IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

UTAS

Optimal Horizontal Resolution Strategy

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Origin of Issue

- Proposals for relatively minor features closely associated with proximal features already named
- Proposals result in clutter, inflation, and naming inconsistent with proximal features already named
- Hence SCUFN may want establish a minimum size – relief and horizontal extent – for proposed features

Horizontal Resolution Strategy

Recommendation following SCUFN31 (Ohara)

"The areal size of an undersea feature should generally be identified on a map scale of 1:1,000,000 and/or a map generated with a 15 arc-second grid bathymetric data. When proposing a minor undersea feature that does not meet this criterion, the proposer should explain the reason why they want to name it. The reasoning may include that the proposed feature is (1) an important landmark for geological and/or geophysical and/or biological phenomena, (2) an important landmark for sampling point such as a dredge point, and/or (3) an important landmark for description of geology and/or geophysics of the area, etc."

Horizontal Resolution Strategy

Recommendation following SCUFN32 (Mackay)

"Minimum dimension

The size of undersea features that are named has always been dependent of the mapping technology. At the time SCUFN was established, in 1975, single beam sounding systems were the 'standard' equipment used and features were identified, defined and named based on a few ship tracks. This meant that only significantly large features, usually greater than 10 kilometres across were mapped and named. Also, there were often assumptions on the form of the feature resulting in the assignment of Generic Terms that do not comply with the criteria set in this cookbook.

Horizontal Resolution Strategy

Recommendation following SCUFN32 (Mackay)

By 2000, multibeam sounders were commonly used on research vessels and smaller features less than 10 square kilometres were being routinely mapped in detail and named. Shipborne multibeam sounders used for offshore surveys typically have a resolution of 10 to 50 m depending on water depth and currently feature architecture on the scale of about 500 m is used to define Generic Terms. With multibeam sounding systems now being used on autonomous underwater vehicles (AUVs) the mapping resolution is better than 1 metre and features of a few 10s in size of meters are being defined.

Recommendation following SCUFN32 (Mackay)

SCUFN does not have any minimum size for features to be named. However as with terrestrial features, undersea features less than a few hundred metres across are usually not named except in special case that are usually based on historical significance."

Recommendation following SCUFN35.1 (Ohara)

SCUFN does not have any minimum size for features to be named. However as with terrestrial features, undersea features generally less than a few hundred metres across are usually not named except in special case that are usually based on historical and/or scientific significance. In these special circumstances, the proposer of the name of a minor undersea feature would need to describe the reason for proposing a minor feature in a proposal".

Questions

- Should a minimum size of undersea features be specified? If so, what should it be?

Seabed 2030 Resolution

DEPTH RANGE	GRID CELL SIZE	% OF WORLD OCEAN FLOOR
0–1500 m	100 × 100 m	13.7
1500–3000 m	200 × 200 m	11
3000–5750 m	400 × 400 m	72.6
5750–11,000 m	800 × 800 m	2.7

GEBCO Resolution

- Kevin Mackay to specify

GEBCO Gazetteer Specifications

- No minimum size; currently accepts whatever resolution is submitted
- Displayed features are of rounded resolution to meet defined minima
  - Shapes on the map have a resolution of 0.000001° longitude, or ~111.32 mm at equator and ~43.496 mm at 67° N/S.
  - Well Known Text representation of feature geometries displayed in the information panel is rounded to 5 decimal places, or ~1.1132 m at equator and ~434.96 mm at 67° N/S. This resolution was a requested feature of the Gazetteer as of about 5 years ago.

Abyssal Hills

A common low-relief feature of the ocean floor, usually found in basins isolated by ridges, rises, or trenches. Abyssal hills are defined as less than 1 km in relief (>1 km is termed a seamount) and several kilometers in diameter. About 85% of the Pacific Ocean floor and 50% of the Atlantic Ocean floor are covered by abyssal hills.

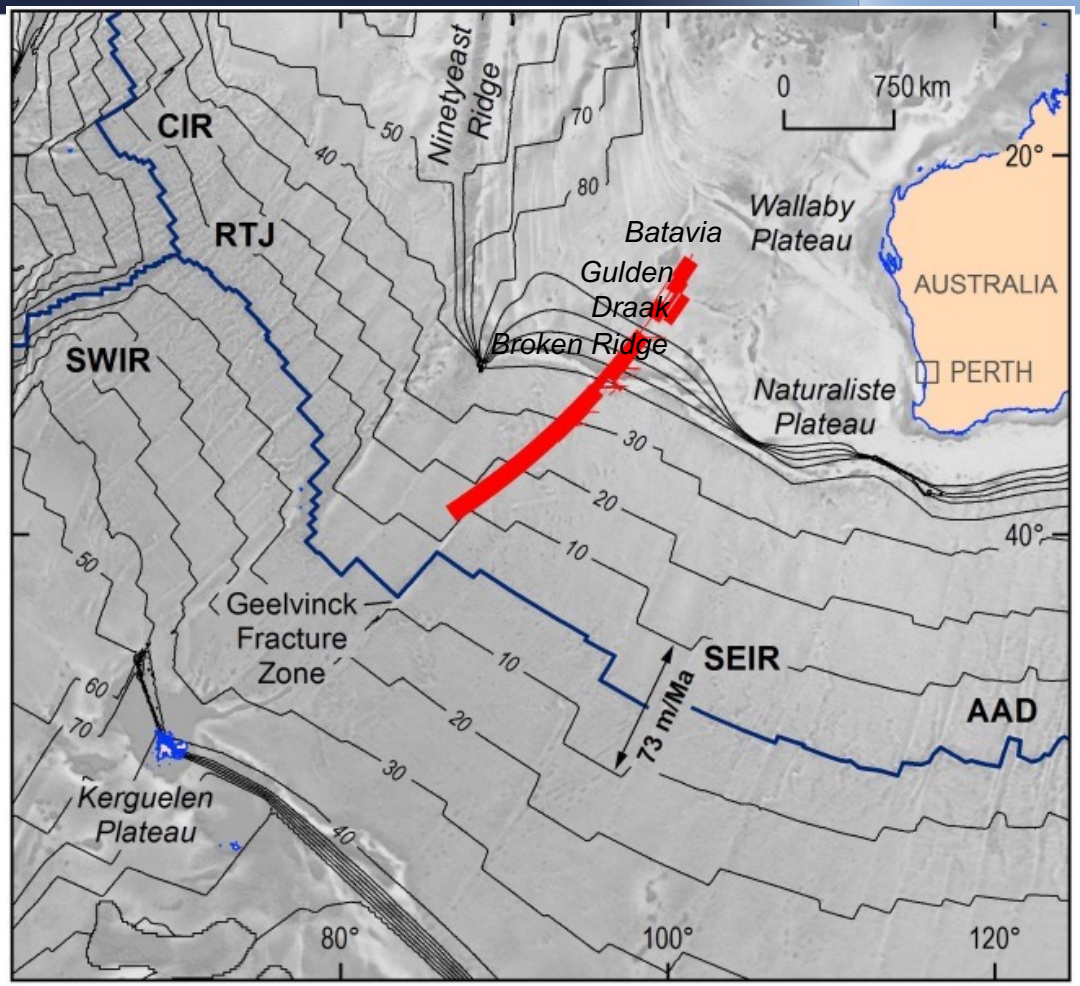
Glossary of Geology, Fifth Edition, Revised

