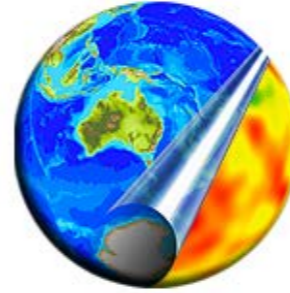


THE UNIVERSITY OF
SYDNEY



Earth **BYTE**

Linking observations to kinematic and dynamic models

A new burst of seafloor mapping and discovery driven by advances in satellite altimetry

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Outline

- New global marine gravity grid and visualisation tool overview
- Buried tectonic features
- Outlook

New global marine gravity grid

- Radar altimetry measurements of the ocean surface topography from two satellites have recently been used to construct a new global marine gravity model (Sandwell et al., Science, 2014)
- It is twice as accurate as previous models
- A new cloud-based web portal (portal.gplates.org) allows users to view the vertical gravity gradient (**VGG**) grid interactively
- The GPlates Portal allows interactive tectonic reconstruction of the grid back to the Jurassic at 200 Ma



Welcome

[Vertical Gravity Gradient Grid](#)

[Raster Reconstructions](#)

[Dynamic Topography](#)

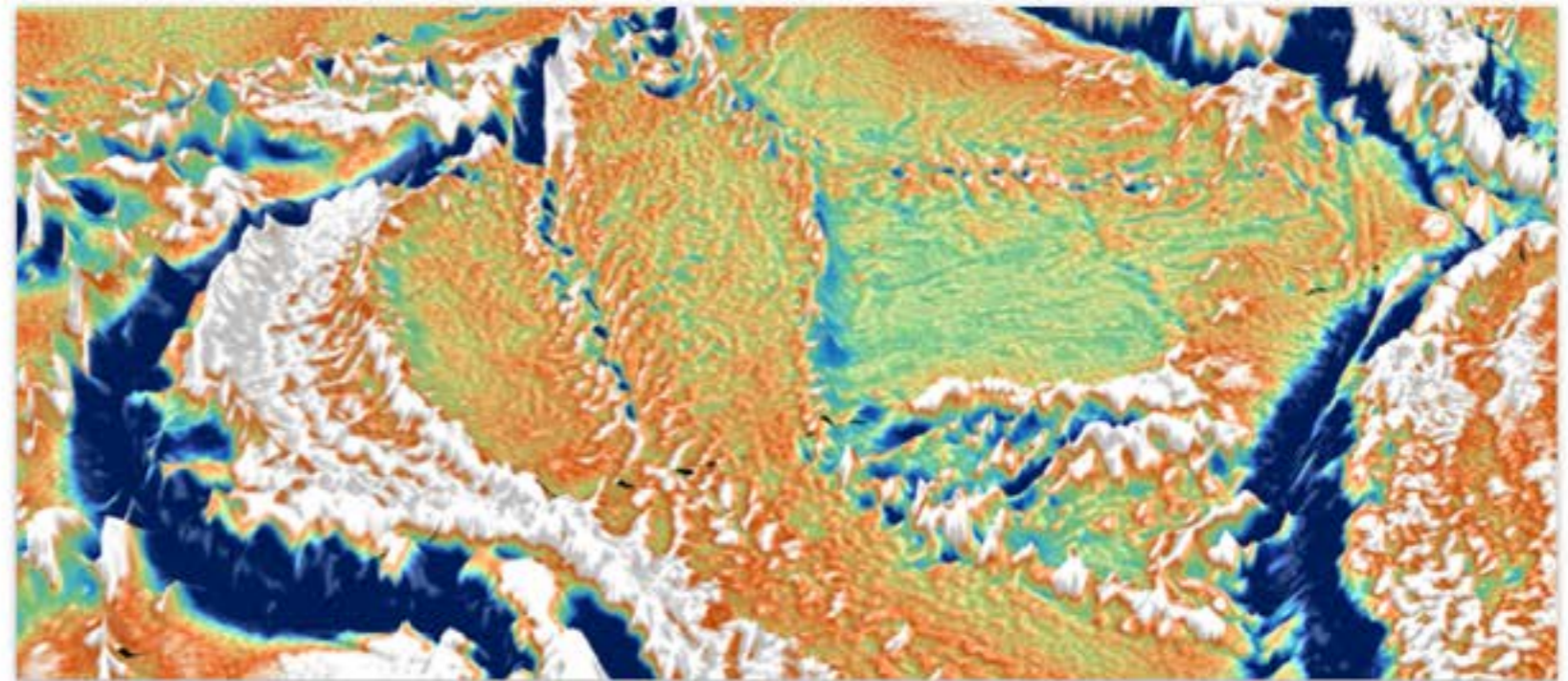
[IPython Sandbox](#)

new!

[Paleomap Services](#)

new!

SRTM coming soon



Welcome to GPlates Portal

This page is a gateway to a series of web pages for the interactive visualisation of cutting-edge geoscience datasets, all possible within freely available web browsers. Use the links on the left side of this page to access visualisations of:

- The new version of the **vertical gravity gradient** derived from satellite altimetry
- **Plate tectonic reconstructions of gravity data** created using GPlates
- **Dynamic surface topography maps** based on simulations of mantle convection (*Industry Sponsors Only*)

The 3D visualisations are powered by [Cesium](#) - for general information on using how to use Cesium, and browser compatibility, [click here](#)

