



# Geoheritage: Protecting geodiversity and raising the visibility of geology in our lives

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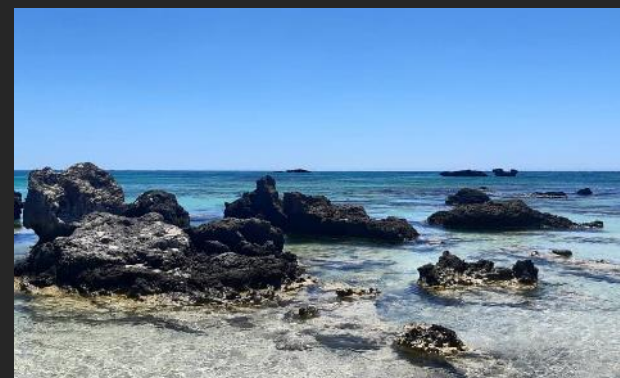
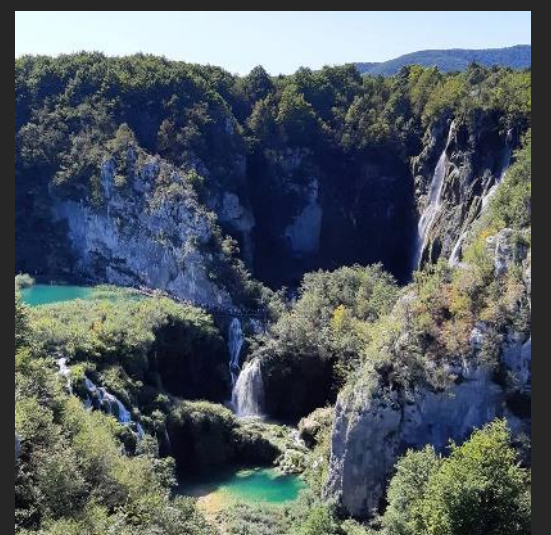
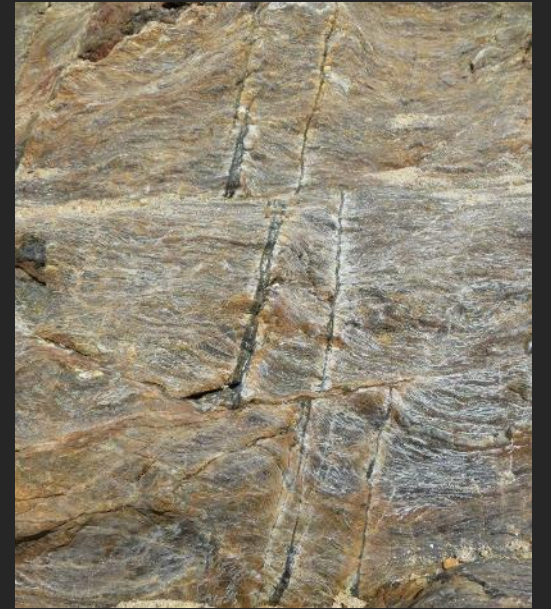
EFG PE on Geological Heritage

Webinar

Promoting geoheritage and geotourism

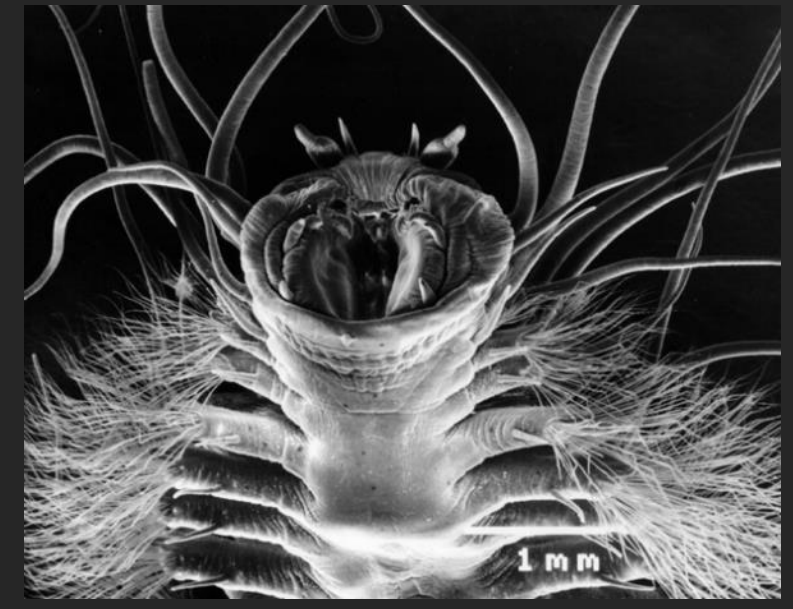


# Earth Geodiversity



# Geodiversity & Biodiversity

© National Geographic  
© National Park Service, USA  
© NOAA



# Geodiversity & Biodiversity



# Geodiversity & Society



# Geodiversity and Society



© Mónica Sousa



"Everything comes from somewhere. If it didn't grow, it was mined."

### 01 Electricity

**Energy generation**  
C Carbon (Coal)  
U Uranium  
La Lanthanum  
Y Yttrium  
Tb Terbium

**Fluorescent lighting**  
Ga Gallium  
Ce Cerium  
Eu Europium  
Tb Terbium  
Fe Iron  
W Tungsten  
Cr Chromium

**Production and transmission**  
Fe Iron  
Cu Copper  
Al Aluminium

**Australian Mining**  
Produced by the Minerals Council of Australia

**Electricity travels at around 90 per cent of the speed of light.**

**Australia an energy powerhouse**  
Australia exports two-thirds of the energy it produces, generating renewable energy for export. Coal, uranium, oil and gas make up 92 per cent of Australia's total electricity, meeting demand around 300 billion a year. Australia will increasingly play a role in meeting global energy demand, according to the IEA.

