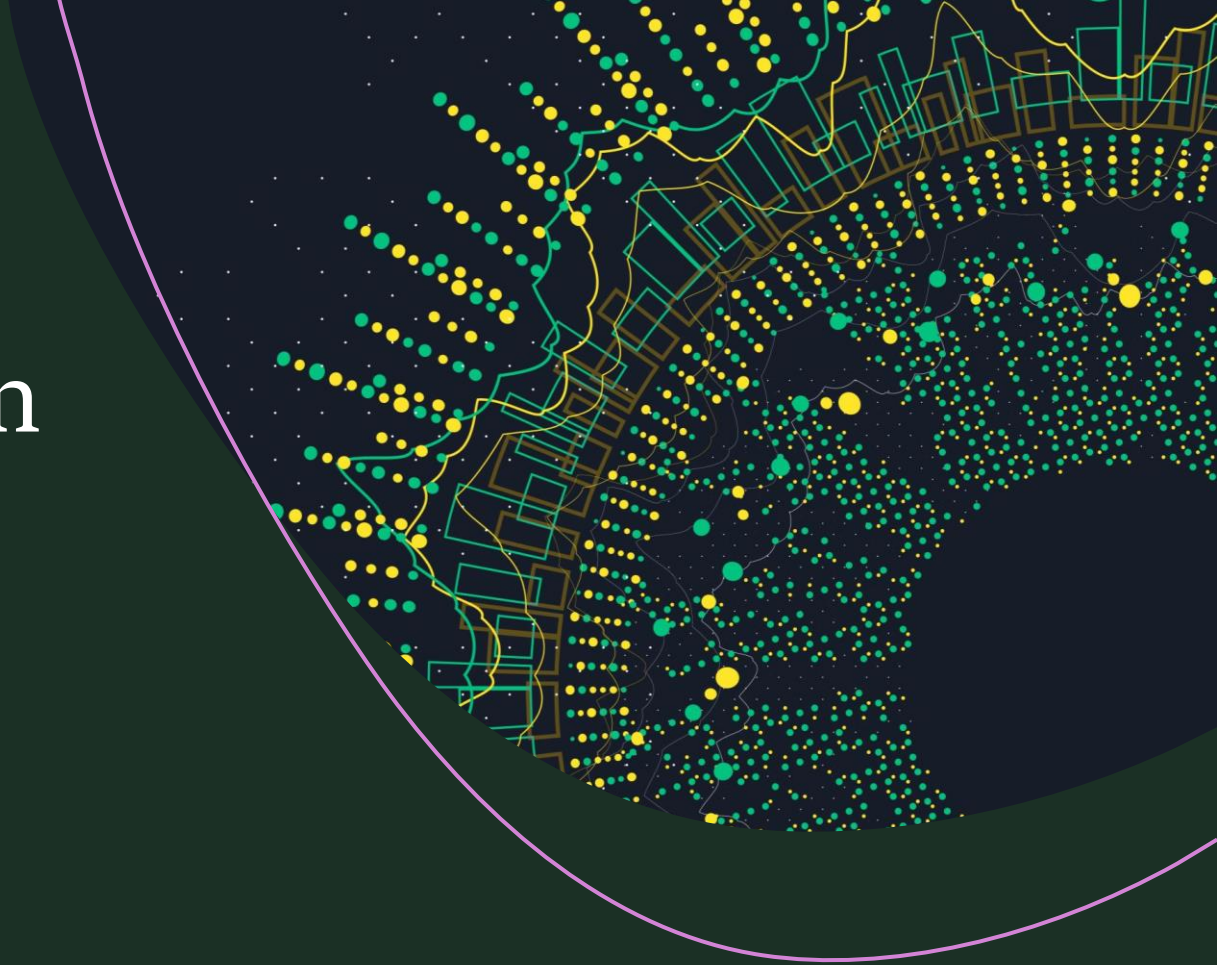
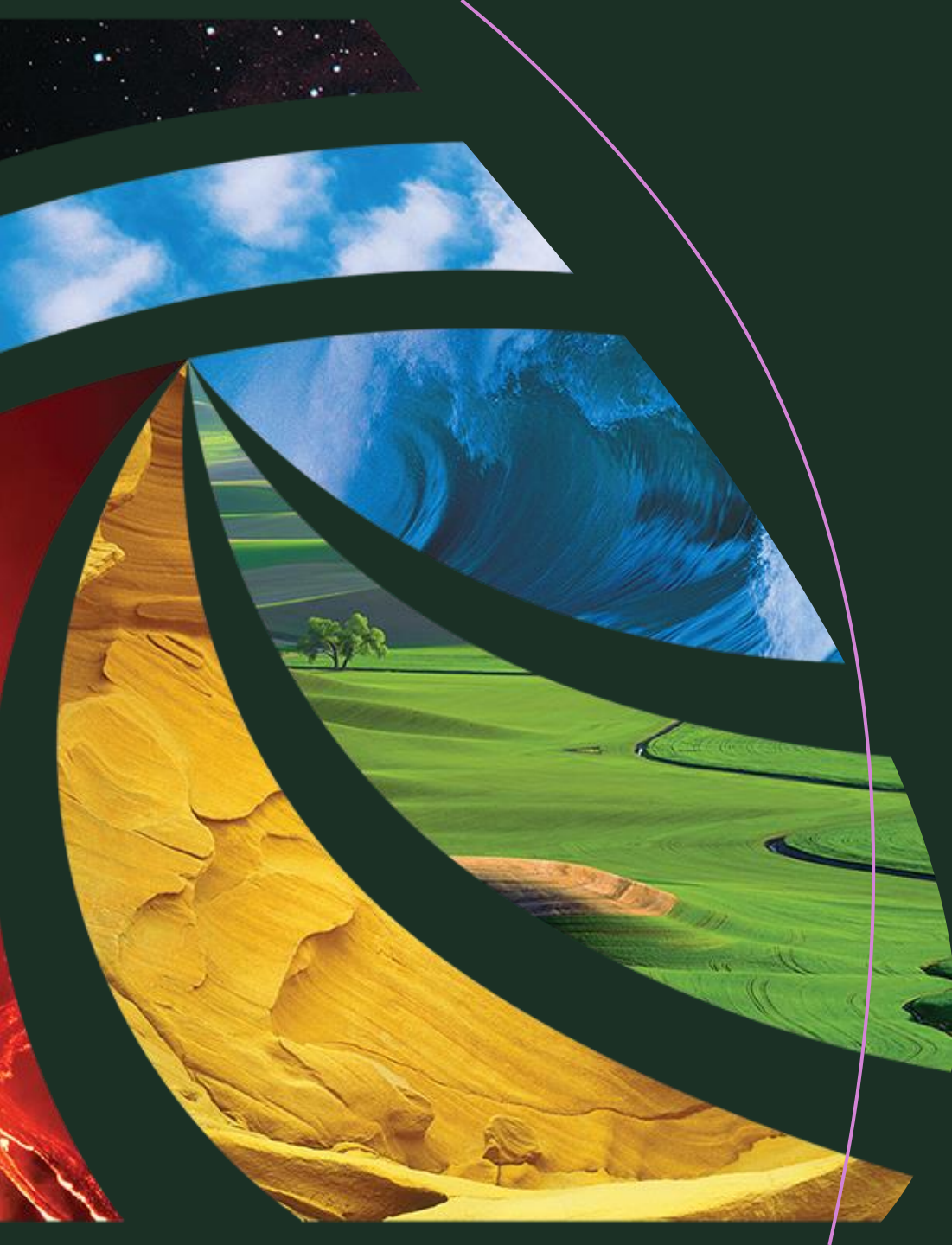


