A strategy for supporting geoscience education across Europe and beyond

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Associação Portuguesa de Professores de Biologia e Geologia Congress, Coimbra, 27/28 April 2019

European Geosciences Union

Meetings | Publications | Outreach | www.egu.eu

Strategy to support Geoscience Education

Geoscience educator groups

Five groups are recognised:

1. teachers of geoscience in schools and colleges with strong geoscience backgrounds;
2. teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds;
3. teachers of geoscience in Higher Education;
4. providers of informal geoscience education;
5. researchers into geoscience education.

Strategy to support Geoscience Education

1. Teachers of geoscience in schools and colleges with strong geoscience backgrounds – EGU:

a) runs GIFT teacher conferences which attract teachers from across the globe:

- the annual EGU General Assembly GIFT conference in Vienna;

Join us for the Vienna GIFT next year:

- Monday 4th – Wednesday 6th May, 2020
- Theme: 'Hydrology today and tomorrow'
- European teachers receive bursaries that cover their accommodation and travel costs
- Part of the EGU General Assembly – registration free of charge
- Several teachers from each Portugal each year
- Apply through the GIFT portion of the EGU website at: https://www.egu.eu/education/gift/

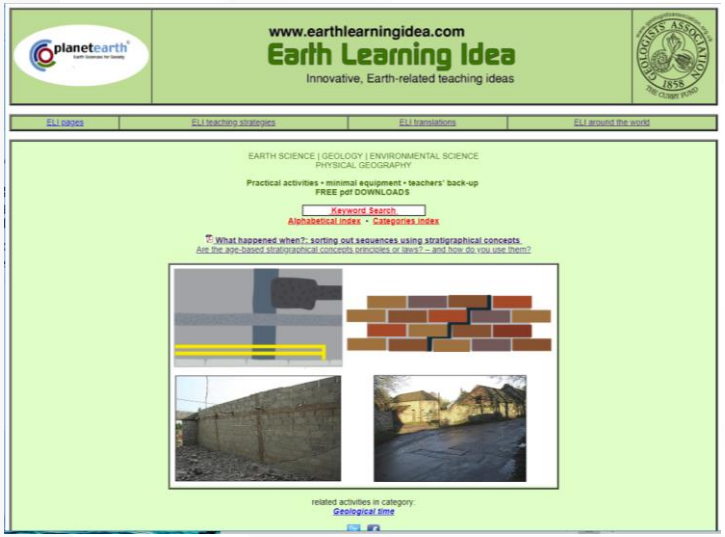
Successful GIFT teachers invited to join Corinth Rift Laboratory and Insegnaci Etna:

- Usually around October each year

Strategy to support Geoscience Education

2. Teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds – EGU:

- continues its publicity support for the Earthlearningidea website initiative with its increasing numbers of teaching activities and its global importance



Number of Earth Learning Idea ACTIVITY DOWNLOADS, December 2008 - March 2019
4,134,108 *Data provided by Webalizer*

Strategy to support Geoscience Education

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ELI Translations

Castellano
Proyecto Internacional de Investigación

Català
Projecte Internacional de Recerca

Norsk

Italiano

Deutsch

Português
(países de língua portuguesa)

Polski

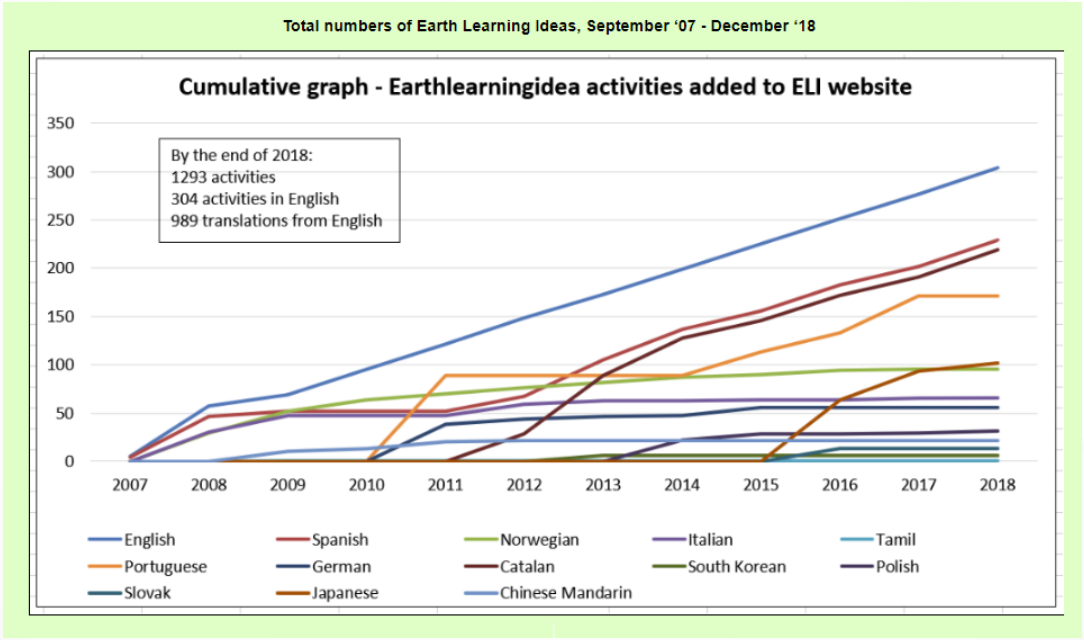
Slovensky

Chinese Mandarin

Japanese

South Korean

Tamil



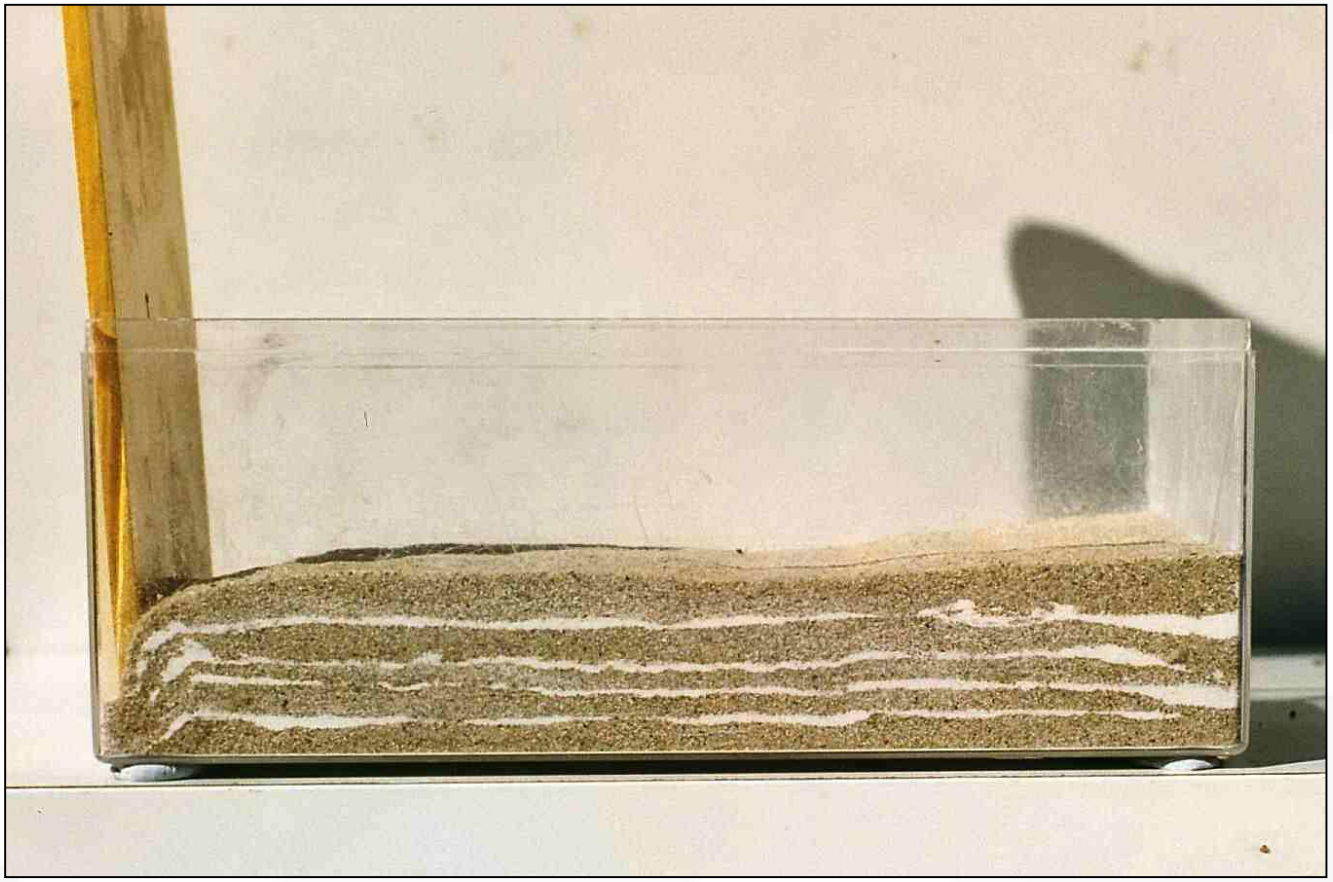
By the end of 2018:
1293 activities
304 activities in English
989 translations from English

All voluntary – so needing no funding

Strategy to support Geoscience Education - some Earthlearningideas

Strategy to support Geoscience Education - some Earthlearningideas

The Himalayas in 30 seconds



Fold mountains in a chocolate box © Peter Kennett

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The Himalayas in 30 seconds

Note: This activity forms part of the ‘Dynamic Rock Cycle’ ESEU workshop

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The Himalayas in 30 seconds

Strategy to support Geoscience Education - some Earthlearningideas

A volcano in the lab

Click to set the volcano off

Strategy to support Geoscience Education - some Earthlearningideas

Best classroom eruption

Bottle, straw, soap

Coke and Mentoes

Champagne

- The ‘eruption’ which best demonstrates how volcanoes actually erupt is the ‘popping’ champagne cork – since eruption is by gas coming out of solution violently when pressure is released

Strategy to support Geoscience Education

2. Teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds – EGU:

- the '*Exploring Geoscience*' textbook initiative and the development of its regionalised versions, through publicity.