### 02 Food processing

**Machinery used in process and manufacture food**  
Fe Iron  
C Carbon  
Cr Chromium  
Mo Molybdenum  
Mn Manganese  
Ni Nickel

**Coca-Cola uses 300,000 tons of aluminium every year in the US - 17.4% of total US aluminium production.**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Food processing**  
Sn Solder  
Cu Copper  
Ni Nickel  
Pb Lead  
Zn Zinc  
Al Aluminium  
Cr Chromium

**Sustainable coffee pods**  
Bio-Tribe has partnered with the green Nespresso to supply sustainable aluminium for its coffee capsules after becoming the world's first company to be certified by the Responsible Environmental Initiative (REI). CertiFoil, a recycled aluminium, is used to manufacture the capsules. Nespresso and Bio-Tribe are working on the aluminium lifecycle.

### 03 Health care

**Mining makes modern medicine and treatment possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Health care**  
Ti Titanium  
Pt Platinum  
Cu Copper  
Li Lithium  
U Uranium  
Nb Niobium

**Metal-based compounds are crucial to the diagnosis and treatment of disease.**

**Modern nanoparticle technology**  
The development of nanotechnology has opened up a new frontier of drug administration, diagnosis and treatment of diseases. Gold nanoparticle technology is being used to target and deliver anticancer drugs to the tumour site. The highest concentrations of the drug are delivered to the cancerous cells, while the rest of the drug is excreted from the body.

### 04 Smartphones

**Mining makes holding the world in your hand possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Smartphones**  
Au Gold  
Cu Copper  
Ag Silver  
Ta Tantalum  
W Tungsten  
Al Aluminium  
Li Lithium  
Co Cobalt  
Si Silicon  
Sn Tin  
K Potassium  
In Indium  
Al Aluminium  
Ga Gallium  
Nd Neodymium  
B Boron  
Ni Nickel  
Pr Praseodymium

**More than 40 mined metals and rare earths are used to produce a single smartphone.**

**Modern day gold mine**  
The historic Croydon (former) mine is gold that is now mined in gold. Each computer is containing it on the gold mine by refining and recycling program. Apple announced a recycling program in 2011. Last year Apple announced a gold mine. They plan to invest \$1 billion in a gold mine in Nevada. The mine is expected to produce 100,000 ounces of gold per year.

### 05 White goods

**More than 75% of fridges sold in Australia are now stainless steel.**

**Australian Mining**  
Produced by the Minerals Council of Australia

**White goods**  
Fe Iron  
C Carbon  
Zn Zinc  
Ti Titanium  
Cu Copper  
Al Aluminium  
Si Silicon  
Ni Nickel  
Mn Manganese

**Mining makes the products that make your life possible.**

**Lost Sock Index**  
Statista revealed a 'Lost Sock Index' in 2016 to find out why people are losing their socks. The formula is  $(L \times C) \div (P \times S)$  where L is the number of socks lost, C is the number of socks owned, P is the number of people, and S is the number of socks per person. The result is a number that represents the number of socks lost per person.

### 06 Electric cars

**Mining makes the cars of today and tomorrow possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Electric cars**  
Fe Iron  
Mn Manganese  
V Vanadium  
Mo Molybdenum  
Al Aluminium  
Mg Magnesium  
Ce Cerium  
Li Lithium  
Co Cobalt  
Ni Nickel  
C Carbon  
Cu Copper  
Dy Dysprosium  
Nd Neodymium

**Electric cars aren't new**  
London inventor Thomas Edison designed and built the first practical electric car in 1881, in the US and only 200 commercial electric cars built by high capacity lead-acid batteries were the most popular cars on the road. It wasn't until the late 1990s that lithium-ion and the expansion of highways that sales spiked.

### 07 Defence

**Mining makes protecting our nation possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Defence**  
Ag Silver  
Bi Bismuth  
Ge Germanium  
V Vanadium  
Sc Scandium  
Mn Manganese  
Cr Chromium  
Re Rhenium  
Sb Antimony

**Australia's F-35 Joint Strike Fighter can travel at 1.6 times the speed of sound - or almost 2000 km/h.**

**Fighter pilot futuristic tech**  
Australia's F-35 Joint Strike Fighter pilots will wear custom-made, augmented reality visors worth A\$5.5 million each. Made of titanium and carbon fibre, the visors are packed with electronics that project data into the pilot's vision from sensors located around the aircraft. The visors effectively act through 'fog' that pilots can't see.

### 08 Solar panels

**Mining makes renewable energy generation possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Solar panels**  
Cd Cadmium  
Te Tellurium  
Mo Molybdenum  
Be Beryllium  
Ge Germanium  
Ga Gallium  
In Indium  
Ag Silver  
Si Silicon  
B Boron  
P Phosphorus  
Cu Copper  
Al Aluminium  
Ti Titanium  
Zn Zinc  
Mg Magnesium

**Solar energy powering mining**  
Solar energy is increasingly powering Australia's remote mining operations. In 2015, Rio Tinto built the Waage Solar Plant to power its remote mine and processing facilities in the Froyer District, North Queensland. The first of its kind. Electricity generated by Waage Solar offsets up to 800,000 tonnes of diesel usage each year.

### 09 Your house

**Mining makes building your dream home possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Your house**  
Fe Iron  
Cr Chromium  
Mo Molybdenum  
Mn Manganese  
Ni Nickel  
Cu Copper  
Al Aluminium  
Ti Titanium  
Mg Magnesium  
Zn Zinc  
Ca Calcium  
Pb Lead  
Sn Tin

**Houses are shrinking (a bit)**  
Apartments are taking up 40 per cent of new home construction. The average house in 1983 is 1,000 square metres. The average house in 1998 is 900 square metres. That's still 8 per cent bigger than 20 years ago and still 20 per cent bigger than in 1997. Only the United States built bigger houses - 2,500 square metres on average.

### 10 Public transport

**Mining makes getting where you need to go possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Public transport**  
Fe Iron  
Mn Manganese  
Al Aluminium  
Mo Molybdenum  
Pb Lead  
Mg Magnesium  
Cu Copper  
Si Silicon  
Ni Nickel  
Zn Zinc  
Ti Titanium  
Sn Tin  
Al Aluminium  
Fe Iron  
Si Silicon  
Cu Copper  
Al Aluminium  
Cu Copper  
Au Gold  
Sn Tin

**Melbourne has the world's largest tram network with 250 kilometres of track.**

**Public transport in Australia**  
Copper is the most common metal used in public transport. The average house in 1983 is 1,000 square metres. The average house in 1998 is 900 square metres. That's still 8 per cent bigger than 20 years ago and still 20 per cent bigger than in 1997. Only the United States built bigger houses - 2,500 square metres on average.

