modeller, Carbon Coach and Energy Analyst, Data Scientist, Environmental Consultant, Geotechnical Engineer, GIS Technician, Graduate Geologist, Junior Ocean Environmental Scientist, Laboratory Analyst, Logistics Graduate, Marine and Coastal Environmental Consultant, Recruitment Consultant, Remote Sensing Surveyor, Trainee Detective Constable, Data Consultant, Wells Engineer, Hydrographic geophysical Surveyor, Environmental and sustainability coordinator, Graduate Engineering Geologist, Geospatial Graduate, Oil Spill Consultant.

Work experience

Laura – Work experience as an Assistant Engineering Geologist with Soil Engineering Services

Emily – Work experience conducting seismic refraction surveys for the National Grid.

Anna – Work experience conducting ecological surveys for GS Ecology.

Charles and colleagues – Work experience in the university research labs.

Ocean and Earth Science Careers Day

WHERE WILL YOUR DEGREE TAKE YOU?

Dr Amber Annett
Employability Lead

2. From Mass Extinctions to Mass Spectrometers

Overview

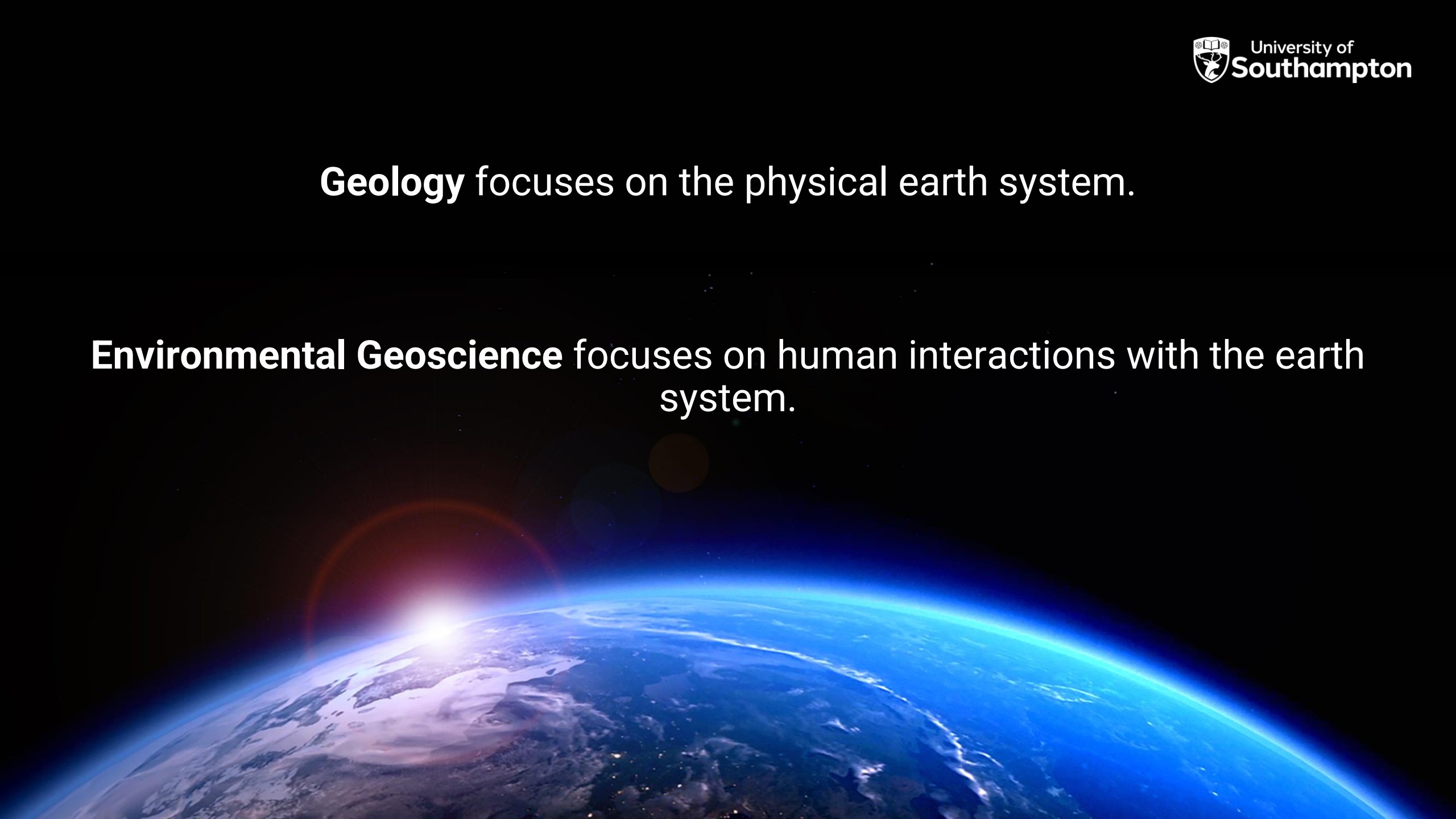
- Take a tour of some of the topics covered in our Geology and Environmental Geoscience Degrees.

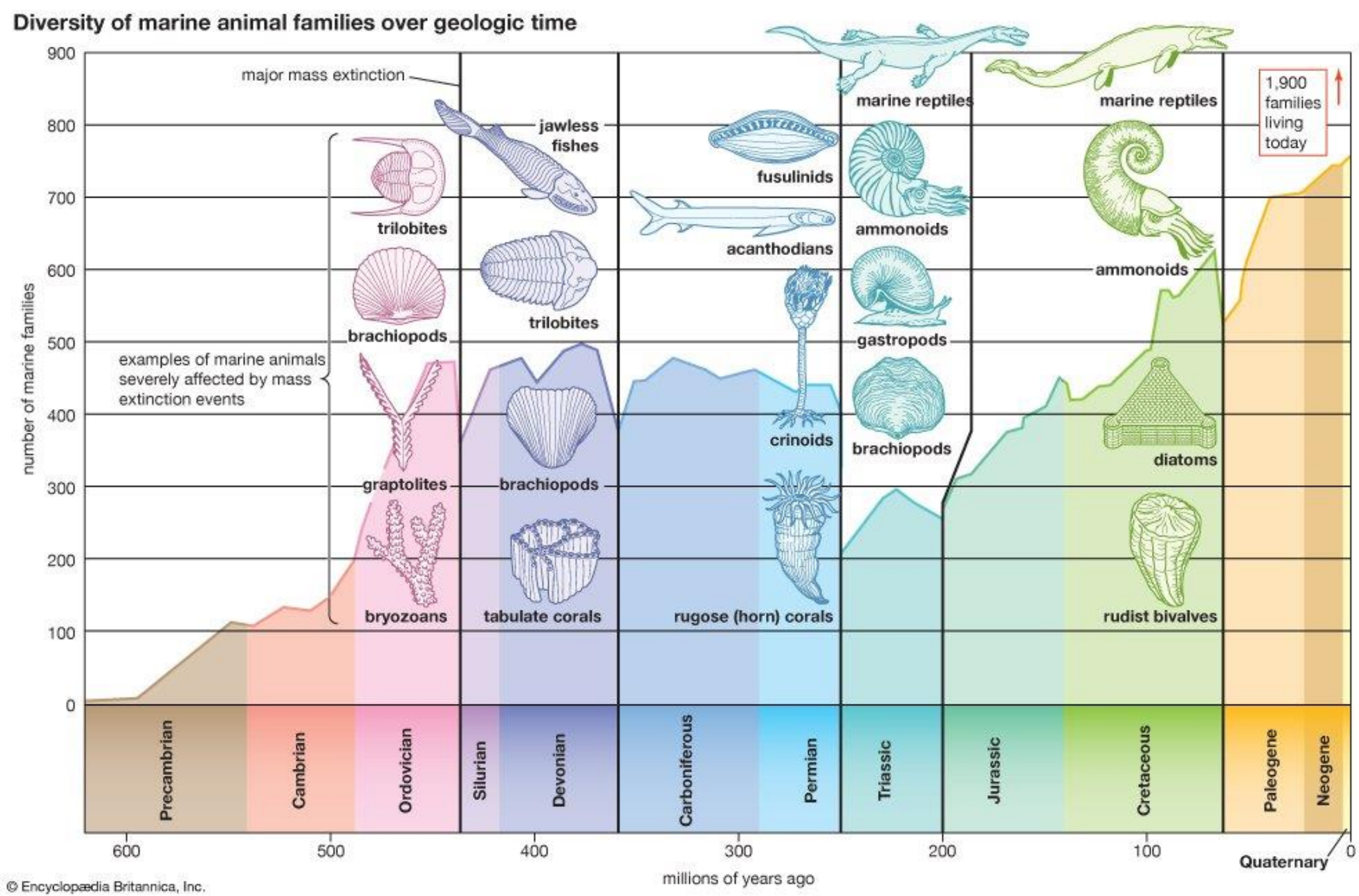
- Link this to the modules that you can study.

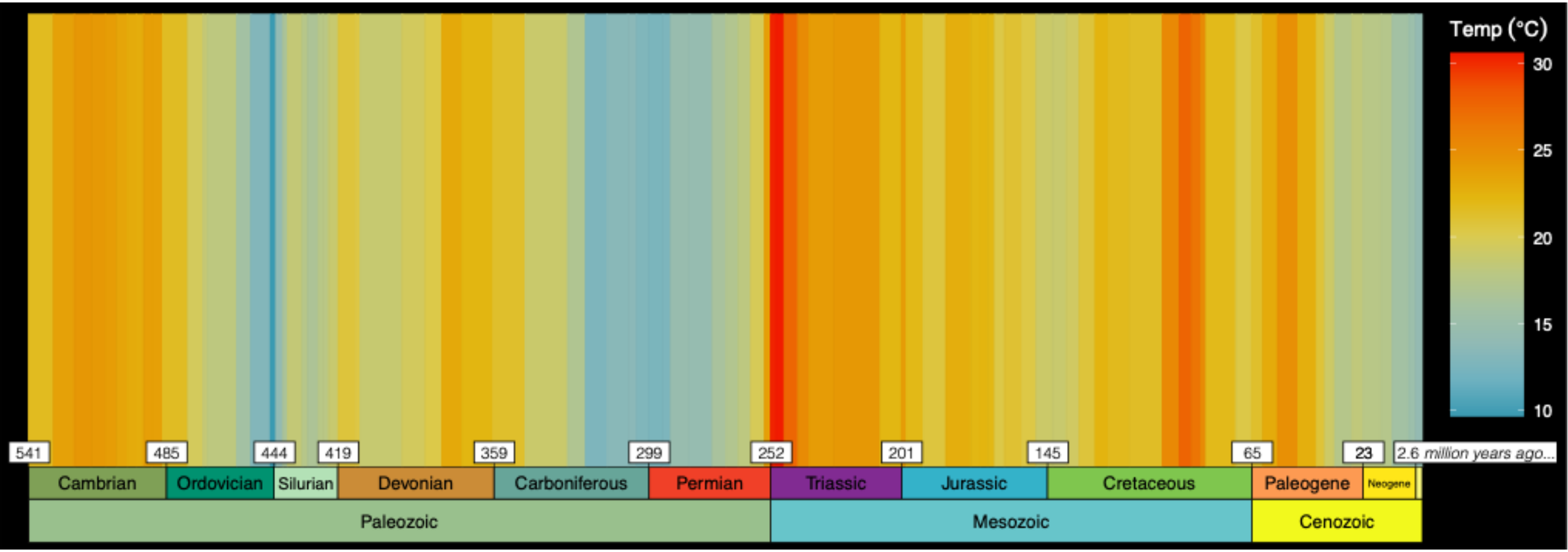
Geologists and Environmental Geoscientists study the whole earth system – the land, oceans, atmosphere, interior, and how these are all interconnected. We also study other planets in our solar system.

Geology focuses on the physical earth system.