Strategy to support Geoscience Education

2. Teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds – EGU:

- continues to support the '*Exploring Geoscience*' textbook initiative and the development of its regionalised versions, through publicity.
  - for 16-year olds and their teachers
  - addressing the international geoscience syllabus (published on the IGEO website)
  - using accessible English, minimum jargon and a wide range of photographs, diagrams and examples
  - this 'international version' written to be taken by 'regionalisers' and adapted for their country, region or city – often to provide an authoritative geoscience textbook for the first time

Strategy to support Geoscience Education

2. Teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds – EGU:

- has developed a Geoscience Education Field Officer programme (pilot programme for field officers in four countries),
- trained the Field Officers in offering interactive workshops to teachers and other educators through methods that research has proved to be effective;
- workshops to be offered at teacher conferences and other venues.

- The Field Officers are:

Guillaume Coupechoux - France

Giulia Realdon - Italy

Gina Pereira Correia - Portugal

Xavier Juan - Spain

- Joined by Field Officers from India and Morocco

Strategy to support Geoscience Education

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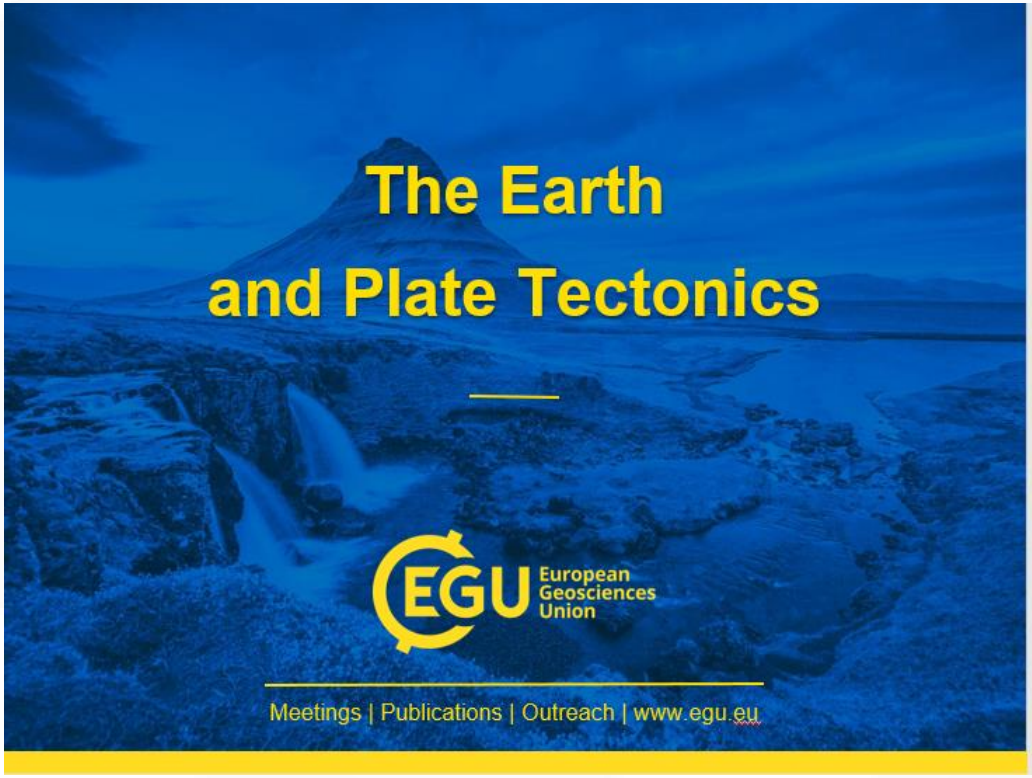
Gina Pereira Correia – EGU Geoscience Education Field Officer for Portugal:

- can come to your teacher conference in Portugal
- can offer a series of hands-on workshops
- the workshops:
  - focus on the curriculum
  - teach thinking skills, knowledge and understanding
  - use simple apparatus and materials
  - have trained 40,000 teachers in the UK
  - are highly evaluated
  - change classroom teaching

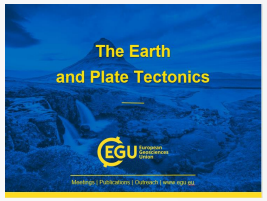
Strategy to support Geoscience Education

2. Teachers of science or geography with some geoscience in their teaching, who have weak geoscience backgrounds – EGU:

- For example:

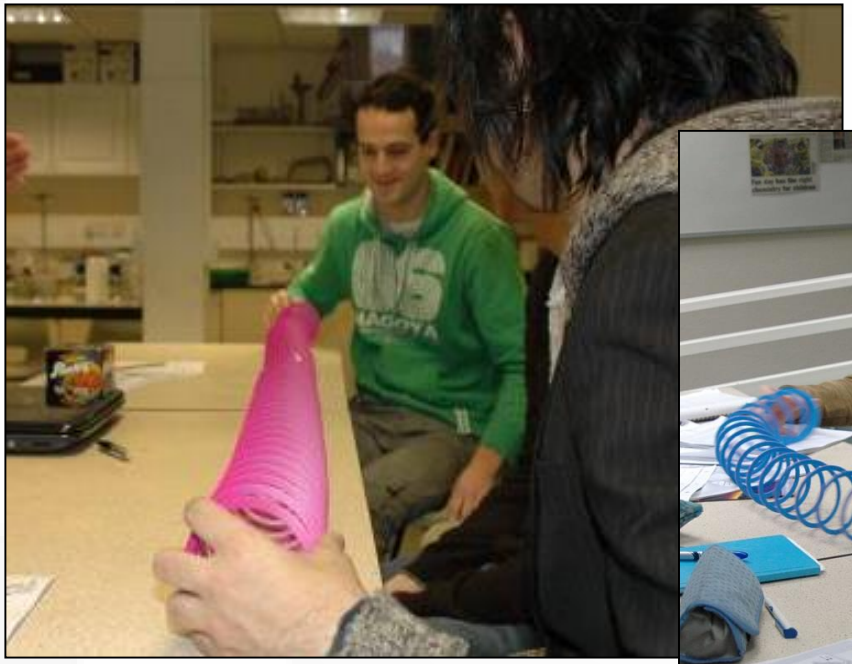


The Earth and plate tectonics workshop



Earthquakes – the slinky simulation

How earthquakes produce **P**- and **S**-waves



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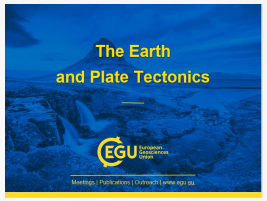
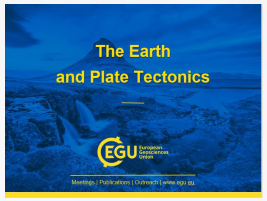


Earthquakes - the slinky seismic waves demo
How earthquakes produce **P**- and **S**-waves

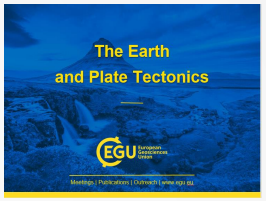
The Earth and plate tectonics workshop



Seismic wave summary

Wave type	Primary wave	Secondary wave
Name meaning	fastest wave, so arrives first, called primary	slower wave, arrives second, called secondary
Other names	longitudinal – travels by vibration along the material	transverse – travels by lateral movement
	push/pull wave; comPressional wave	shake wave; shear wave; sideways wave; slow wave
Transmission	through solids and fluids (liquids and gases)	through solids only
Earthquake damage is caused mainly by seismic **Surface waves**, and not by Primary or Secondary waves		