### 11 Cleaning products

**Mining makes the unavoidable possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Cleaning products**  
Na Sodium  
B Boron  
Zn Zinc  
P Phosphorus  
Cl Chlorine  
Si Silicon  
C Carbon  
I Iodine

**Salt has been used as a natural scourer since medieval times.**

**Tomato sauce and elbow grease**  
Tomato sauce and elbow grease are common household items and are made from natural ingredients. The average house in 1983 is 1,000 square metres. The average house in 1998 is 900 square metres. That's still 8 per cent bigger than 20 years ago and still 20 per cent bigger than in 1997. Only the United States built bigger houses - 2,500 square metres on average.

### 12 Sydney Harbour Bridge

**Mining makes Australian landmarks possible**

**Australian Mining**  
Produced by the Minerals Council of Australia

**Sydney Harbour Bridge**  
Cu Copper  
C Carbon  
Fe Iron  
Si Silicon  
Mn Manganese  
Sb Antimony  
Zn Zinc  
Ti Titanium  
Ba Barium  
Sr Strontium  
Cu Copper  
Al Aluminium  
Zn Zinc

**Building the bridge**  
The Sydney Harbour Bridge is a steel arch bridge, 1,500 metres long, 50 metres wide and 130 metres high. It was built by the New South Wales Government. The bridge was built by the New South Wales Government. The bridge was built by the New South Wales Government.

Earth is alive!



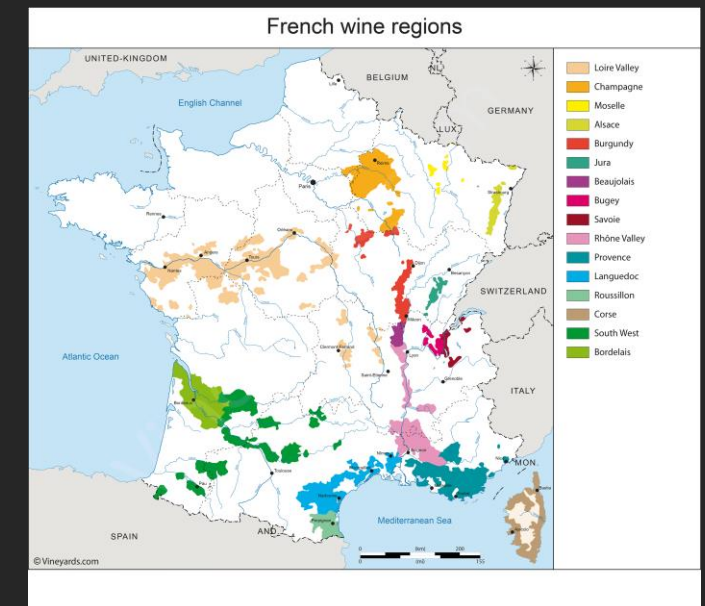
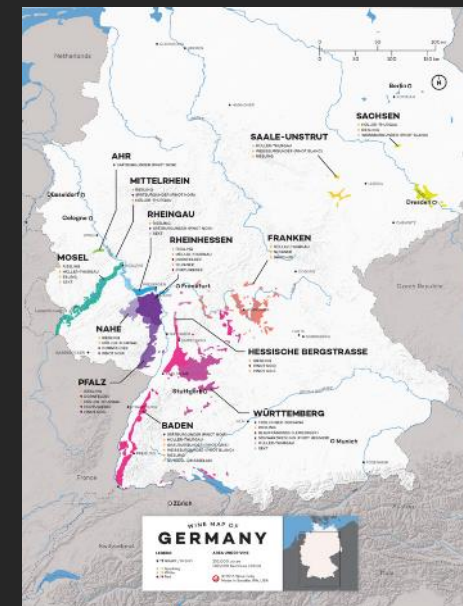
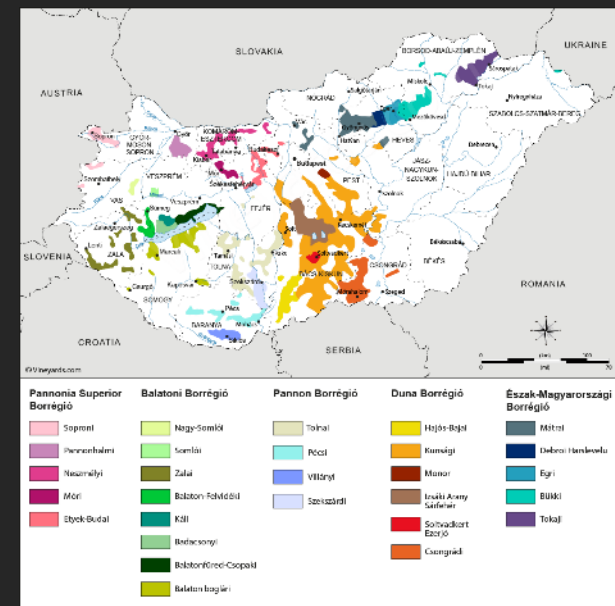
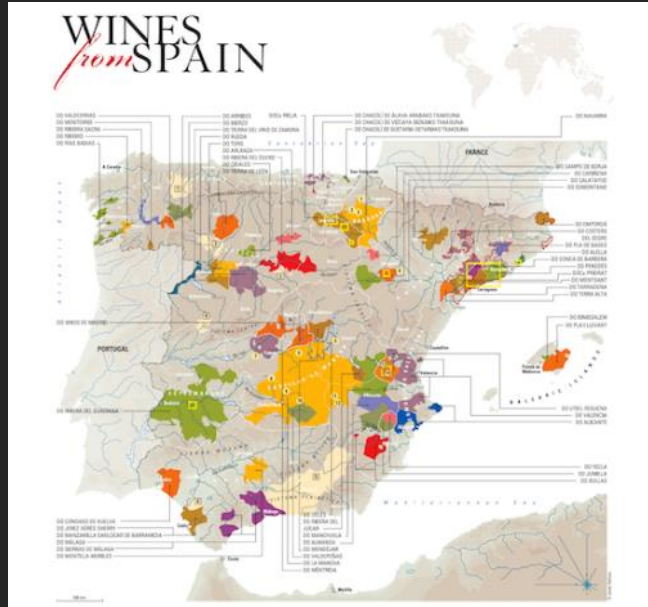
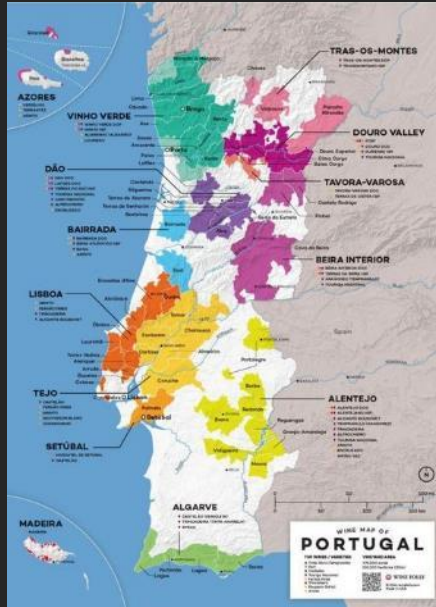