# Trends and Opportunities in Training in the Geoscience Sector: Raw Materials

Professor John Ludden – Heriot-Watt University & International Union of Geological Sciences

Mrs Anna Clark – Heriot-Watt University





# What is Geoscience?

The science of the processes that form and shape the Earth. Geoscientists seek to better understand the Earth.

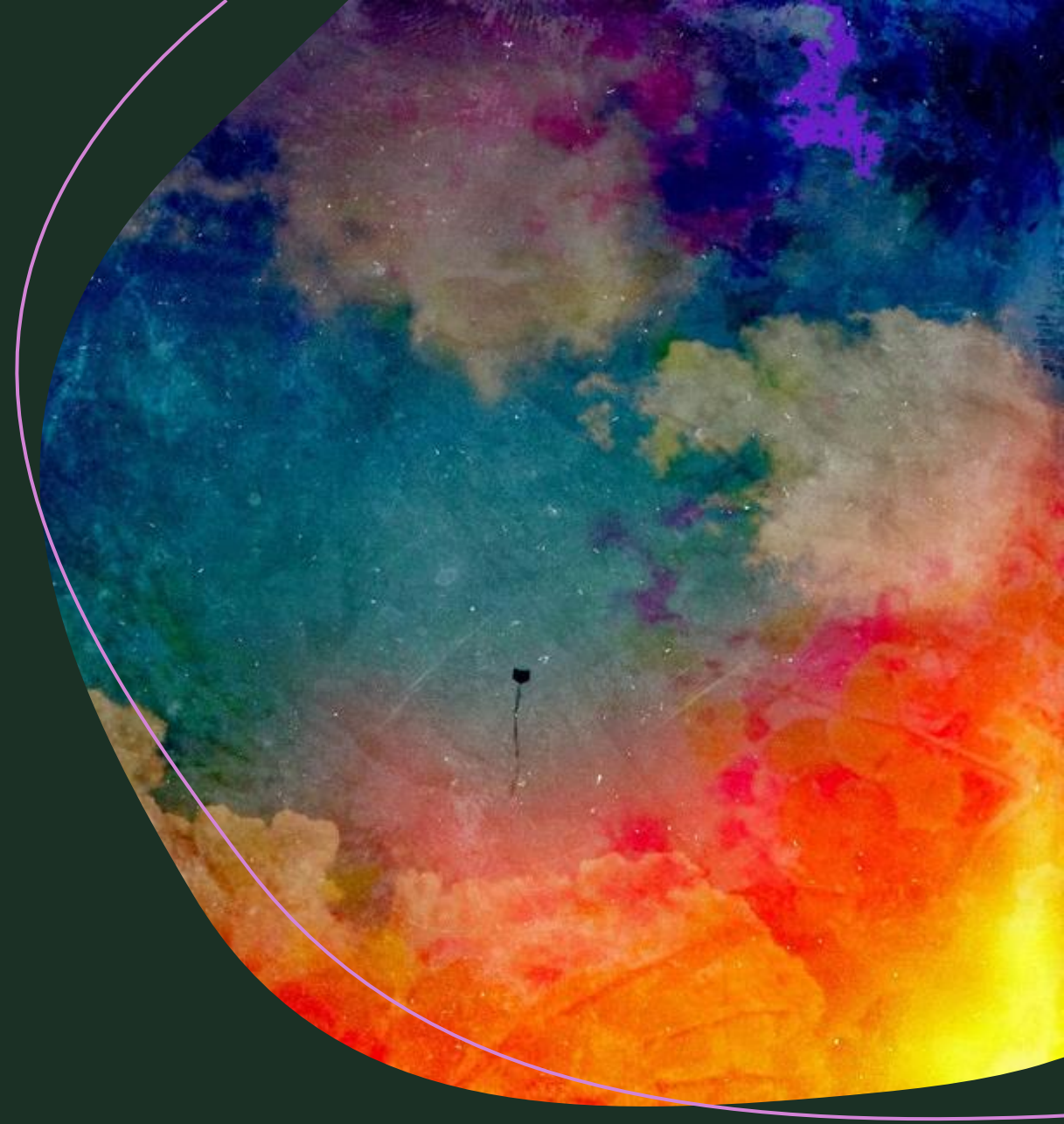
The foundations of geoscience were shaped by observations of Earth's surface and modern-day active processes.

Modern geoscience encompasses the surface, subsurface and planetary science.



# Why is on-going Geoscience training crucial in the raw materials sector?

- Data disparities demand an understanding of geological processes.
- Our understanding of geological processes is underpinned by data.
- A holistic view is developed over time, through access to training and new data sources/types.



# Geoscience subjects have seen a consistent drop in enrolment in the UK – why?

- 43% reduction in university student numbers for Geology since 2014. General declining trend since the late 1980s.
- Lack of clear subject identity?
- Lack of defined career path?
- Association with environmental damage?



<https://t.co/BRypKc2KNM?amp=1>

## Geology Perceptions Survey

This pedagogic research project is being conducted by Steven Rogers ([s.l.rogers@keele.ac.uk](mailto:s.l.rogers@keele.ac.uk)), Rehemat Bhatia, Anna Clark ([a.e.clark@hw.ac.uk](mailto:a.e.clark@hw.ac.uk)), Natasha Dowey ([n.dowey@shu.ac.uk](mailto:n.dowey@shu.ac.uk)), Sam Giles ([s.giles.1@bham.ac.uk](mailto:s.giles.1@bham.ac.uk)), Sarah Greene ([s.e.greene@bham.ac.uk](mailto:s.e.greene@bham.ac.uk)), Chris King ([chrisjhking36@gmail.com](mailto:chrisjhking36@gmail.com)) and Katrien Van Landeghem ([k.v.landeghem@bangor.ac.uk](mailto:k.v.landeghem@bangor.ac.uk))

\* Required

### Information about the study

#### Aims of the Research

A recent decline in students studying geology has led to understandable concern from geologists. A number of causes have been suggested, but the voice of prospective and current students is missing from these discussions. It is vital to ask prospective students whether they are considering pursuing geology, to ask current students why they are or are not studying geology, and to ask alumni similar questions. A better understanding of public perceptions of geology will allow the Higher Education (HE) sector to create and apply strategies to address the issues raised.

The key aims of this project are to: 1) compare the perception of geology degrees and geology in a broader sense amongst Further Education (FE) students, HE students and alumni, 2) identify why people choose to study, or not study, geology degrees, and 3) suggest interventions or practice to increase recruitment to geology degrees and make geology a more accessible and equitable subject.