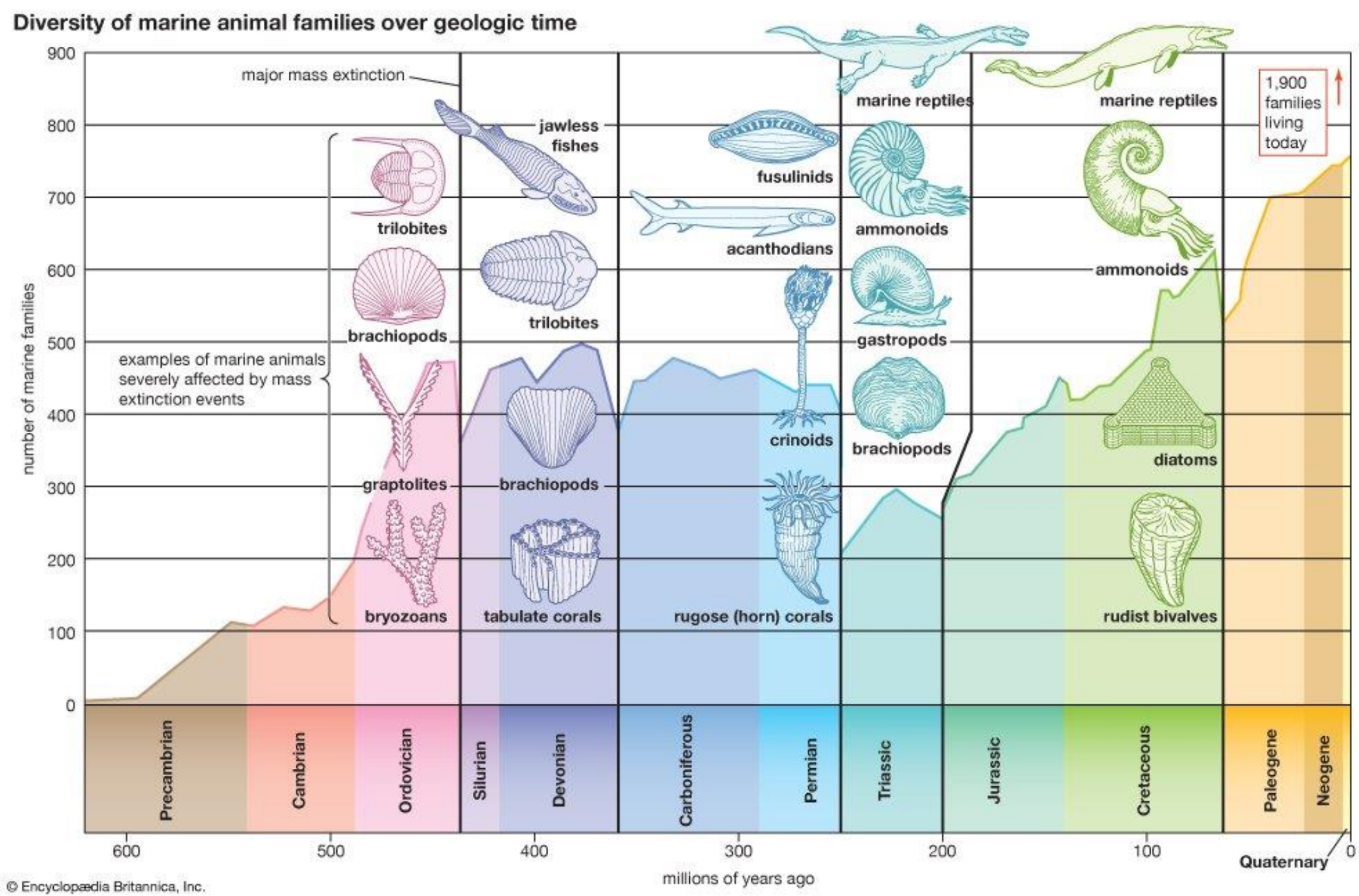
Environmental Geoscience focuses on human interactions with the earth system.