# Geodiversity & Wine

© UNESCO



# Geodiversity & Wine





# Geodiversity & Game of Thrones

Vatnajökull ice cap, Iceland



Azure Window, Malta



Meteora, Greece



Itzurun Beach, Spain



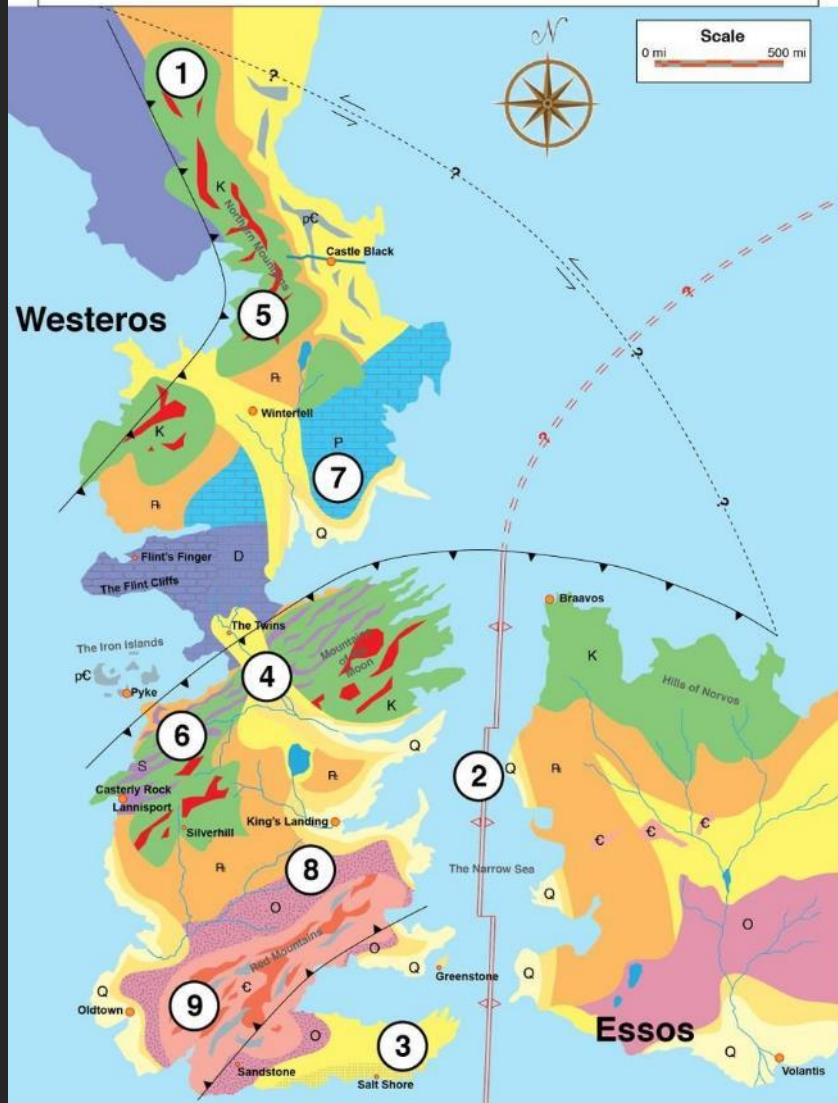
Northern Ireland



Bridge between Europe and North America, Reykjanes Peninsula, Iceland

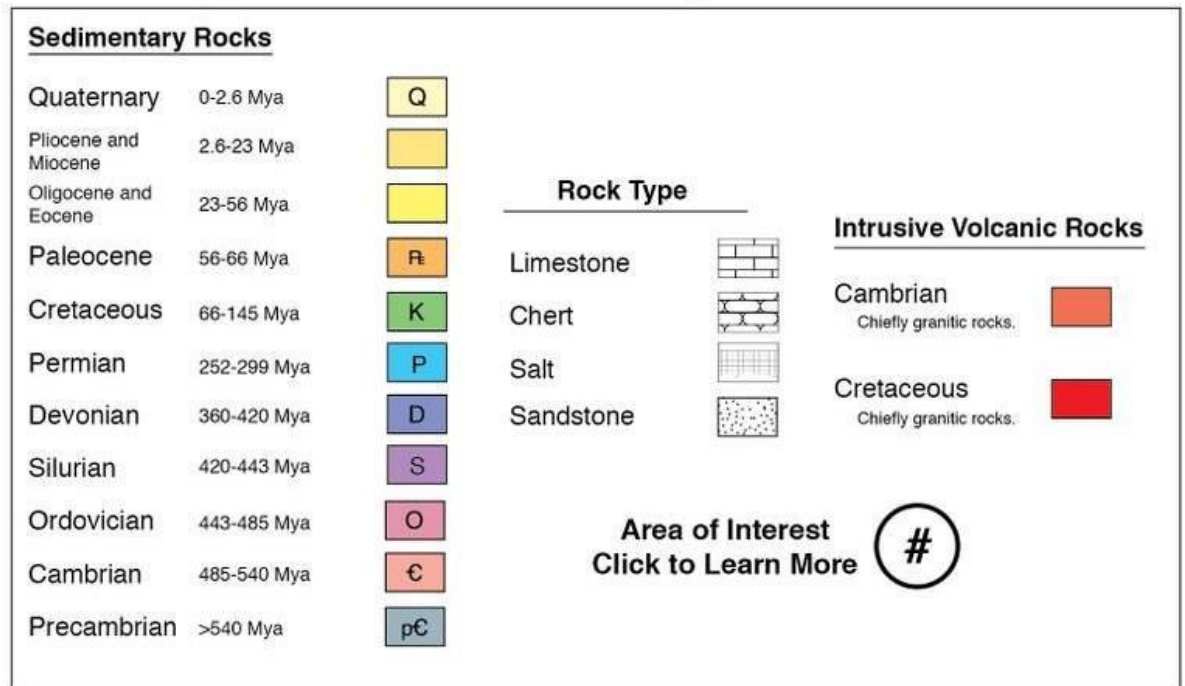
# A GEOLOGIC MAP FOR GAME OF THRONES

BASED ON CHARACTER OBSERVATIONS,  