The Earth and plate tectonics workshop



Wave motion – student molecules

How **P**- and **S**-waves are transmitted

The structure of the Earth – from the seismic evidence

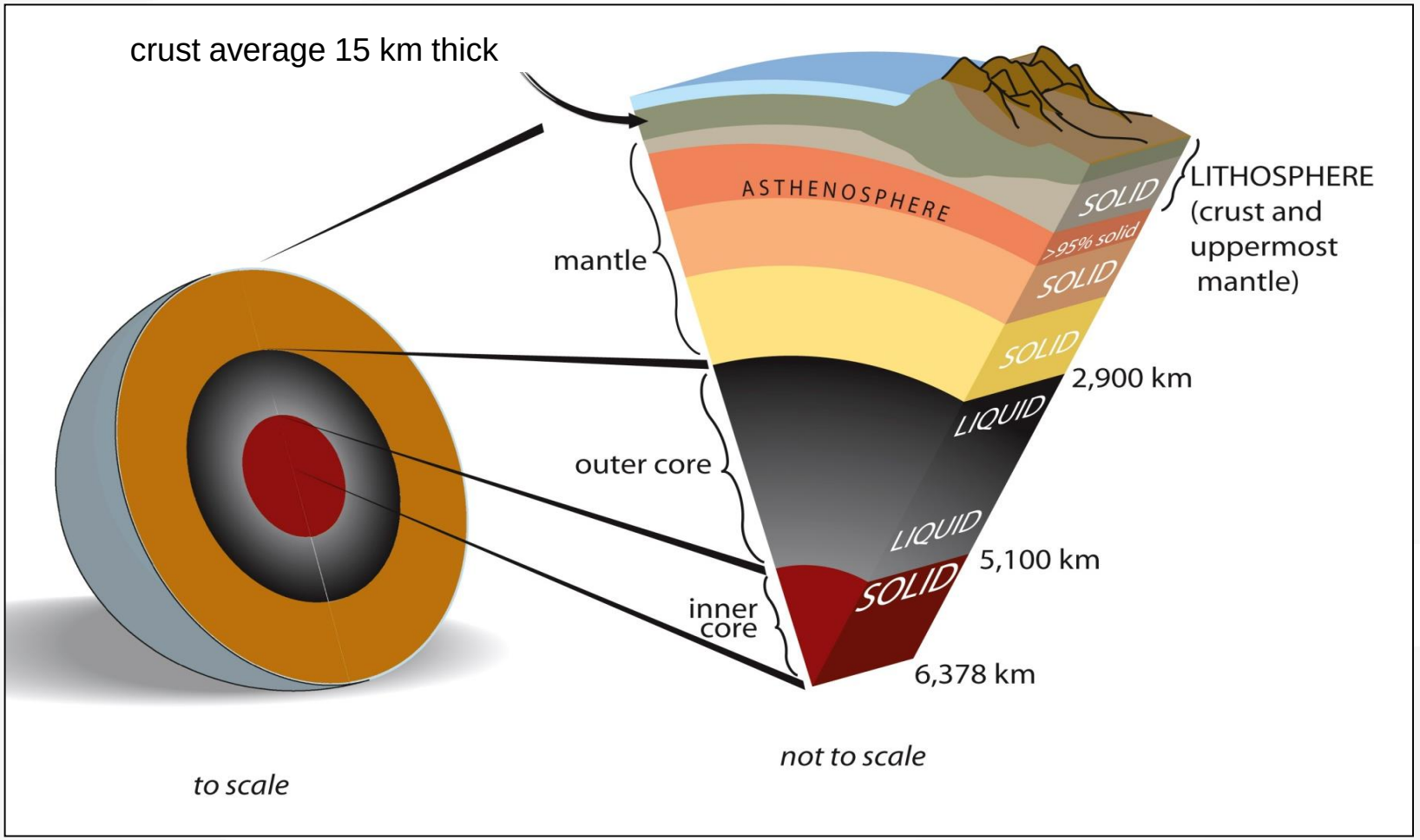
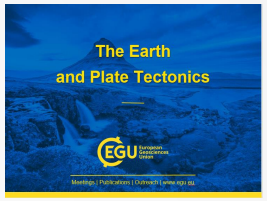
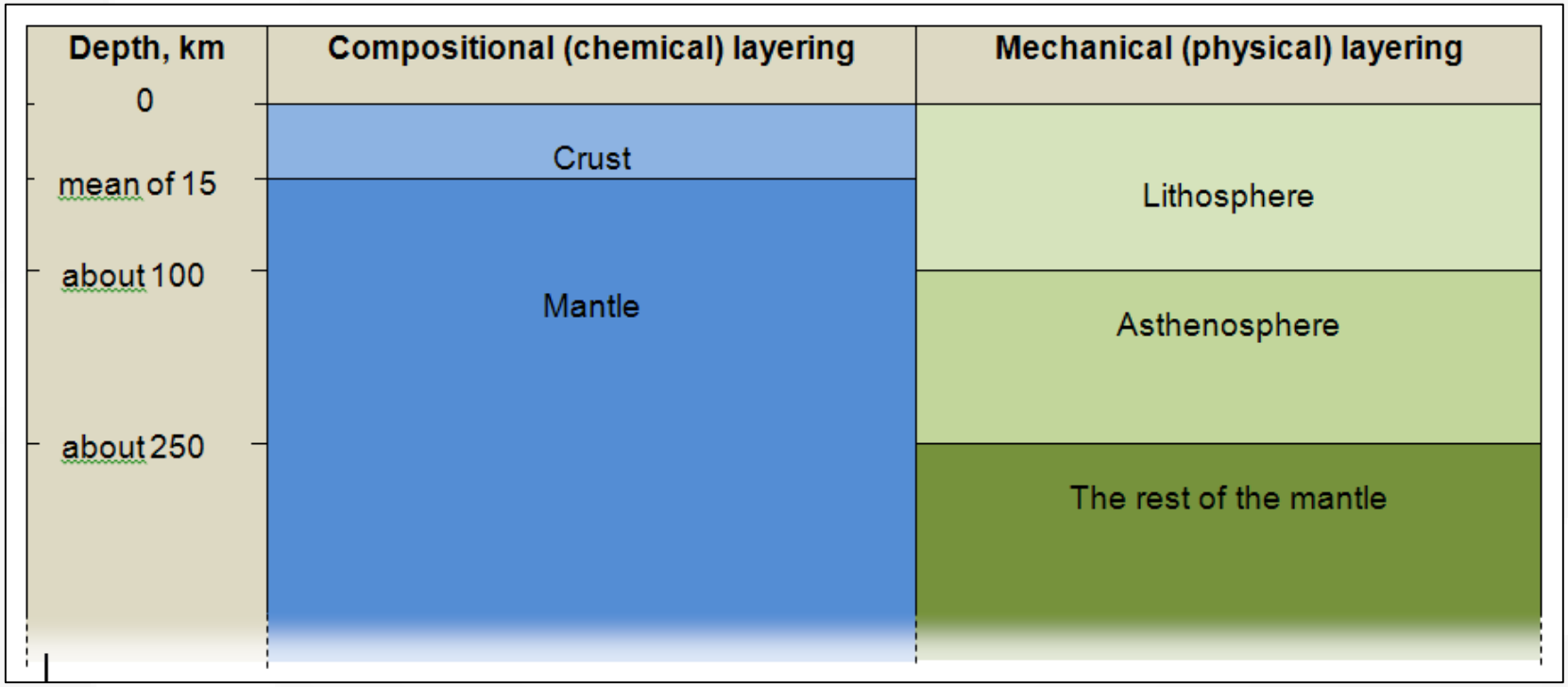


Diagram of the internal structure of the Earth, an example of a diagram showing the crust very much thicker than in reality.
Reproduced with the kind permission of the U.S. Geological Survey, redrawn by ESEU.

The Earth and plate tectonics workshop

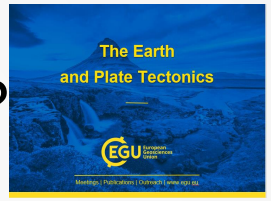


The lithosphere, asthenosphere and below:



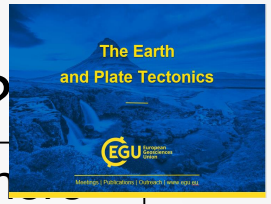
Note. The crust has a mean thickness of 35 km beneath continents and 6 km beneath oceans giving an overall mean of about 15 km.

The Earth and plate tectonics workshop



Modelling the lithosphere and asthenosphere (?

The Earth and plate tectonics workshop

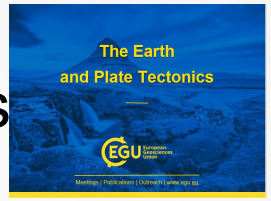


Modelling the lithosphere and asthenosphere (?