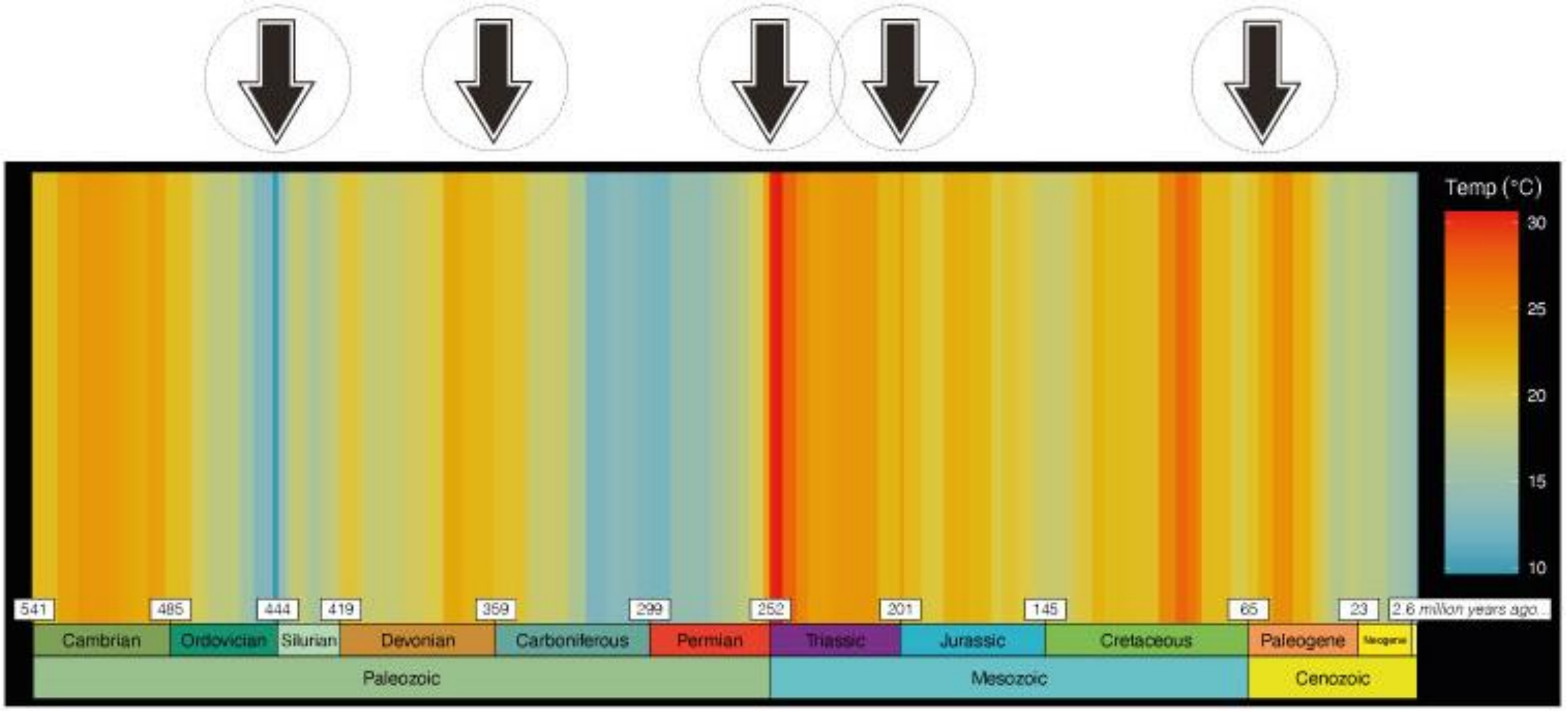




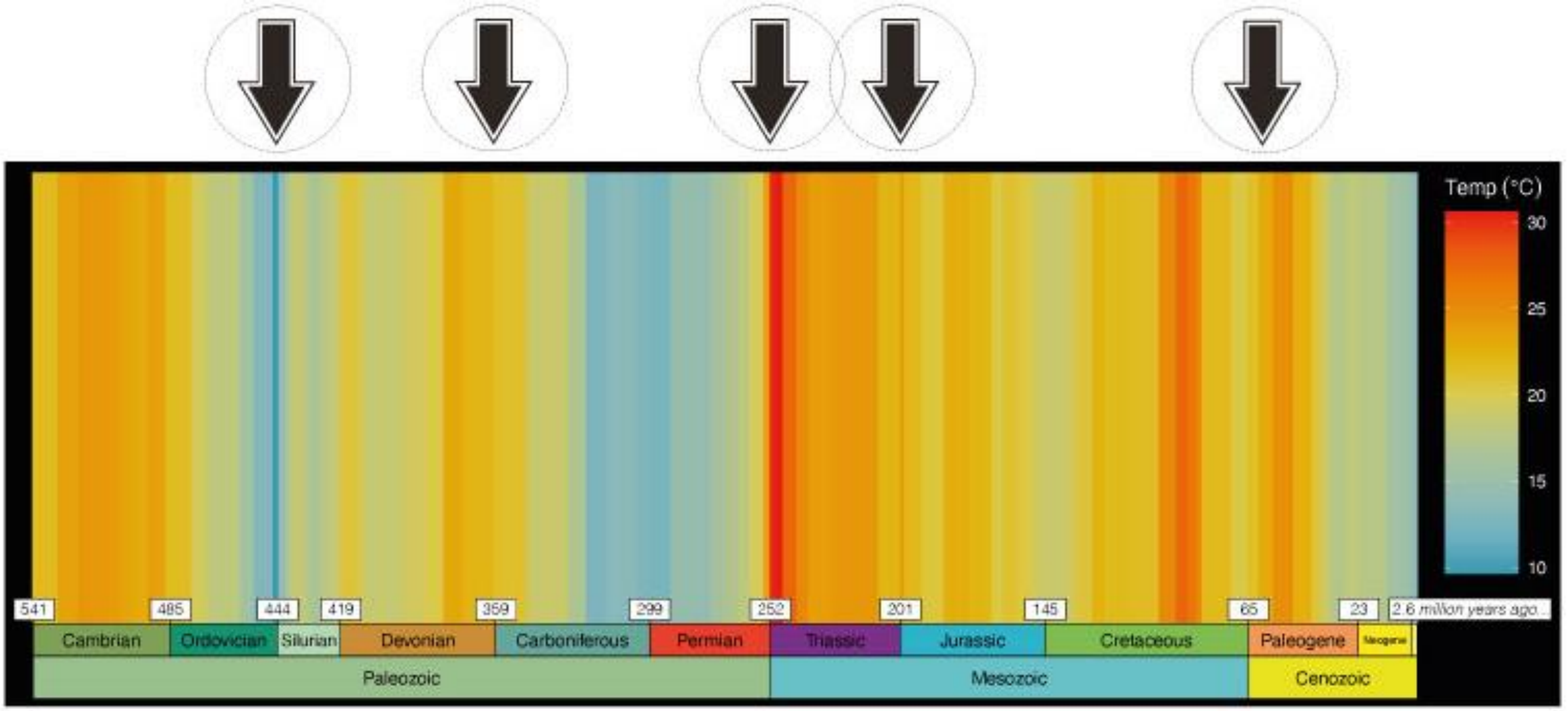


- Label mass extinctions
- Choose which fossilised organisms were most affected

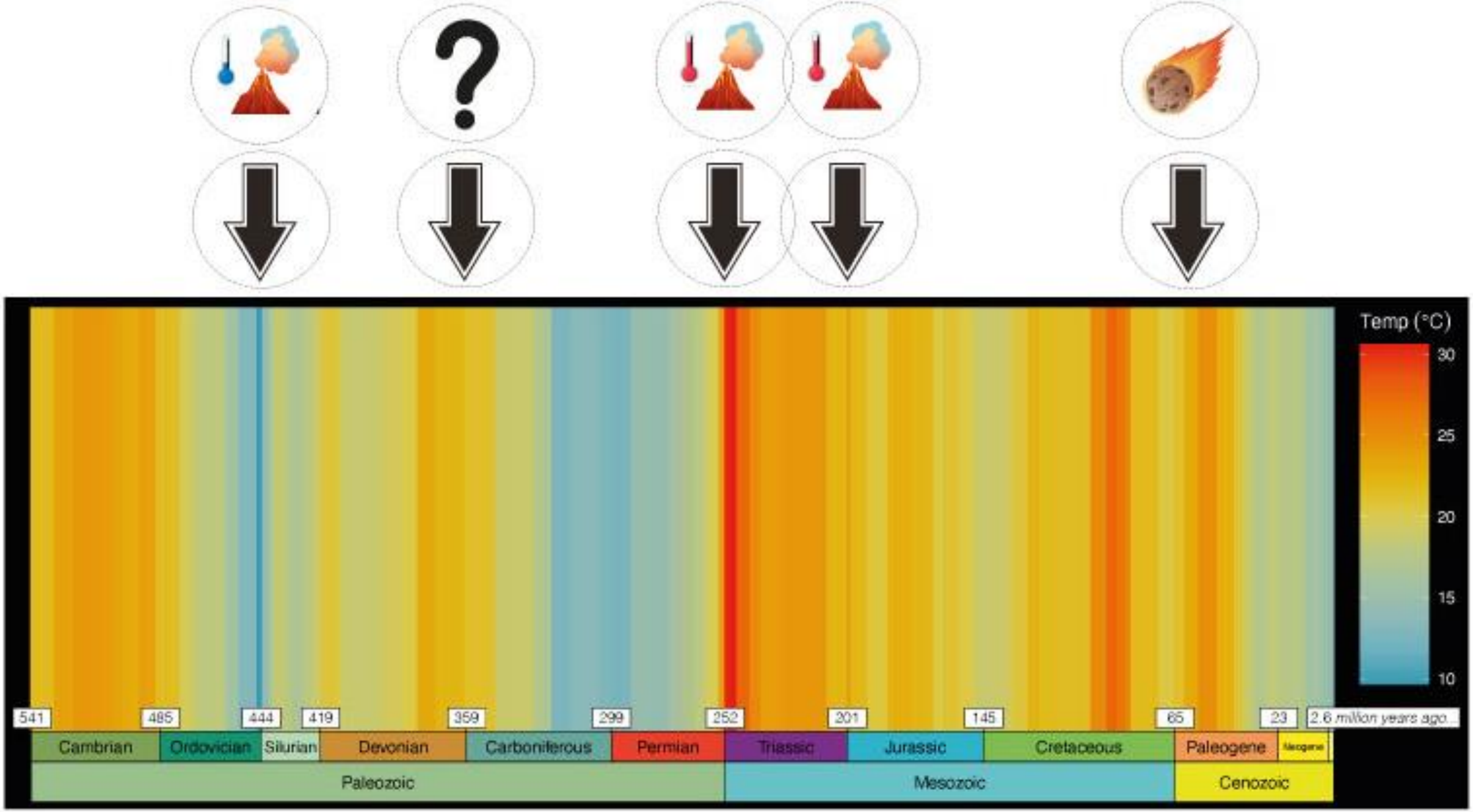




- What is happening to global temperatures when mass extinctions occur?



- What caused each mass extinction?


Temp (°C)
30
25
20
15
10
541
485
444
419
359
299
252
201
145
65
23
2.6 million years ago...
Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Paleozoic
Mesozoic
Cenozoic

Palaeontology and Earth History

Dr Rich Stockey

Dr Alison Cribb

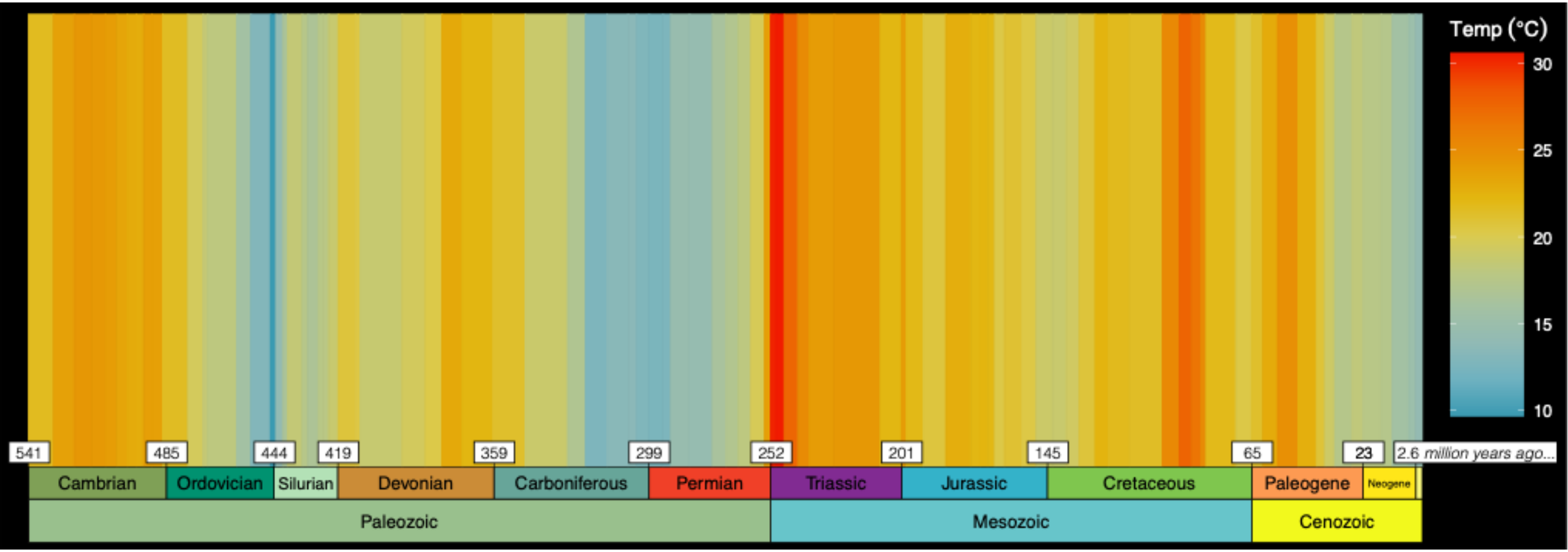
Dr Jeff Thompson

Prof. John Marshall

Selected modules:

+ Year 1 – Coevolution of life and Earth Geology
+ Year 2 – Palaeobiology Geology
+ Year 3 – The Evolving Earth Geology
+ Year 3 – Palaeoclimate change Geology + Env Geo

Local world class fossil sites on the Isle of Wight and Jurassic Coast.



- How do we know past temperatures?

How do we know about past temperatures?

University of Southampton

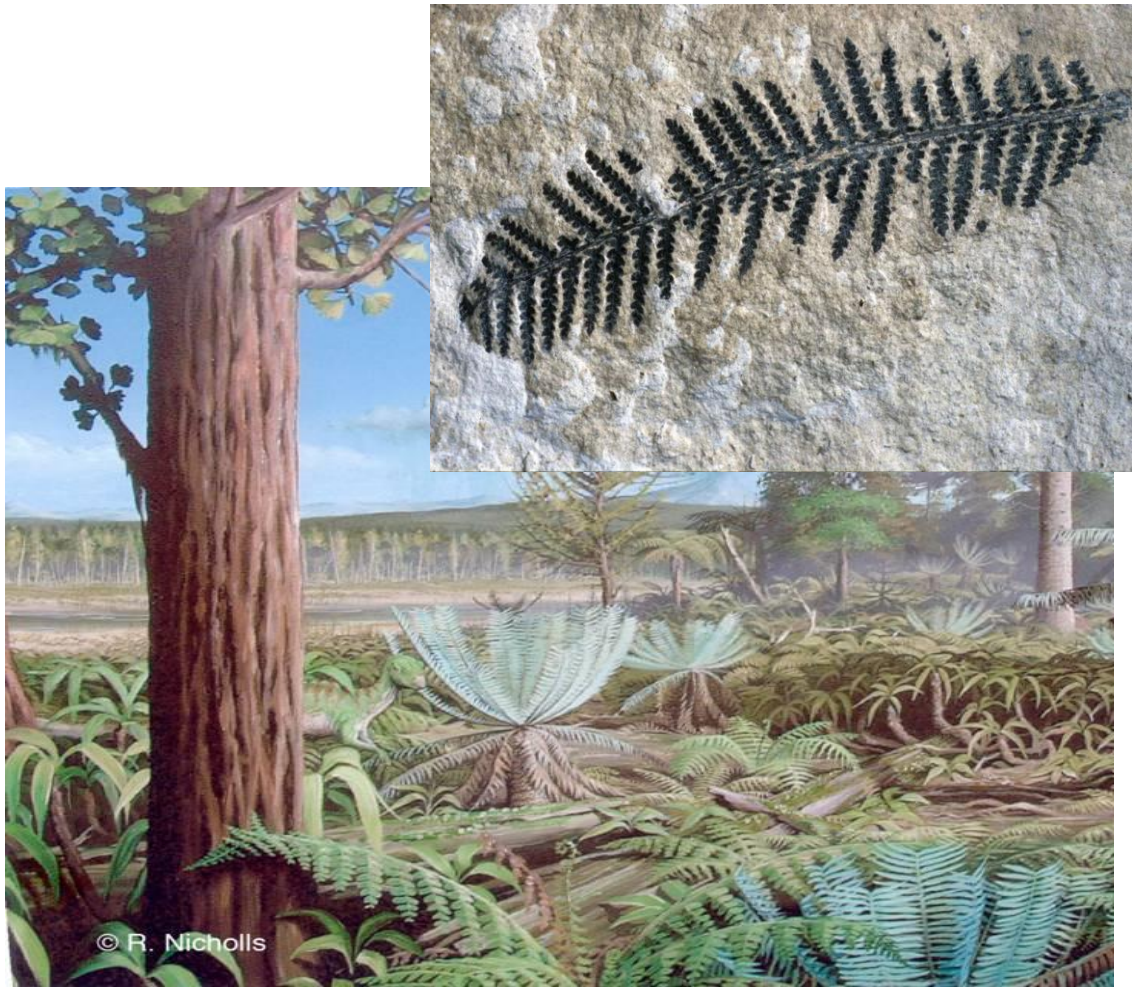
Engabreen Glacier, Norway, **1889**

Engabreen Glacier, Norway, **2010**

How do we know about past temperatures?