OFFICIAL MAPS, AND  
EARTH PRINCIPLES OF THE GEOLOGIC SCIENCE



## Europe's Geodiversity & Game of Thrones

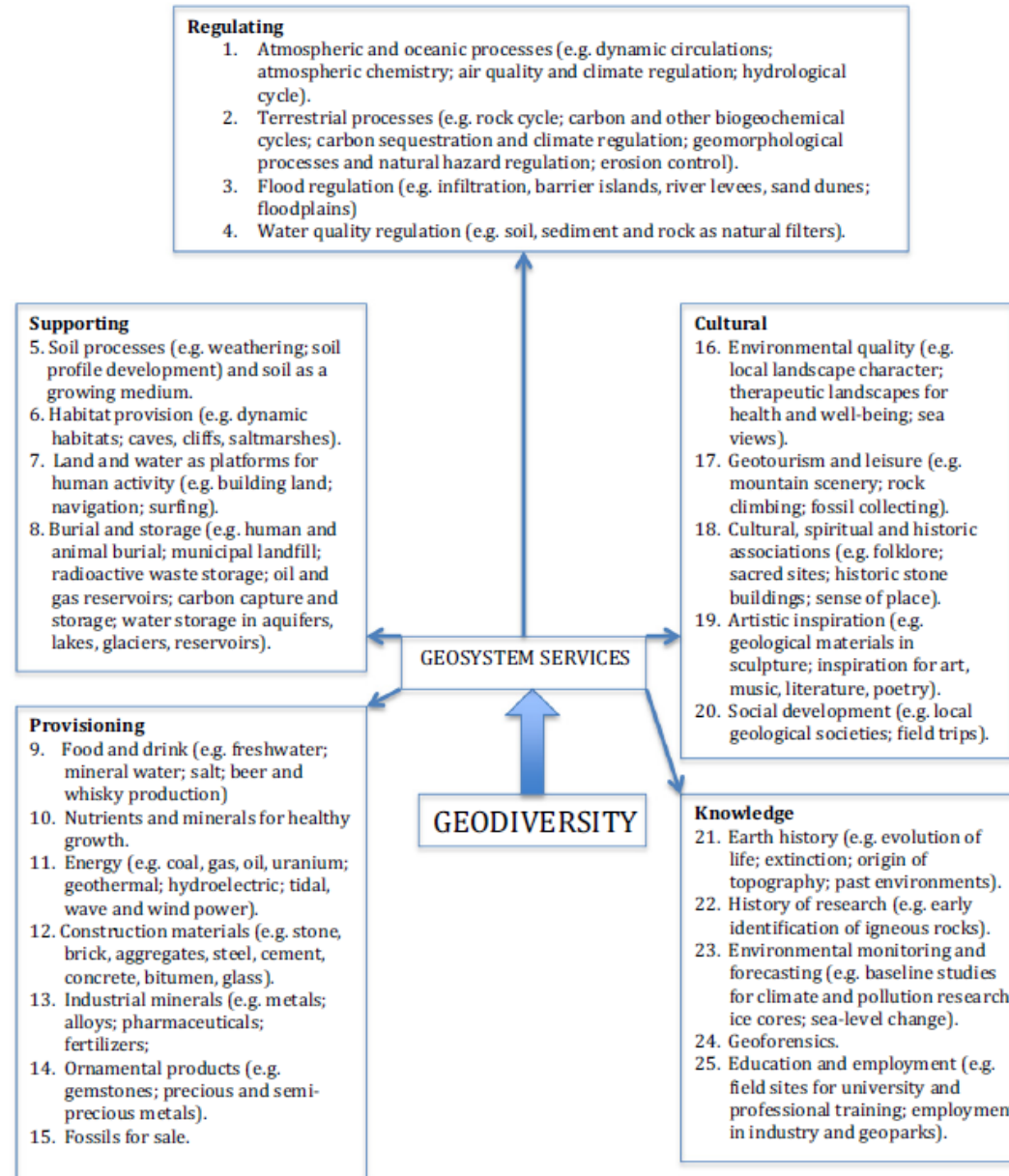
Fire & Ice



Miles Traer, 2016

<http://miletraer.com/the-geology-of-game-of-thrones/>

# The Values of Geodiversity



**Fig. 1.** The 25 major geosystem services, all of which are related to the planet's geodiversity. (From Gray (2018b) with permission of Elsevier).