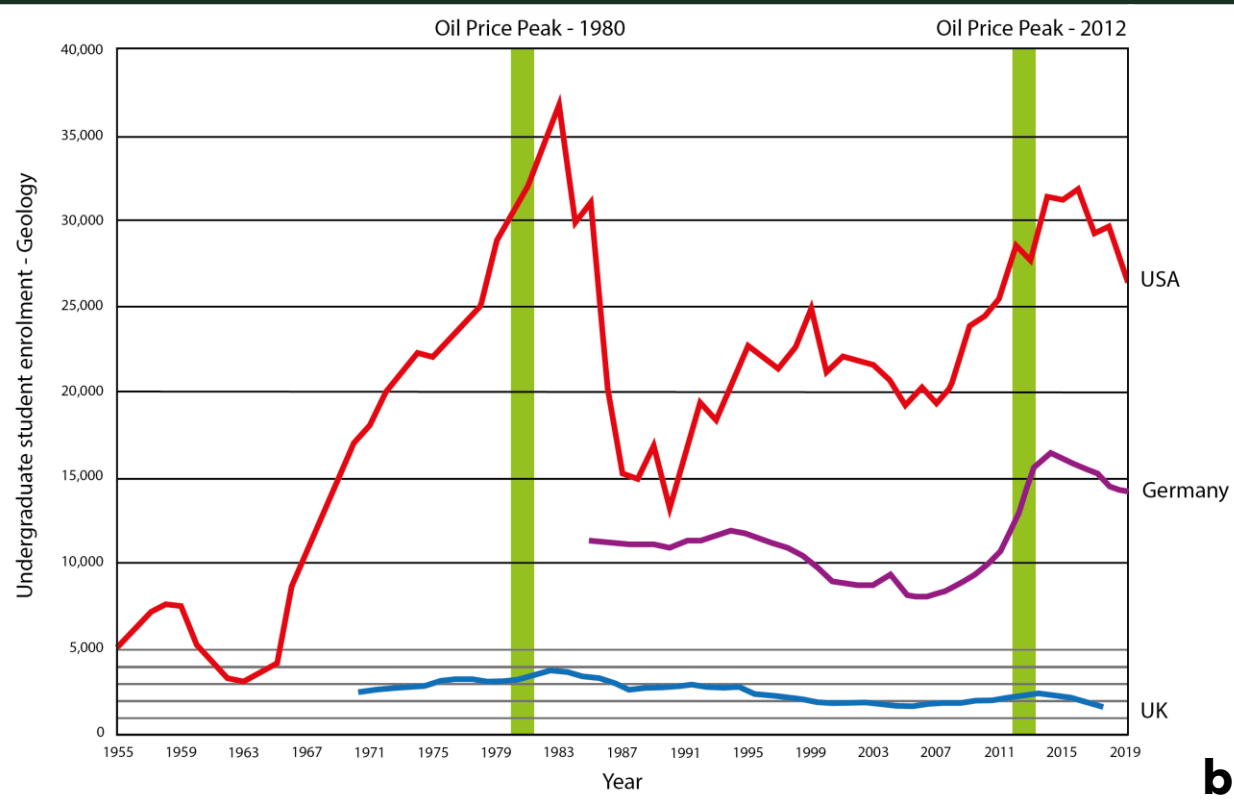
#### Why have I been invited?

We have asked you to take part either because you are a (16+ year old) HE or FE student in geology or an allied subject, or a recent graduate or alumnus in geology or an allied subject. Any individual currently residing in the UK is welcome to complete the survey. We are particularly interested in participation of geology, geography and STEM students.