Abyssal Hills

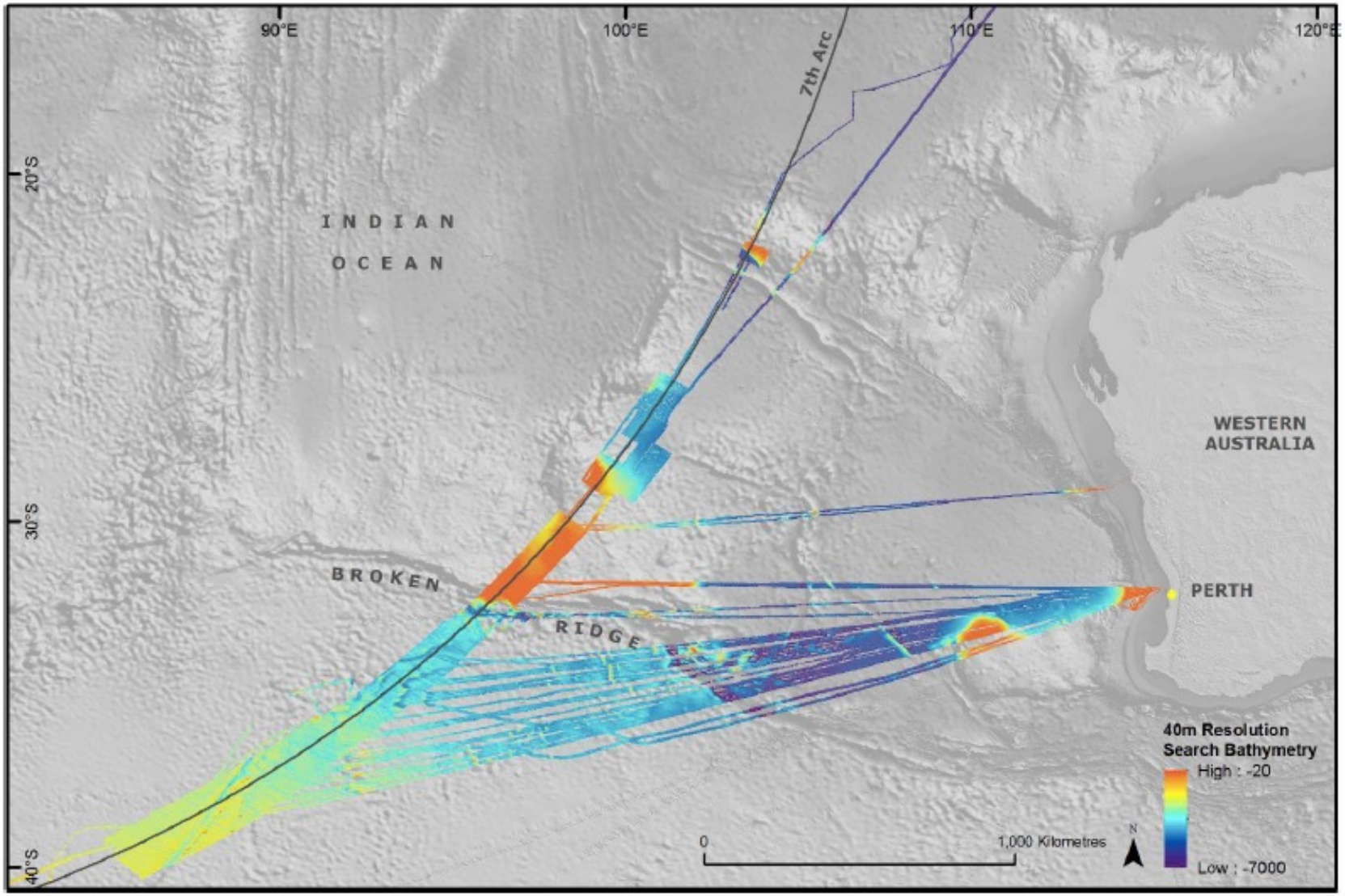
- ~50% of Earth's surface is oceanic crust
- All oceanic crust has abyssal hills
- Abyssal hills are typically buried by 10s to a few hundred meters of sediment
- Abyssal hills are typically exposed along mid-ocean ridges with little sediment, in areas where bottom currents prevent sediment accumulation, and below the carbonate compensation depth (CCD) of ~4000 m
- The millions of abyssal hills are the most common 'minor feature' on 50% of Earth's surface