# Geoheritage & Geoconservation for Society



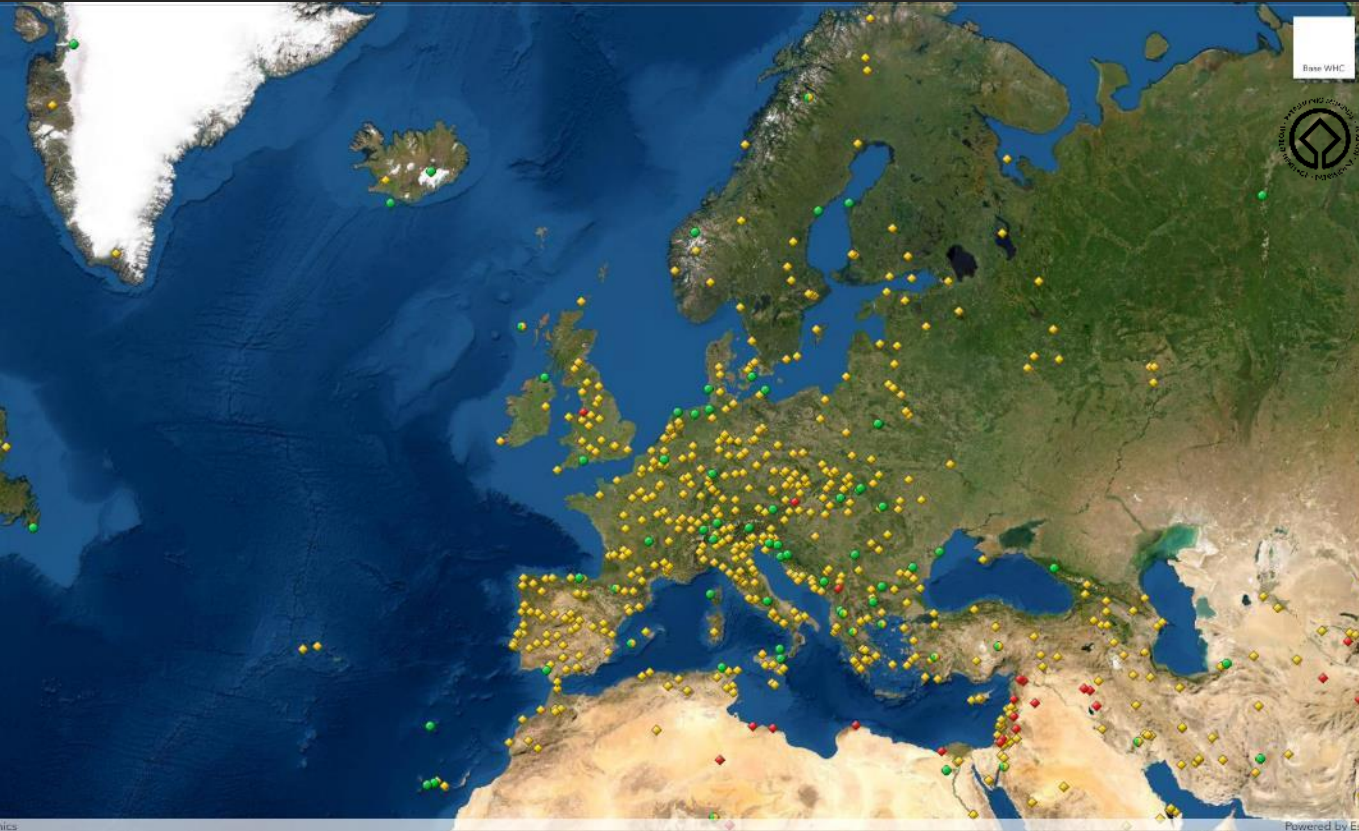
Dem König Friedrich Wilhelm III. von Preußen gewidmet  
**Symphony No. 9 in D Minor**  
mit Schlußchor über Schillers Ode an die Freude  
Op. 125