Credit: Alexandre Meneghini/Reuters

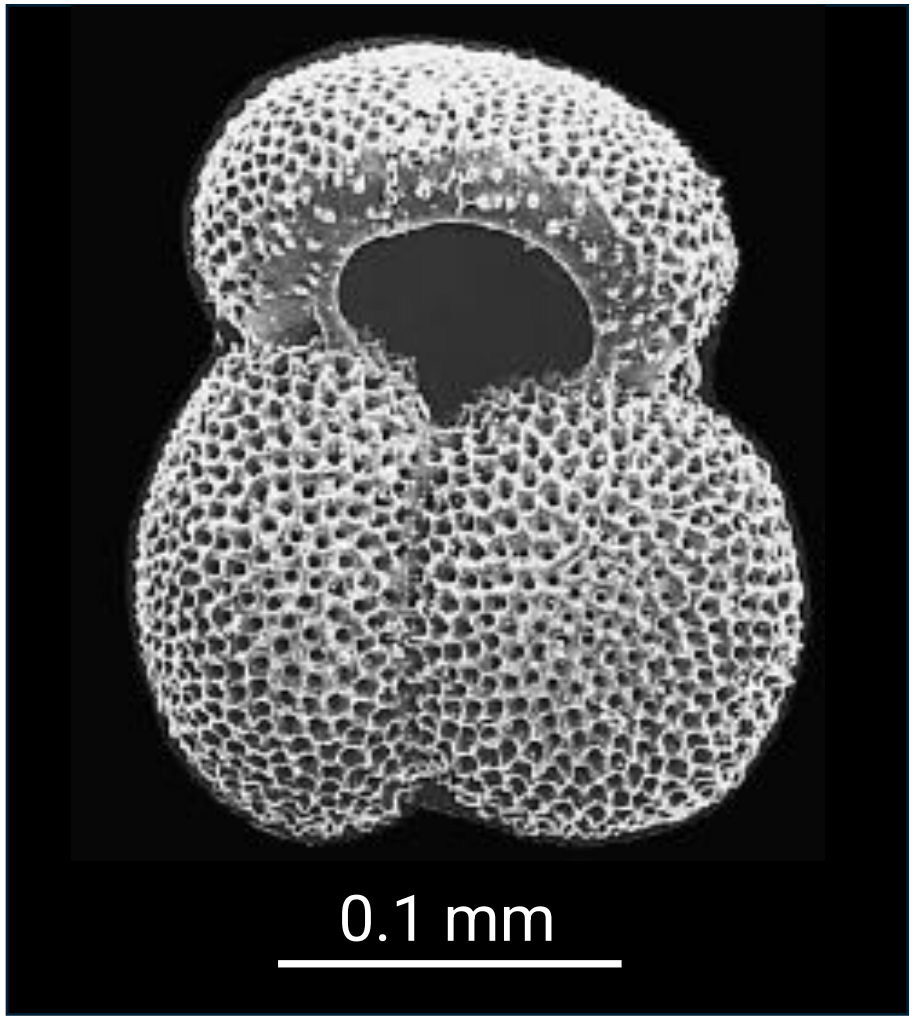
Antarctica today



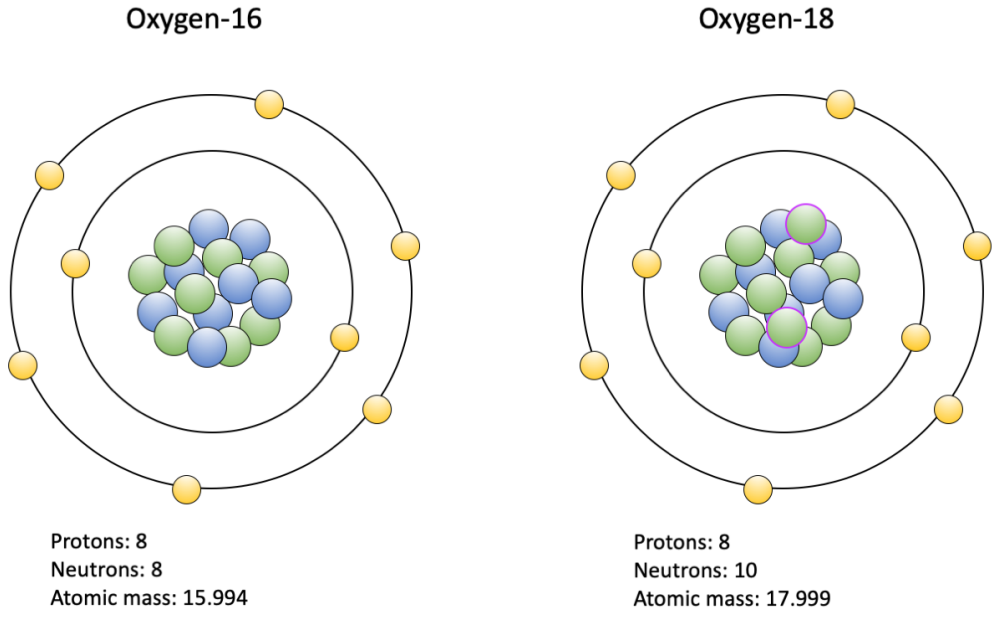
Credit: R. Nicholls

Antarctica 120 million years ago

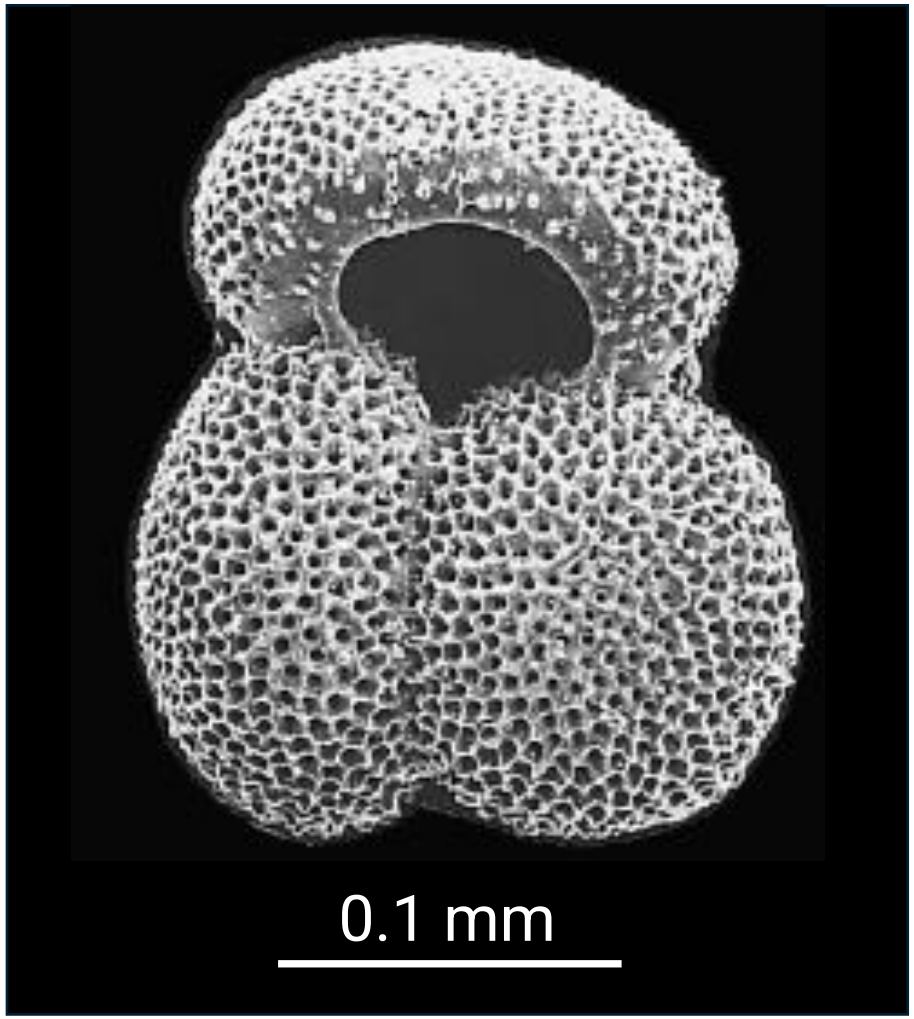
How do we know about past temperatures?



- Single celled organisms e.g. foraminifera that live in the world's oceans.
- Chemistry of their shells changes as the chemistry of the ocean water changes.

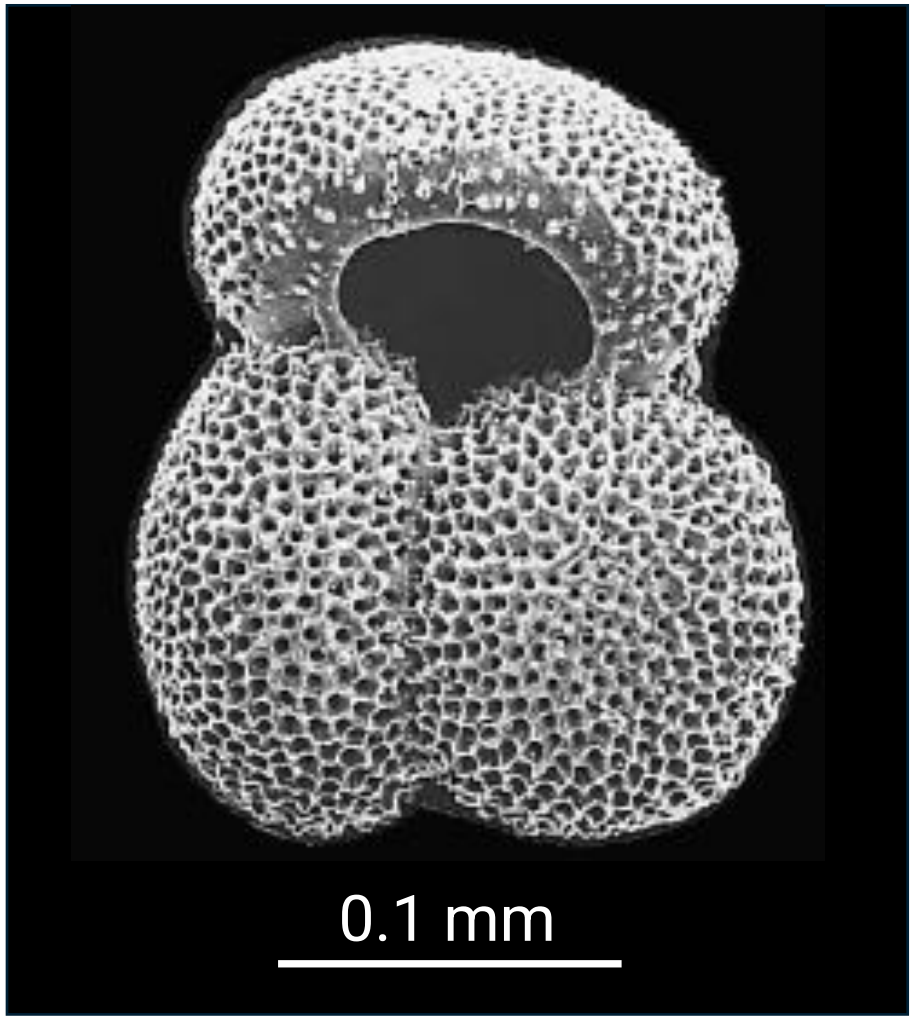


How do we know about past temperatures?

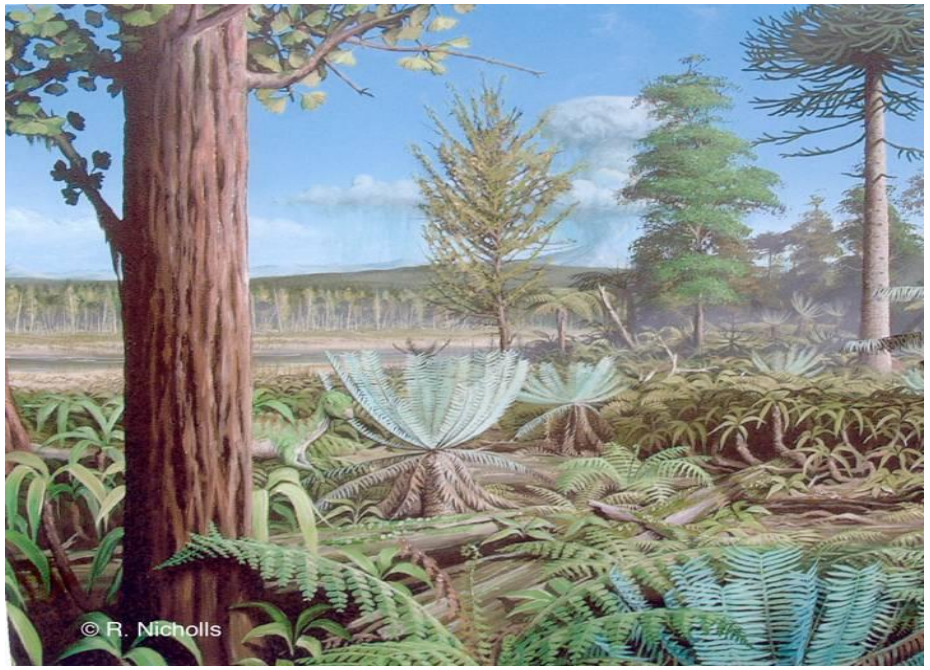


+ In our Mass Spectrometry labs we can measure the ratios of different isotopes.

How do we know about past temperatures?

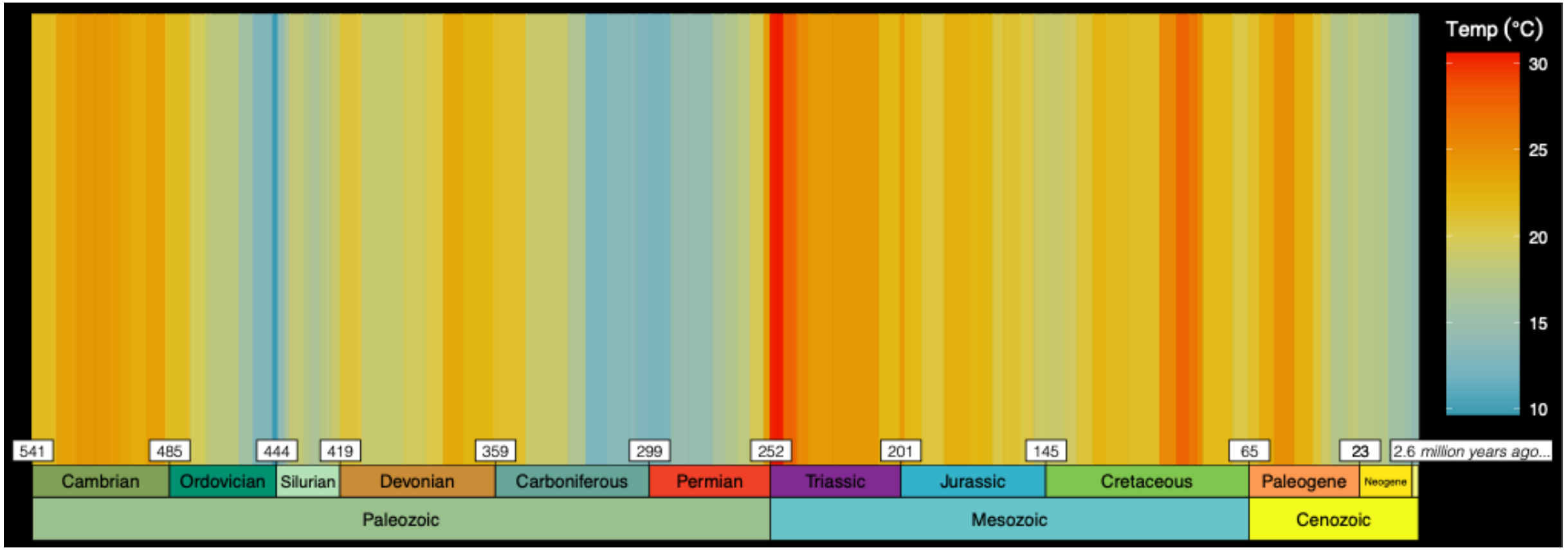


- In our Mass Spectrometry labs we can measure the ratios of different isotopes.
- Throughout Earth's history high CO_2 correlates with high global temperatures.