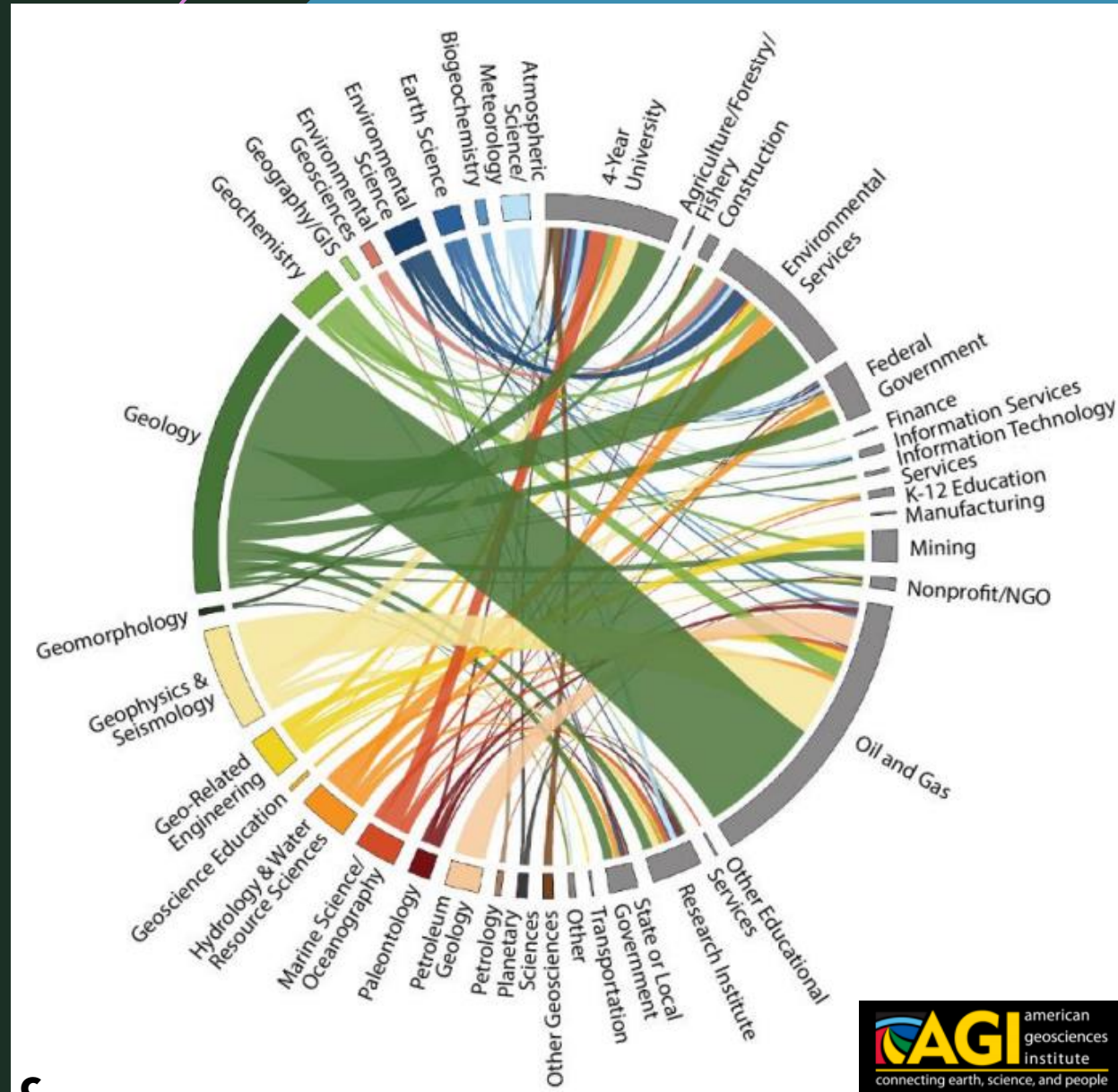
Participation is voluntary. If you do decide to take part, you are asked to give your consent below. One of the research team can go through this information with you, should you wish. If you have been given this survey by a gatekeeper (e.g. your A-Level teacher etc.) they may also be able to help go through this information, or contact the research team on your behalf. You are free to withdraw from this study up to