Indian Ocean – MH370

- Example: Malaysia Airlines MH370 Search Data
- Area: 2500 x 100 km (279,000 km^2), the largest known seafloor area ever mapped in one continuous effort
- Total area: 710,000 km^2



Total Data



710,000 km² (France = 641,000 km²)

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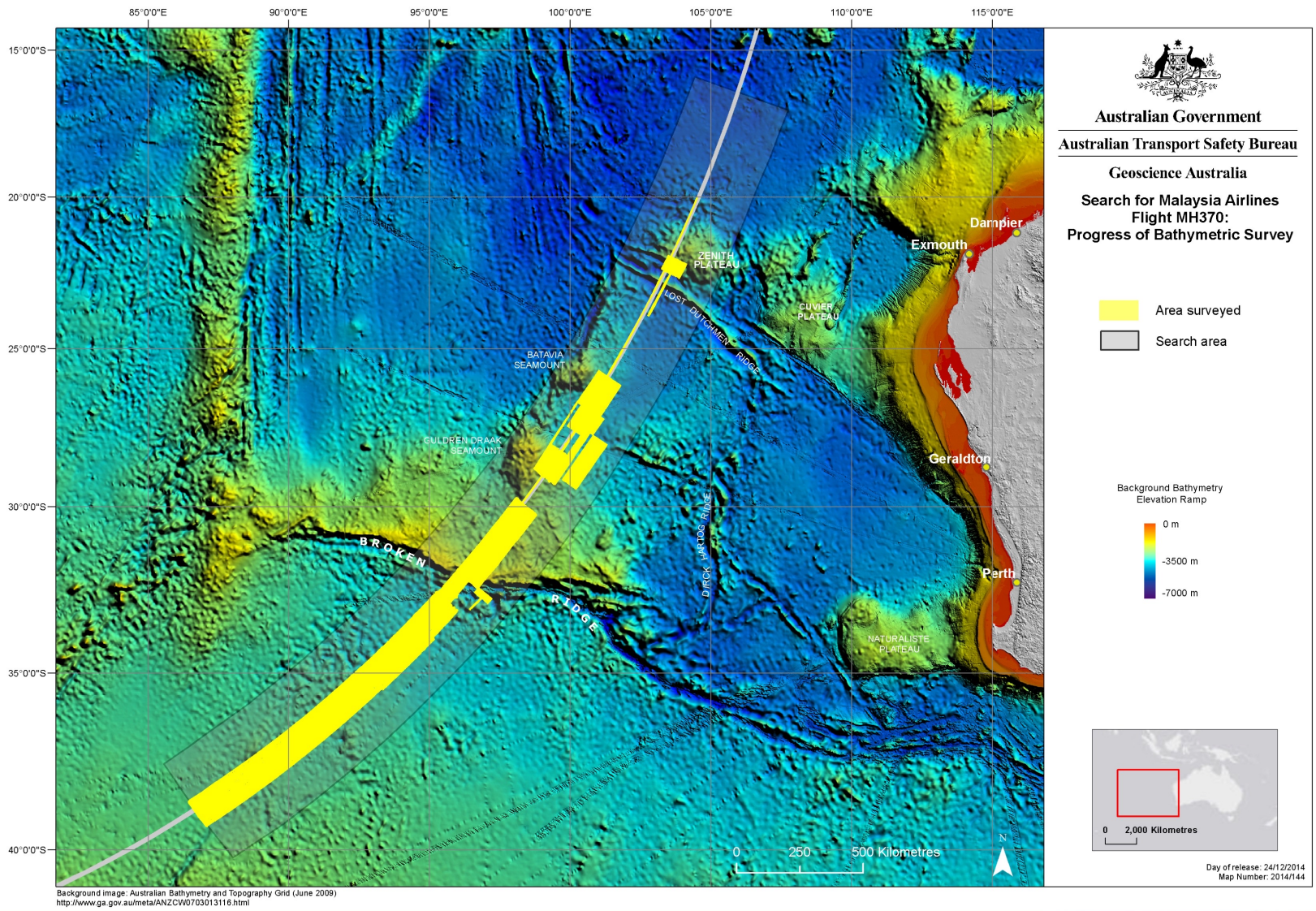
Shipboard Multibeam Bathymetry (Phase 1)



279,000 km^2 (Philippines = 300,000 km^2)

