



“...this region of the Earth is one that is accessible to observation by a variety of geophysical tools...”

Parmentier, 2056

“...dramatic increase on both quality and quantity of multiple geophysical and geochemical datasets...”

Afonso et al., 2016

CHALLENGES OF SEA-FLOOR OBSERVATIONS

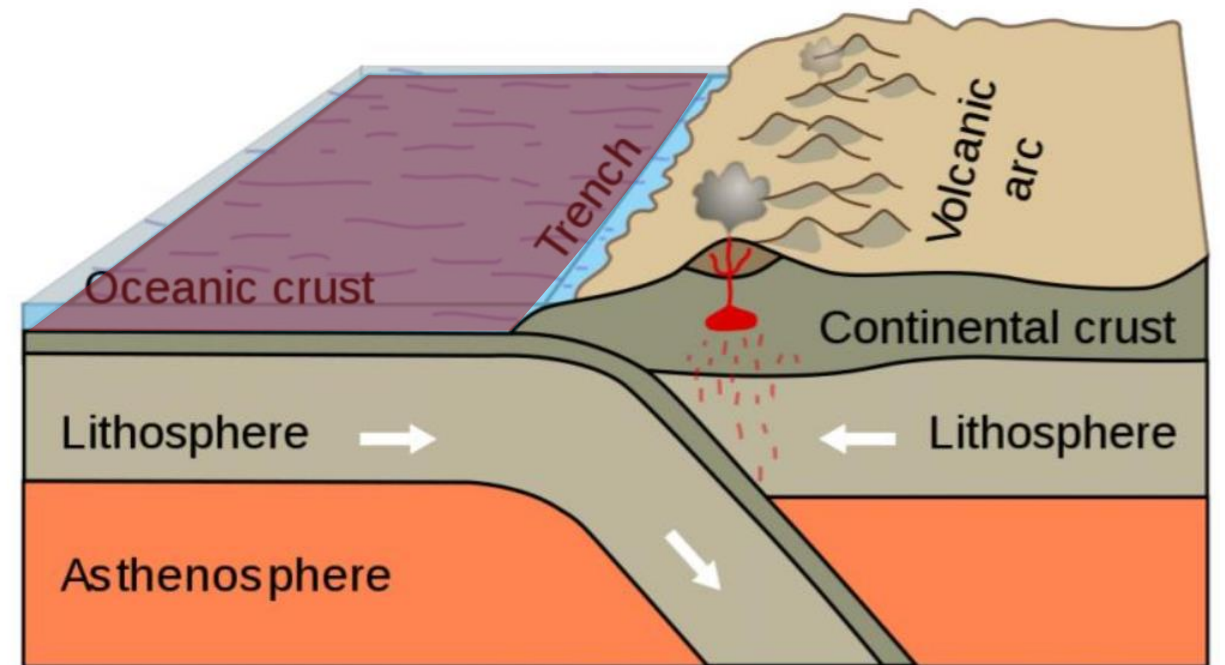
Valentina Espinoza F.

GEO-DEEP9300 Course
Autumn 2021



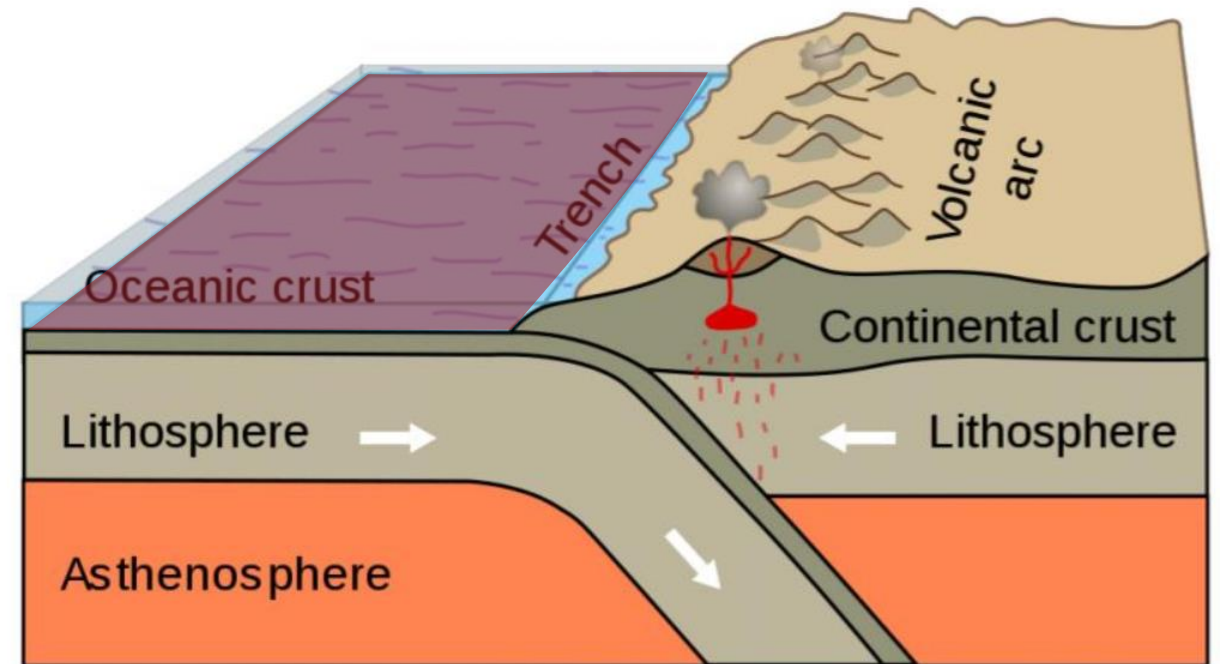
TYPES OF SEA-FLOOR OBSERVATIONS

- Heat-flow
- Bathymetry
- Stratigraphy
- Magnetism
- ...



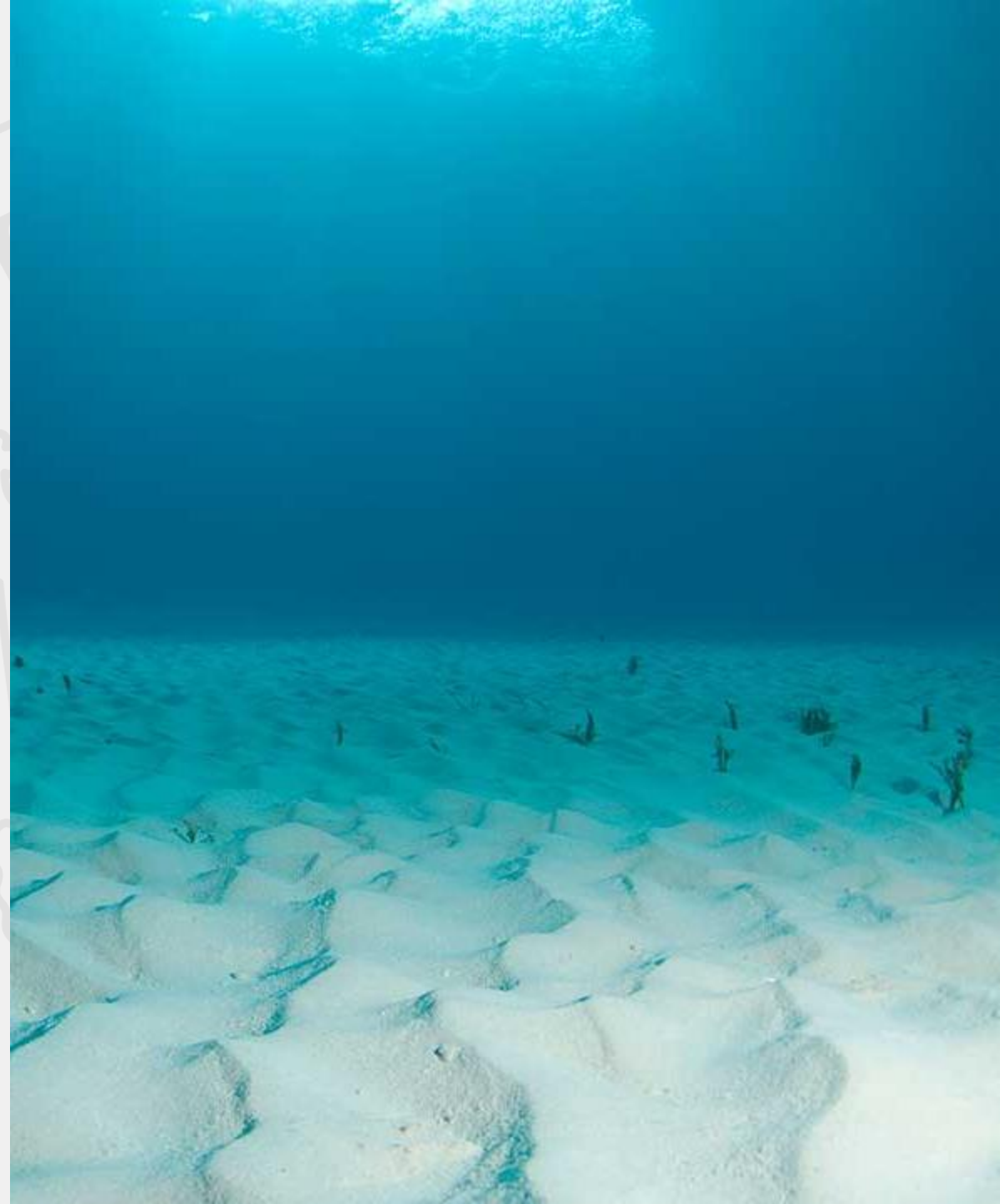
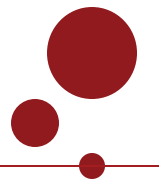
TYPES OF SEA-FLOOR OBSERVATIONS