# Geoscience student enrolment figures – Recent decline



Data from the American Geosciences Institute, The Geology Society of London and Destatis.



Geoscience graduate first sector of employment 2013-2018 (USA)





Image search: “Geologist”

Rocks – Hammer – Outdoors – Lack of Diversity – PPE?



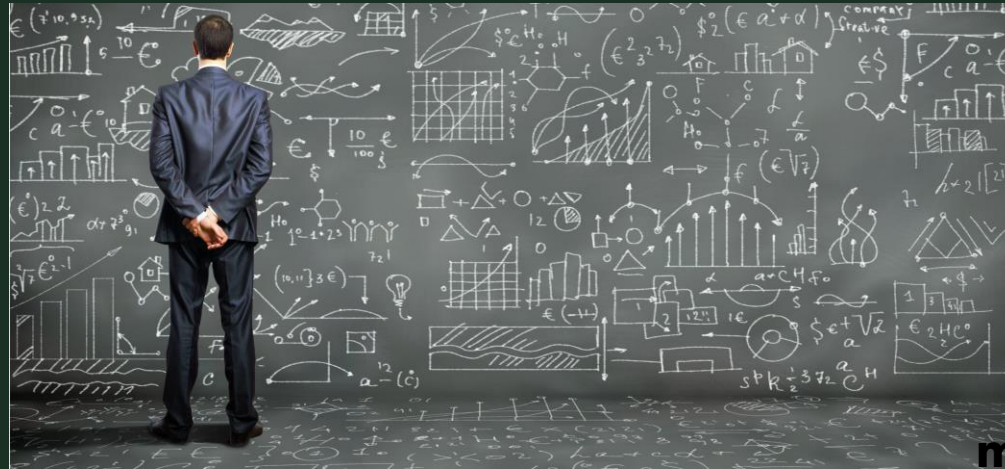


Image search: “Data Scientist”

Data – Technology – Indoors – Lack of Diversity



# The Relevance of Geoscience

The focus of geoscience training has changed with time to reflect societal needs and political aspirations.

- Economic development – map the location and understand the development potential of natural resources.
- Environmental monitoring – understand and predict geohazards and ensure sustainability of resource exploitation.







Traditionally geoscience education has focussed upon local geology and local databases and platforms. The move from analogue to digital provision of data has and will enable increased national and international collaboration. **Freedom to access geological and geophysical datasets is changing the way that training can take place.**

**Geologists can consider global challenges and seek global perspectives.** It also opens the way for greater integration of geoscience with automated data recognition through machine learning and artificial intelligence. Open access data enables integrated information flows, which are crucial when considering training development and learning outcomes.