The crust – trainers	The extreme upper mantle – skate board	The asthenosph… wheels

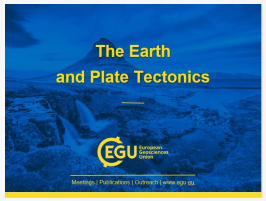
The asthenosphere (wheels) flows, carrying the plate of lithosphere = trainers (crust) + extreme upper mantle (skateboard) along

The Earth and plate tectonics workshop

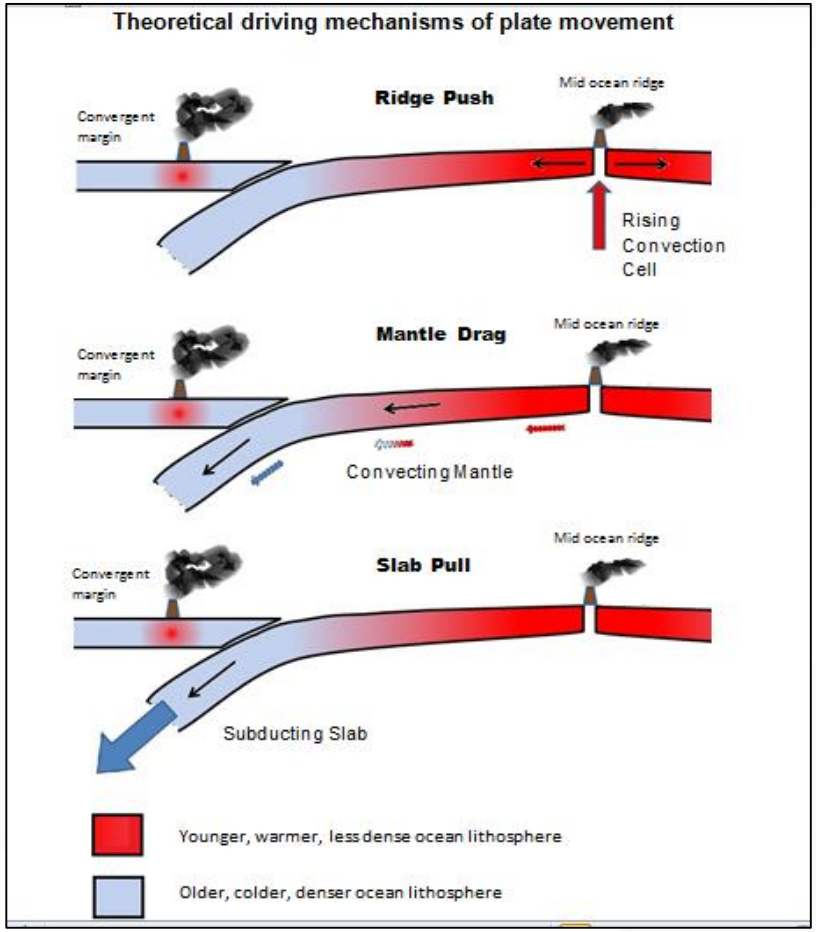


Why are the Earth's tectonic plates called plates

The Earth and plate tectonics workshop

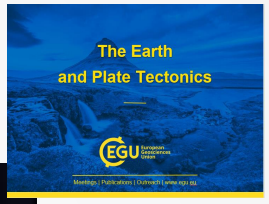


What drives the plates?



Theoretical driving mechanisms of plate movement © Pete Loader

The Earth and plate tectonics workshop



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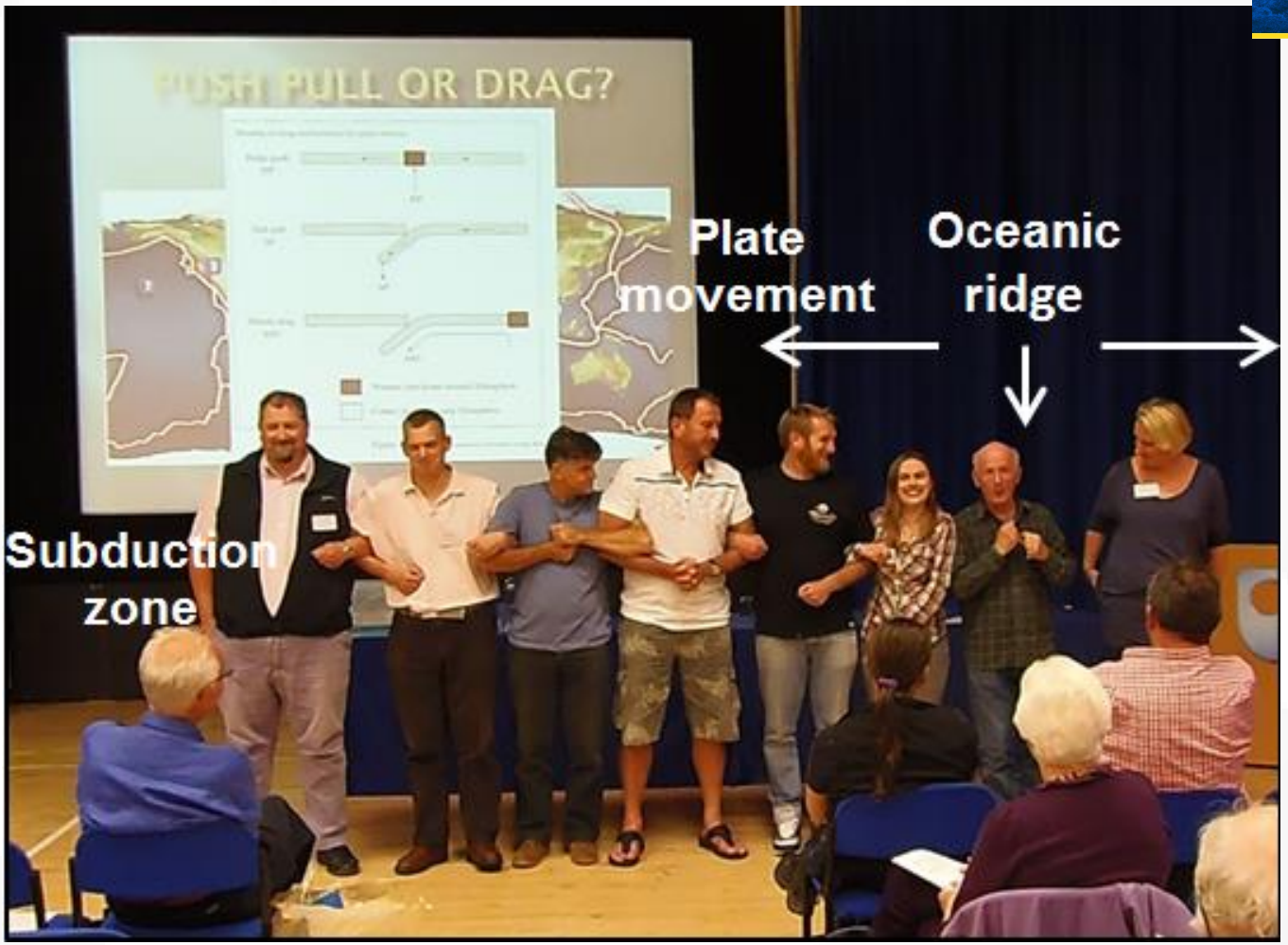
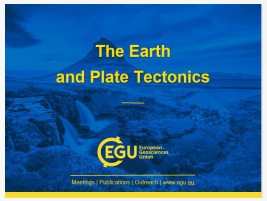


Stab pull © David Bailey

The Earth and plate tectonics workshop



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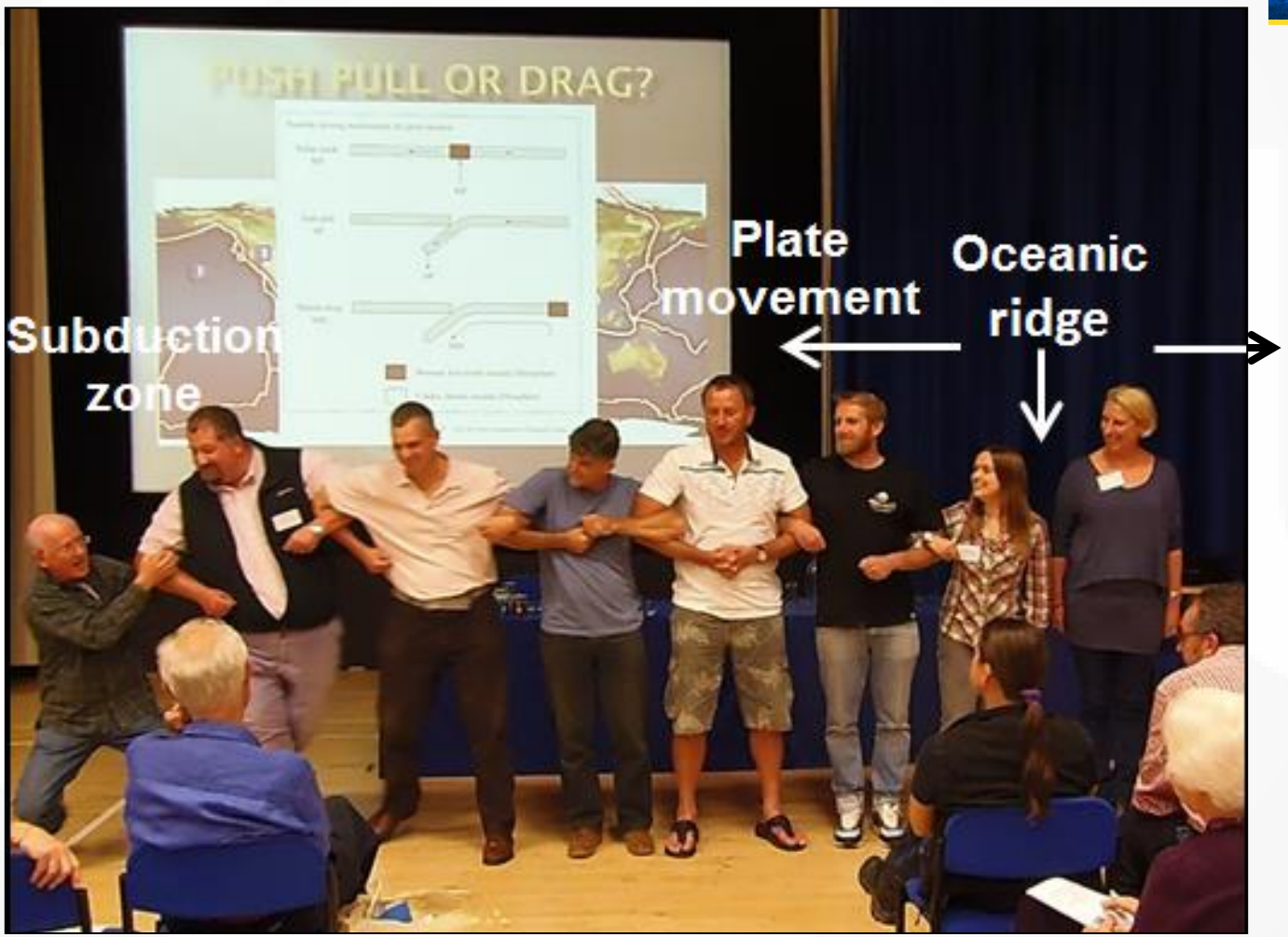