1. Heat-flow
2. Bathymetry
3. Stratigraphy
4. Magnetism



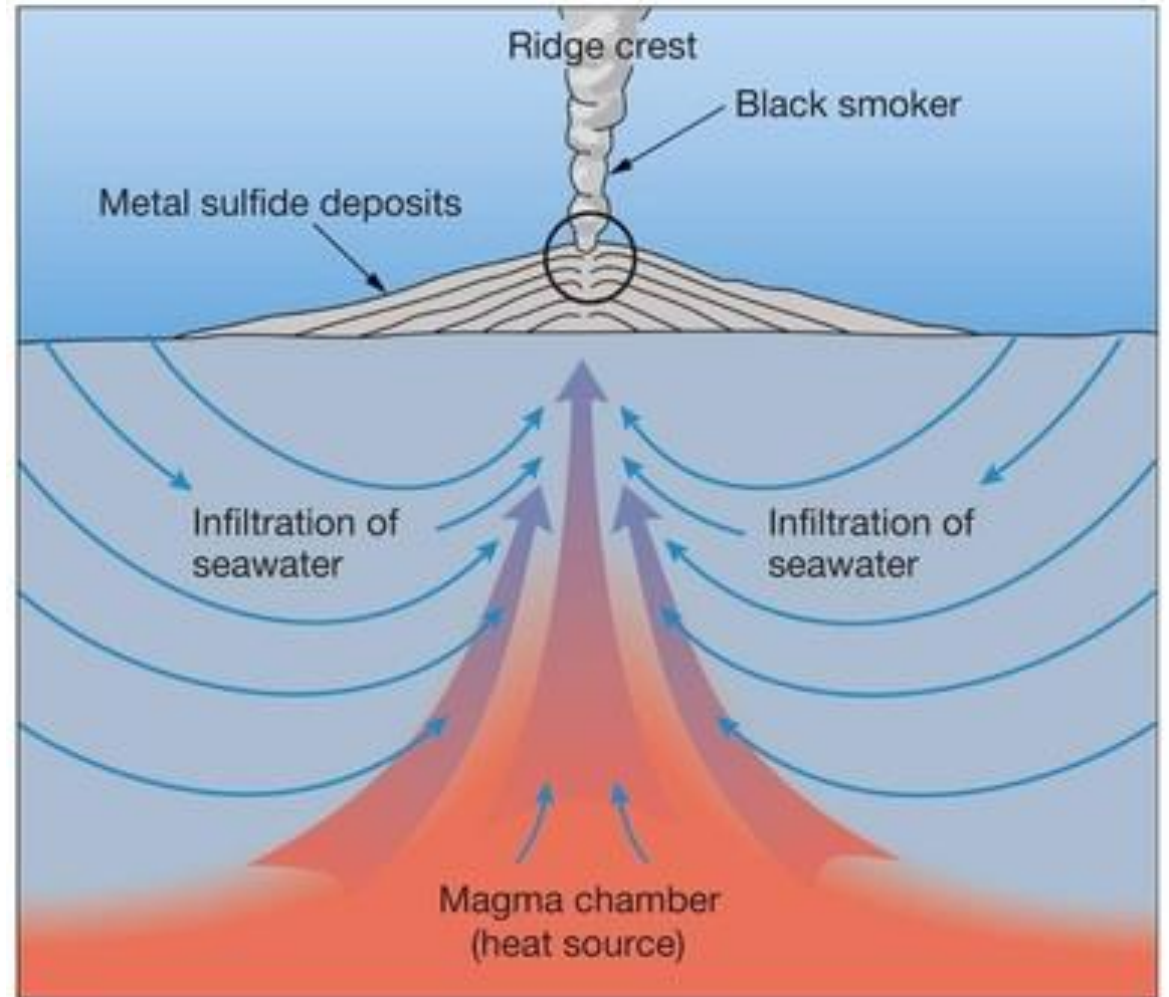
1 HEAT-FLOW

A look beneath the surface



HEAT-FLOW

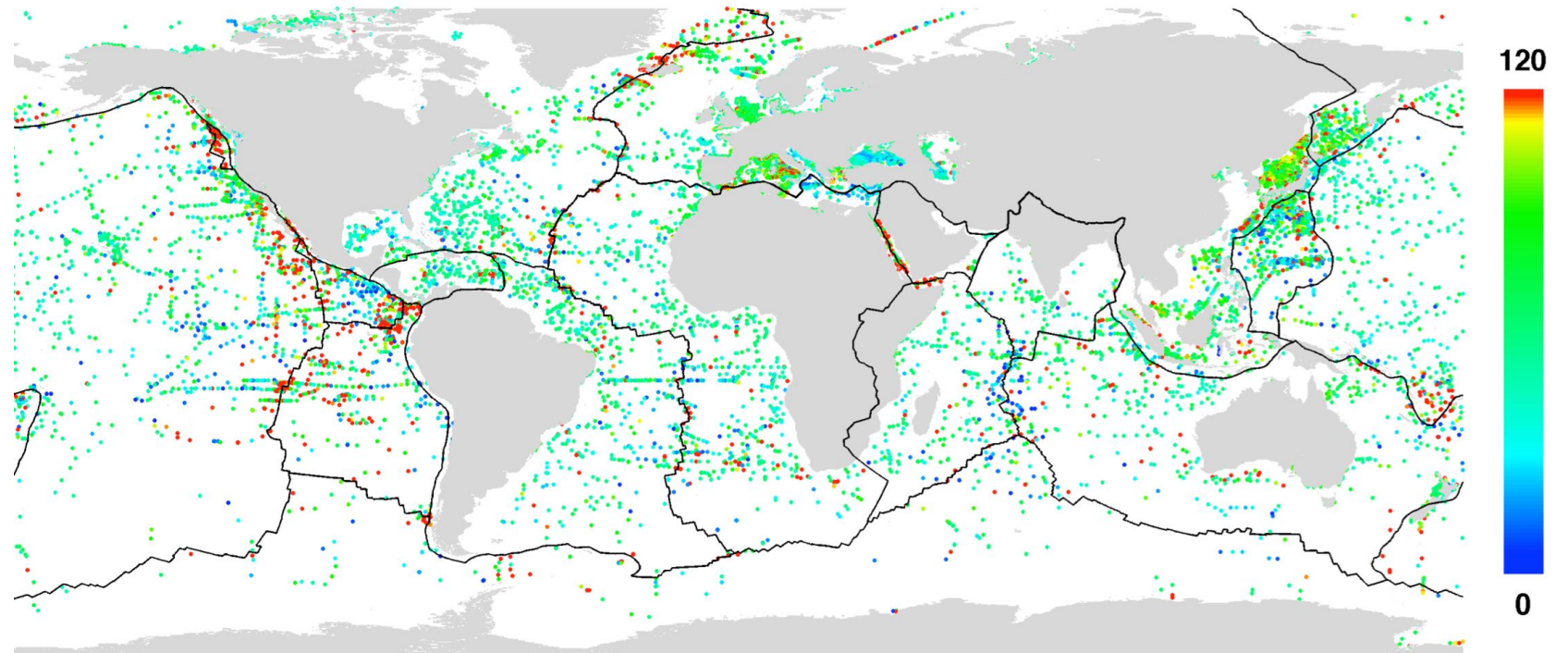
- Hydrothermal influence



HEAT-FLOW

- Hydrothermal influence
- Detection levels

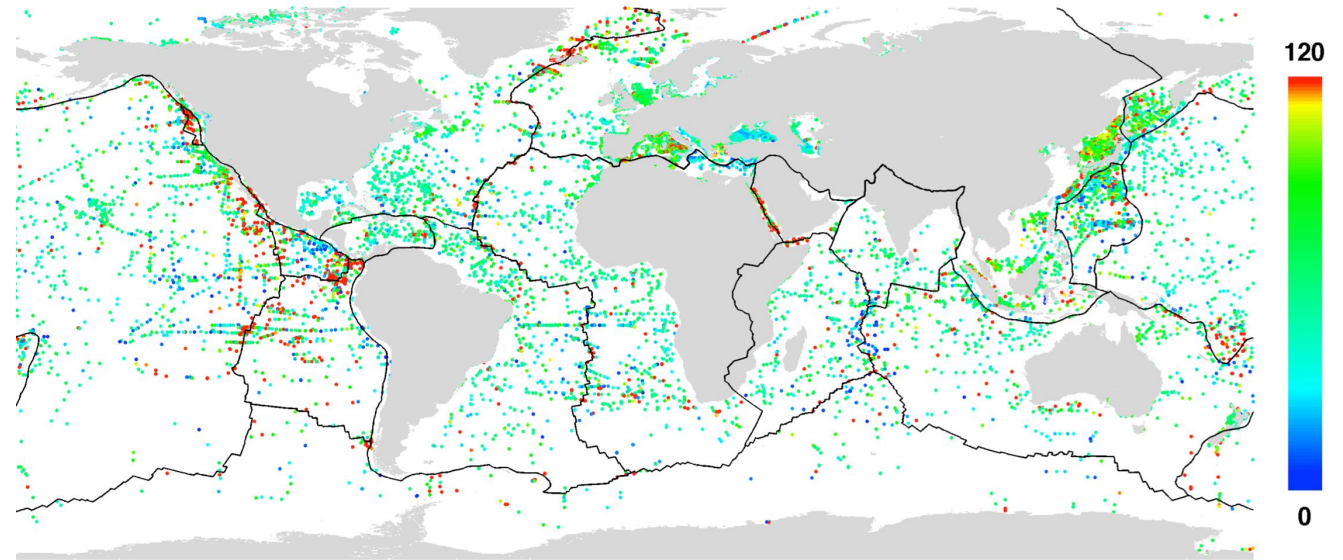
Ocean-floor heat-flow (mW / m^2) from measurements