# Collaboration is key

- **Centres for Doctoral Training**  
(thematic, specialist training for multidisciplinary cohorts)
- **Doctoral Training Partnerships**  
(multidisciplinary, broad training for focused subject cohorts)
- Formal linkages between industry and academia



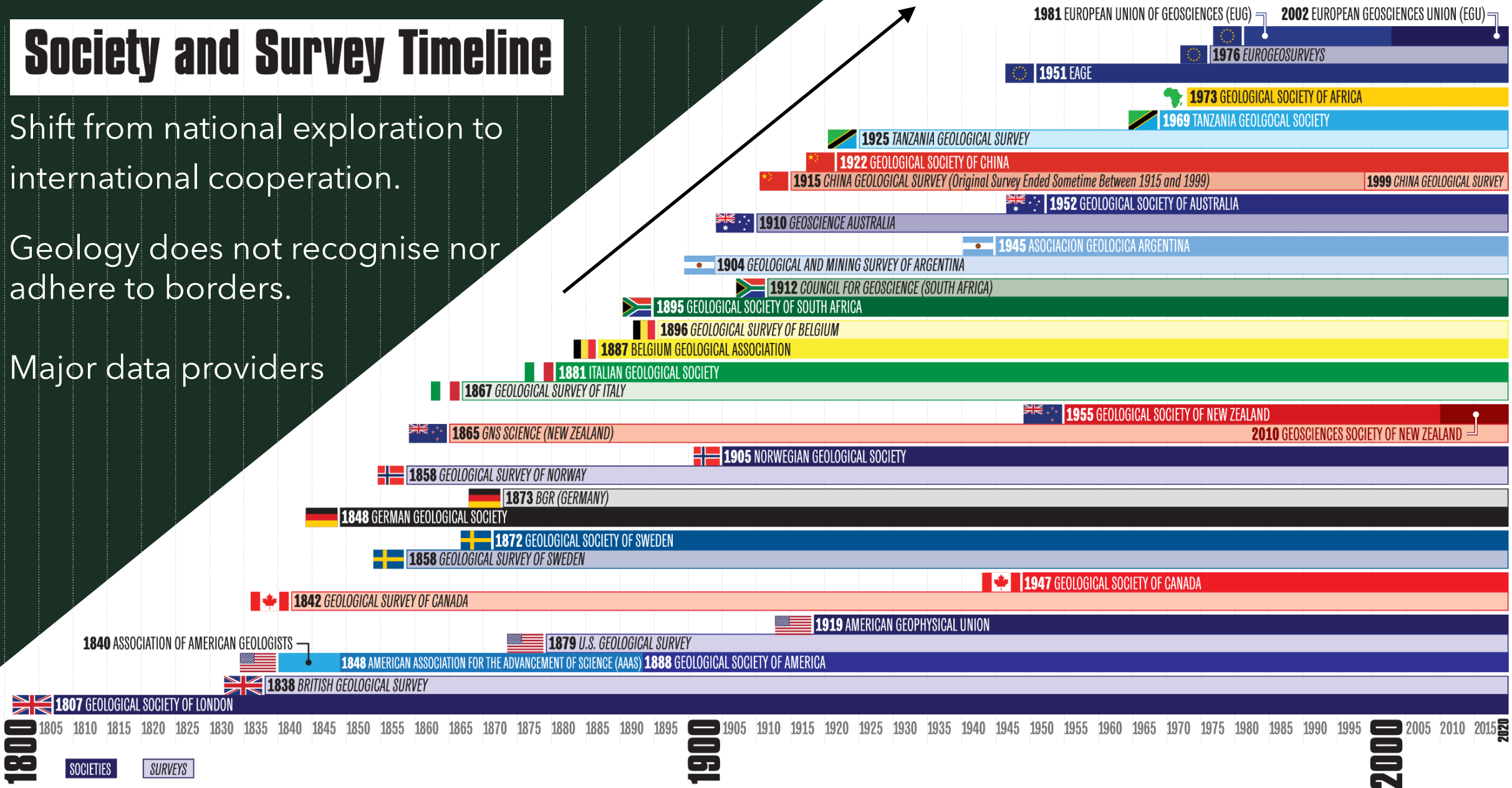


# Society and Survey Timeline

Shift from national exploration to international cooperation.

Geology does not recognise nor adhere to borders.

Major data providers



# Open Data as a training resource

- Opportunity to think globally.
- Promotes multi-disciplinary collaboration.
- Develops skillsets required beyond academia.



## Team Emerald

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Industrial University of Santander, Colombia

Yukon Plateau Dataset

## CSM Exploration Initiative

Liam Clegg (CSM), Sharlotte Mkhonto (Queen's University, Canada), David Campbell Cambor (CSM), Cyprien Niyigana (CSM), Xuyang Meng (Laurentian University, Canada), Charlie Hicklin (CSM), Chetan Soni (CSM), Leoni Strobl (University of Utrecht), Oscar Ryan (CSM), Josh Grattage (CSM), Alda Chimuco (CSM), Ayub Mhina (Manitoba University, Canada), Alexandra Hutchings (CSM) and Alex Jenkins (University of Bristol, UK)

Camborne School of Mines (CSM), United Kingdom

Quesnel Trough Dataset

## Platypus Xplorer

Alexandre Le Boulch, Mélanie Bonnefoy, Pierre Laine, Emerik Royer, Arthur Lagirarde and Maxime Peron