Antarctica 120 million years ago

How do we know about past temperatures?



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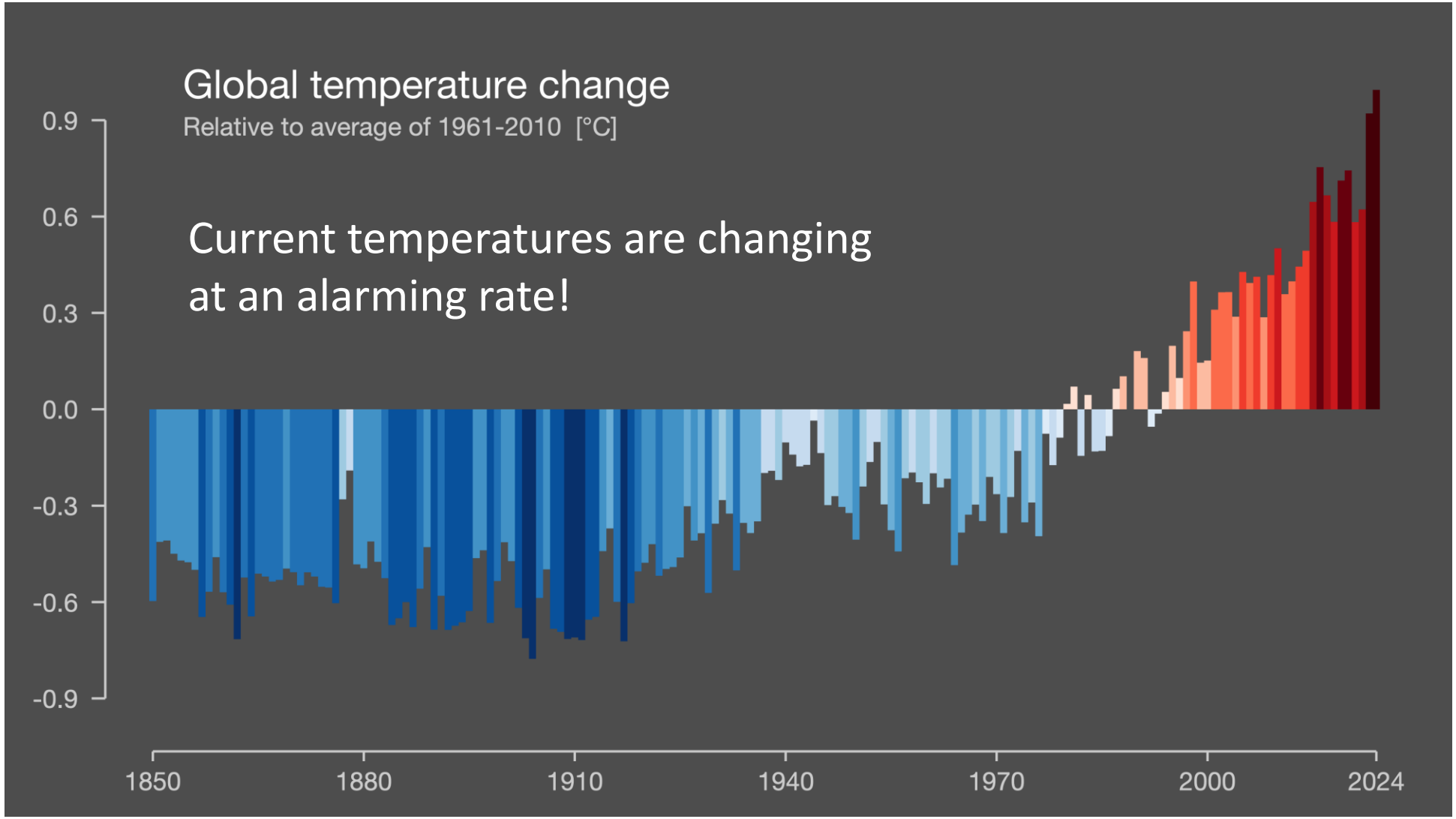

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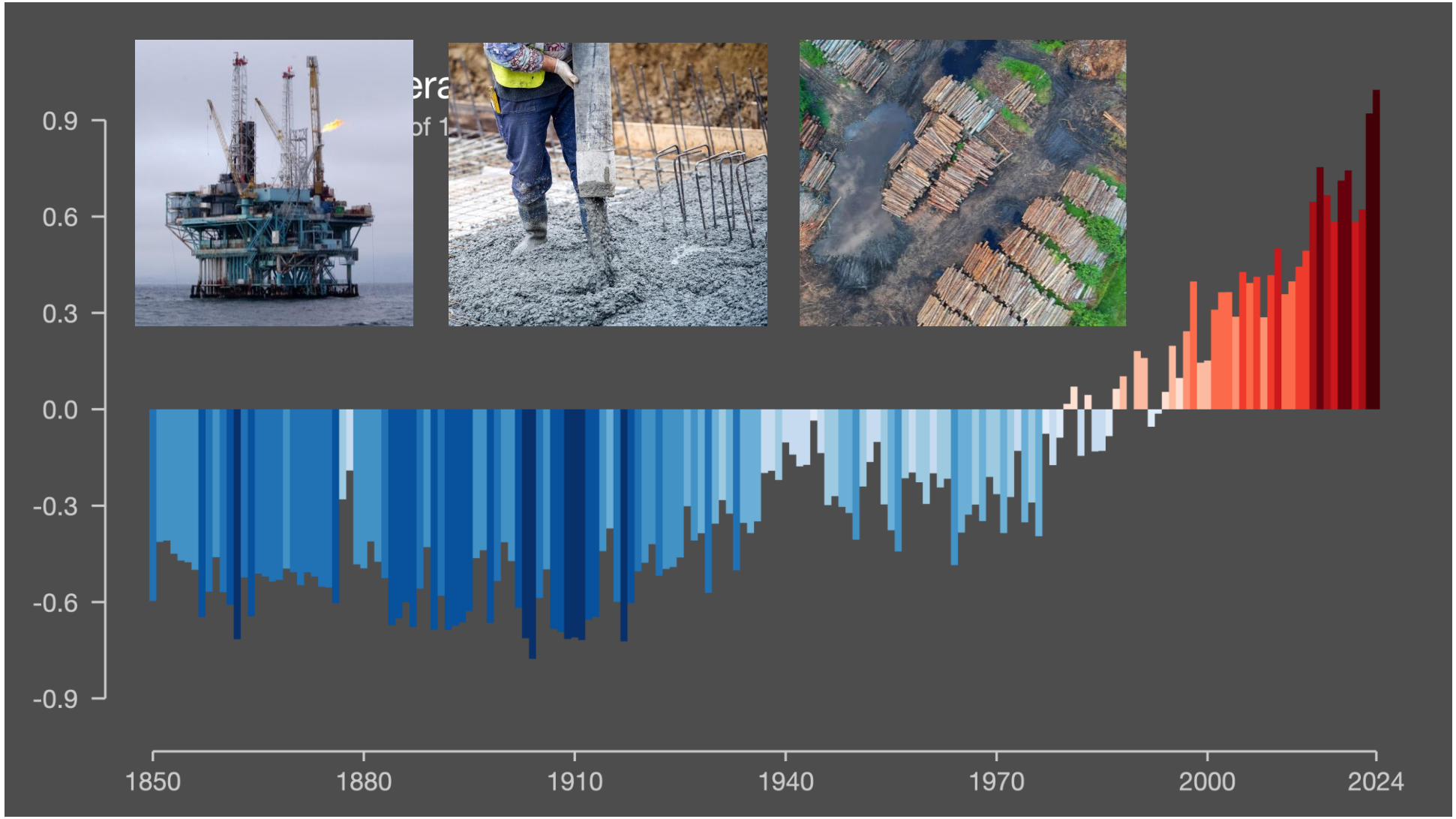
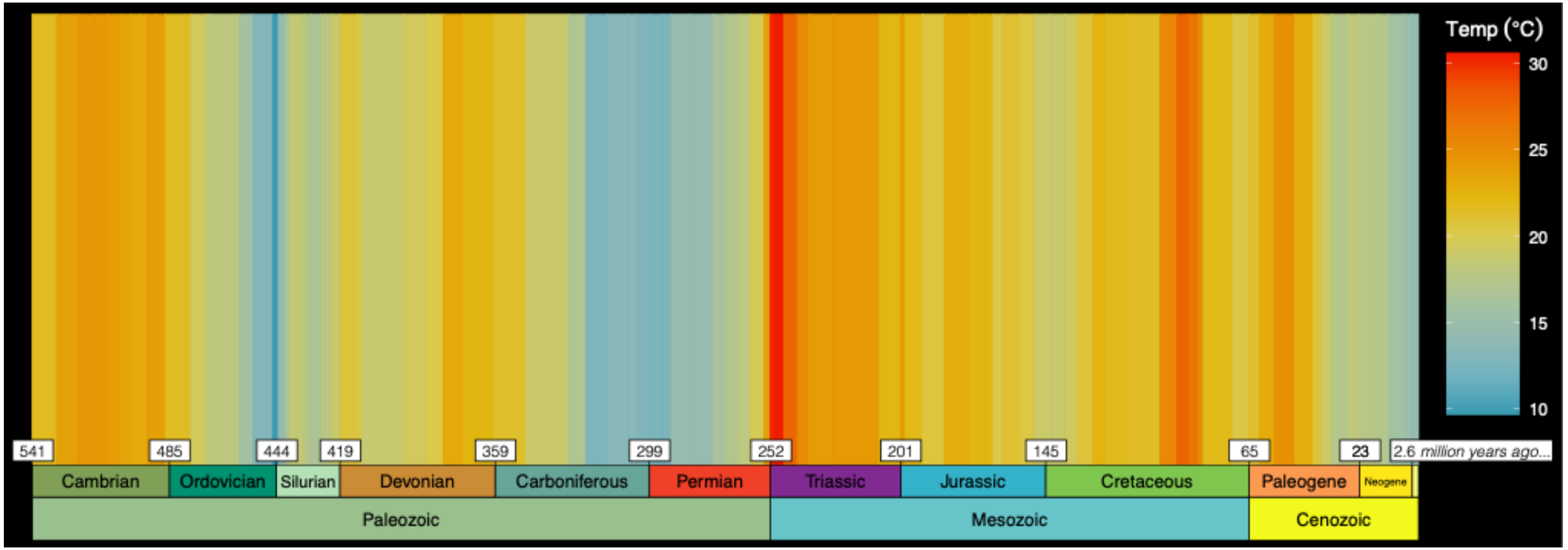


How do we know about past temperatures?



+ In earth history such rapid changes in temperature are only seen when we have mass extinctions.