Stab pull © David Bailey

Strategy to support Geoscience Education

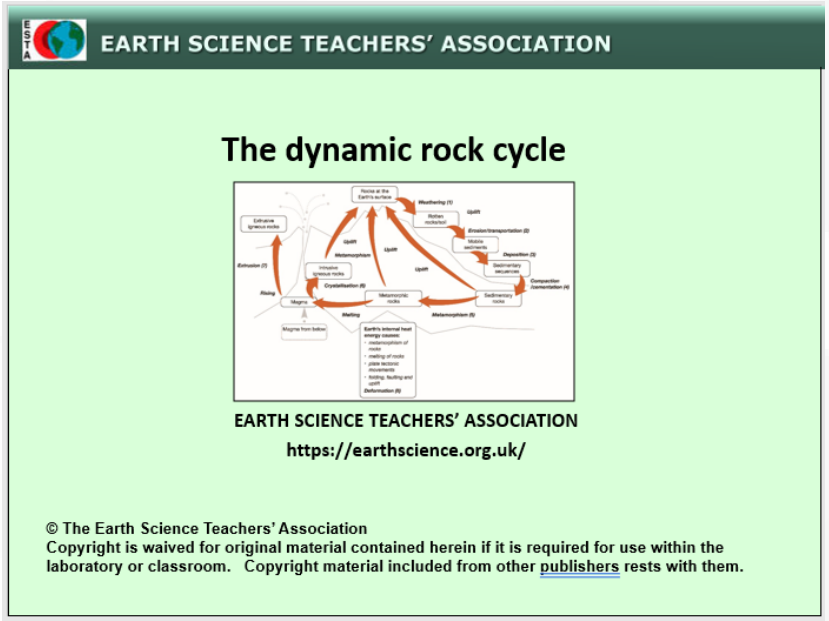
3. **Focus on teachers of geoscience in Higher Education (HE) who have strong geoscience backgrounds and have received generic training in HE teaching, but who have usually received little professional development in geoscience education.**

- Strategy to be developed for presentation to the EGU Council in October 2019; provisional ideas based on:
  - Support for HE teachers would focus on early career academics in the broadest sense, including full time and part time staff, and postgraduates, postdoctoral fellows, researchers. The audience would be anyone who is interested in, or required to, lecture to geoscience undergraduates or postgraduates, to demonstrate in laboratories, or to lead fieldtrips.
  - Courses could also act as a refresher for existing staff on new technology and new approaches to teaching, or HE teachers who teach outside of their main discipline.
  - There would also be scope for providing courses, networking events, and discussion forums for more senior HE staff who have responsibilities for co-ordinating teaching geoscience in their institutions/departments
  - The Annual General Assembly of EGU is an ideal event in which to launch, and then in the light of experience, to develop and expand, a programme of HE teaching courses, workshops and activities.

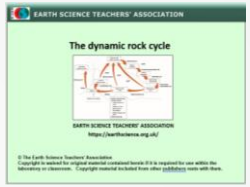
Strategy to support Geoscience Education

4. Focus on those providing informal geoscience education

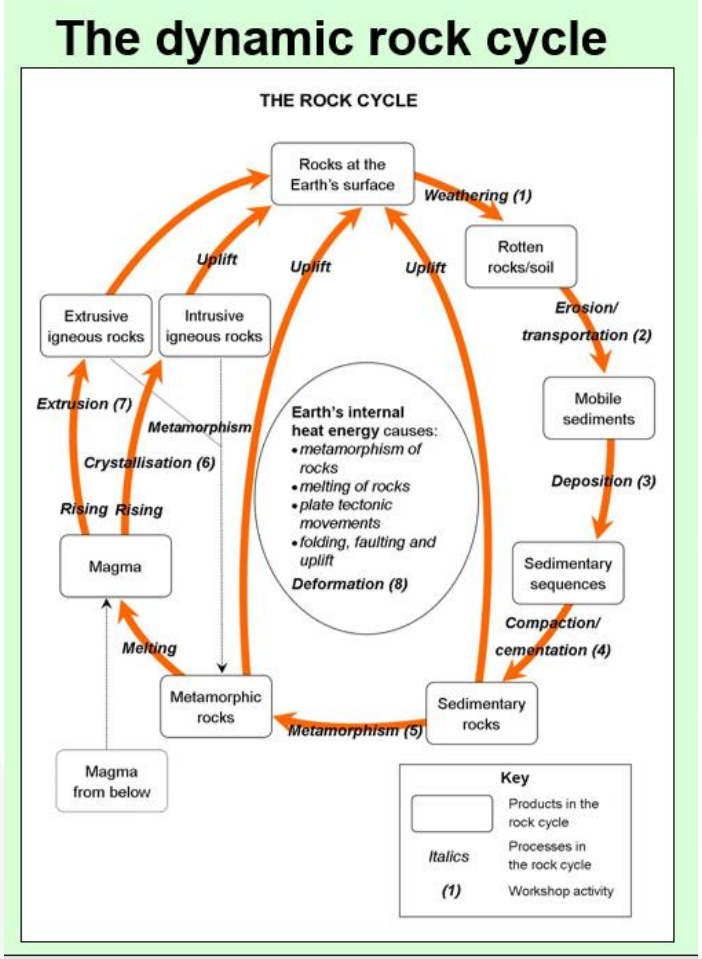
- A workshop package devised by the Earth Science Teachers' Association (ESTA) in the UK has been developed for training staff in Geoparks and aspiring Geoparks.
- The EGU Geoscience Education Field Officers have been trained to offer this package in their own countries, when funded by the Geoparks involved
- For example:

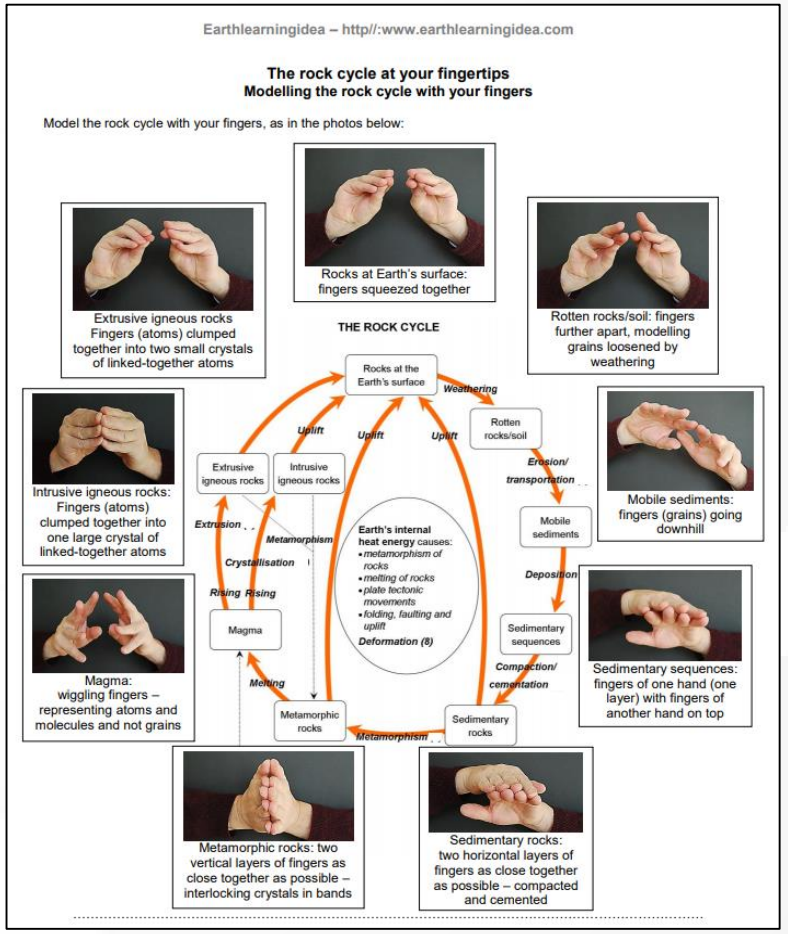


Strategy to support Geoscience Education



4. **Focus on those providing informal geoscience education**



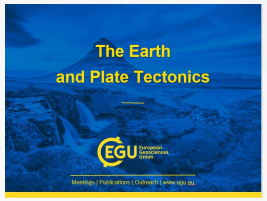


Strategy to support Geoscience Education

5. Focus on researchers into geoscience education

- There are strong geoscience research communities in the USA, Israel and Brazil, but the apparent dearth of geoscience educational research elsewhere
- But we know of few geoscience educational researchers in Europe
- We are planning to develop a database of geoscience educational researchers, partly to discover how widespread geoscience educational research is in Europe (and elsewhere)

The Earth and plate tectonics workshop



What am I doing?