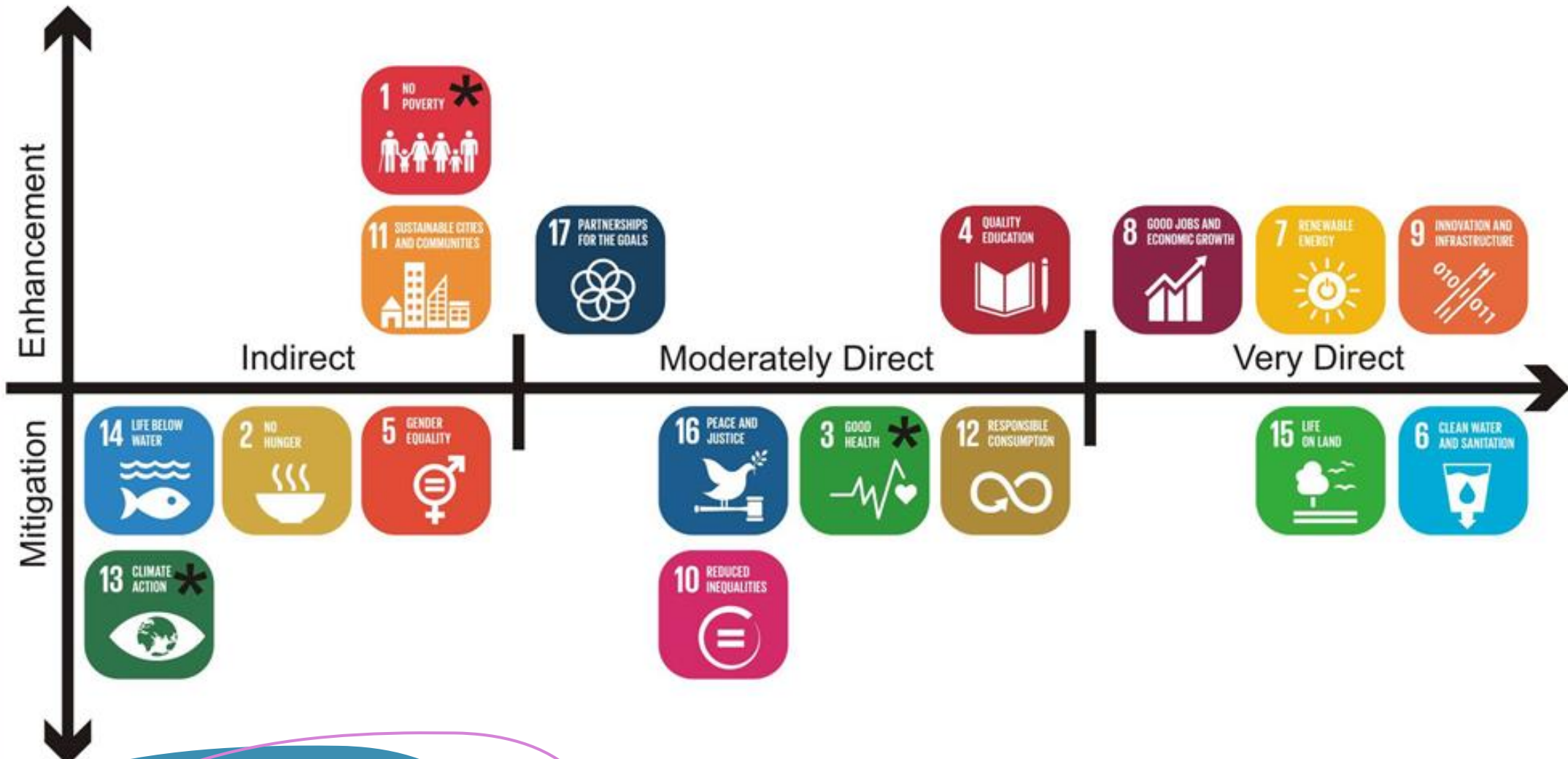
UniLaSalle, France

Gawler Craton Dataset





# Mining and the 17 SDGs: Indicative Priorities



The wider value of raw materials

# Geoscience for Global Sustainable Development

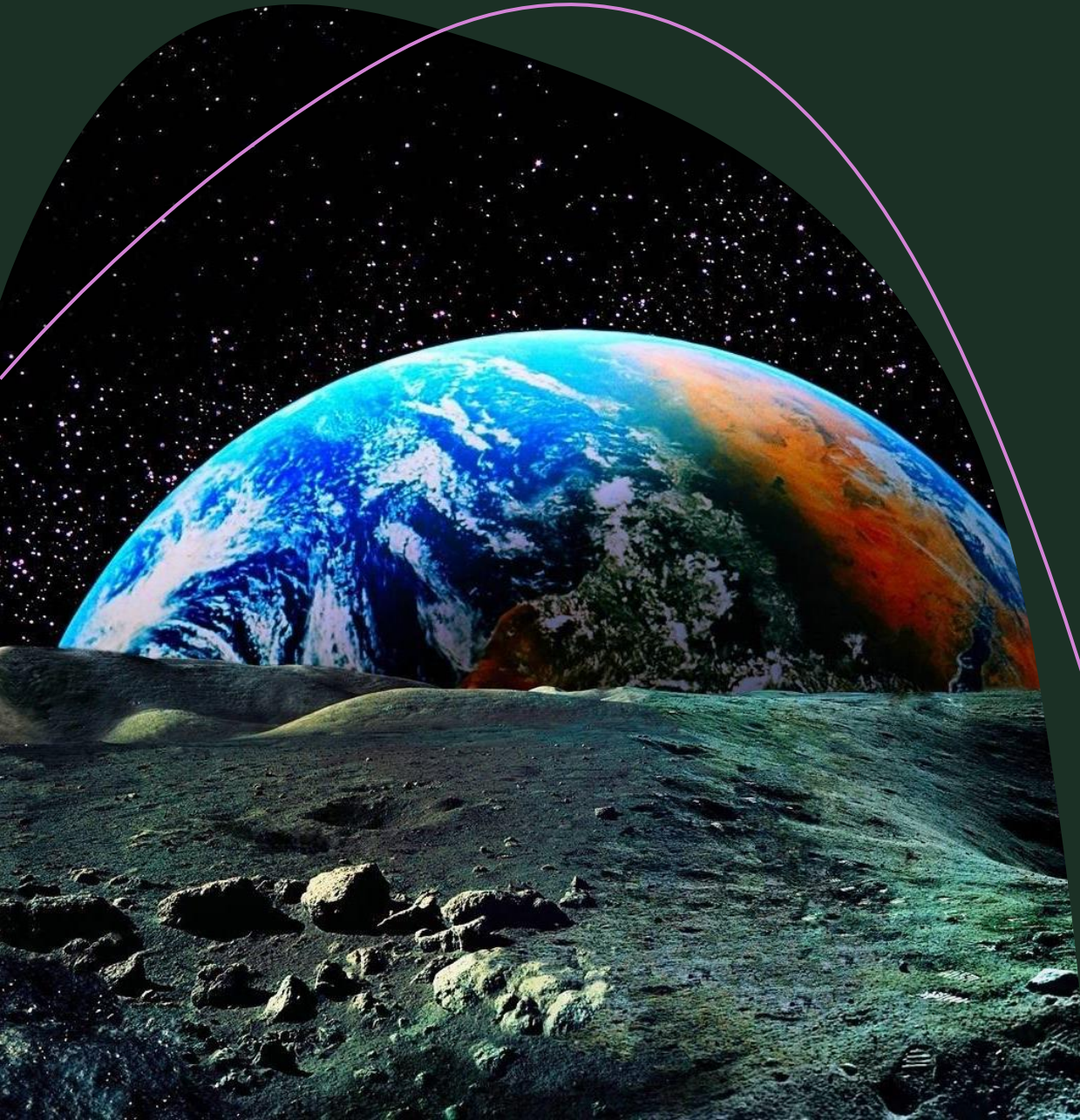
- Increasing demand for certain raw materials (e.g. for battery technology and electronic components) – potential for this demand to be met in developing regions. Requires skills development to enable management to mitigate and minimize negative impacts of mining.





# A Big Science for Big Questions...

- Opportunity to branch out from being seen as a subject based purely around where to find raw materials.
- Impact
- Solutions
- Sustainability





# GEOSCIENCE FOR THE FUTURE

Geoscientists will be crucial in meeting society's future challenges, be that through the United Nations Sustainable Development Goals, the Paris Agreement to avoid dangerous climate change, or through other important policies to protect the environment and ensure the availability of vital resources for all.

Geoscientists will be critical in:

- Ensuring access to clean and sustainable water supplies
- Sourcing and extracting critical minerals needed for green technologies like solar and wind power
- Understanding the subsurface to harness geothermal energy, enable safe infrastructure development, and carbon capture and storage technologies
- Mitigating climate change and influencing governmental policy through understanding past climates, modelling potential future outcomes and understanding climate impacts on environment, livelihoods and natural hazards.

## SUSTAINABLE DEVELOPMENT GOALS



THE GEOLOGICAL SOCIETY OF LONDON SUPPORTS THE SUSTAINABLE DEVELOPMENT GOALS





# Image source locations

- a = Geology Perceptions Survey
- b = Author's own – data from AGI, Geolsoc and Destatis
- c = americangeosciences.org
- d = seek.com.au
- e = forbes.com
- f = yesofcorsa.com
- g = sarvgyan.com
- h = bsu.edu
- i = simplilearn.com
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- m = techgenix.com
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- o = de24.news
- p = scmp.com
- q = Nickless, E., Hess, J., 2021, The Origins, Current State, and Future of Geological Surveys and Societies, pp. 607-626, Encyclopaedia of Geology (2<sup>nd</sup> Edition)
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- u = line.17qq.com
- v = geolsoc.org.uk
- Unreferenced imagery sourced from unsplash.com