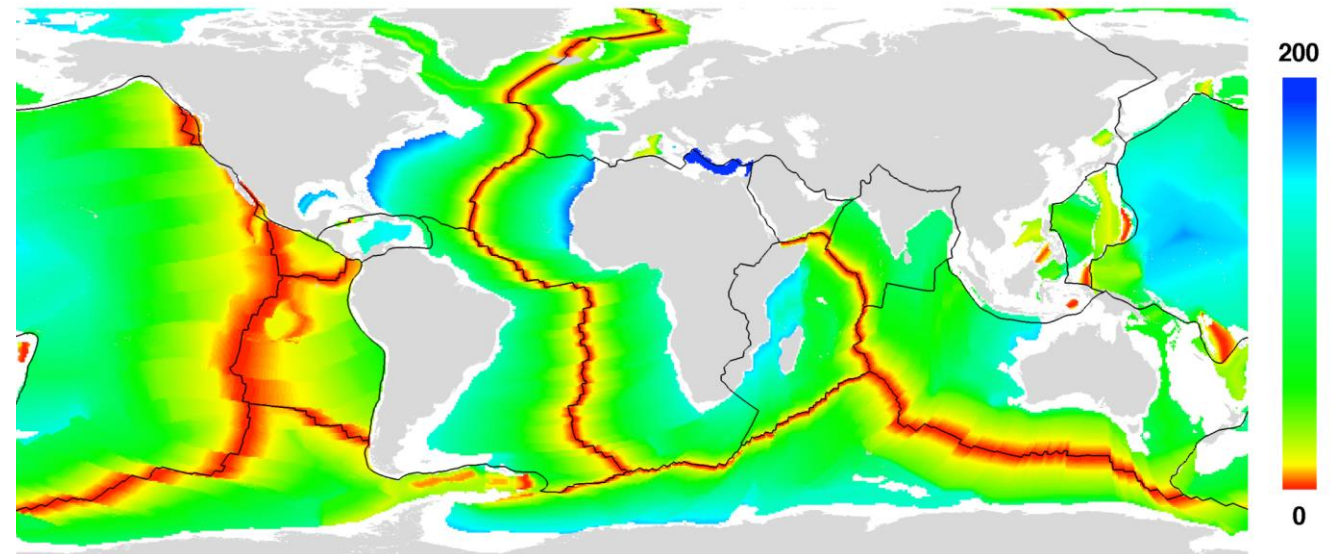
HEAT-FLOW

- Hydrothermal influence
- Detection levels
- Thickness variations

Ocean-floor heat-flow (mW / m^2) from measurements

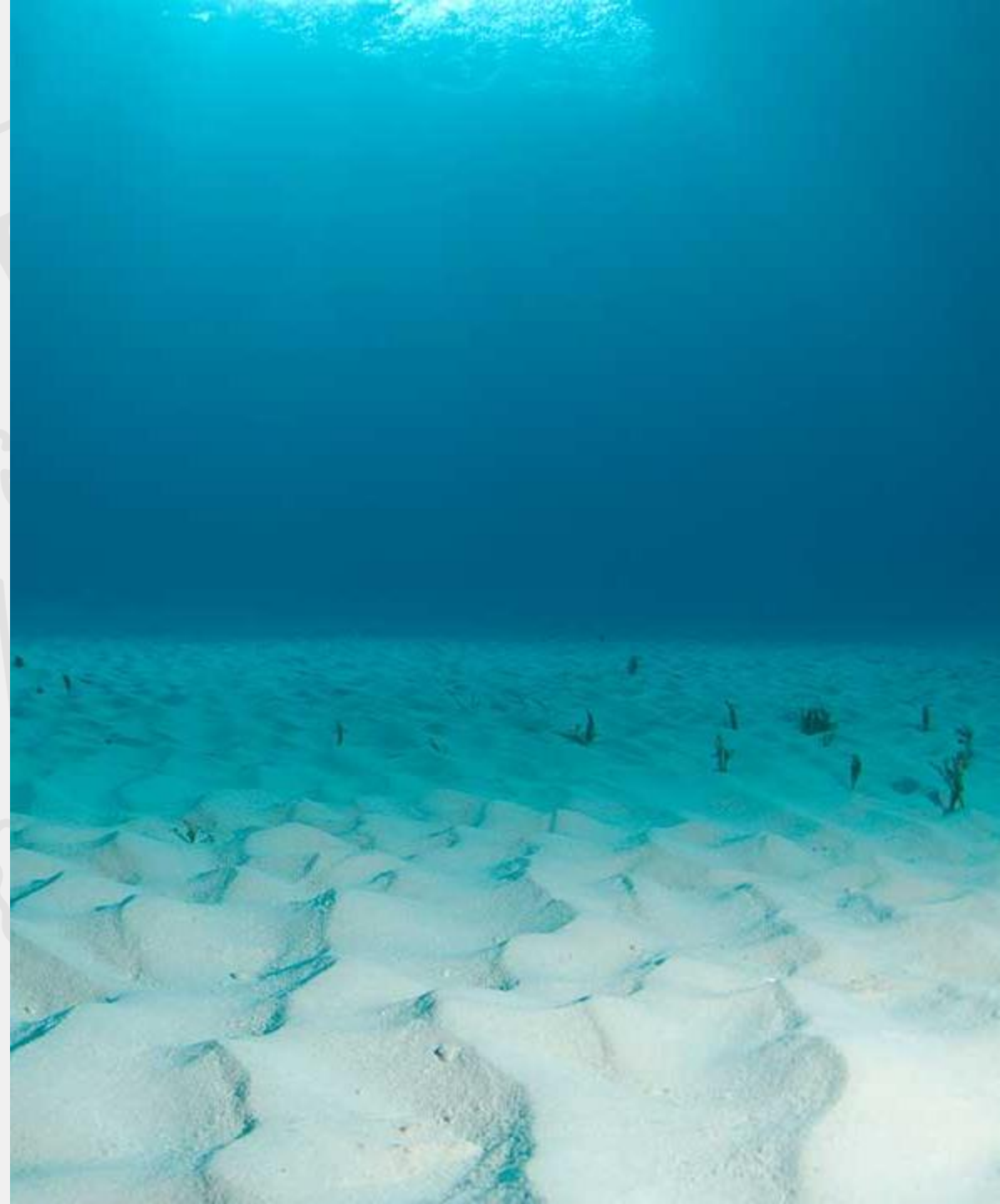
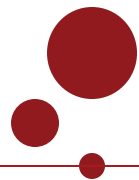