The Earth and plate tectonics workshop

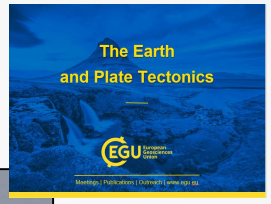


Plate-riding

'Surfer' by United States Marine Corps (public domain)

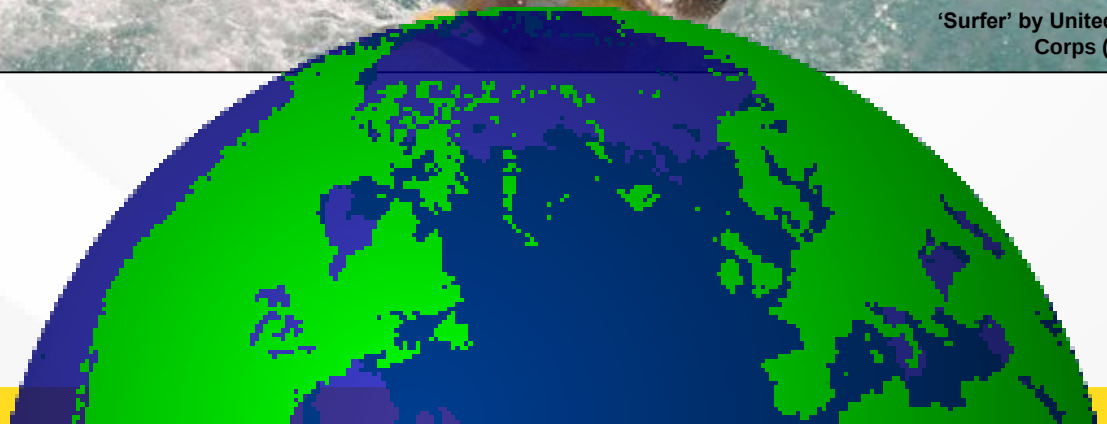


Image of the Earth © Noldoaran

The Earth and plate tectonics workshop

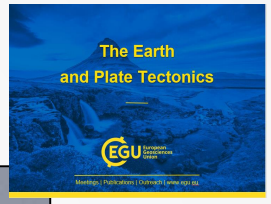


Plate-riding

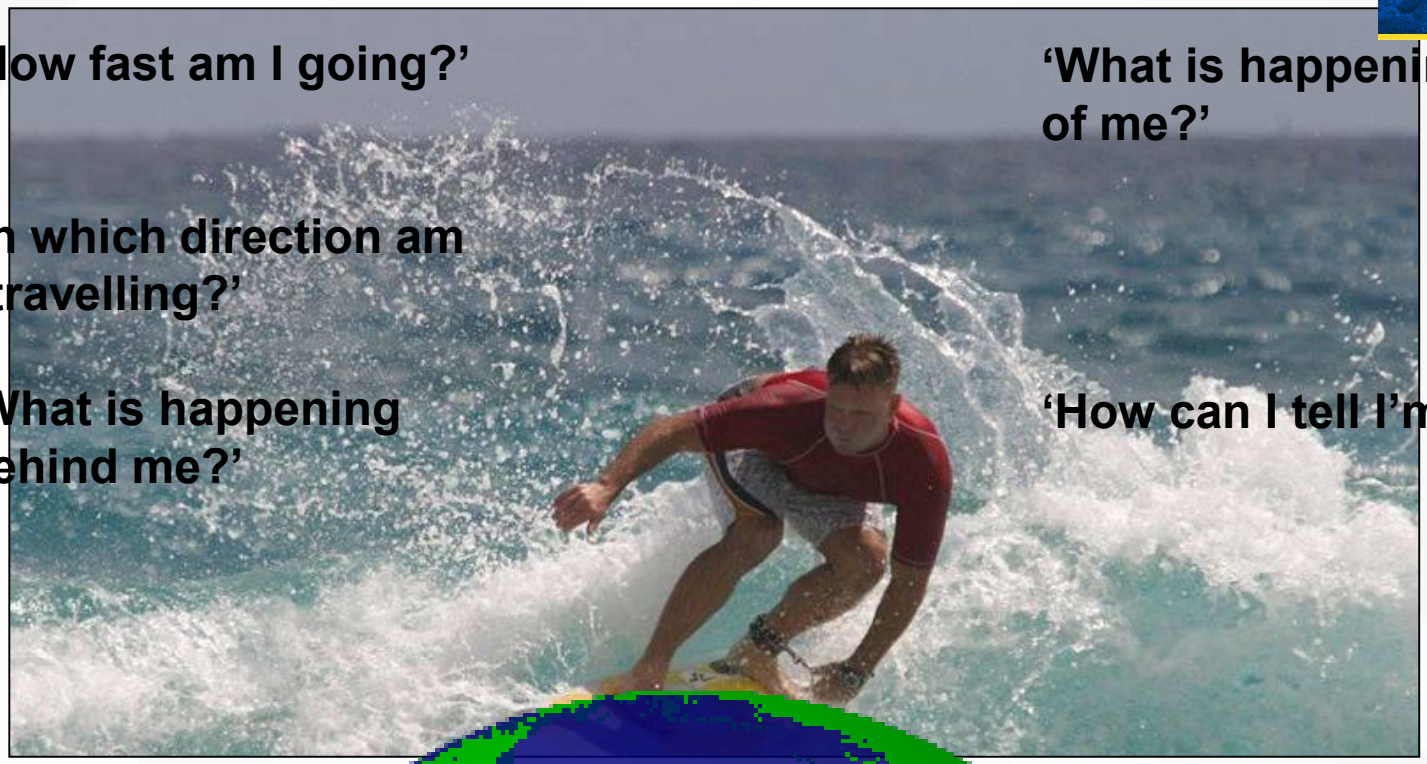
‘How fast am I going?’

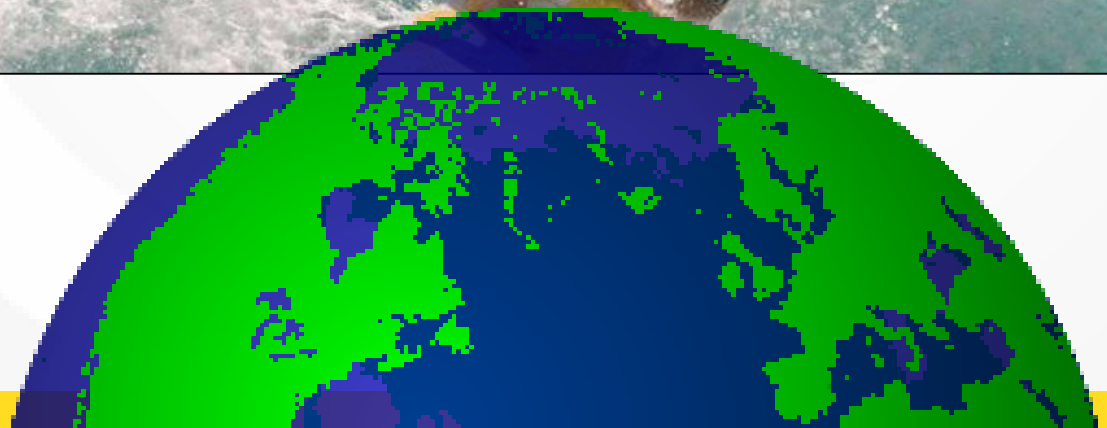
‘What is happening in front of me?’

‘In which direction am I travelling?’

‘What is happening behind me?’

‘How can I tell I’m moving?’