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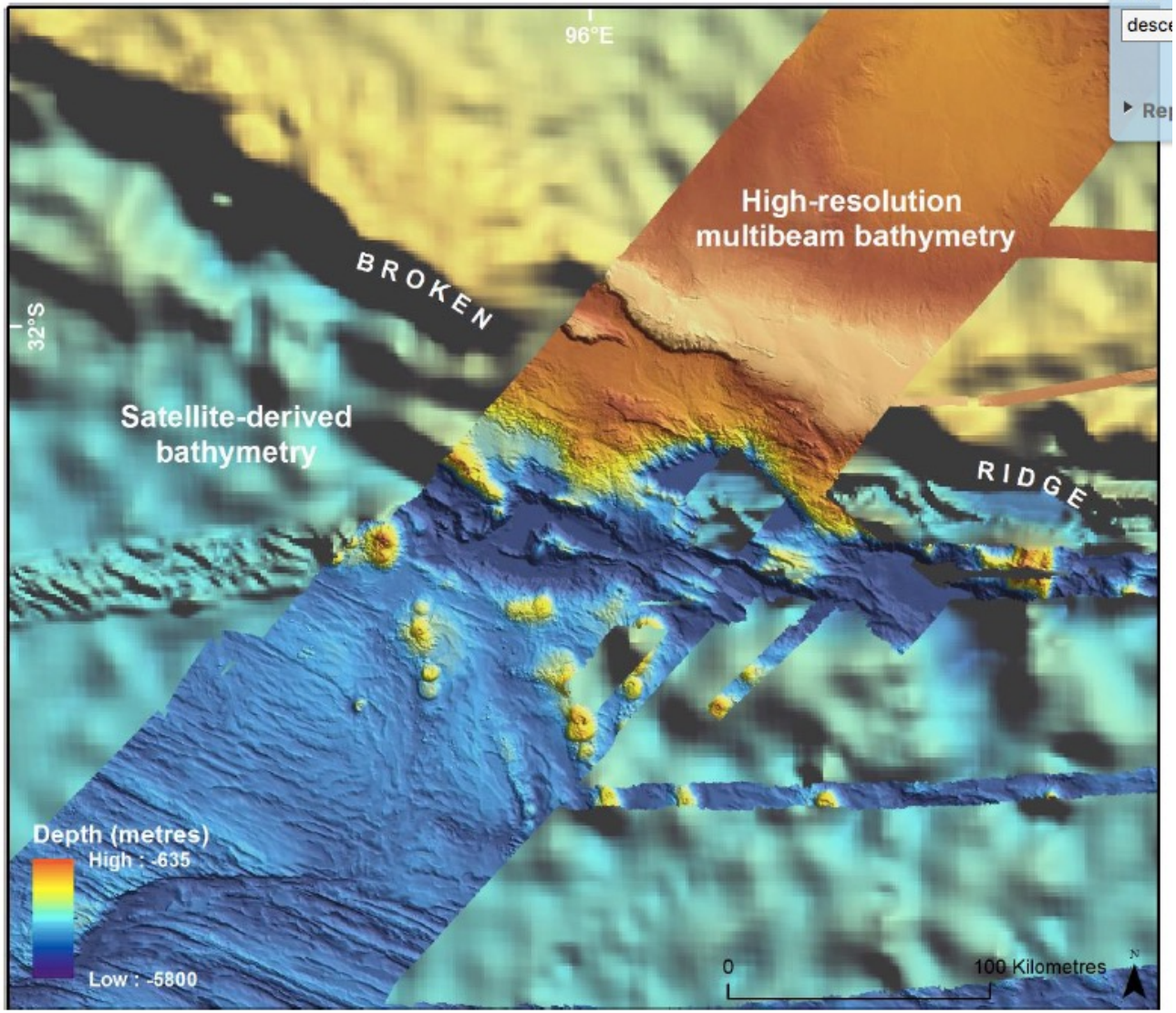
Satellite vs Multibeam Bathymetry