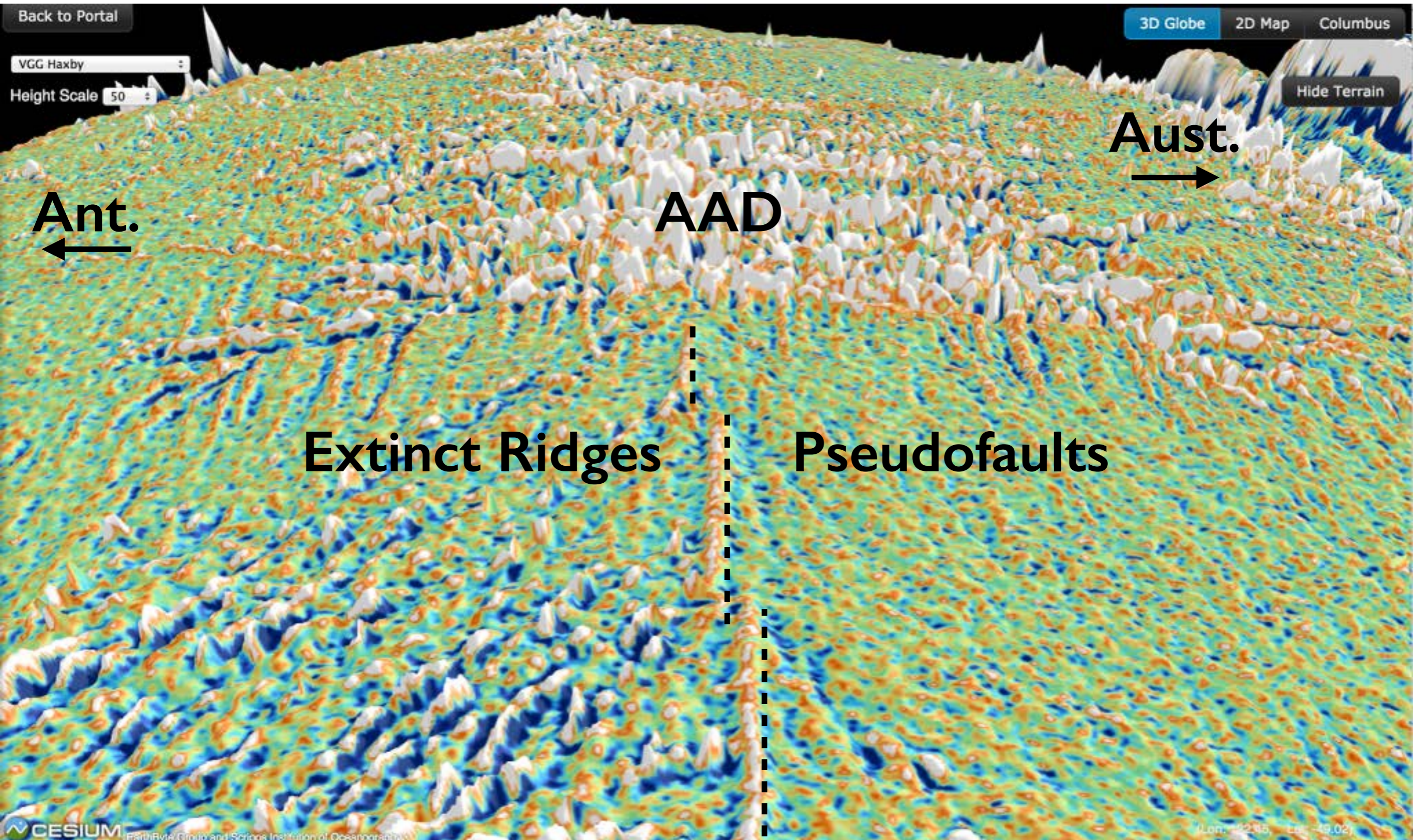
About Earthbyte

The [EarthByte Group](#) in the [School of Geosciences](#) of [The University of Sydney](#) is one of the world's leading research groups for global and regional plate tectonic reconstructions and for studying the interplay between the deep earth and surface processes.

Improved imaging of small-scale seafloor features

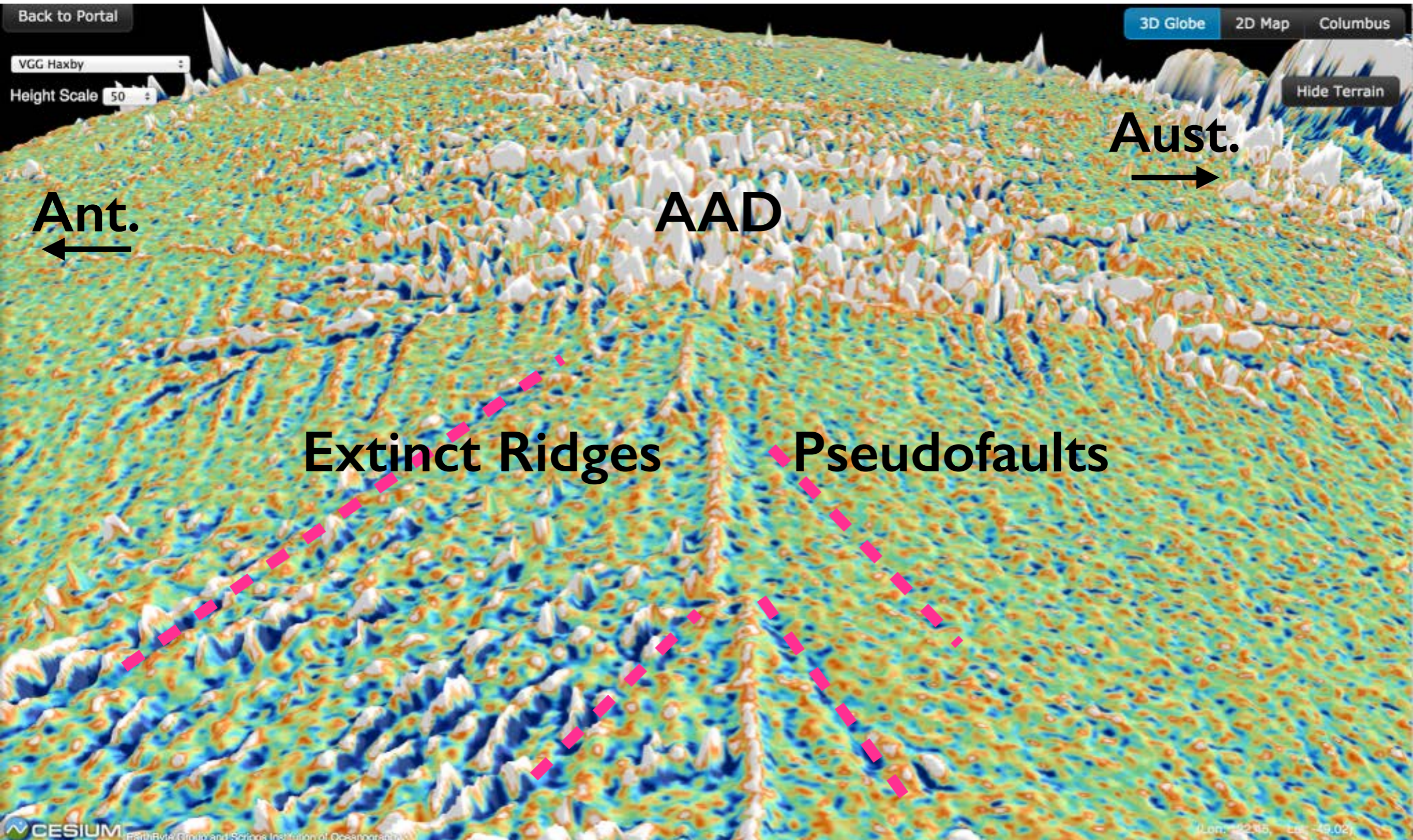
- **Previously invisible abyssal hill fabric**
 - improved constraints on changes in spreading direction
- **Previously unmapped oceanic microplates and unknown extinct mid-ocean ridges**
 - improved understanding of tectonic reorganisations and past spreading
- **Important for more than just tectonics!**
 - ocean circulation, tsunami forecasting, submarine navigation