The Earth and plate tectonics workshop

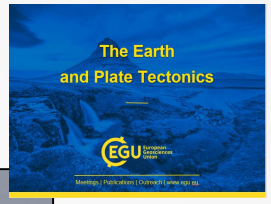
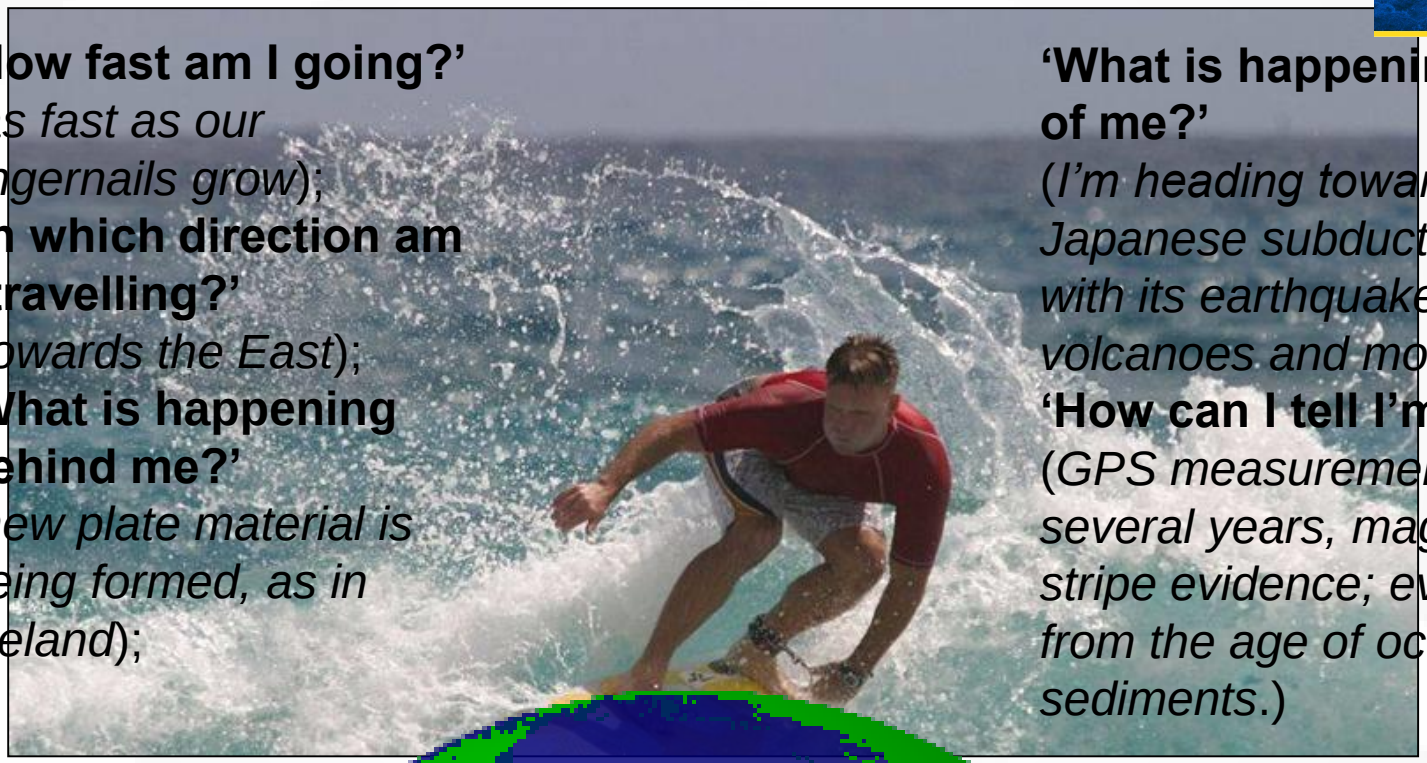
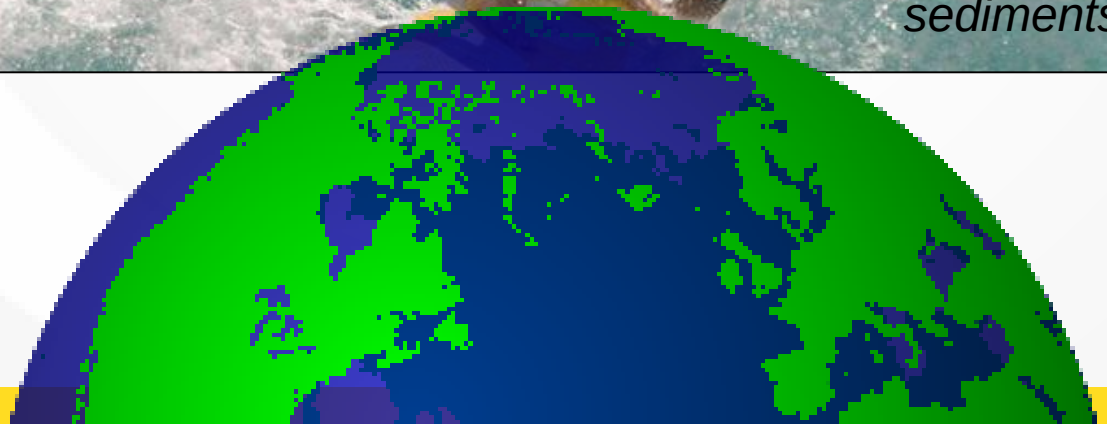


Plate-riding

‘**How fast am I going?**’ (*as fast as our fingernails grow*);
‘**In which direction am I travelling?**’ (*towards the East*);
‘**What is happening behind me?**’ (*new plate material is being formed, as in Iceland*);



‘**What is happening in front of me?**’ (*I’m heading towards the Japanese subduction zone, with its earthquakes, volcanoes and mountains*);
‘**How can I tell I’m moving?**’ (*GPS measurements over several years, magnetic stripe evidence; evidence from the age of ocean floor sediments*.)



Strategy to support Geoscience Education - some Earthlearningideas

An earthquake in your classroom

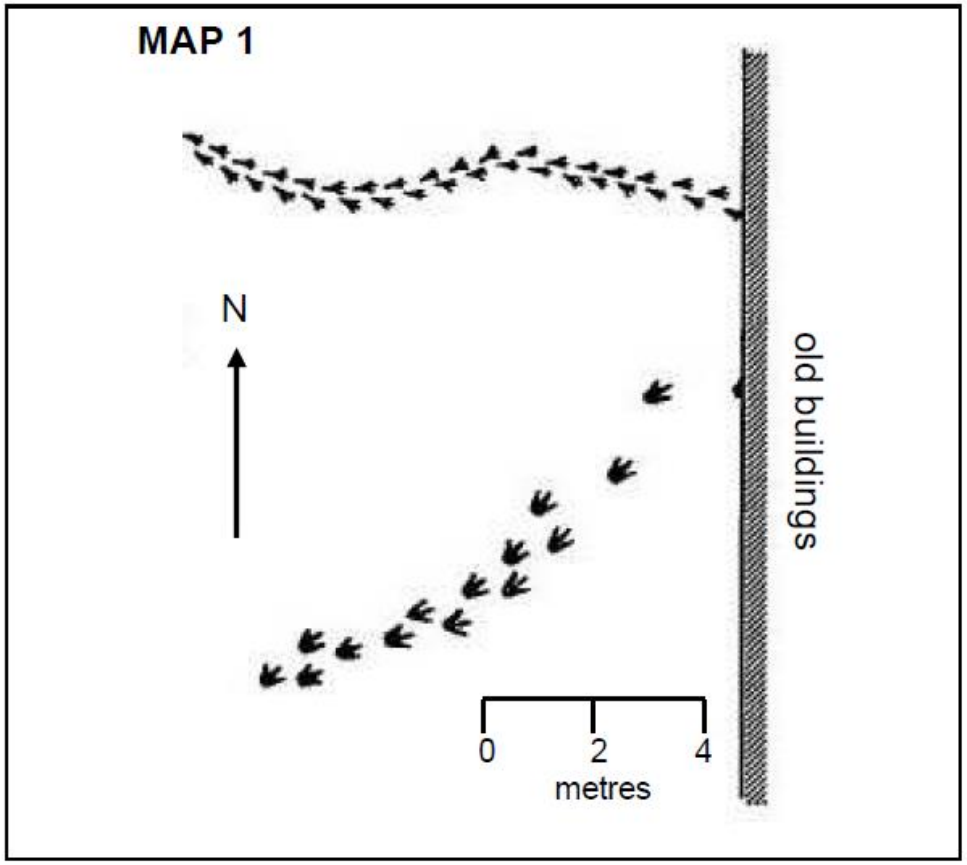
Earthquake intensity	Description	What you would feel and see, what to do
I	Not felt	Nothing
II	Scarcely felt	If you are on an upper floor, vibrate the table slightly to make pens or pencils move
III	Weak	Move the table a little more, so that things on the desk clearly vibrate
IV	Largely observed	Move the table more, note the rattling noises. Lots of other things in the classroom are rattling too; hanging objects are swinging backwards and forwards
V	Strong	Shake the table even more, the pupil should get under the table to feel safer; top-heavy objects on the desk topple over; hanging objects are swinging even more, while doors and windows swing open and shut
VI	Slightly damaging	Rock the table – your pupil should certainly be under the table by now, and holding onto the legs so that, if the table vibrates across the room, they can follow; objects fall off walls, cupboards shake, wall plaster cracks, flakes fall from the ceiling
VII	Damaging	Greater movement of the table, your pupil should hang on tight; things fall off shelves, walls crack, bigger flakes from the ceiling, lots of dust
VIII	Heavily damaging	Great table movement, desks and chairs overturn; large cracks in walls and big chunks fall off the ceiling onto the desk and other furniture; even more noise and dust
IX	Destructive	The ceiling collapses onto the desk, but your pupil is safe beneath; much vibration, crashing noises and dust
X	Very destructive	The classroom walls begin to collapse outward or inward, but it is still safe under your sturdy table; it is dark, very dusty and noisy
XI	Devastating	The rest of the building collapses, but people protected by strong furniture and in protected corners of buildings survive
XII	Completely devastating	All buildings in the area collapse, but alarms have gone out far and wide; the rescue services are coming, but this will take time as all the roads have been destroyed; stay under the table and be patient – help is on its way