Ocean-floor age (Ma) inferred from magnetisation

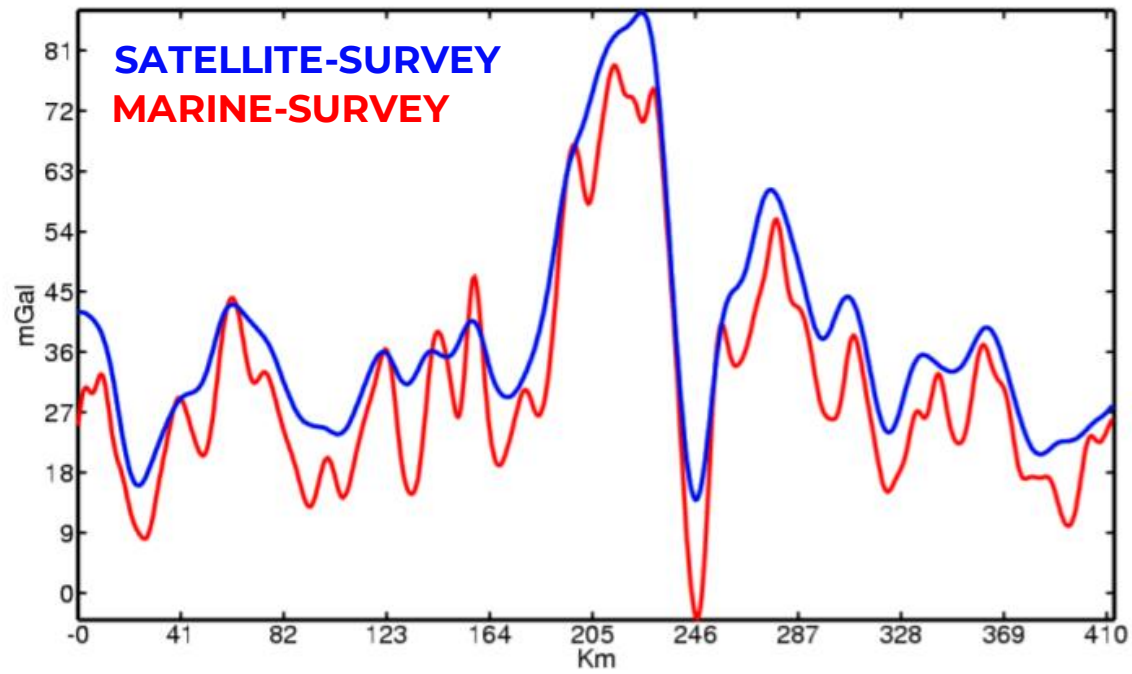


2 BATHYMETRY

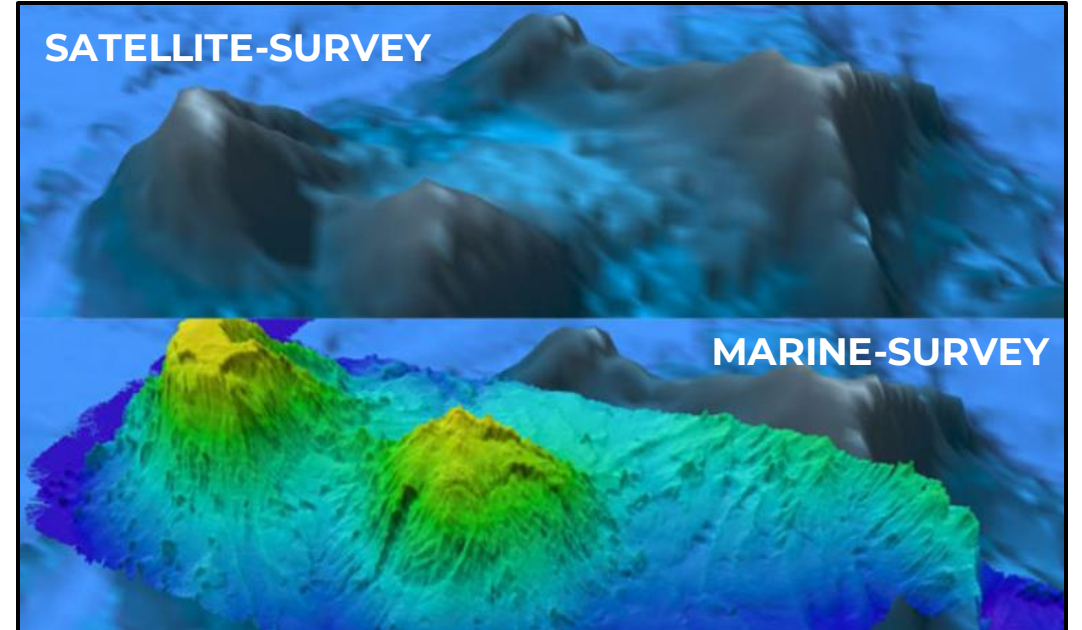
Understanding the sea-floor fabric



RESOLUTION PROBLEM

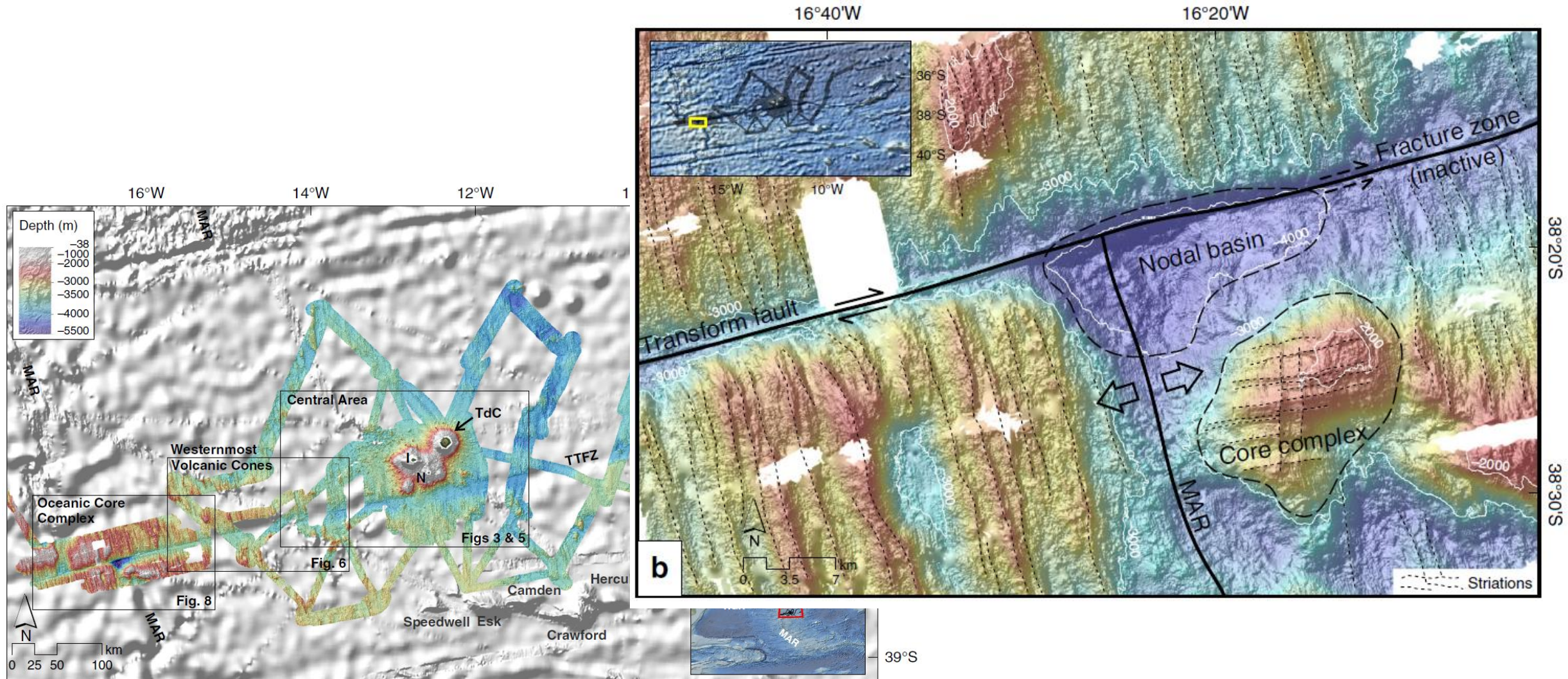


LeQuentrec-Lalancette et al., 2006



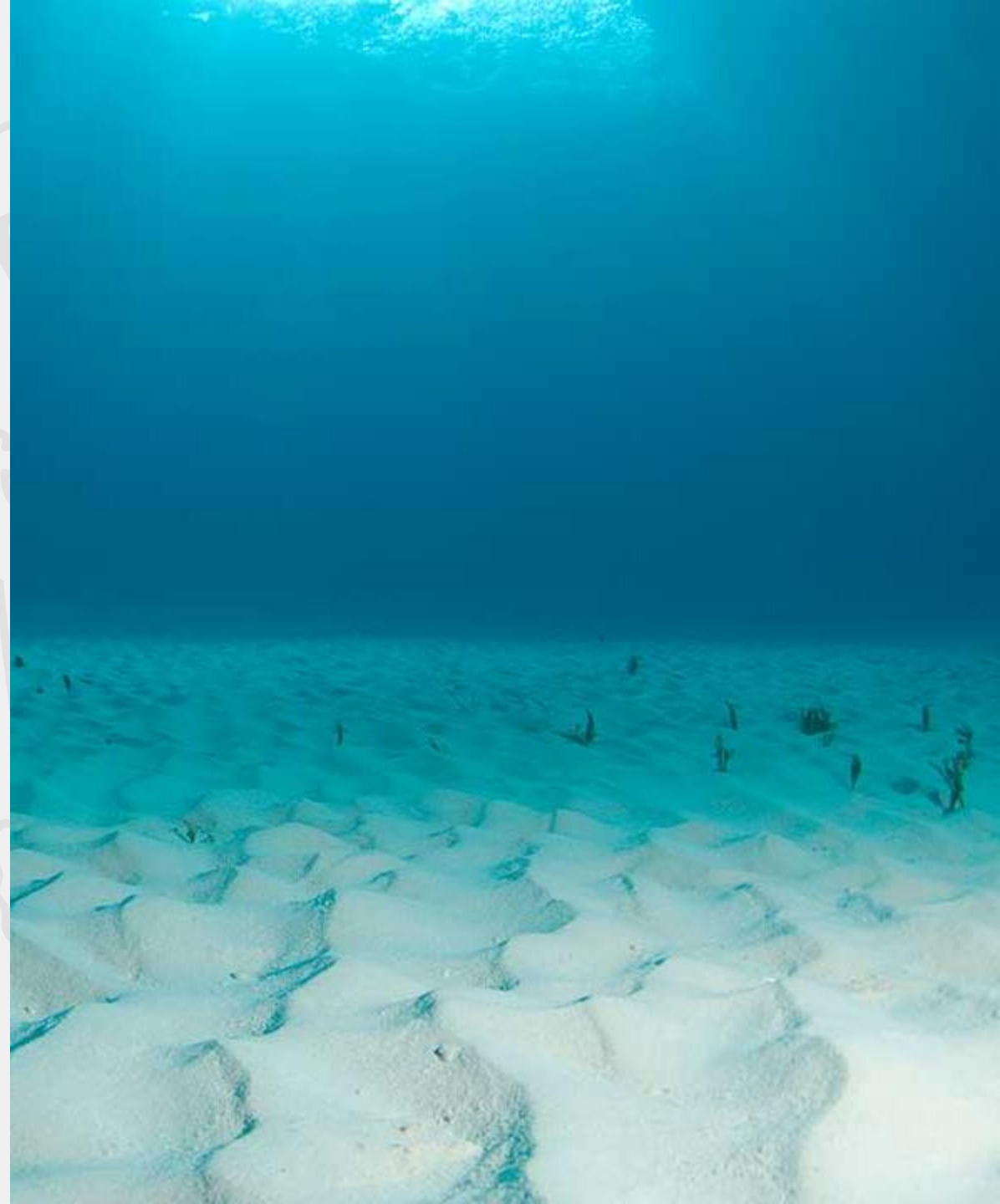
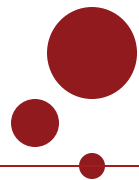
Source: NOAA