Ludwig van Beethoven  
Transcribed by Franz Liszt

Allegro ma non troppo, un poco maestoso  $\text{♩} = 88$

*pp*  
*sotto voce*  
*sempre pp*  
*cresc.*  
*più cresc.*  
*ff*

# Geoheritage & Geoconservation for Society



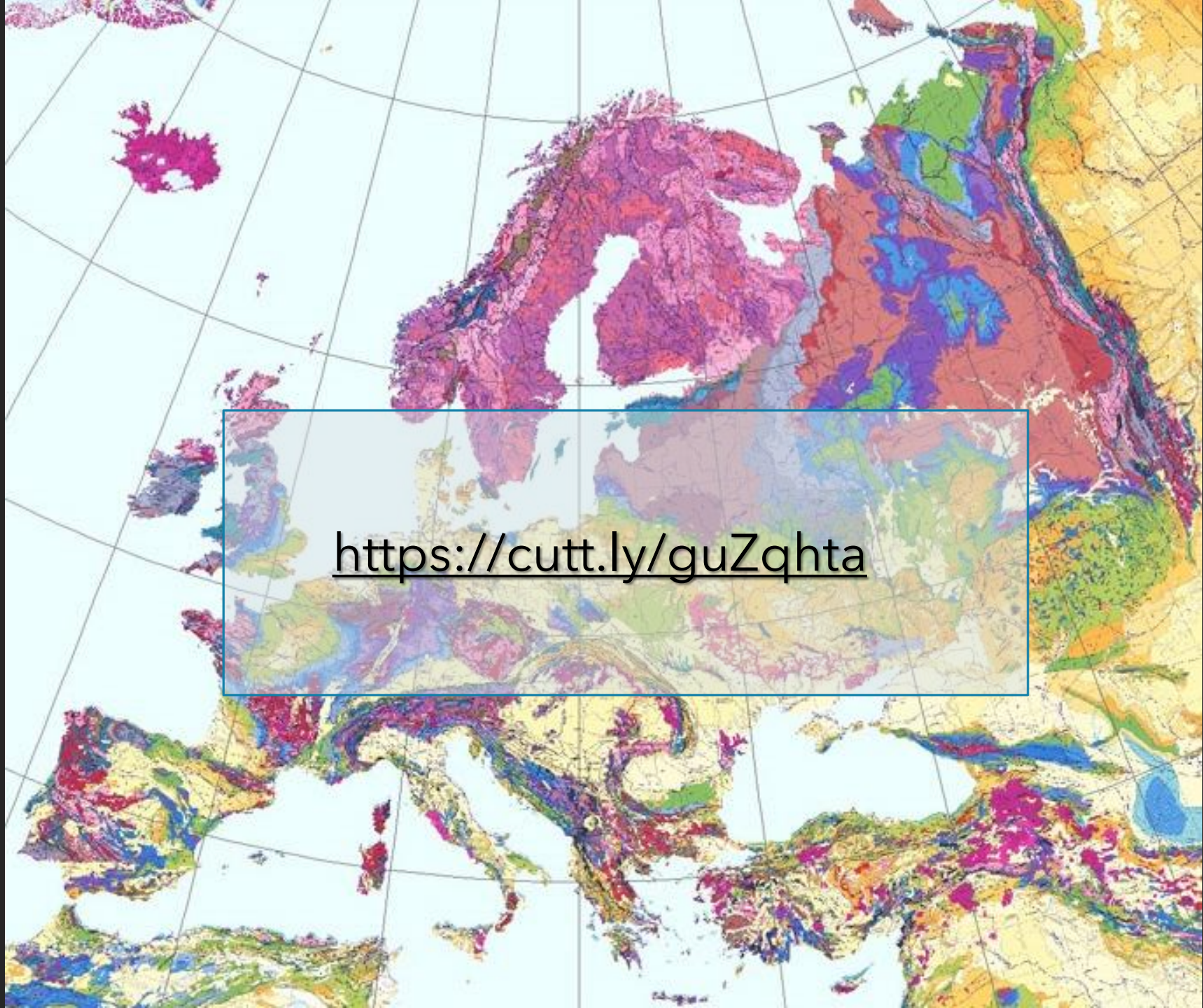
<https://whc.unesco.org/en/list/>

<http://www.europeangeoparks.org/?lang=pt>





# Europe's Geodiversity



<https://cutt.ly/guZqhta>

IGME 5000

# Bridge between Europe and North America, Reykjanes Peninsula UNESCO Global Geopark, Iceland



Cliffs of Moher, Burren and Cliffs of Moher  
Unesco Global Geopark, Ireland

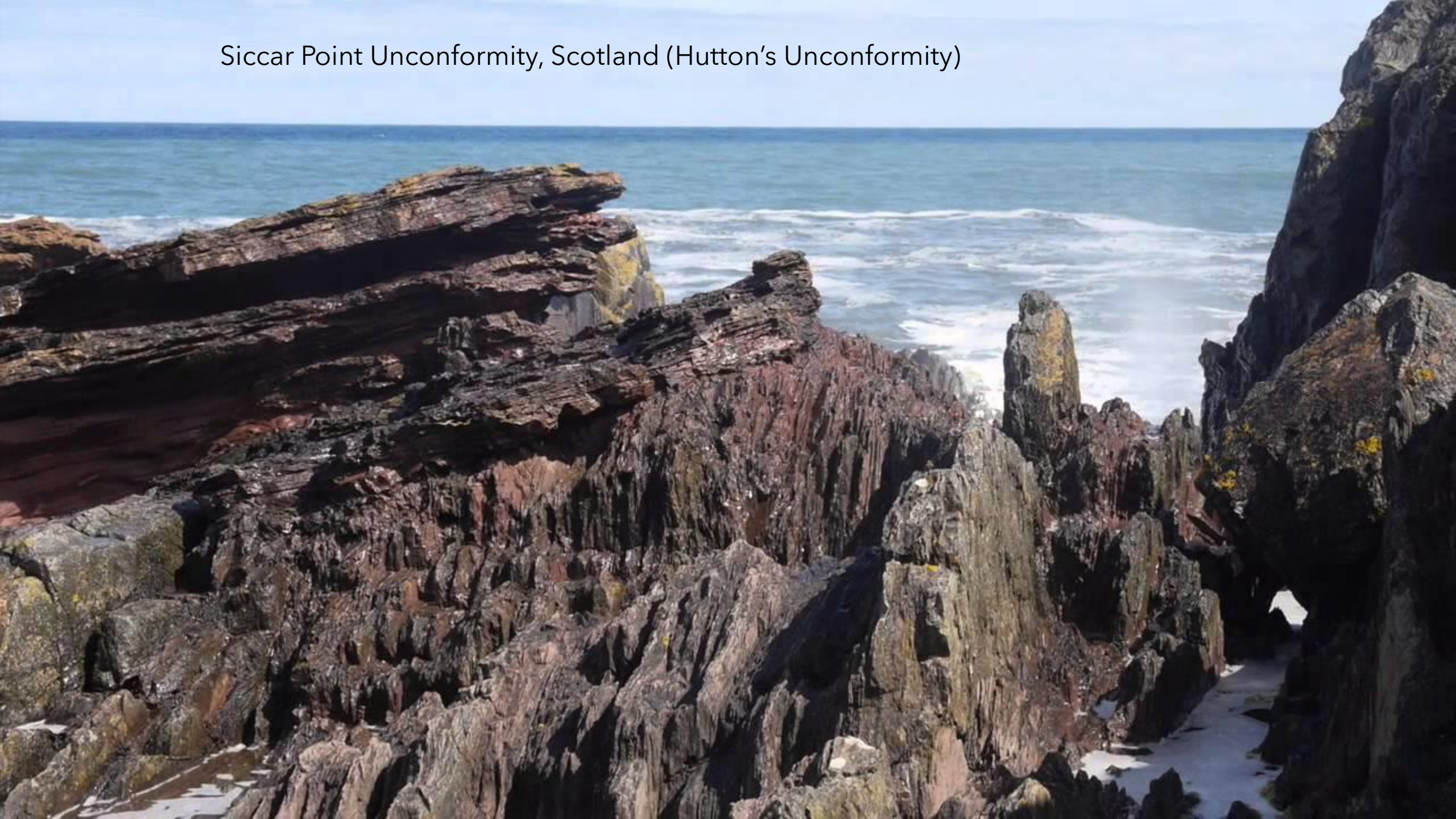


# Giant's Causeway and Causeway Coast, Ireland



<https://www.nationaltrust.org.uk/giants-causeway>

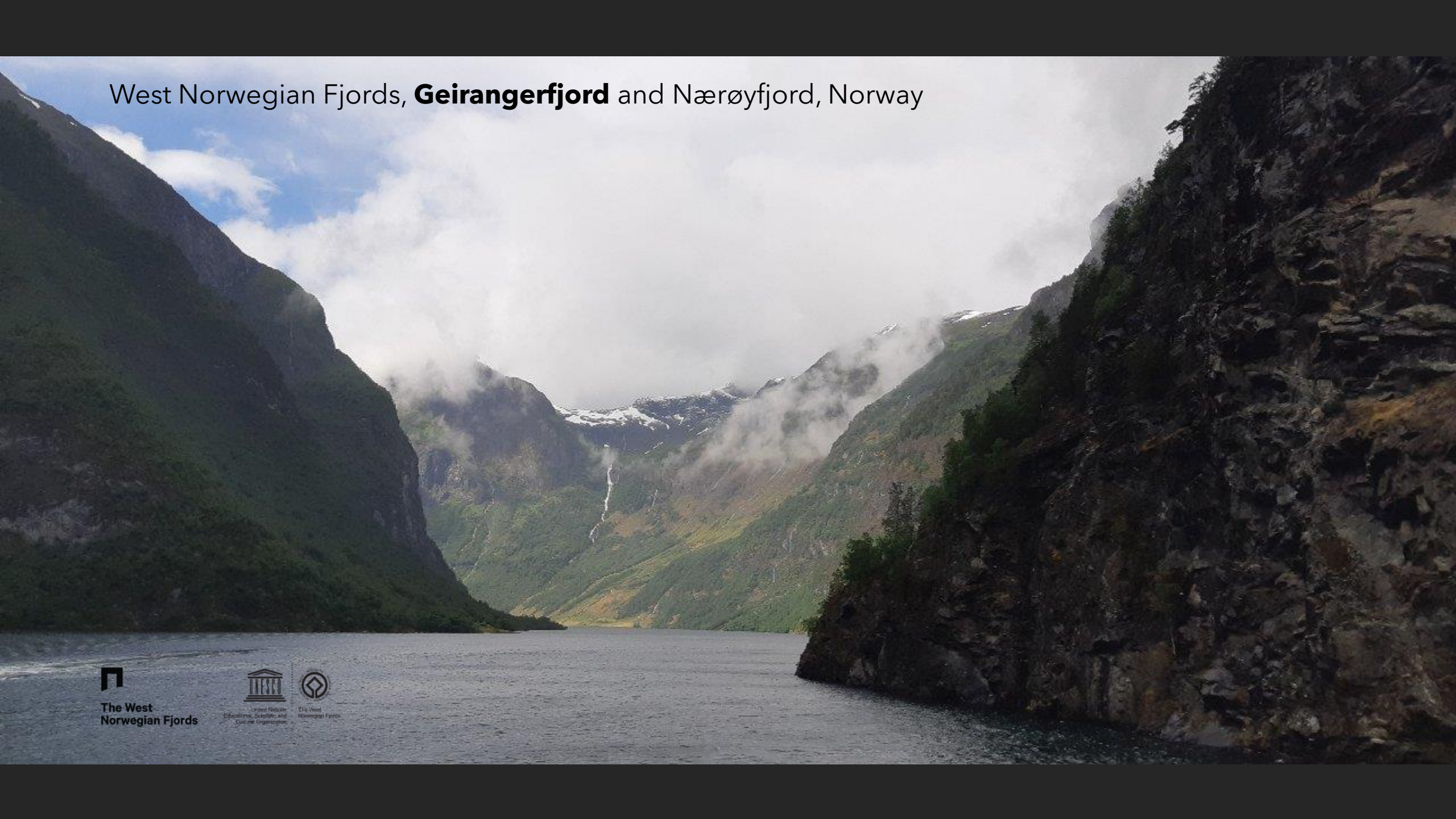
Siccar Point Unconformity, Scotland (Hutton's Unconformity)



Briksdal Glacier  
(Briksdalsbreen ),  
Jostedalbreen  
National Park, Norway



West Norwegian Fjords, **Geirangerfjord** and Nærøyfjord, Norway



The West  
Norwegian Fjords



United Nations  