Welcome to the Portal: SE Indian Ridge



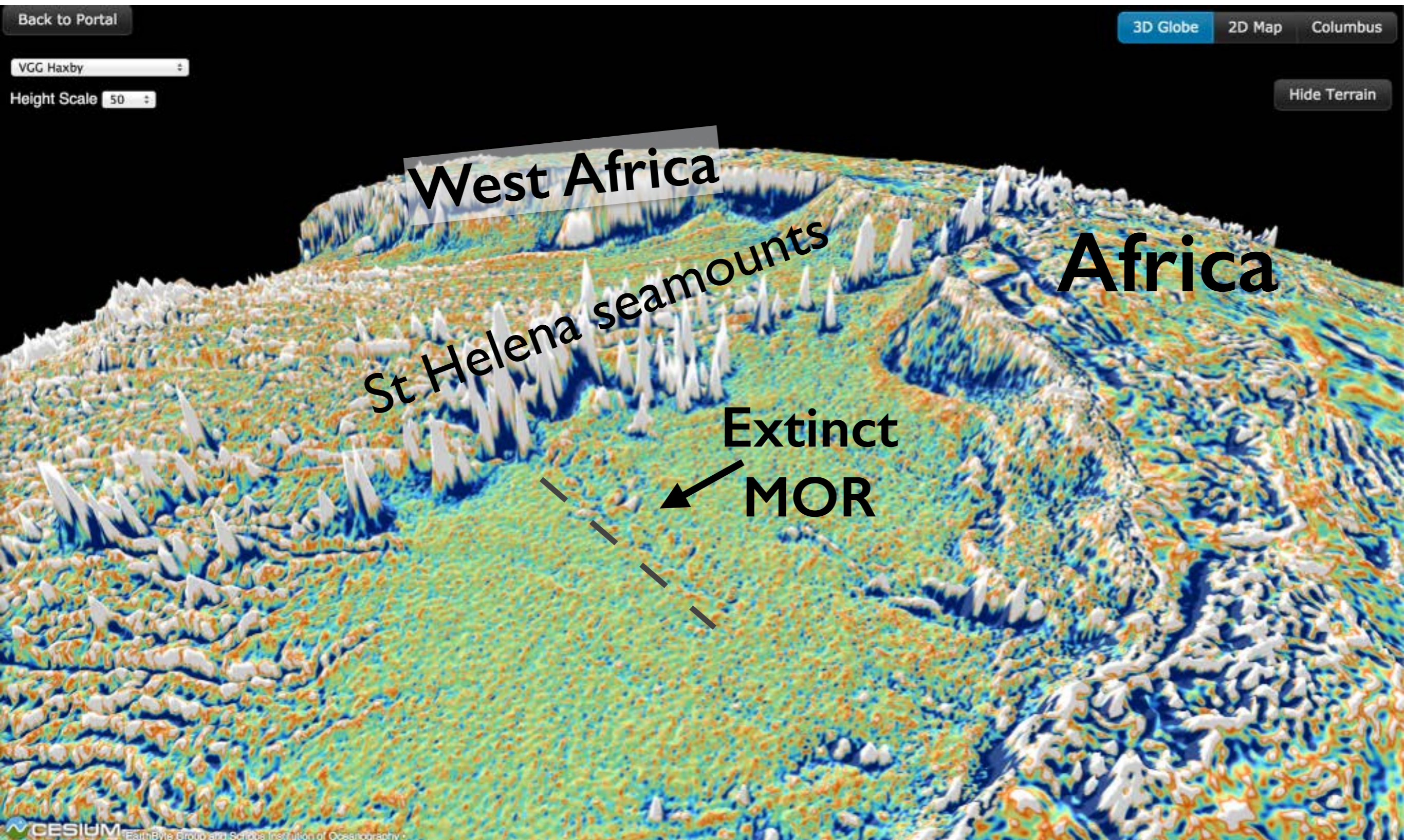
Westward view. Note detailed image of conjugate extinct ridges and pseudofaults

Welcome to the Portal: SE Indian Ridge



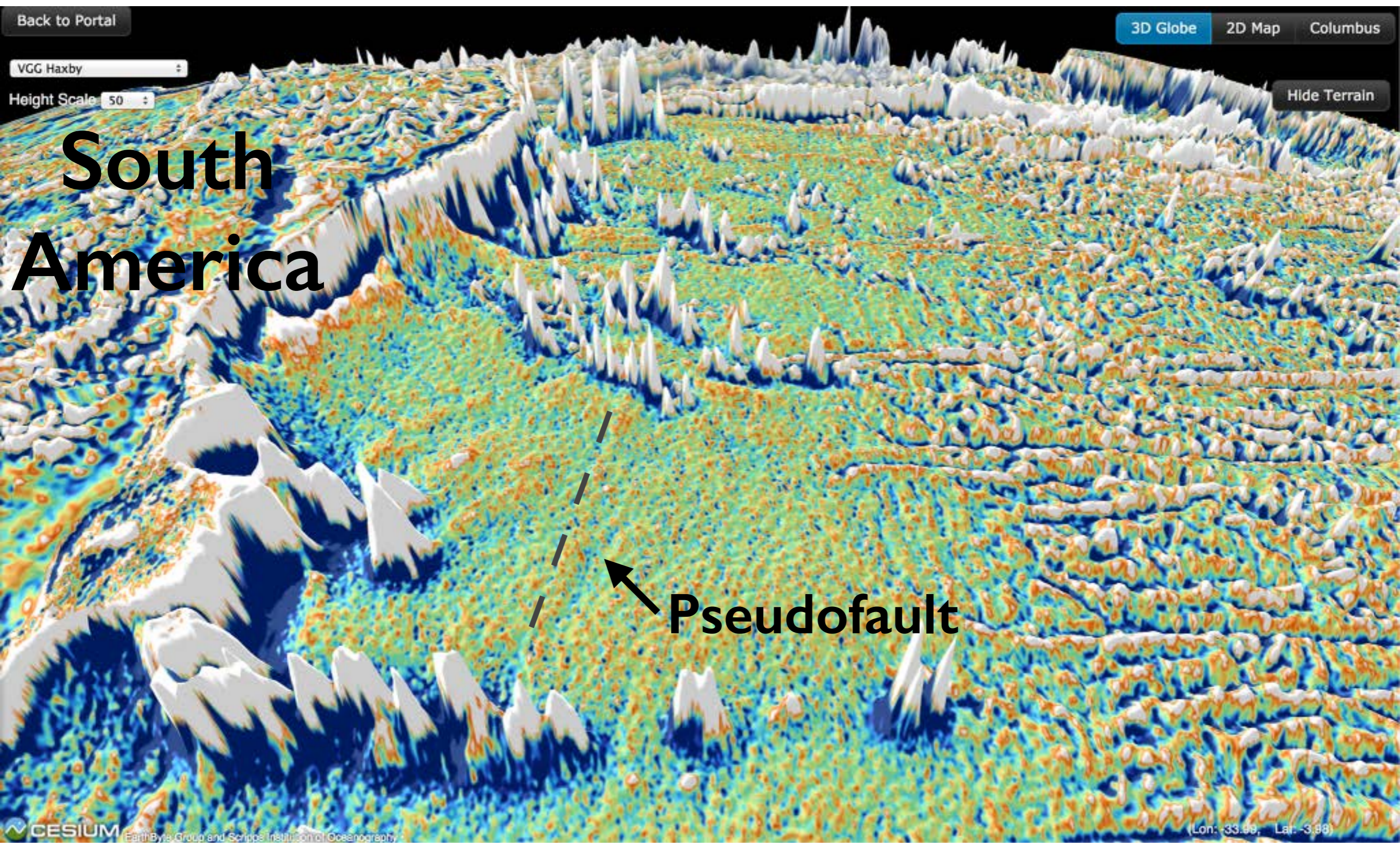
Westward view. Note detailed image of conjugate extinct ridges and pseudofaults