DEEP TECTONIC STRUCTURE



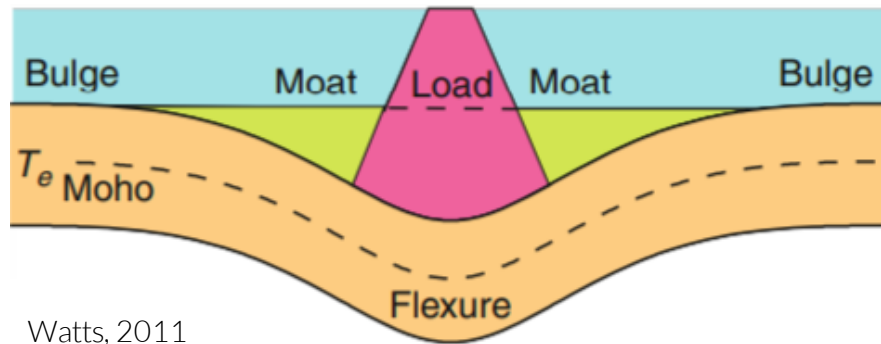
3 STRATIGRAPHY

Sedimentary sequences over the ocean floor

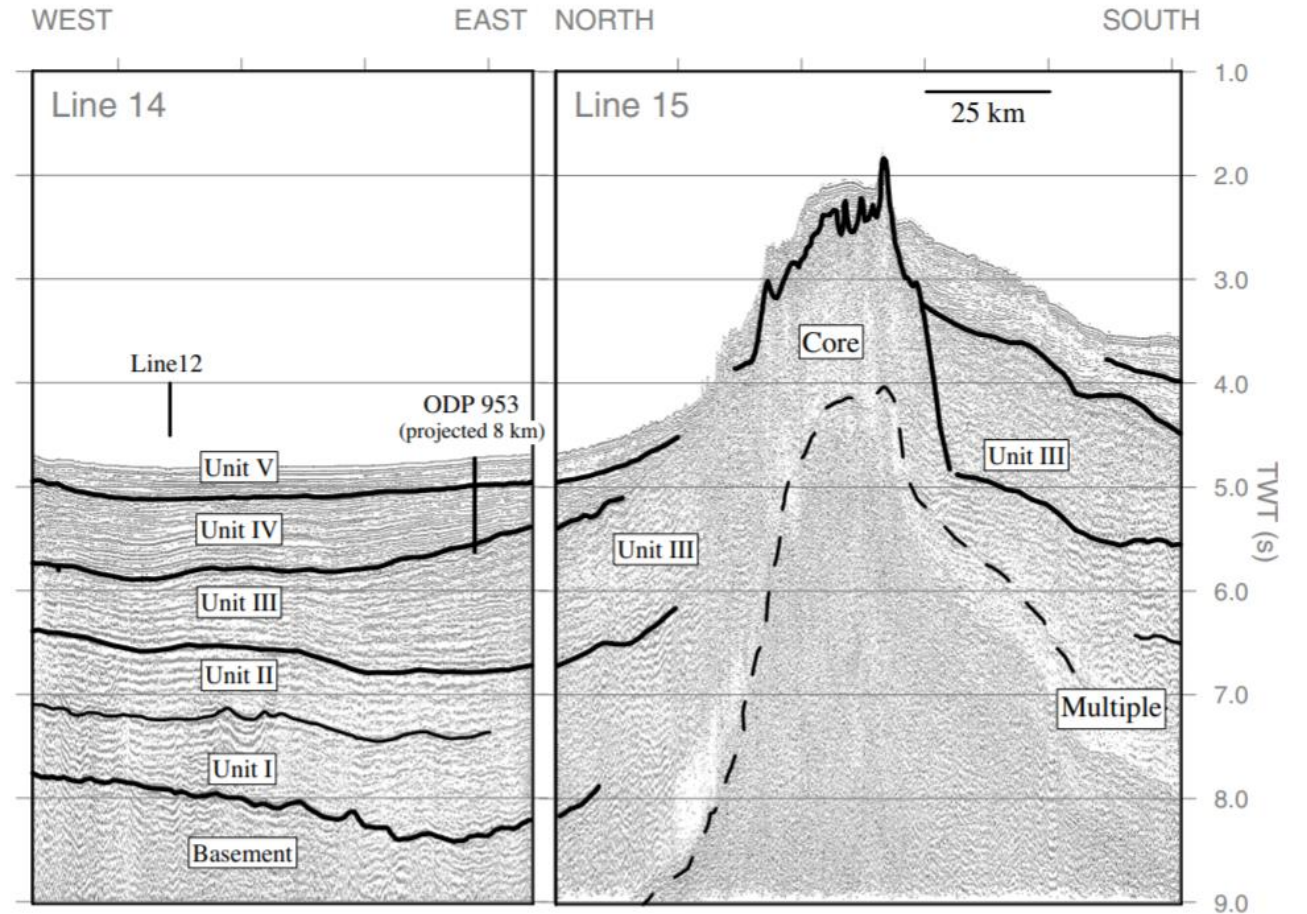


LOAD-INDUCED SEDIMENTATION

- Incomplete sequences



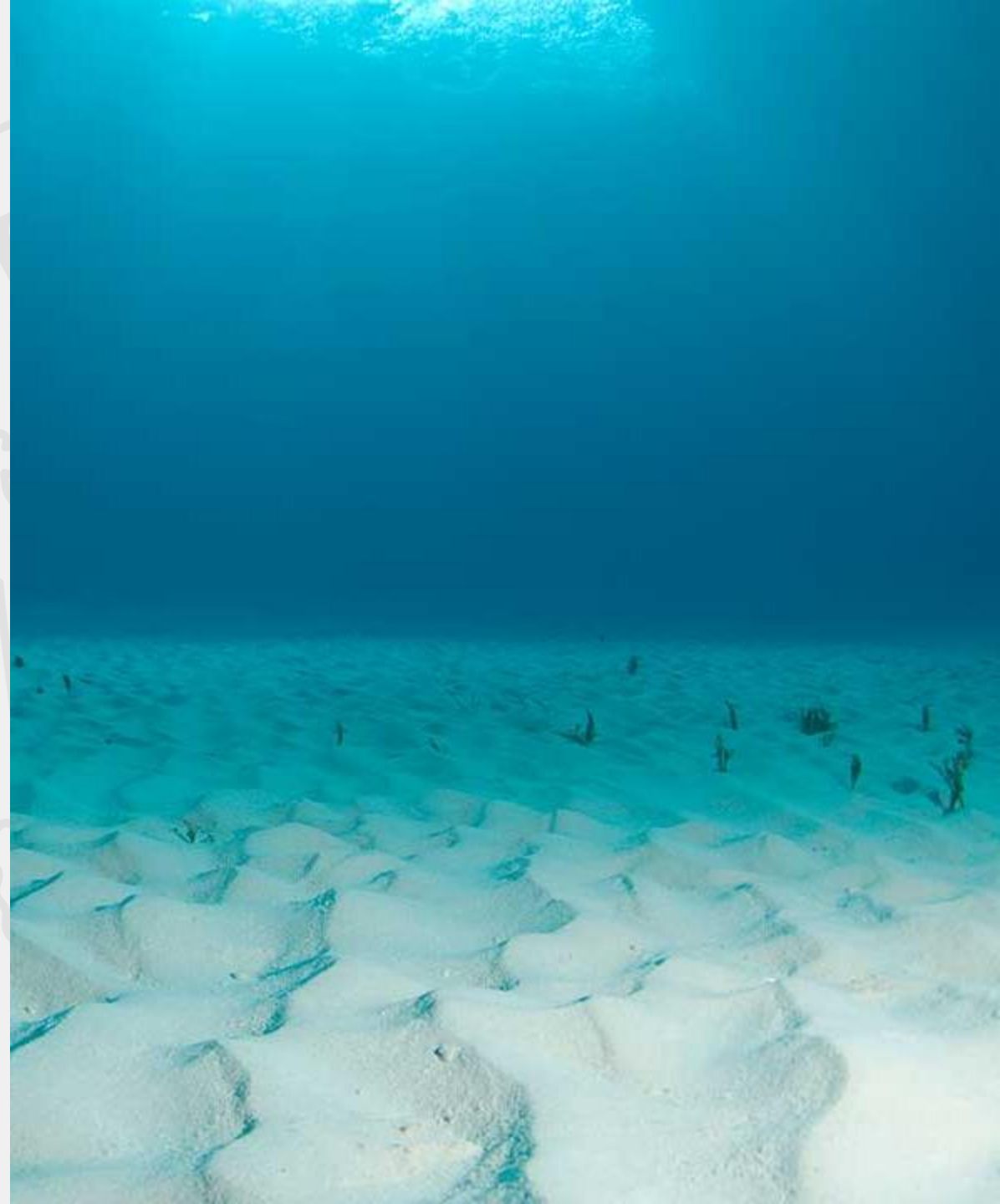
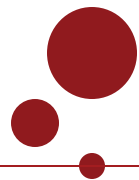
Watts, 2011