Developed from: the Wikipedia article on the European Macroseismic Scale at: https://en.wikipedia.org/wiki/European_macroseismic_scale and the British Geological Survey synopsis at: http://earthquakes.bgs.ac.uk/education/education/ems_synopsis.htm

Lisbon Earthquake 1755

Strategy to support Geoscience Education - some Earthlearningideas

The meeting of the dinosaurs

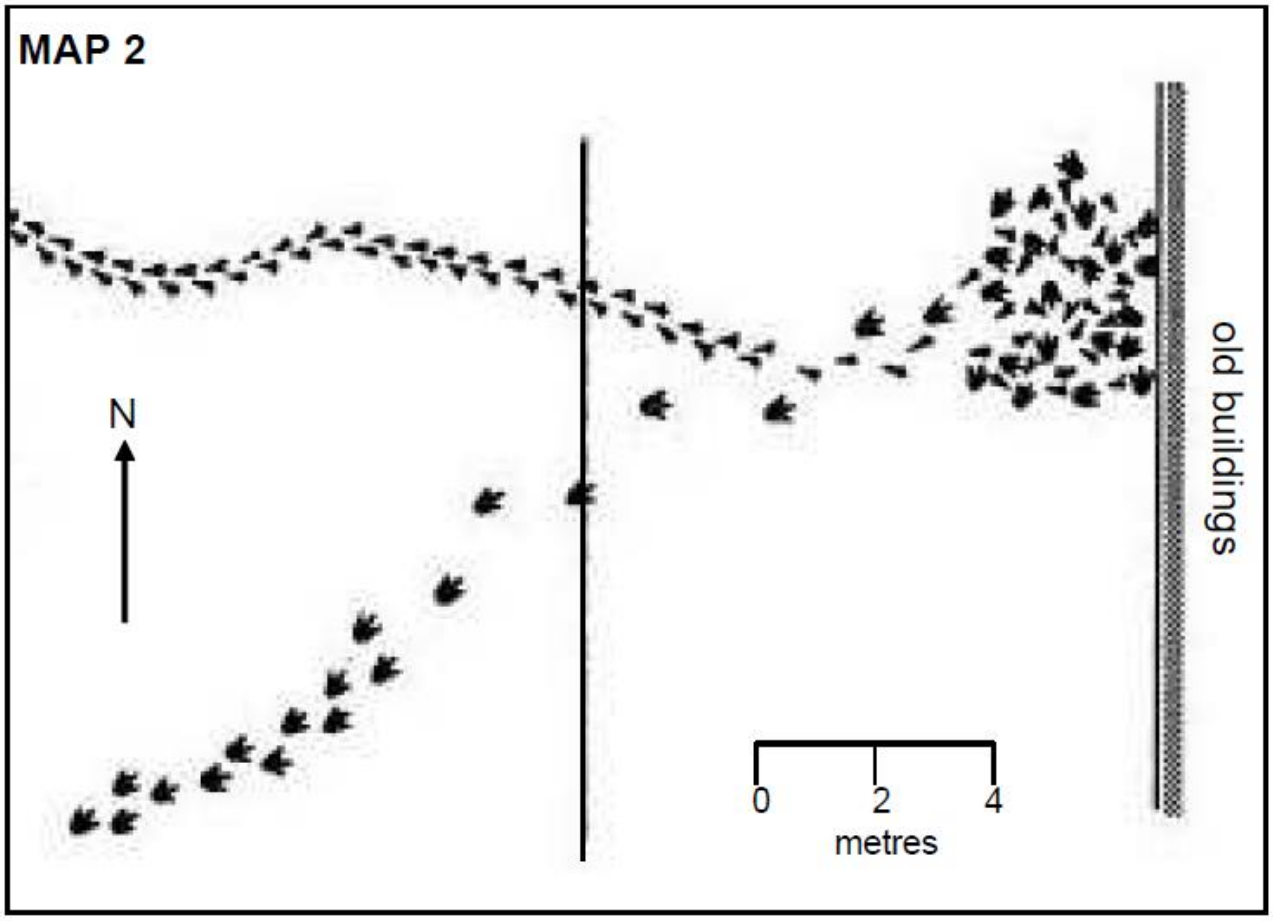


Ask the pupils:

- What do you think the footprints shown in Map 1 tell you about the two dinosaurs?
- What do you think happened to the two dinosaurs where the ground is hidden by the buildings in the east? Ask older pupils to suggest three different ideas.
- What evidence in support of your ideas would you expect to see when more of the footprints have been uncovered? Ask older pupils to provide evidence for each of their three different ideas.

Strategy to support Geoscience Education - some Earthlearningideas

The meeting of the dinosaurs



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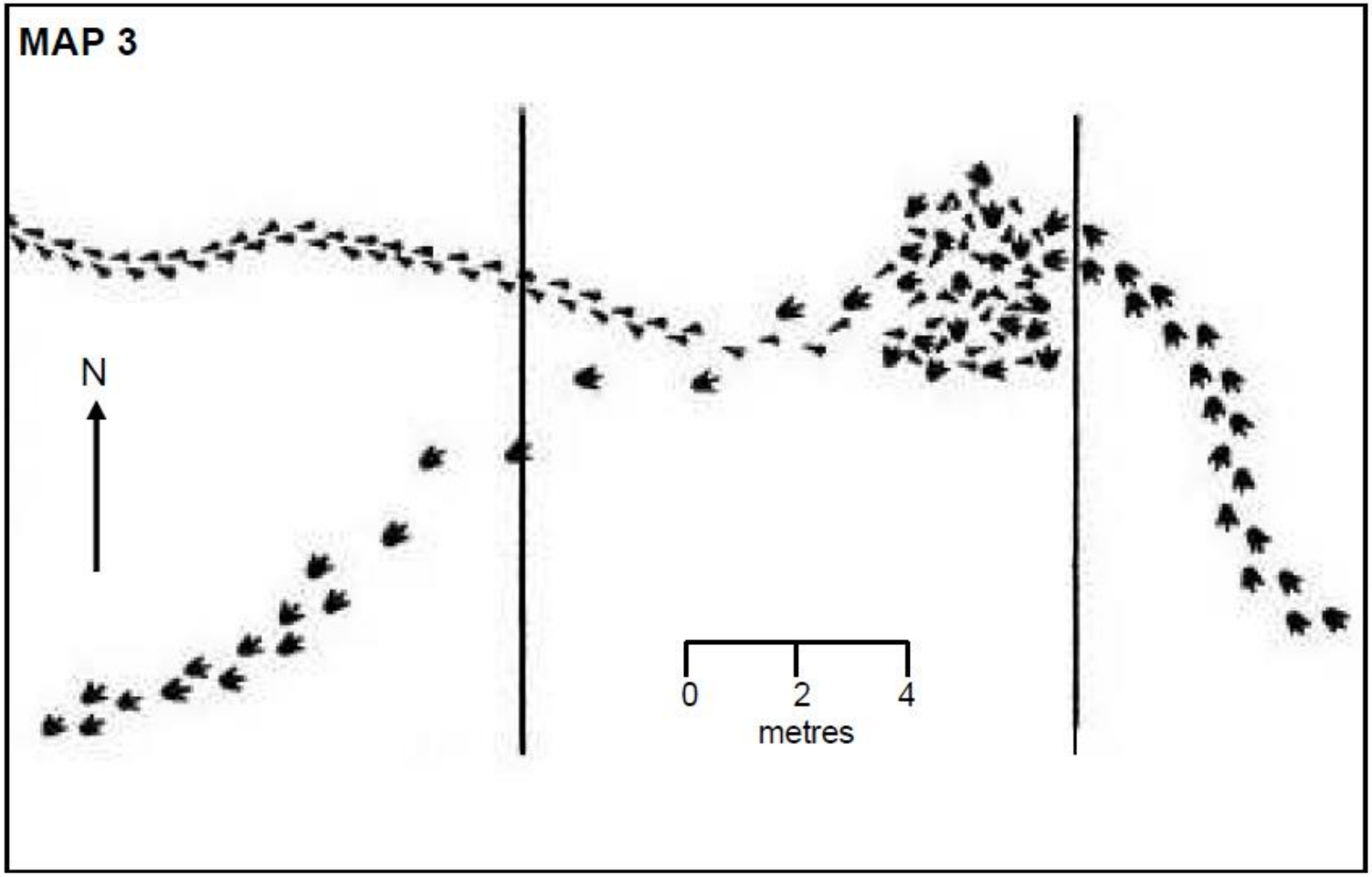

A strategy for supporting geoscience education across Europe and beyond

Chris King

The Headline | bold 26pt

Here is the text placed | Regular 18pt | text colour RGB 77/77/77

- Bullets are blue squares | EGU blue RGB 0/114/188
- Language is set to British English (we are Europeans)
- Font is Helvetica
- Slide transition is set to ‘None’
- Yellow RGB 255/222/2