Climate change

Prof. Paul Wilson

Dr Yu-Tuan Huang

Prof. Toby Tyrell

Prof. Emma Tompkins

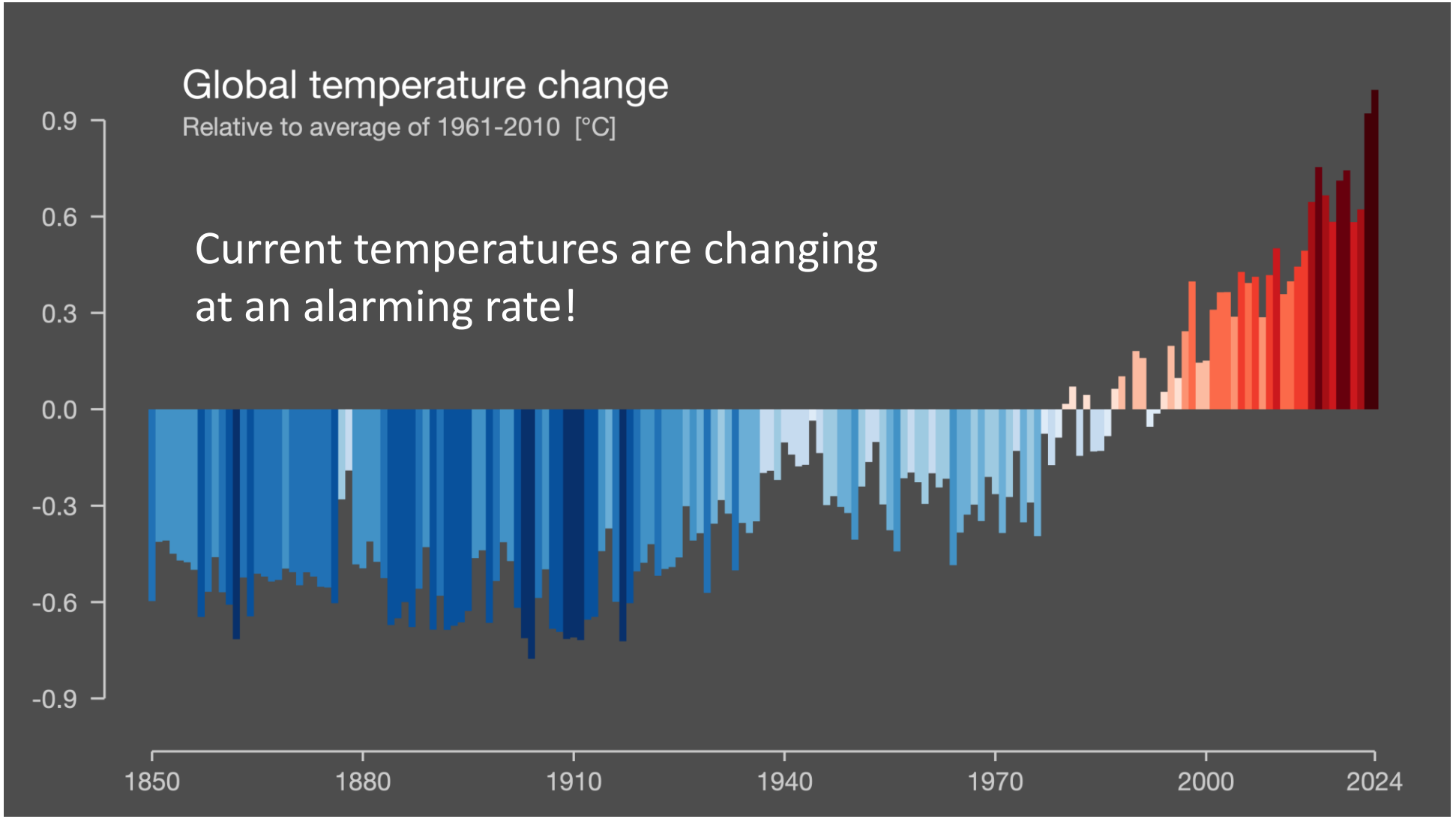
Dr Kevin Oliver

Prof Eelco Rohling

Selected Modules

+ Year 1 – Earth and Ocean System Geology + Env Geo
+ Year 1 – Introduction to Environmental Biogeochemistry Geology + Env Geo
+ Year 2 – Global Climate Change, Science, Impacts and Policy Env Geo
+ Year 2 – Adapting to Climate Change and Weather Hazards Env Geo
+ Year 2 – Geohazards Geology + Env Geo
+ Year 3 – Palaeoclimate change Geology + Env Geo
+ Year 4 – Climate and climate change Geology + Env Geo
+ Year 4 – Biogeochemical Cycles in the Earth System Geology + Env Geo

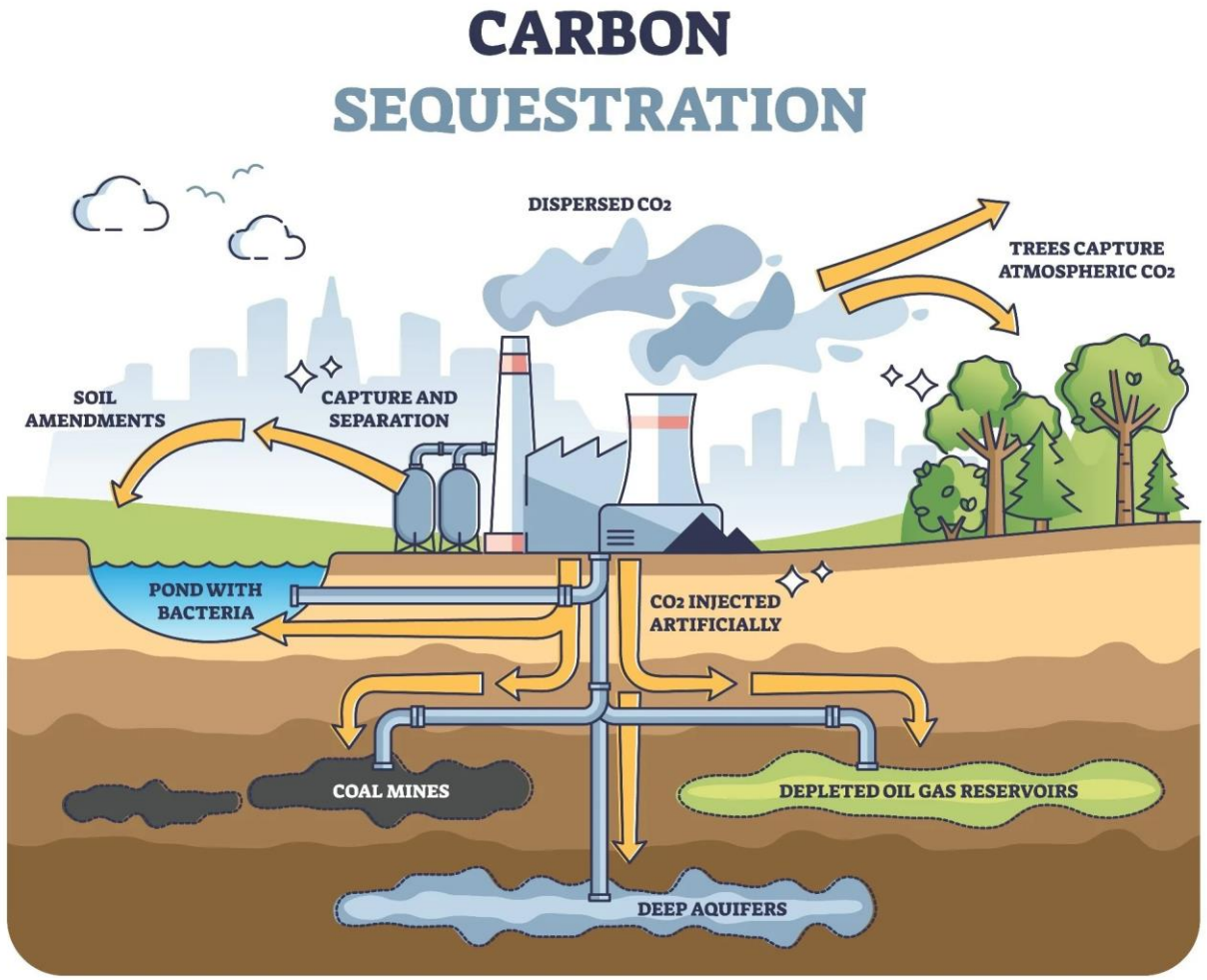
How do we deal with rising global temperatures?



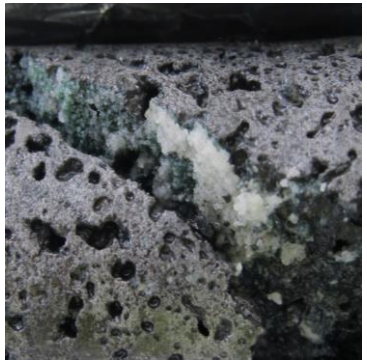
Sustainable Energy

- Geologists and Environmental Geoscientists are involved in the development of sustainable energy solutions.

Carbon Management



+ CO_2 =



Basalts/ peridotite

Carbonate minerals


RED FUNNEL

Carbon Management

Prof. Juerg Matter

Prof. Rachael James

Prof. Jon Bull

Prof. Phyllis Lam

Dr Hector Marin Moreno

Selected modules:

- Year 1 - Introduction to Environmental Biogeochemistry Geology + Env Geo
- Year 2 – Exploration Geophysics and Remote Sensing Geology + Env Geo
- Year 3 – Environmental and Engineering Geology Geology + Env Geo
- Year 4 – Carbon Storage in the Sub-Surface Environment Geology + Env Geo

Resources

- All of our renewable technologies and other tech are made using Earth’s finite resources.

What is in your Smart Phone?

- In 2023 we found an old smart phone washed up on a beach near Southampton and decided to find out what it was made of.

Prof. Gavin Foster

What is in your Smart Phone?

- The phone was analysed at the University of Southampton's Centre for Earth Research and Analysis (CERAS) at the National Oceanography Centre Southampton.

What is in your Smart Phone?

- The phone was analysed at the University of Southampton's Centre for Earth Research and Analysis (CERAS) here at the National Oceanography Centre Southampton.

Immersion in liquid nitrogen at -196°C to make it brittle and easy to break.

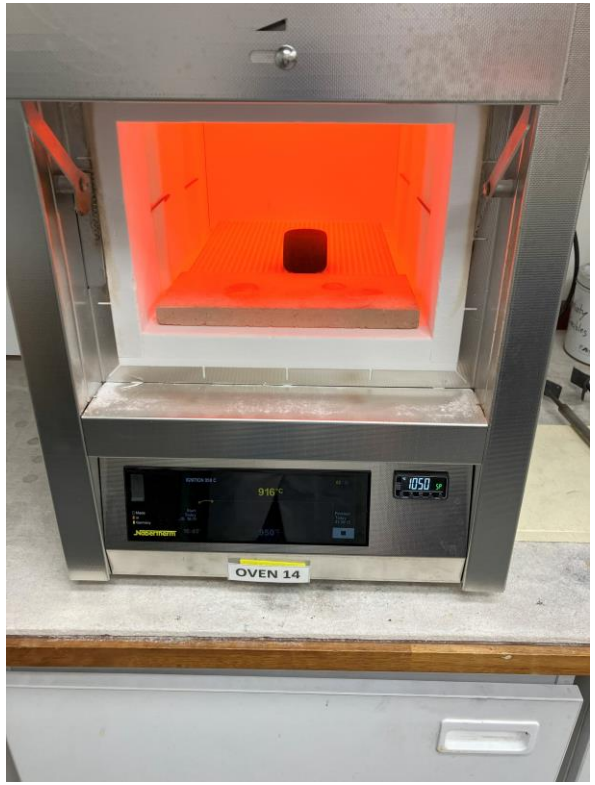
What is in your Smart Phone?

Smashing it to pieces!

What is in your Smart Phone?

To isolate the metal within the phone the plastic was removed by burning it at 450 ^{o}C. The plastic content was ~20.5 g

What is in your Smart Phone?



The metal was melted at 950 ^{o}C making it easy to dissolve in acid.

The dissolved metal part was then taken to the clean laboratory at CERAS where it could be safely diluted free from contamination from the environment.