Collier & Watts, 2001

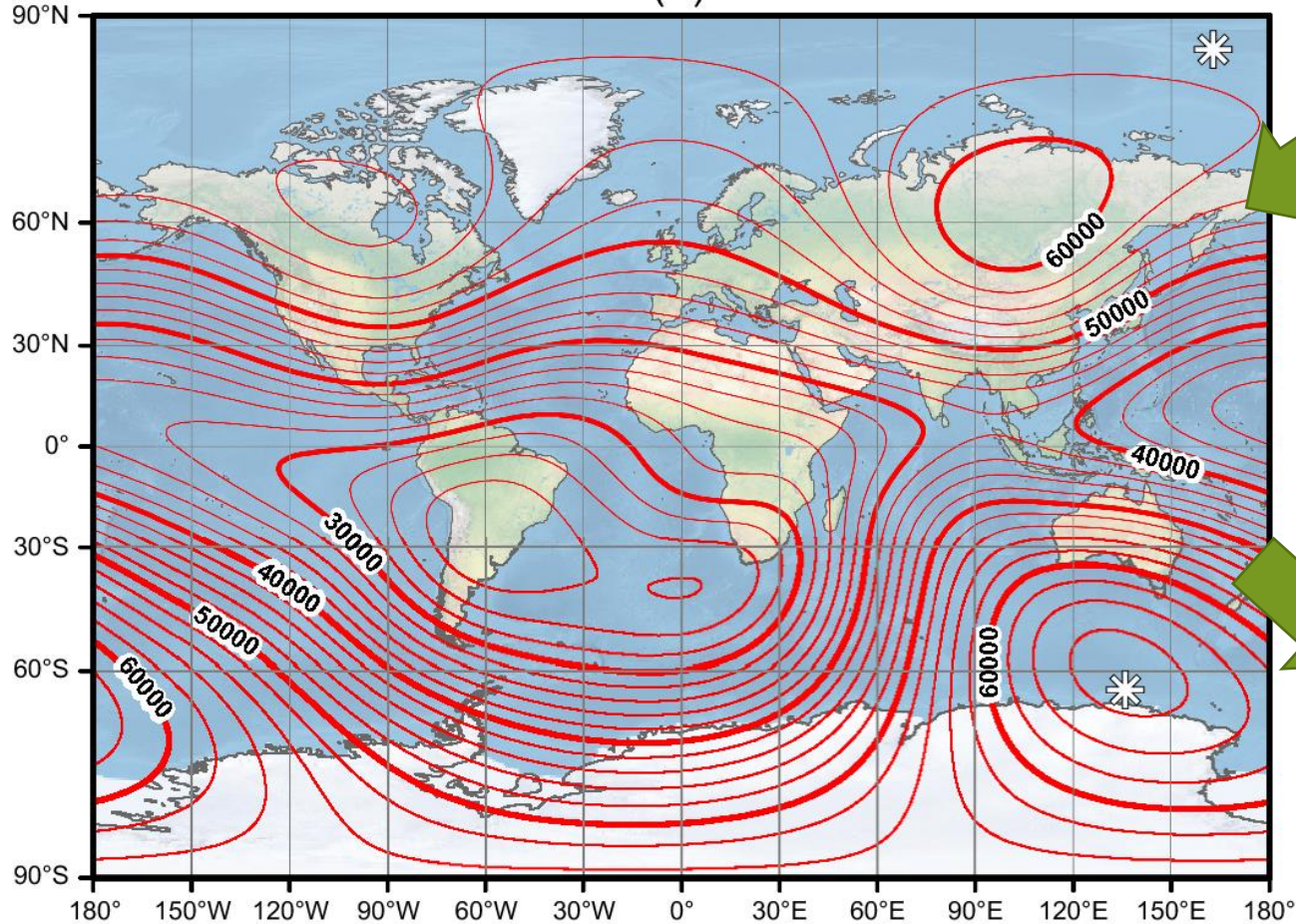
4 MAGNETISM

Magnetic stripes in the ocean floor



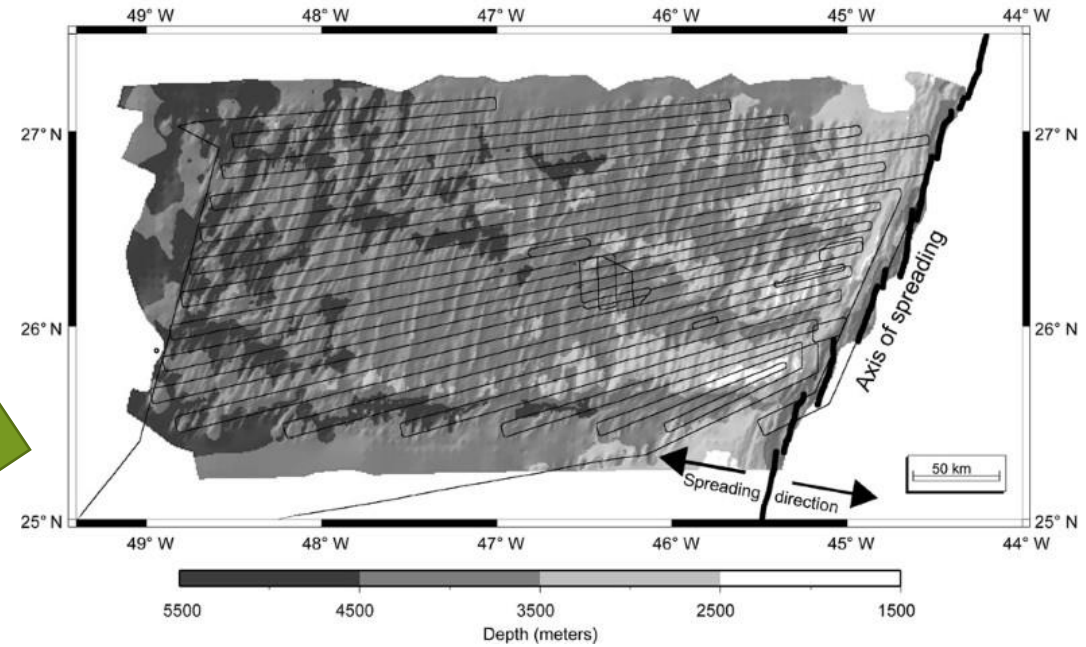
MAGNETIC ANOMALY FIELD

Total Field (F) in nT 2020

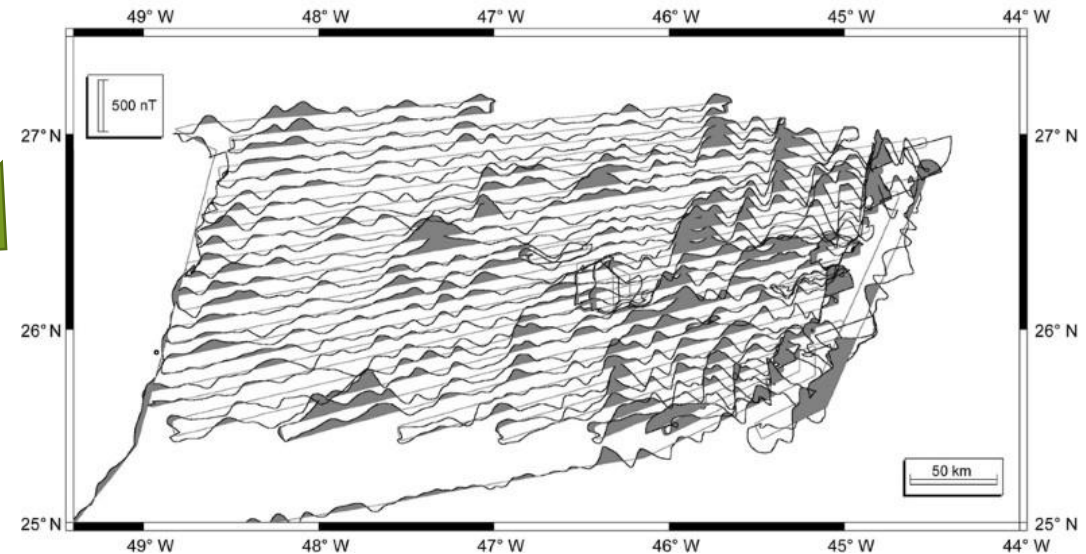


Alken et al., 2021

Mid-Atlantic Ridge Bathymetry - Magnetic Survey Tracklines



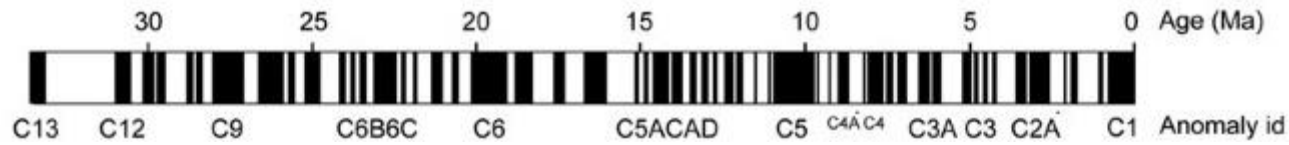
Magnetic Anomaly Wiggly Plot



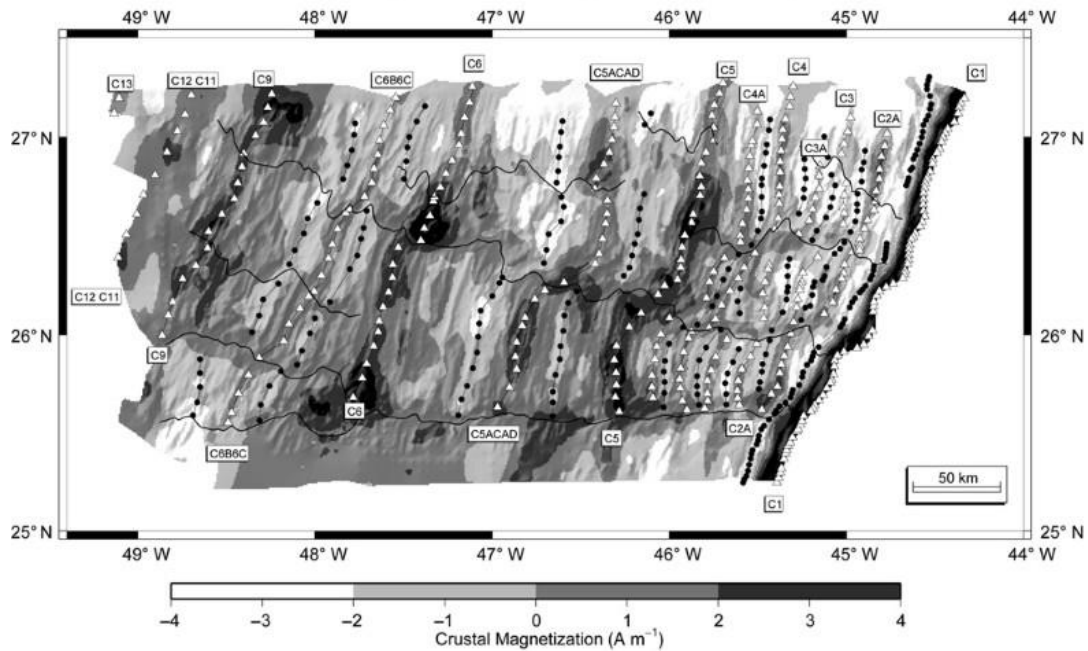
Tivey, 2007

MAGNETIC ISOCRONS

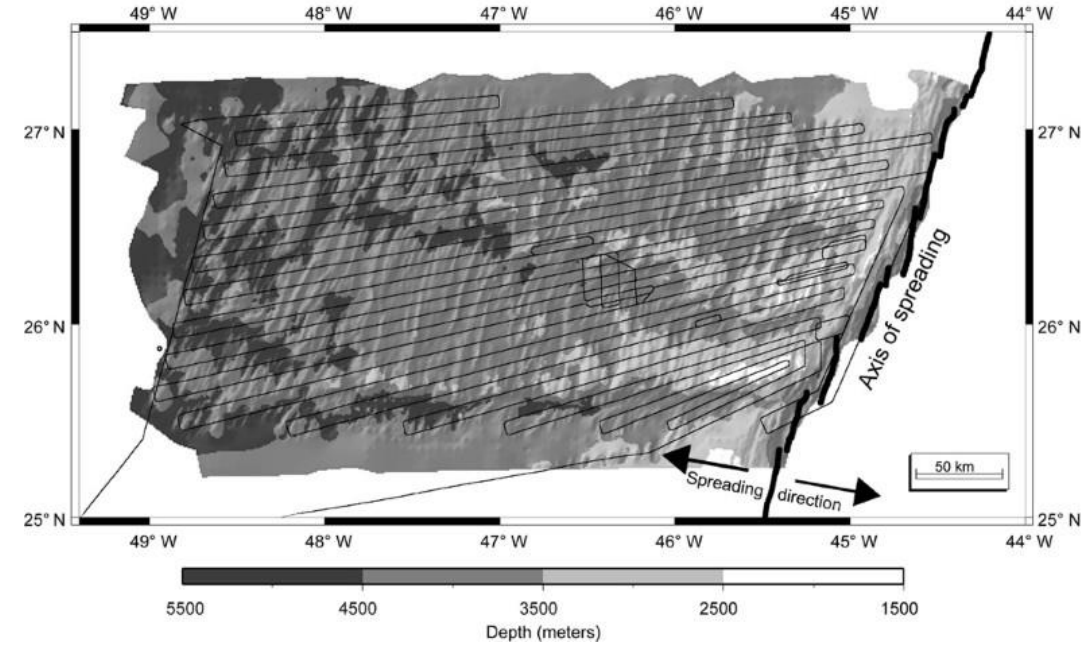
Geomagnetic Polarity Timescale



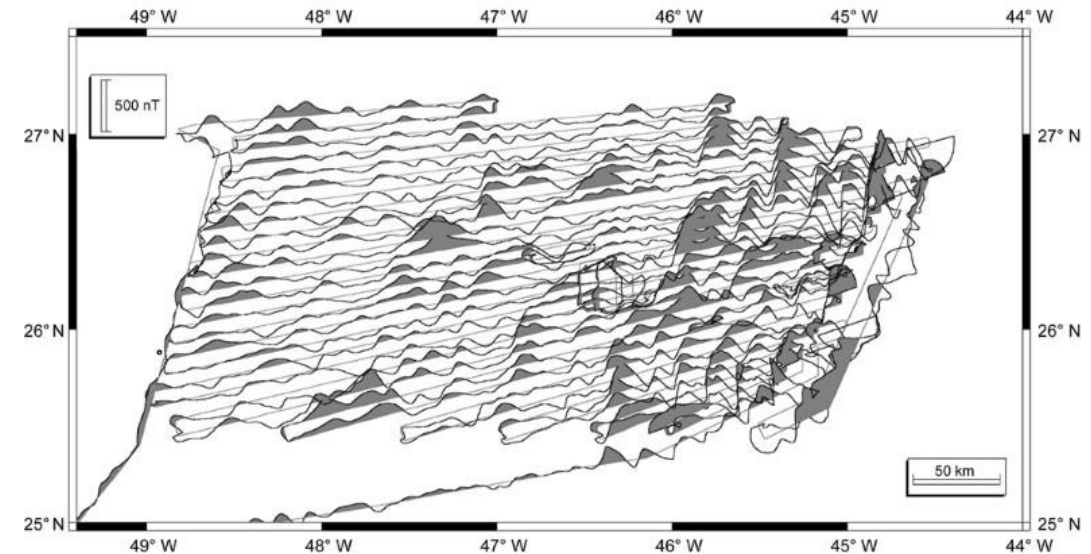
Crustal Magnetization and Magnetic Isochrons Map



Mid-Atlantic Ridge Bathymetry - Magnetic Survey Tracklines

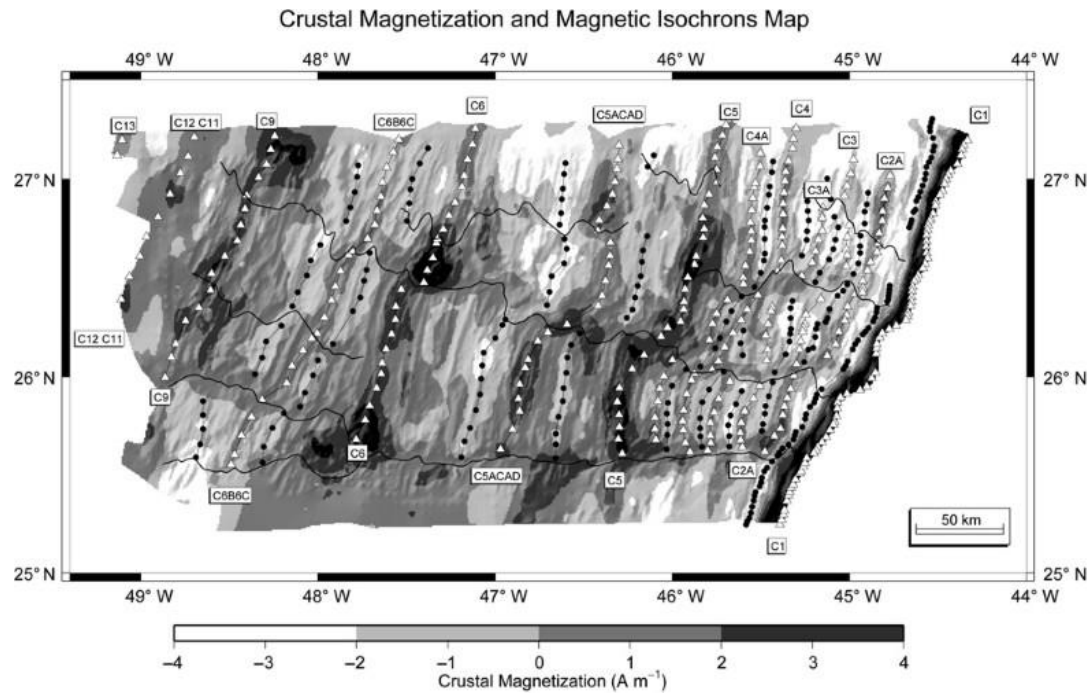
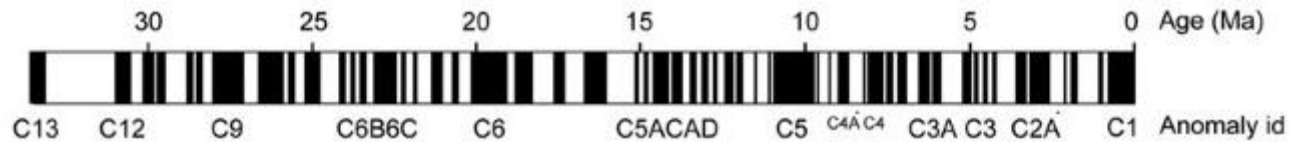