Eastern South Atlantic



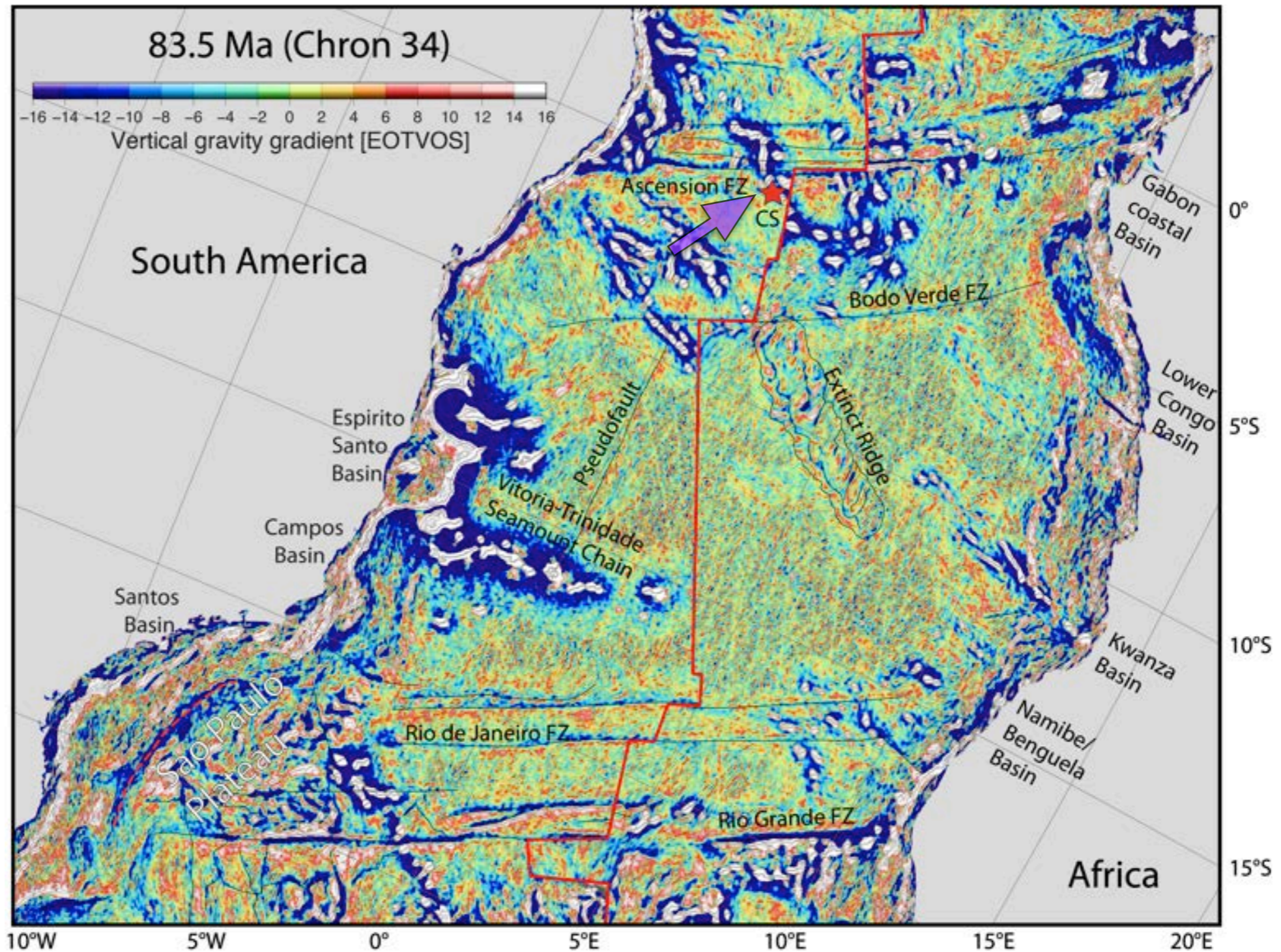
Northward view. Note extinct mid-ocean ridge in abyssal plain.