5 km² vs 40 m² per pixel

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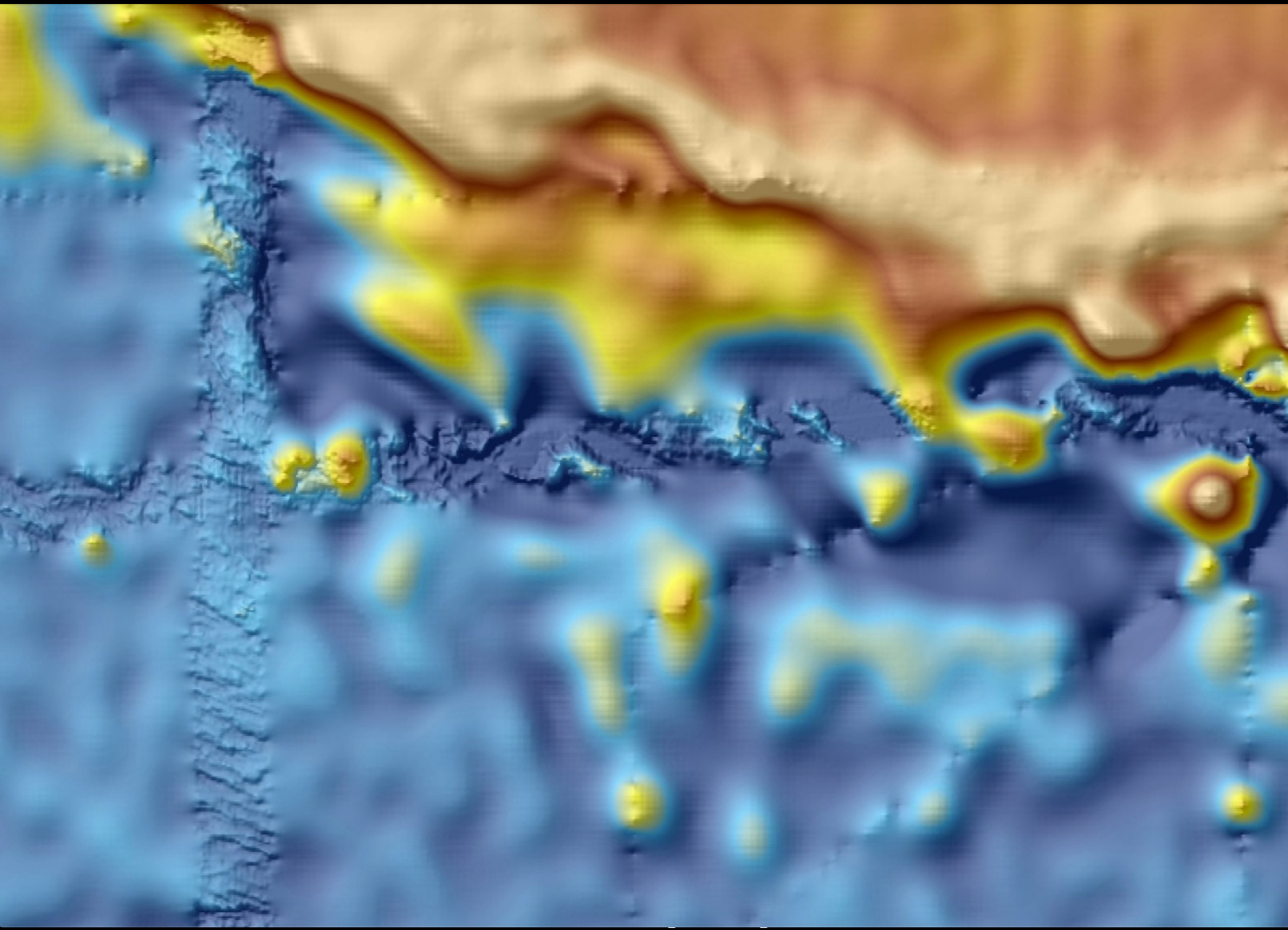
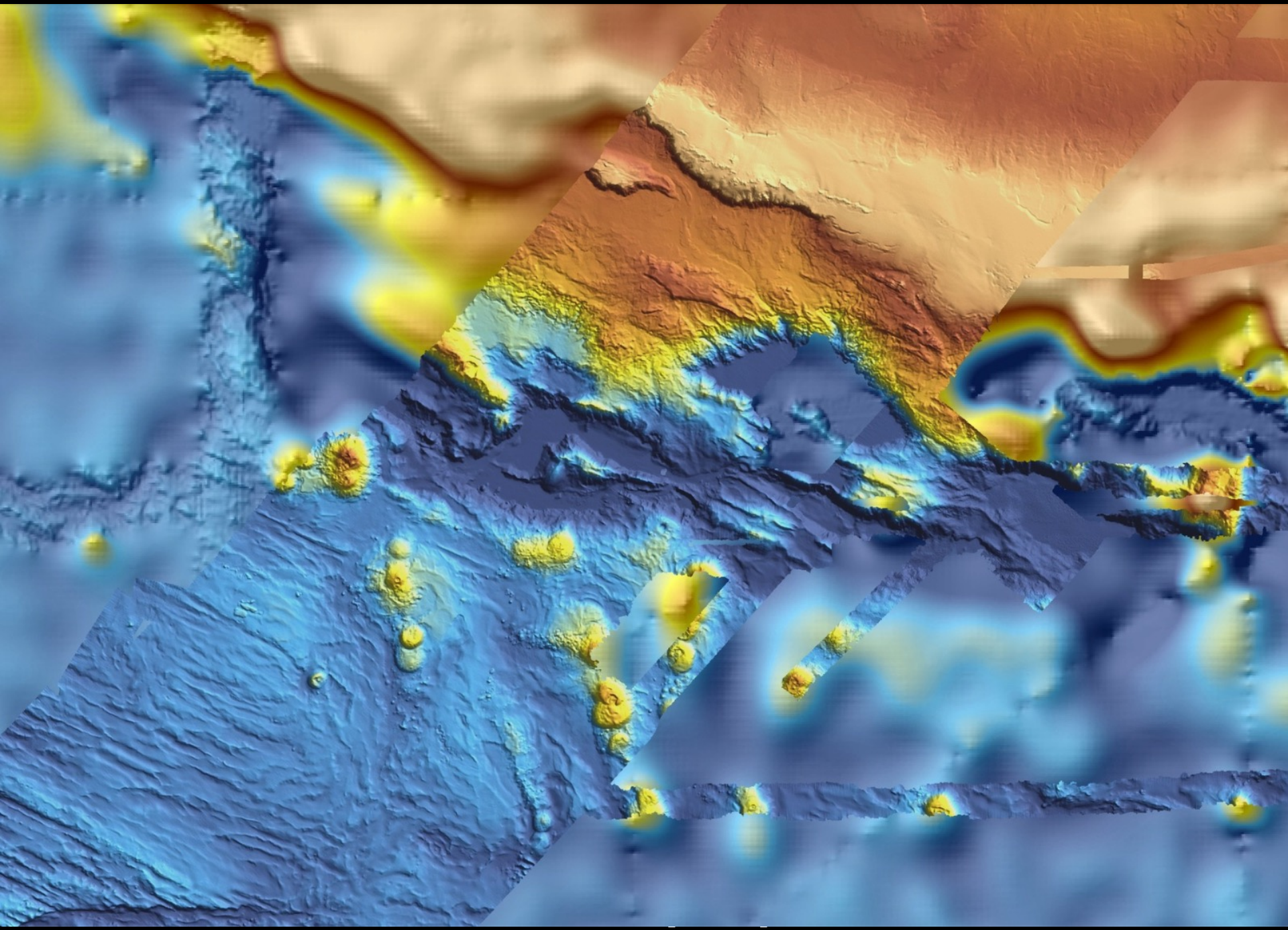
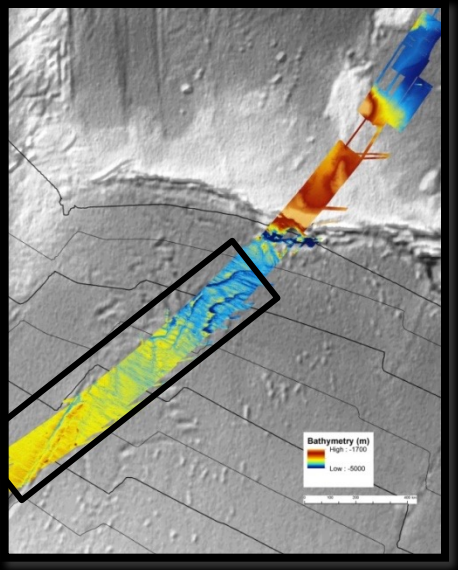