Magnetic Anomaly Wiggle Plot

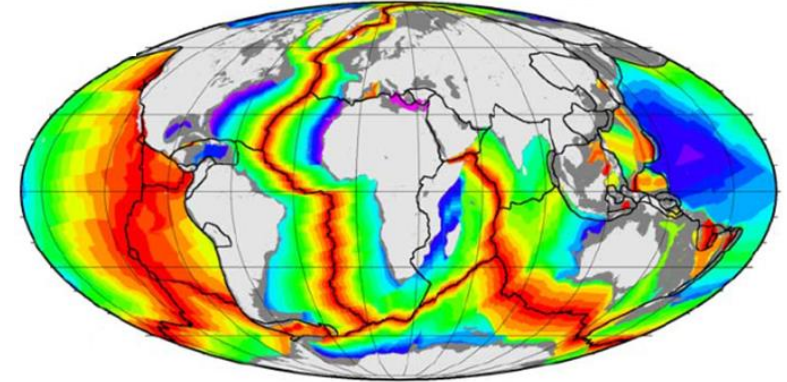


MAGNETIC ISOCRONS

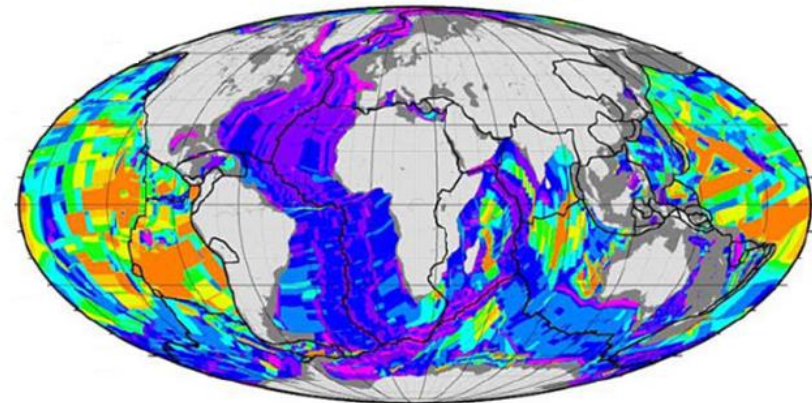
Geomagnetic Polarity Timescale



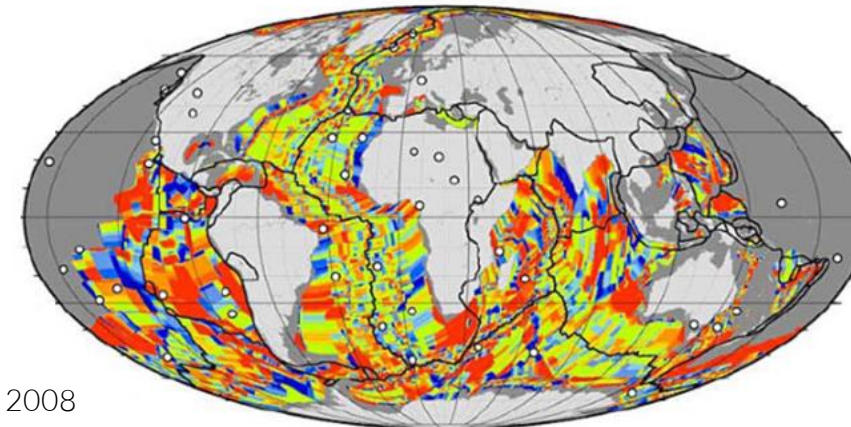
Age of Oceanic Lithosphere [m.y.]



Half Spreading Rate [mm/yr.]



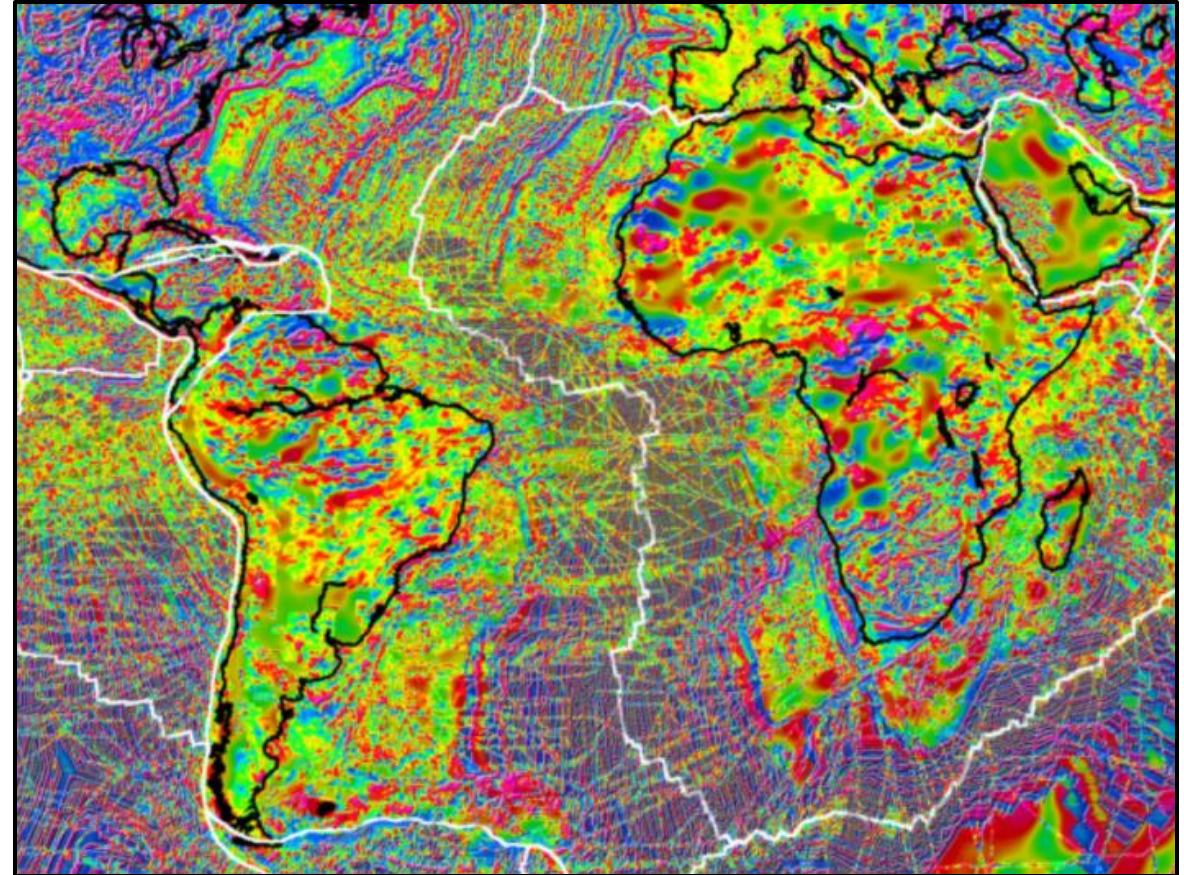
Crustal accretion percentage [%]



MAGNETISM - CHALLENGES

Intrinsic

- Cretaceous Quiet Period

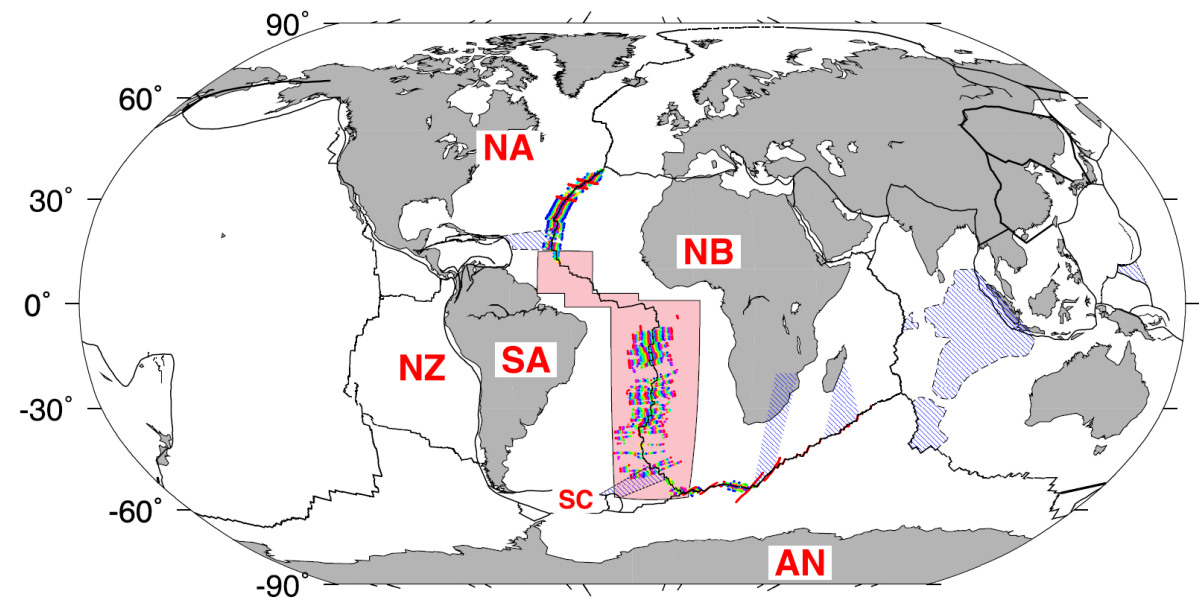
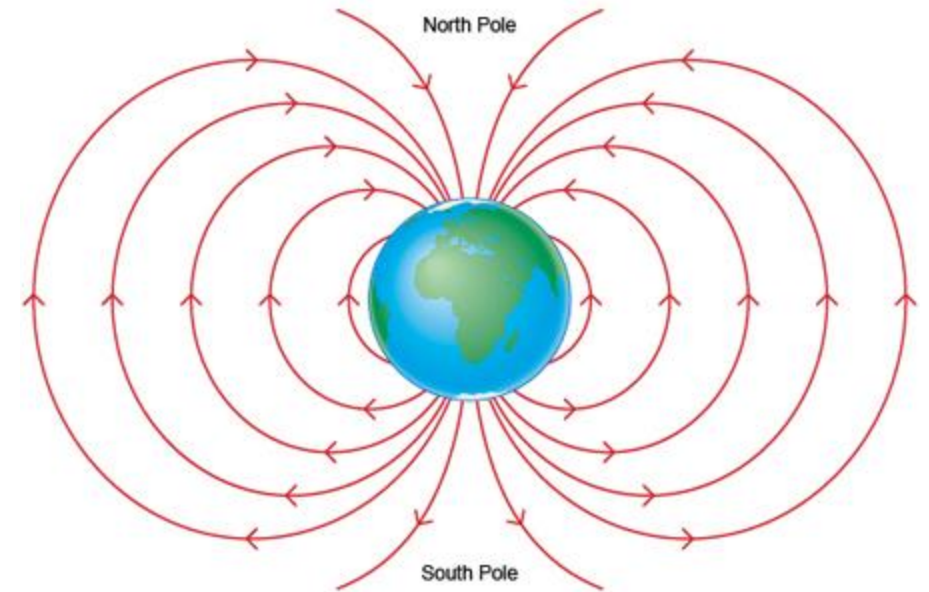