Western South Atlantic



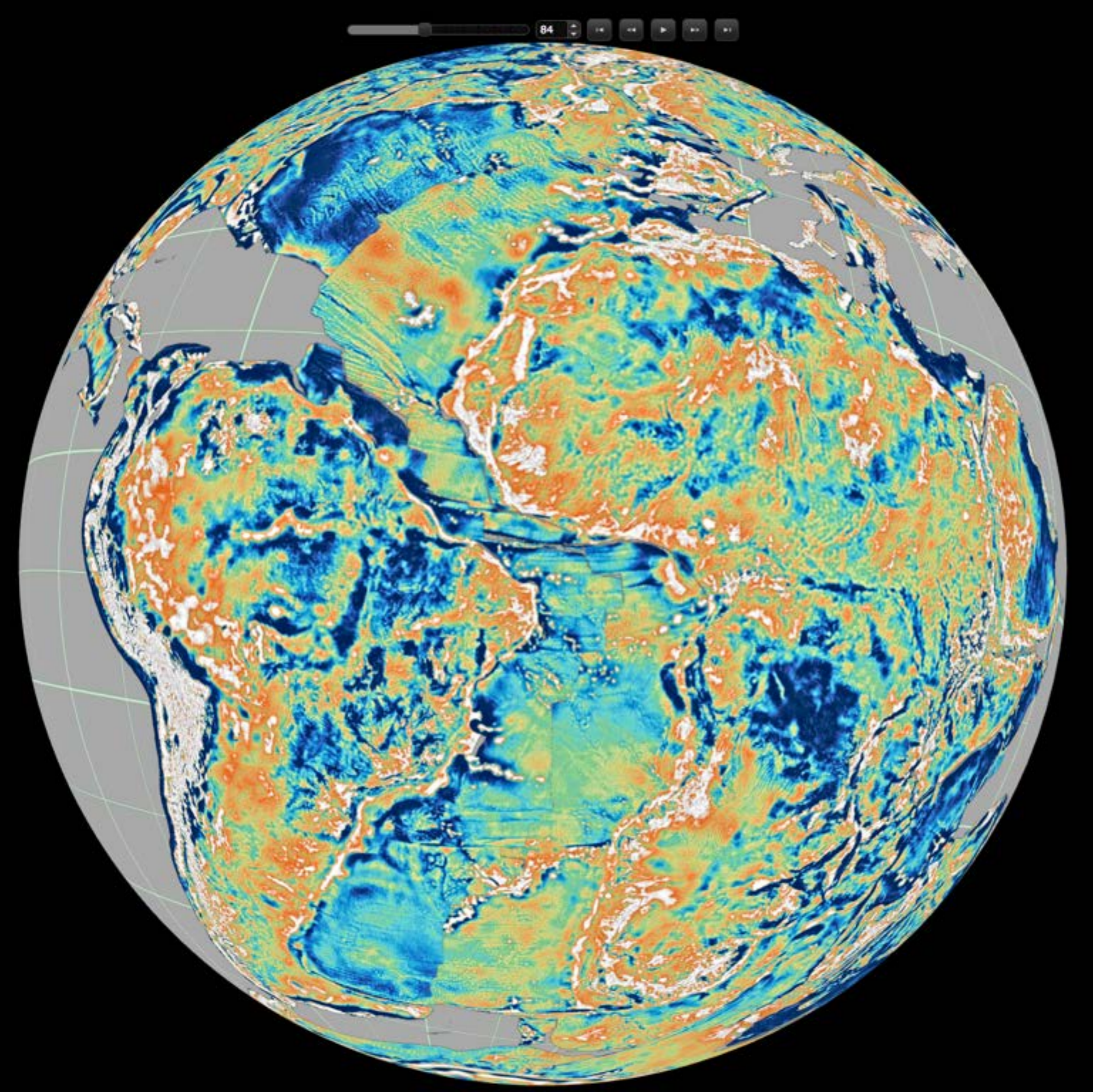
Northward view. Note pseudofault in abyssal plain.

Vertical Gravity Gradient grid reconstruction at 83.5 Ma



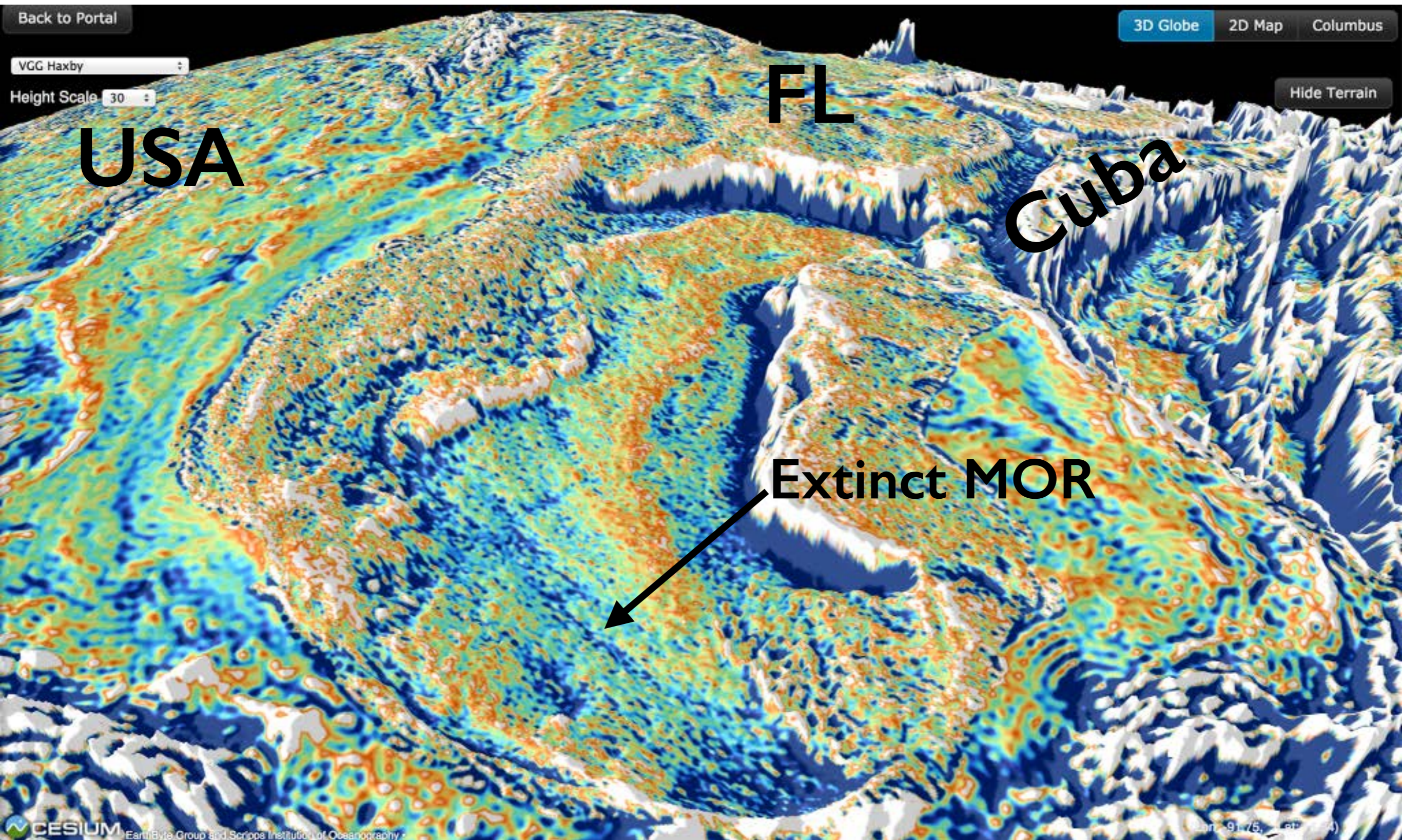
Sandwell et al.
(2014)

The mid-ocean ridge is outlined in red and the reconstructed position of the Cardno hotspot (CS) is outlined by a red star. Most of the seafloor shown was formed during the Cretaceous Normal Superchron.