Seafloor Spreading

~40 - ~10 Ma



Picard et al., 2017

Volcanoes

Fracture Zone

30 Ma

Fracture Zone

Volcanoes

Abyssal Hills

20 Ma

Fracture Zone

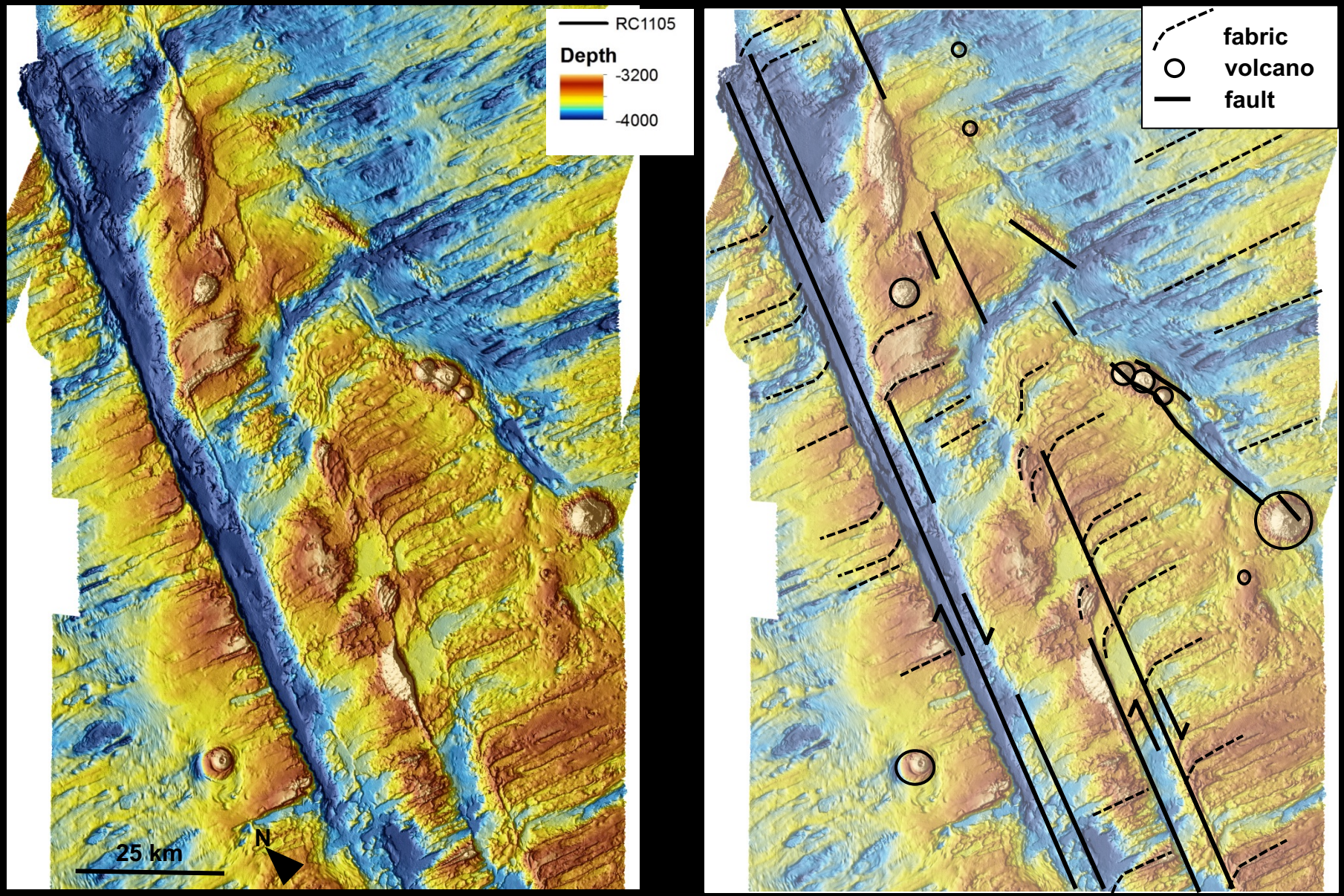
Volcanoes

10 Ma

Depth (m)
-3200
-4500

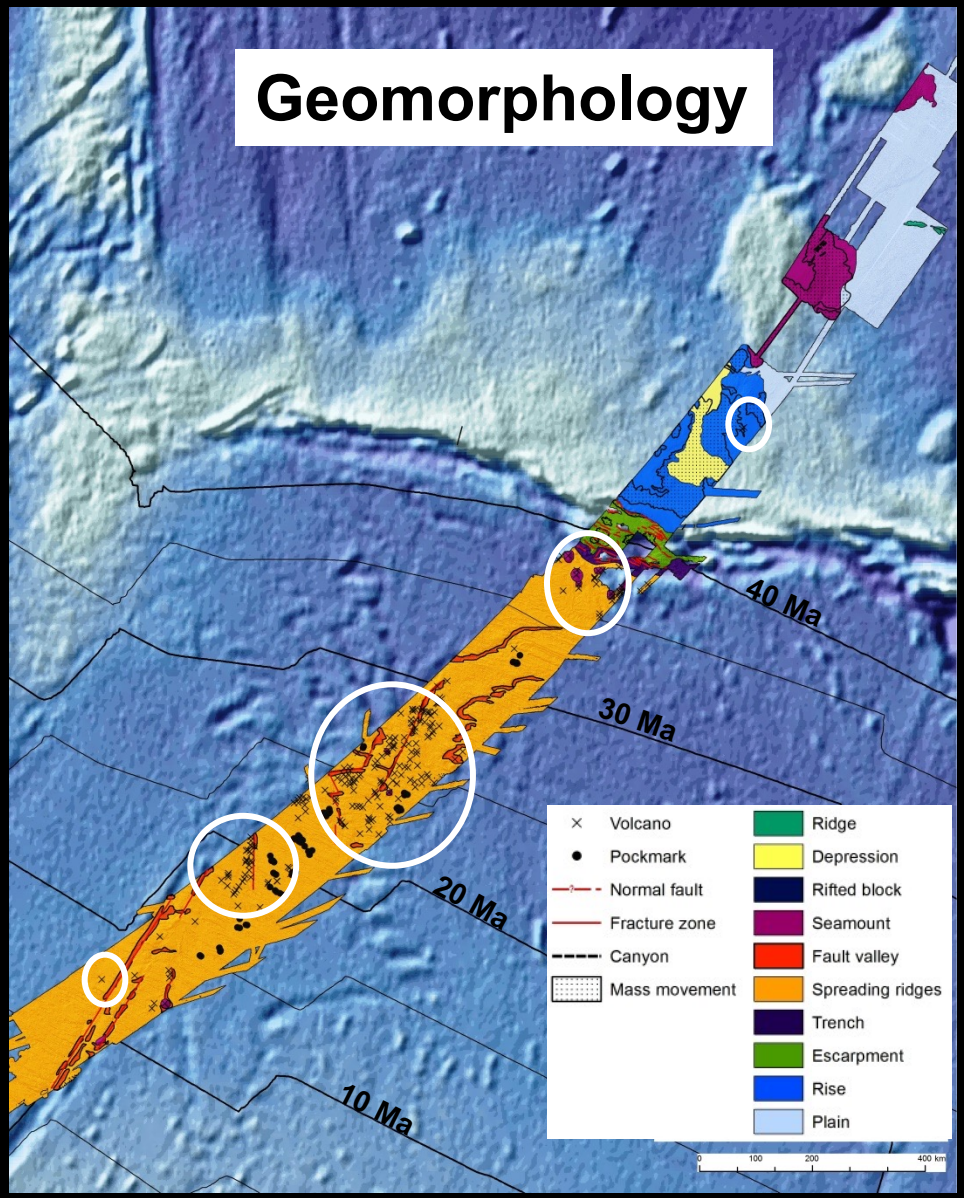
0 60 120 240 km

Geelvinck Fracture Zone

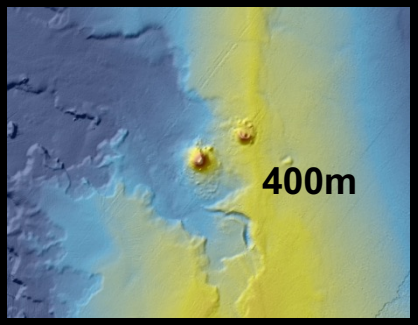


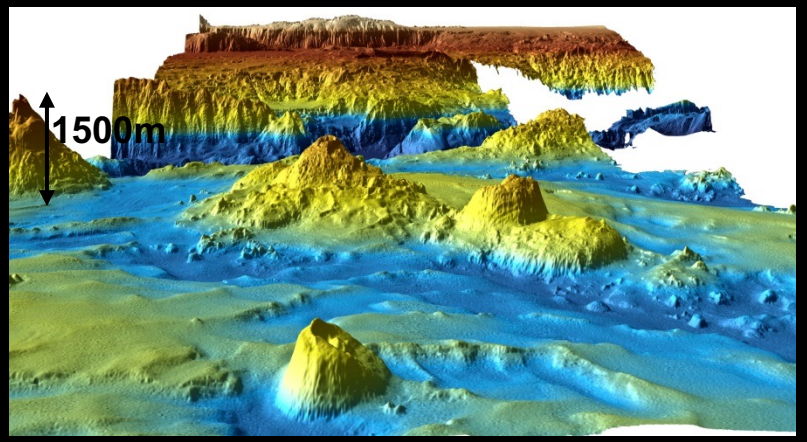
Picard et al., 2018

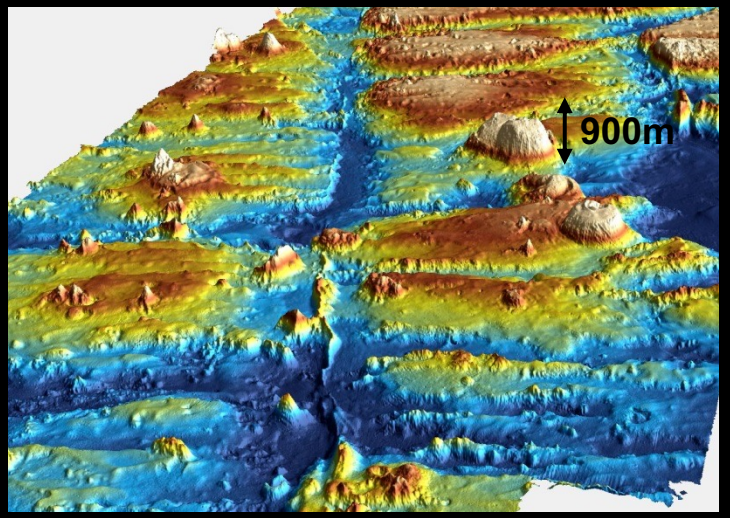
Volcanoes



Numbers: 2 vs >220
Location
Relative age
Processes

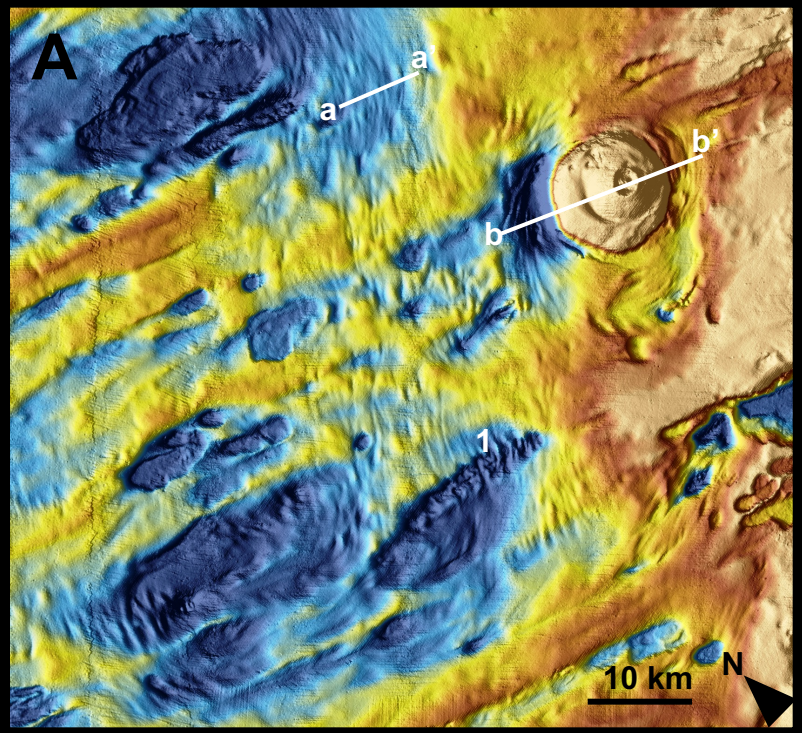


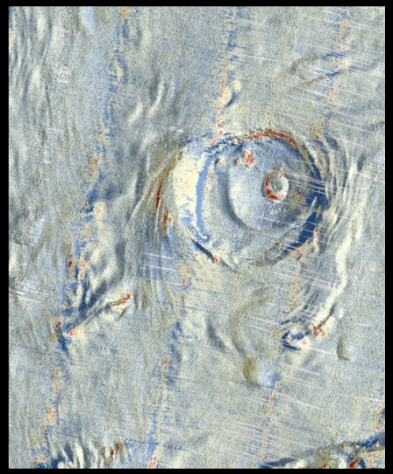


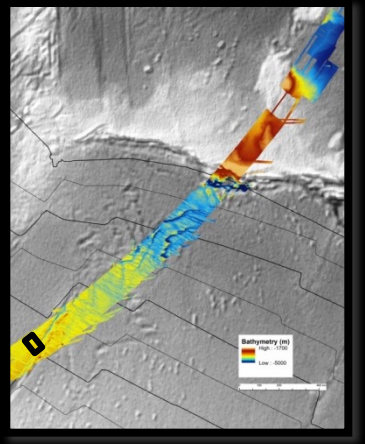