Modified from Dyent, 2015

MAGNETISM - CHALLENGES

Intrinsic

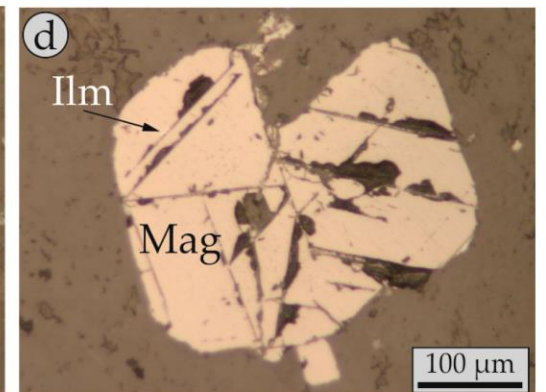
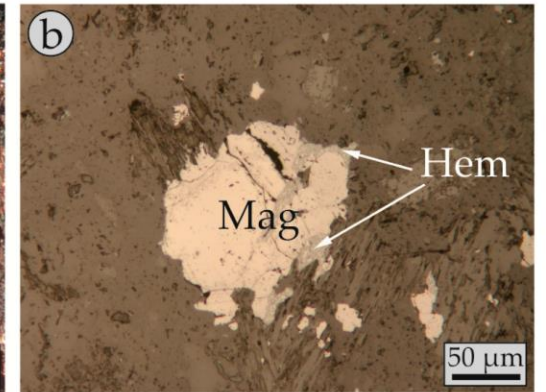
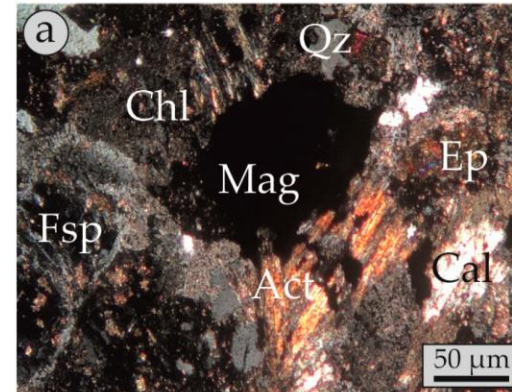
- Cretaceous Quiet Period
- Weak magnetism in the Equator



MAGNETISM - CHALLENGES

Intrinsic

- Cretaceous Quiet Period
- Weak magnetism in the Equator
- Secondary Magnetization



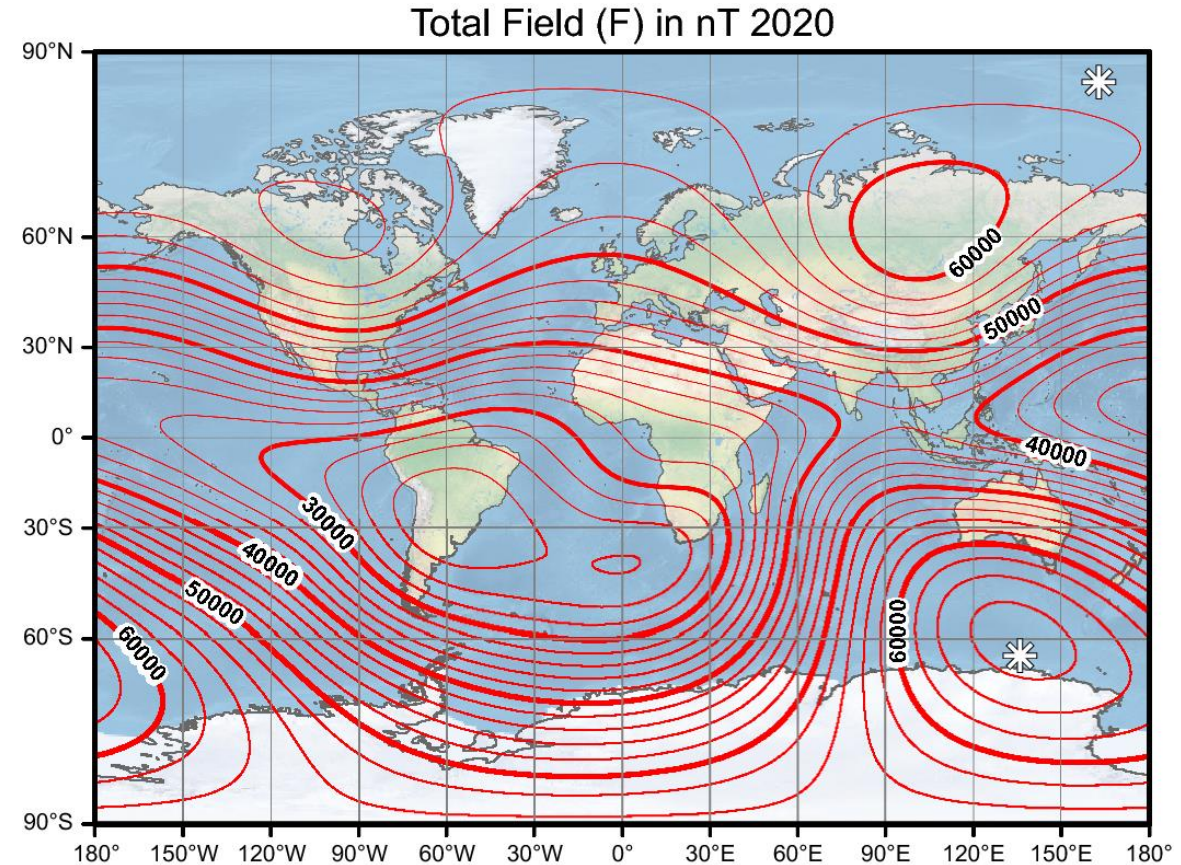
MAGNETISM - CHALLENGES

Intrinsic

- Cretaceous Quiet Period
- Weak magnetism in the Equator
- Secondary Magnetization

Methodological

- Reference magnetic field



MAGNETISM - CHALLENGES

Intrinsic

- Cretaceous Quiet Period
- Weak magnetism in the Equator
- Secondary Magnetization

Methodological

- Reference magnetic field
- Spatial Positioning



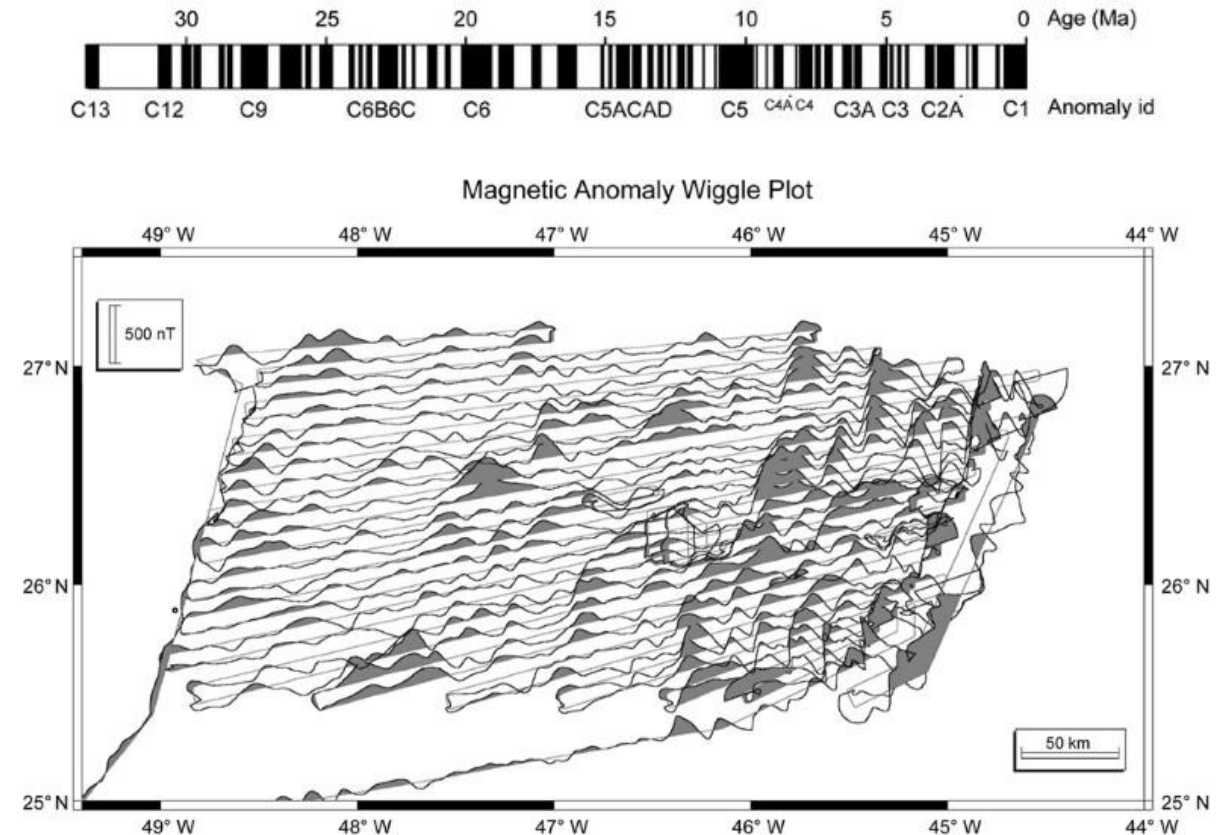
MAGNETISM - CHALLENGES

Intrinsic

- Cretaceous Quiet Period
- Weak magnetism in the Equator
- Secondary Magnetization

Methodological

- Reference magnetic field
- Spatial Positioning
- Visual picking



Tivey, 2007

REFERENCES

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