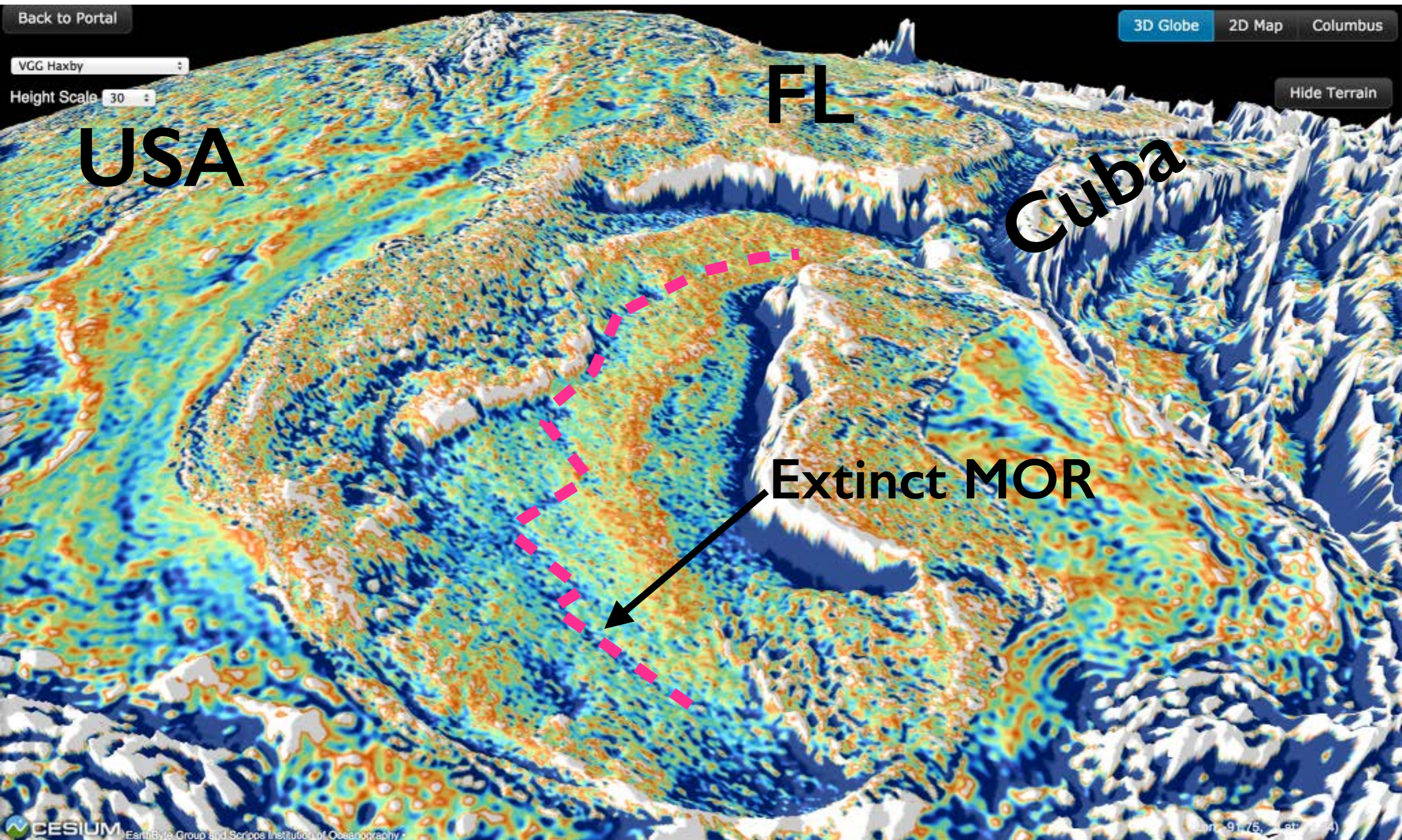
- GPlates Portal VGG grid raster reconstruction
- Grey regions are where the seafloor no longer exists at present-day

Gulf of Mexico



NE view. Note extinct mid-ocean ridge (below ~8 km of sediment) outlined by negative VGG anomaly