University of Southampton

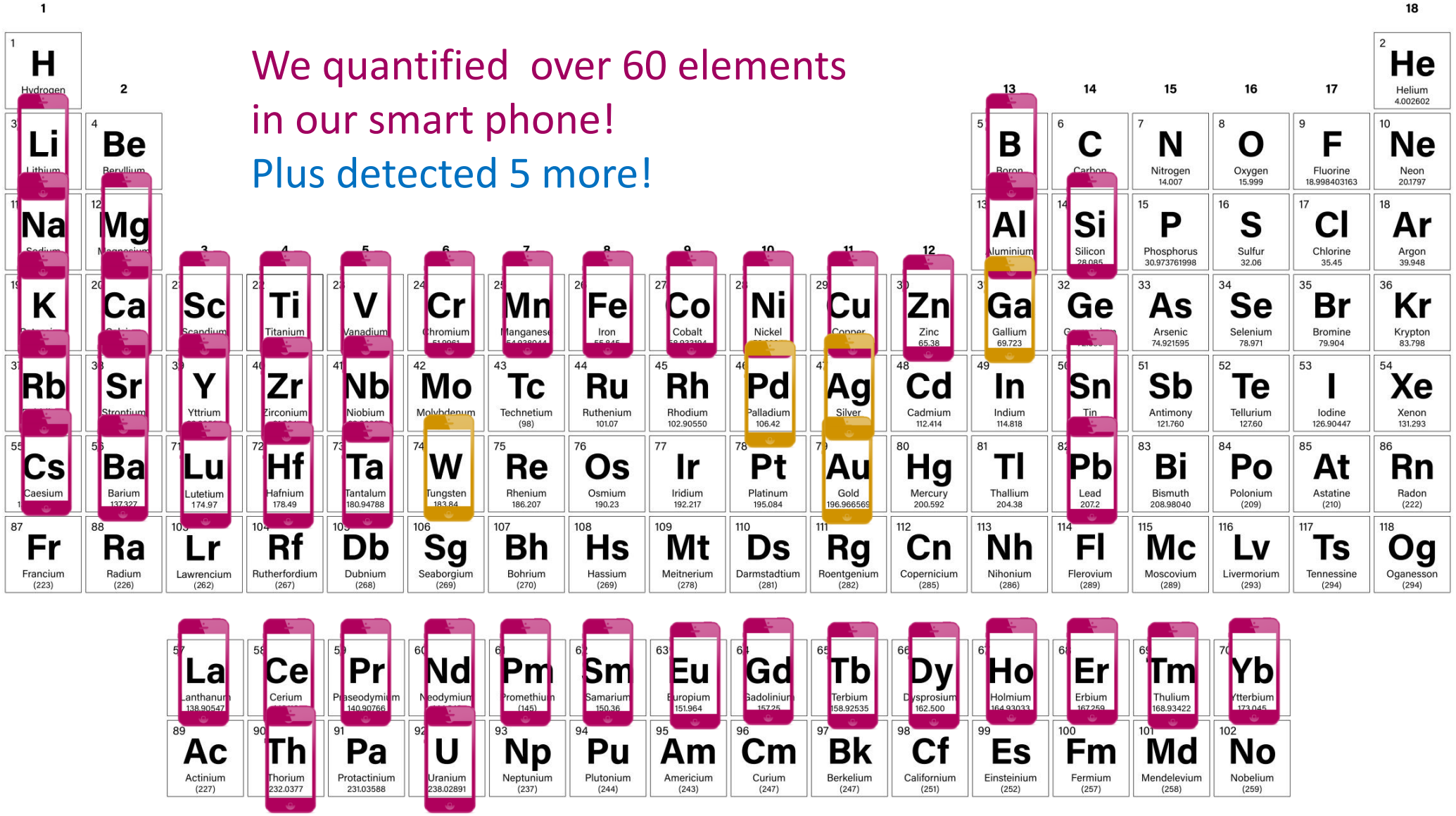
The concentrations of metals and other elements were then determined at CERAS using inductively coupled plasma mass spectrometry

University of Southampton

What is in your Smart Phone?

We quantified over 60 elements in our smart phone!

Plus detected 5 more!



Camera

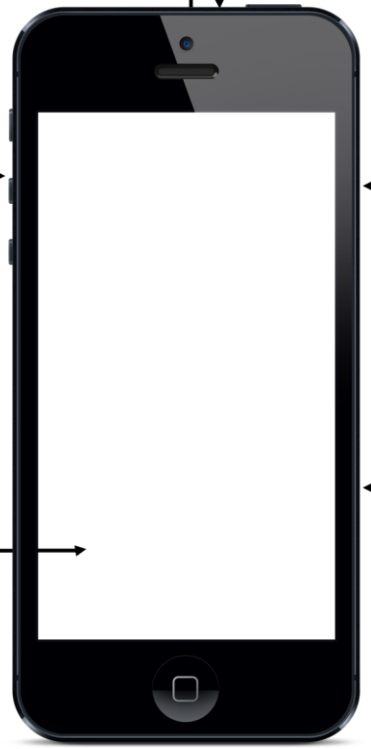
36% Plastics
25% Metals
39% Ceramics

Speaker

33% Plastics
47% Metals
20% Ceramics

Battery

5% Plastics
90% Metals
5% Ceramics



PCB

20% Plastics
43% Metals
37% Ceramics

Screen

28% Plastics
5% Metals
67% Ceramics

Casing

77% Plastics
5% Metals
18% Ceramics

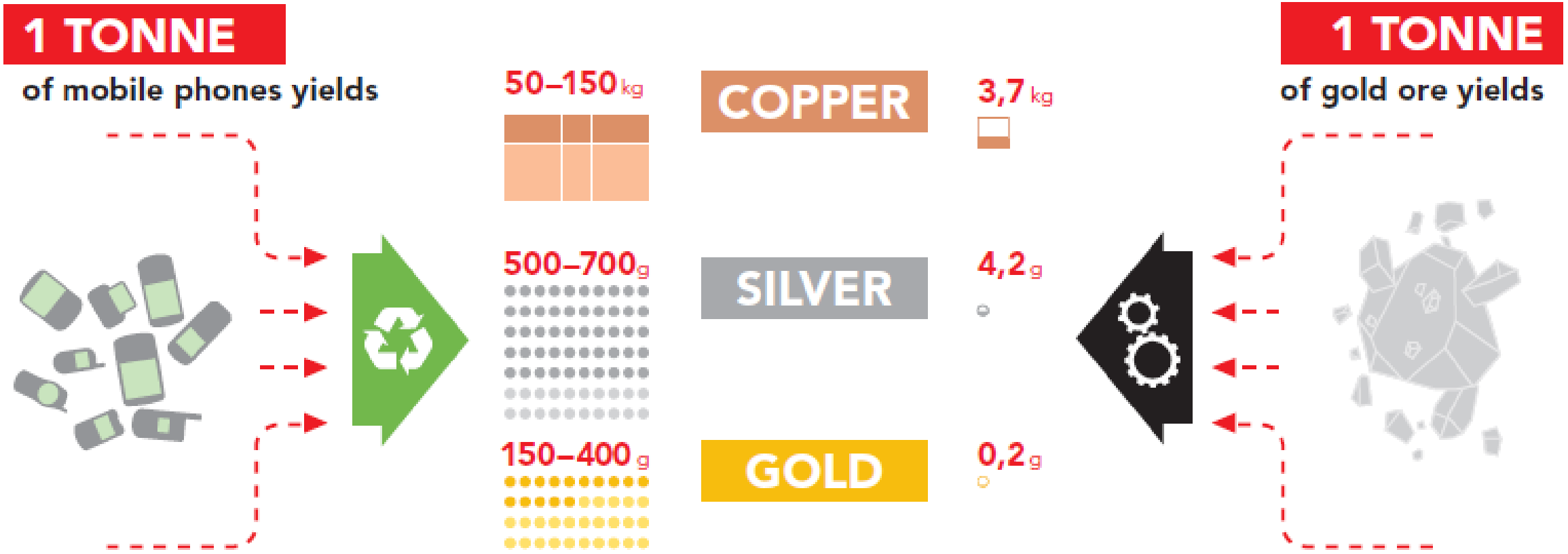
A typical smart phone is made from: **40% plastic, <u>35% metal</u> and 25% ceramics**

Minerals 5(4):815-836 DOI:10.3390/min5040527

Sustainable Resources

Students studying gold formation and the environmental impact of gold mining during a fieldclass to SE Spain.

Sustainable Resources



+ There is ~1000 times more gold in your phone than in the equivalent weight of gold ore!

Environmental pollution

GAU Radioanalytical Laboratories

- Commercial and research laboratory involved in environmental monitoring and nuclear decommissioning.
- Our undergraduates can take modules in environmental radiochemistry.
- Unusual opportunity for our students with great career prospects.

Energy, Resources and Pollution

Dr Gordon Inglis

Prof Andy Cundy

Prof. Damon Teagle

Prof. Ian Williams

Prof. Phil Warwick

Selected modules:

- Year 2 - Geochemistry Geology + Env Geo
- Year 3 – Air Quality and Environmental Pollution Env Geo
- Year 3 – Earth Resources for the Green Transition Geology + Env Geo
- Year 3 – Sustainable Resource Management Env Geo
- Year 3 – Environmental and Engineering Geology Geology + Env Geo
- Year 4 – Environmental Radioactivity and Radiochemistry Geology + Env Geo

Geohazards

University of Southampton

Geoscientists study a wide range of natural hazards in order to protect people.

Explosive eruptions

Viscous magma (sticky), lots of magmatic volatiles

Ballistics ejected – rocks and ash.

Shiveluch (Kamchatka, Russia)

Non-explosive (effusive) eruptions

Low-viscosity magma (flows easily), few trapped volatiles

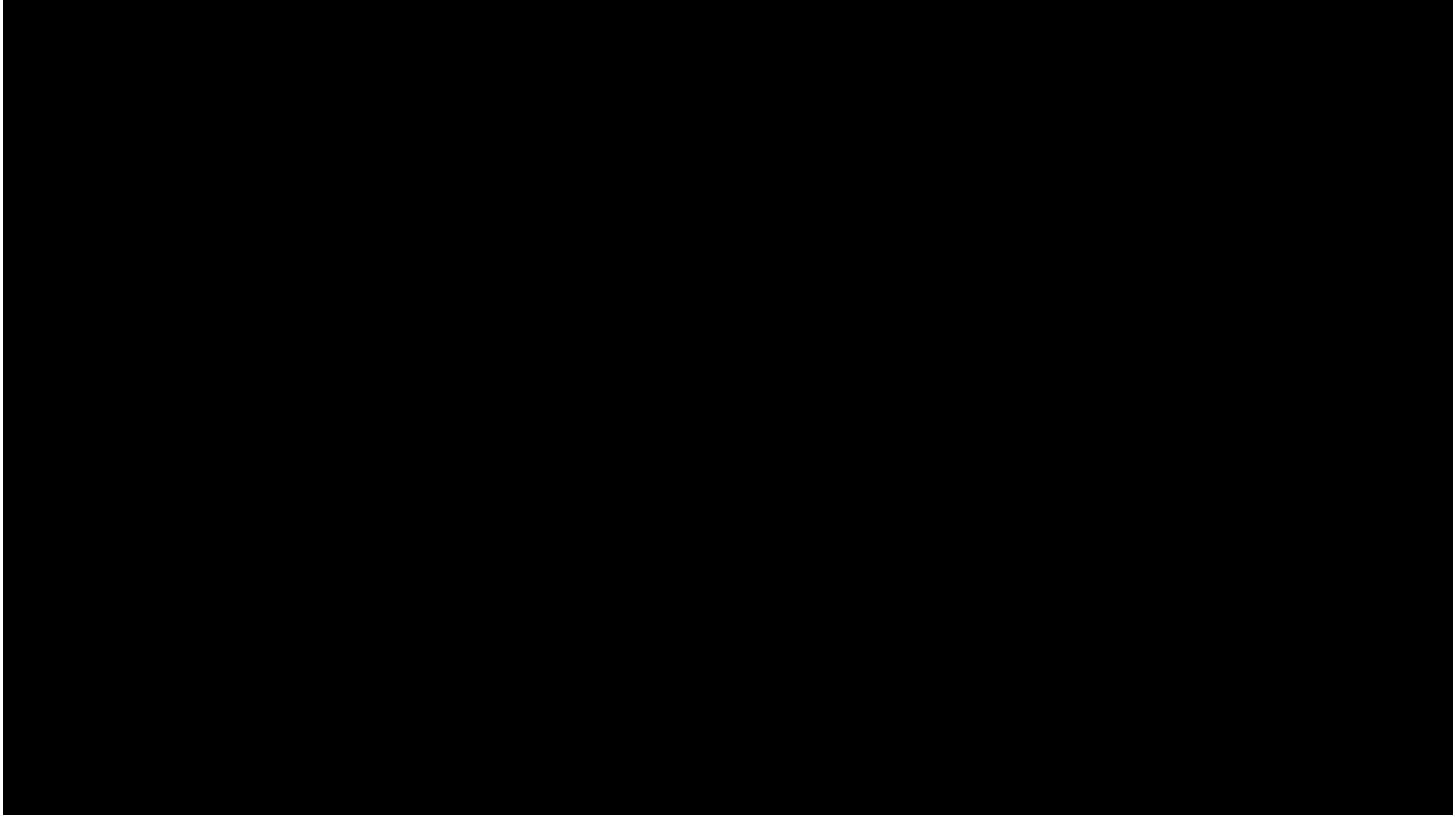
Lava solidifies to form crystalline rocks