Picard et al., 2018

Volcanoes







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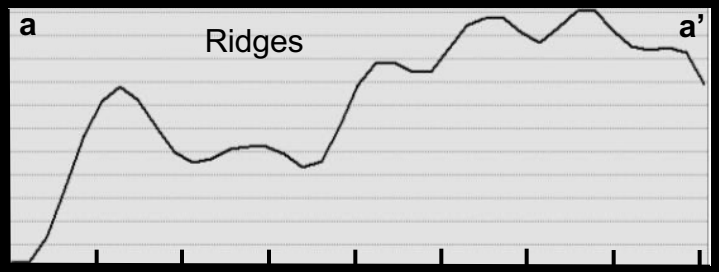

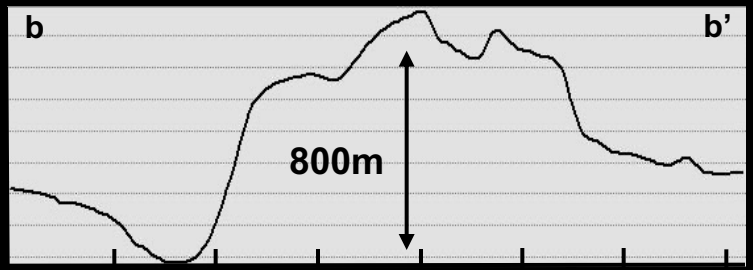

Picard et al., 2018

Abyssal Hills

Consultation with a leading world expert on abyssal hills, Dr John Goff (University of Texas)

Recommendation: ***limit nameable features to those >2-sigma above the mean height, where sigma is the standard deviation of the surrounding abyssal hill morphology***

Abyssal Hills

Because abyssal hill distribution and density strongly depend on seafloor spreading rate, a minimum area for the surrounding abyssal hill morphology could be as little as 20 km^2 (e.g., East Pacific Rise abyssal hills) or as much as 200 km^2 (e.g., Mid-Atlantic Ridge abyssal hills).

Hence no recommendation for specifying an area for consideration, only heights (which correlate with widths and lengths).

Consequence: proponents of names for abyssal hills required to undertake statistical analyses.

Questions

- Should the minimum size of a feature considered by SCUFN be greater than the GEBCO resolution for specific depth intervals?
- If so, what should the minimum size be?
- Should SCUFN adopt the recommendation of abyssal hill expert Dr John Goff?

Thank you!