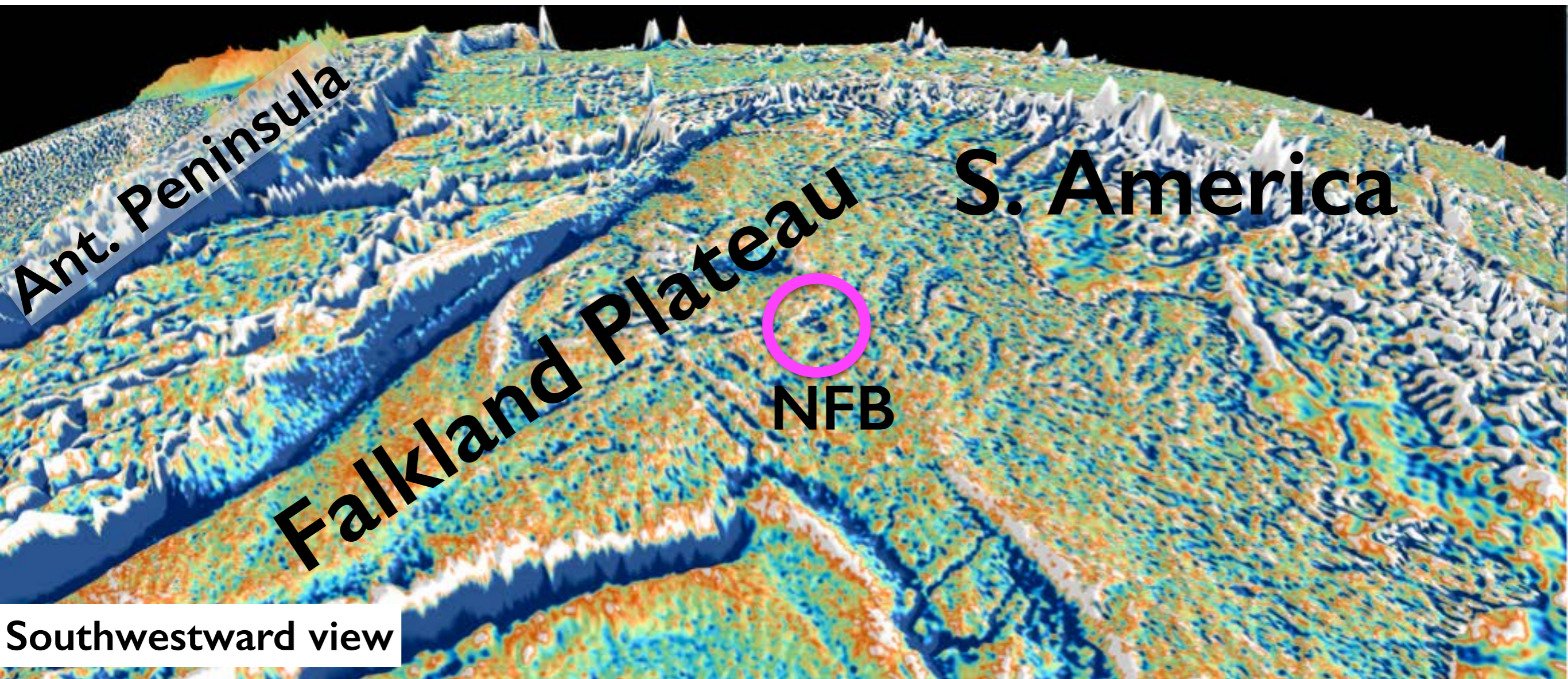
Gulf of Mexico



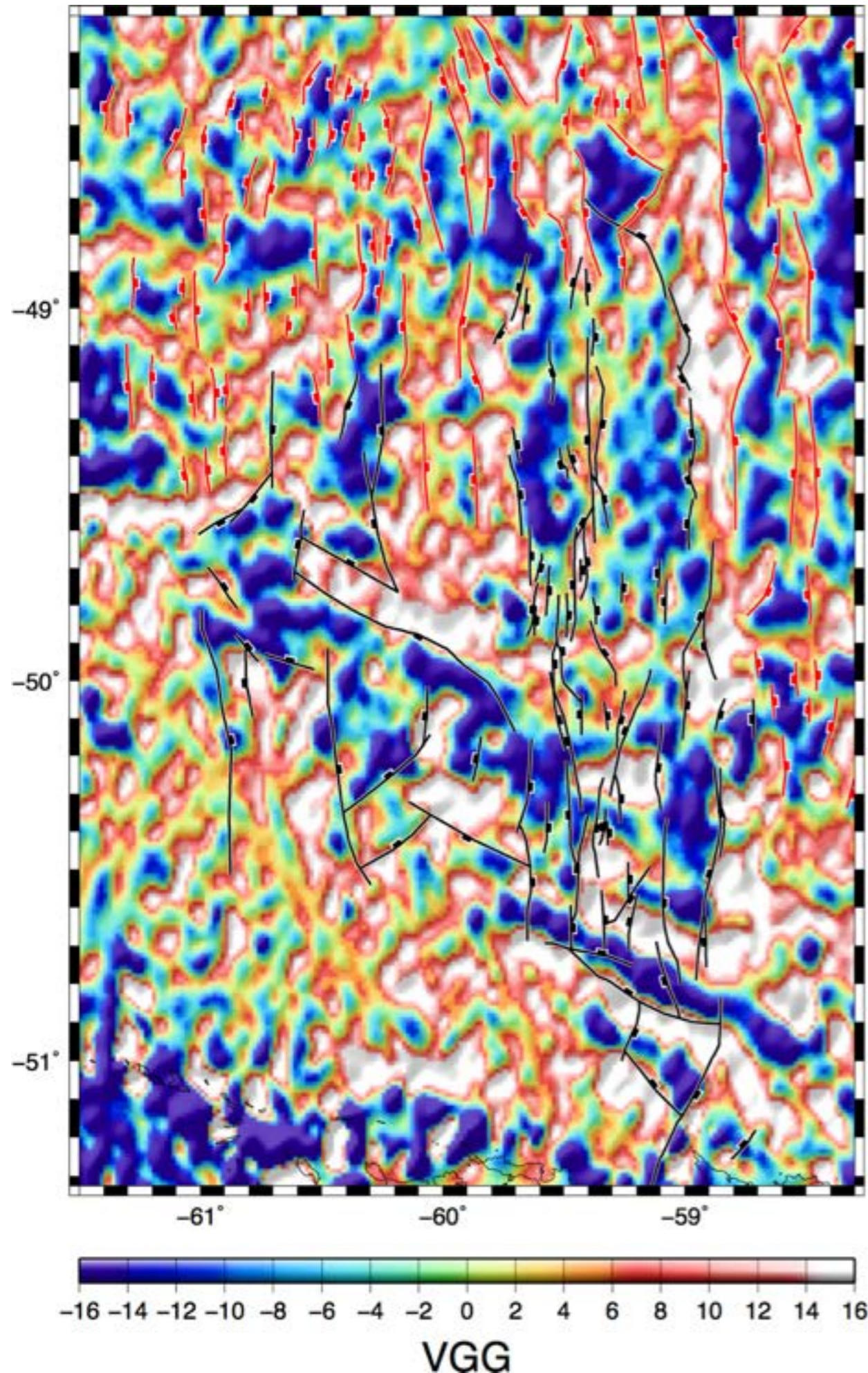
NE view. Note extinct mid-ocean ridge (below ~8 km of sediment) outlined by negative VGG anomaly

Fault Structures

- The new grid provides breathtakingly detailed views of individual fault structures, previously only mapped via expensive seismic surveys.
- Two examples: Falkland Plateau (N Falkland Basin) and Lord Howe Rise.