Educational, Scientific and  
Cultural Organization



The West  
Norwegian Fjords

Wieliczka and Bochnia  
Royal Salt Mines





Plitvička jezera,  
Croacia



**PLITVIČKA  
JEZERA**  
Nacionalni park - National park

# Swiss Tectonic Arena Sardona

The mountains are upside down here!



<https://unesco-sardona.ch/en/be-amazed>

Santorini, Greece



© MacGillivray Freeman  
Films

# Giant Trilobites, Arouca UNESCO Global Geopark, Portugal



# "Birthing Stones" ("Pedras Parideiras"), Arouca UNESCO Global Geopark, Portugal



Igneous breccia (Plutonic), Porto, Foz do Douro Metamorphic Complex, Portugal



# Lagoa do Fogo, Azores UNESCO Global Geopark, Portugal



United Nations  
Educational, Scientific and  
Cultural Organization





Bardenas Reales, Spain



Telheiro beach, Portugal



Saturnia, Italy



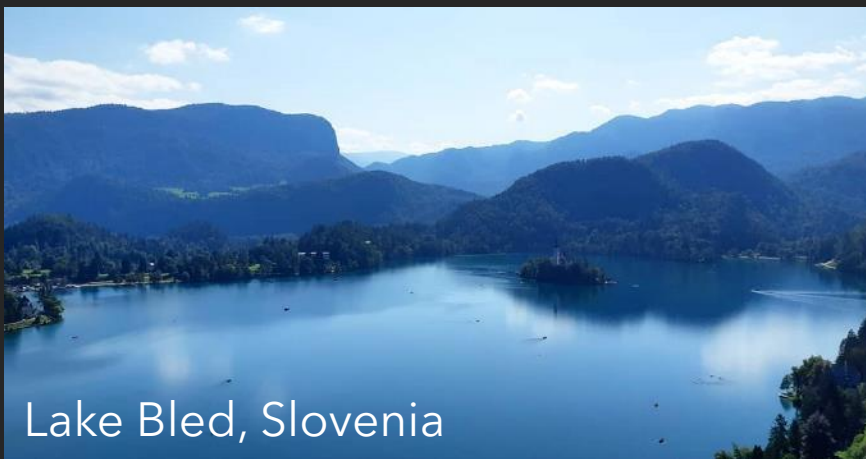
Belogradchik\_Rocks, Bulgaria



Gruta de Benagil, Portugal



Lesvos Petrified Forest, Greece



Lake Bled, Slovenia



Dune du Pilat, France



Uvac\_River, Serbia