Image credit: National Geographic

Fagradalsfjall, Iceland

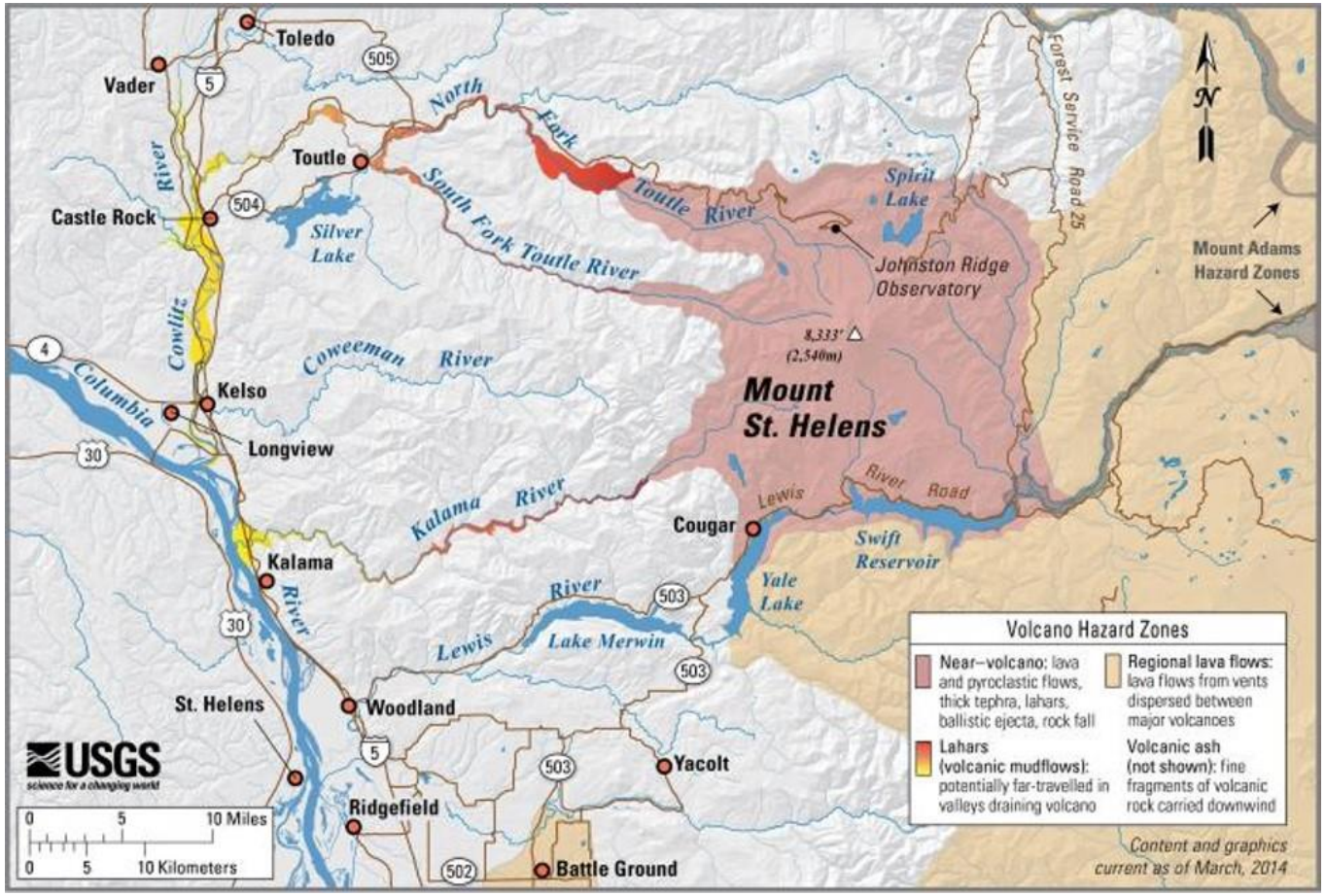
Geohazards

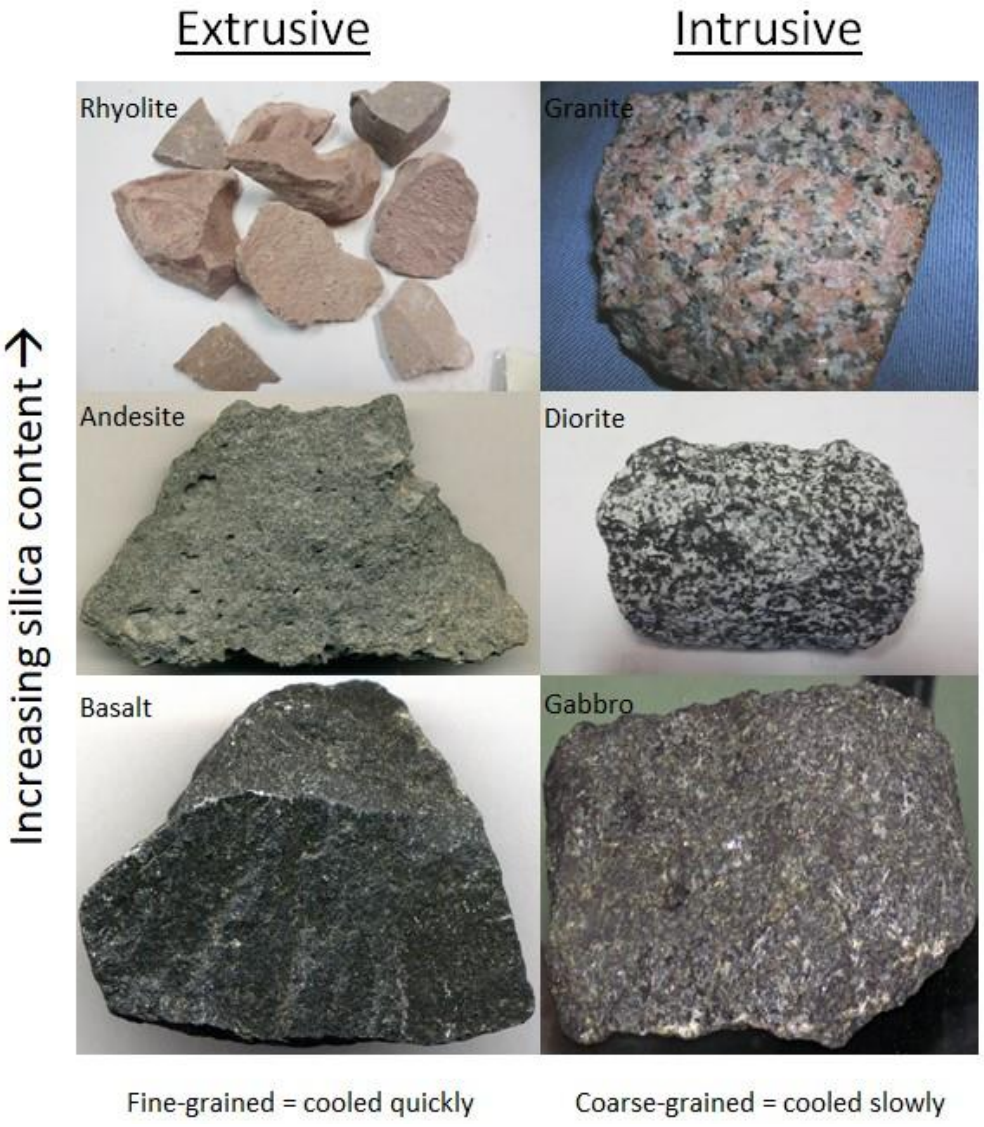
- A major control on the explosivity of an eruption is how viscous the magma is.
- A major control on viscosity is silica content.
- Silica-rich rocks are typically paler in colour.



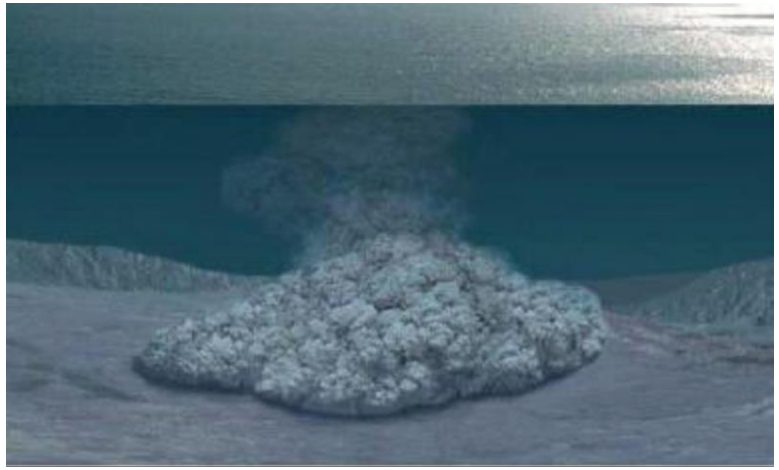
Geohazards

- Interpreting past eruptions from their deposits is an important part of assessing volcanic hazards.





Geohazards


- Pyroclastic flows on volcanoes, avalanches on the seafloor and snow avalanches in the mountains have similar physics that we can explore with laboratory experiments.

Geohazards

Prof. Tom Gernon

Dr Clara Waelkens

Prof. Lisa McNeill

Dr Masashi Watanabe

Prof. Tim Henstock

Dr Esther Sumner

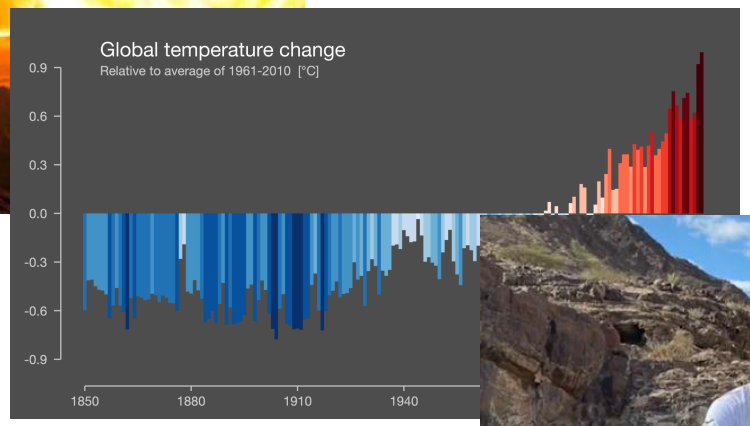
Dr Martin Mangler

Prof. Tim Minshull

Selected modules:

- Year 1 - Earth Materials Geology + Env Geo
- Year 1 – Dynamic Earth Geology + Env Geo
- Year 2 – Geohazards Geology + Env Geo
- Year 2 – Igneous and Metamorphic Petrology Geology
- Year 3 – Earthquake and Volcano Seismology Geology
- Year 3 - Volcanic and Mantle Processes Geology + Env Geo
- Geodynamics and Solid Earth Geophysics Geology

Mass Extinctions



Climate Change

Carbon Capture

Resources

Geohazards

GEOLOGY

GEOGRAPHY

BIOLOGY

GEOSCIENCE

CHEMISTRY

MATHS

PHYSICS

3. Any Questions?

Our Geoscience Degrees

Entry Requirements 2025

Geology/ Env. Geoscience BSc –
ABB including two sciences
BBB including two preferred sciences
BBB including two sciences and A-grade EPQ

Geology/ Env. Geoscience MSci –
AAB including two sciences
ABB including two preferred sciences
ABB including two sciences and A-grade EPQ

Sciences

- Biology
- Chemistry
- Physics
- Maths
- Geology

Preferred sciences

- Geography
- Environmental Studies
- Computer Science
- Electronics