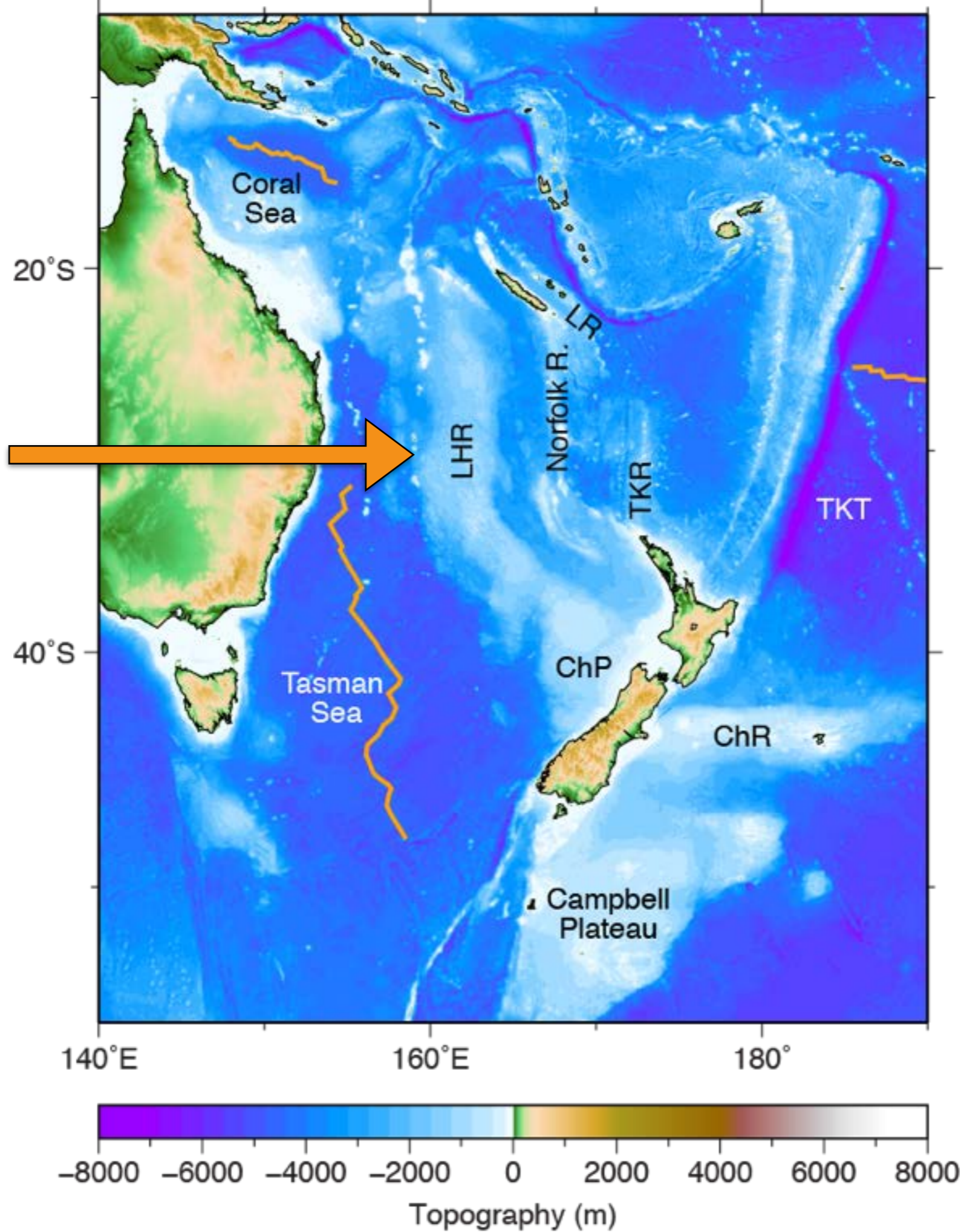


Vertical gravity gradient (VGG) map, North Falkland Basin



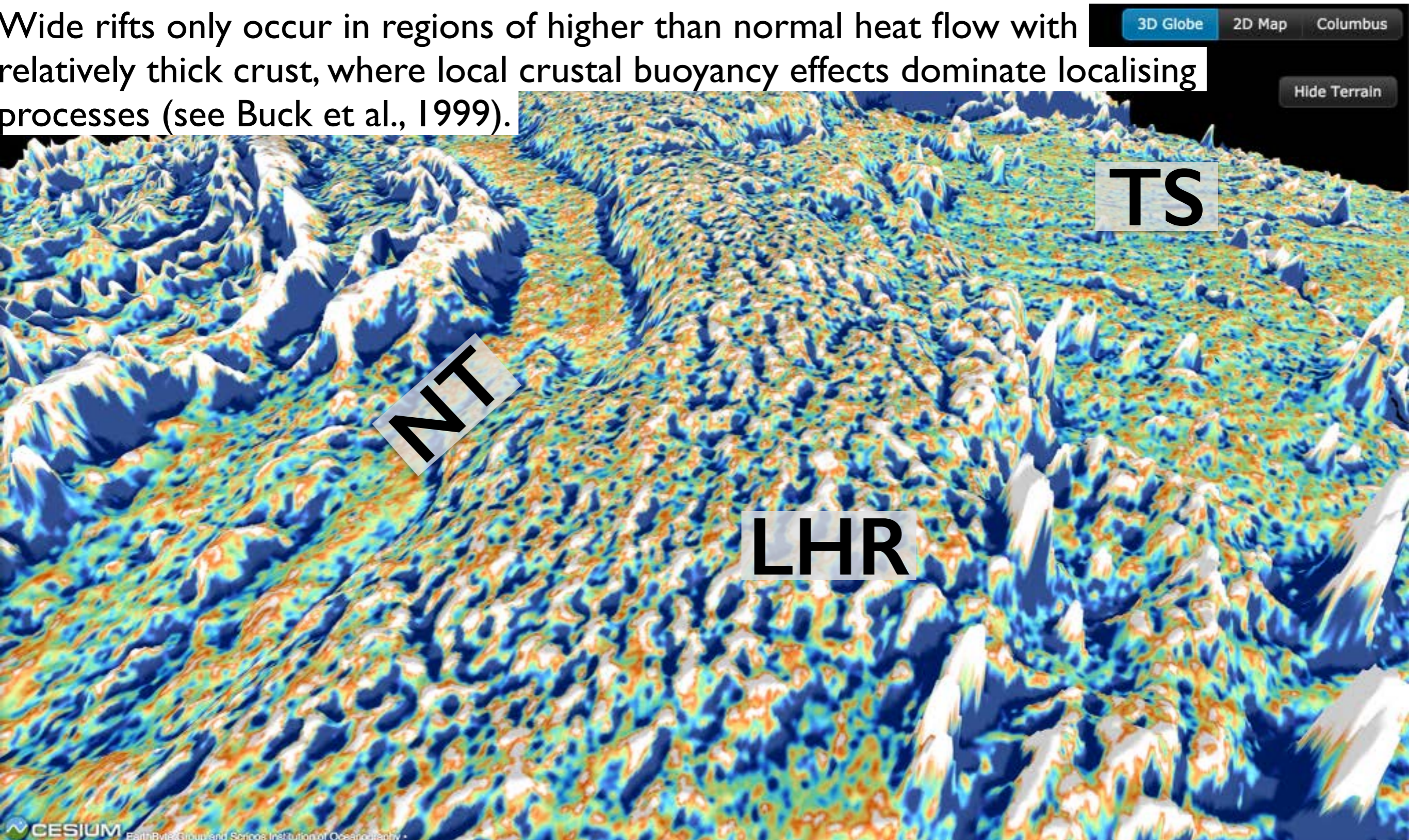
- **Black lines** are normal faults interpreted from seismic reflection data (Richards and Hillier, 2000)
- Normal faults follow the boundaries of elevated horst blocks, expressed as VGG highs
- **Red lines** are normal faults interpreted from VGG data
- A fault network emerges that illustrates that this region of the Falkland Plateau is characterised by broadly distributed faulting

Lord Howe Rise



Lord Howe Rise

Wide rifts only occur in regions of higher than normal heat flow with relatively thick crust, where local crustal buoyancy effects dominate localising processes (see Buck et al., 1999).



Southward view. Note “Basin and Range”-style wide rift characteristics

Conclusions

- The new gravity grid sheds light on many small-scale features in abyssal plains, along continental margins and on submerged continental plateaus, facilitating a new period of discovery in remote parts of the oceans, and leading to a revised tectonic fabric map of the seafloor
- The grid will play a major role in mapping and modelling buried tectonic structures along continental margins and in submerged continental plateaus
- Check out the GPlates Portal!! portal.gplates.org