



Temperate rainforests near the South Pole during peak Cretaceous warmth

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British
Antarctic Survey



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Klages et al. (2020), nature

Acknowledgements



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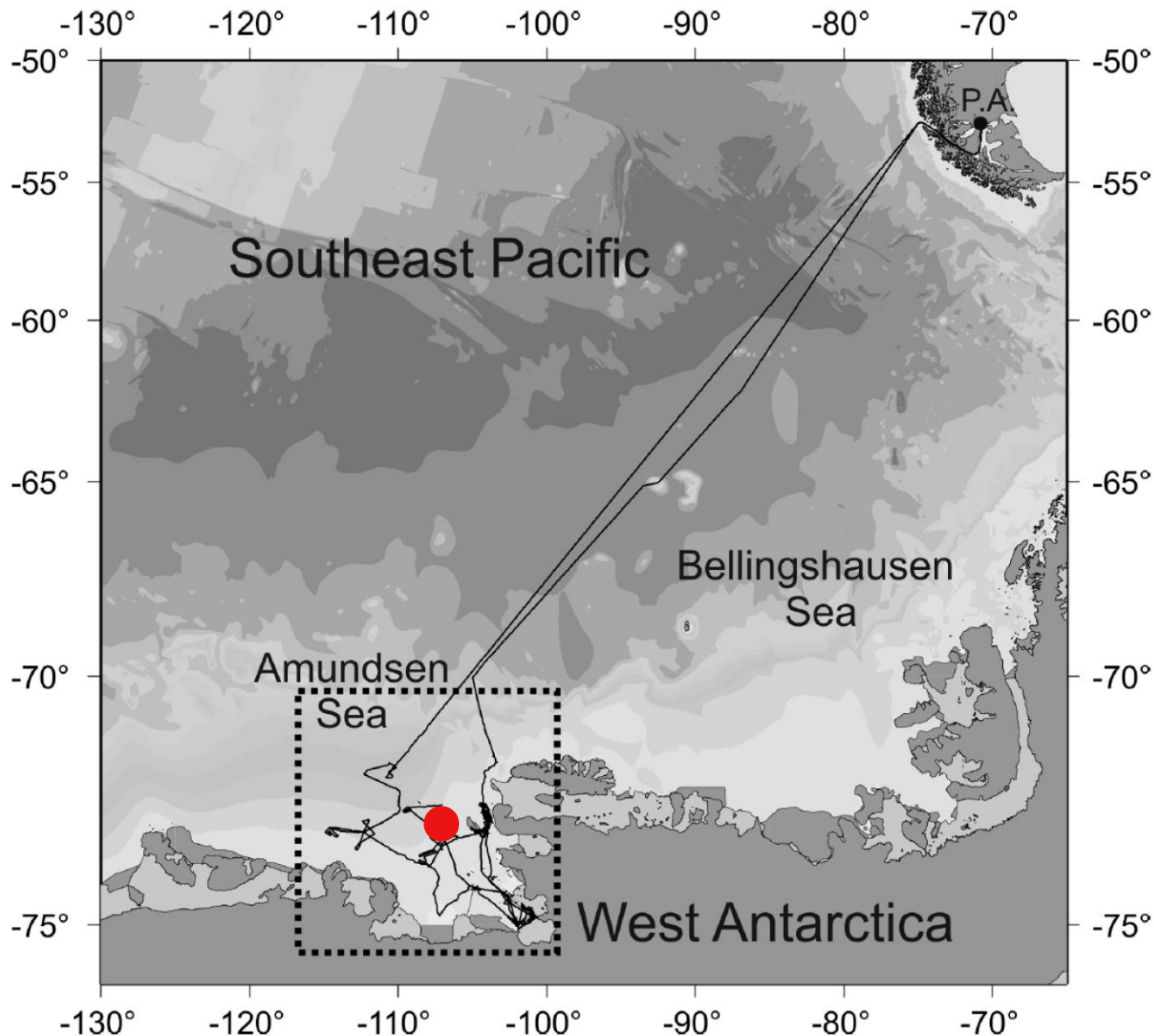


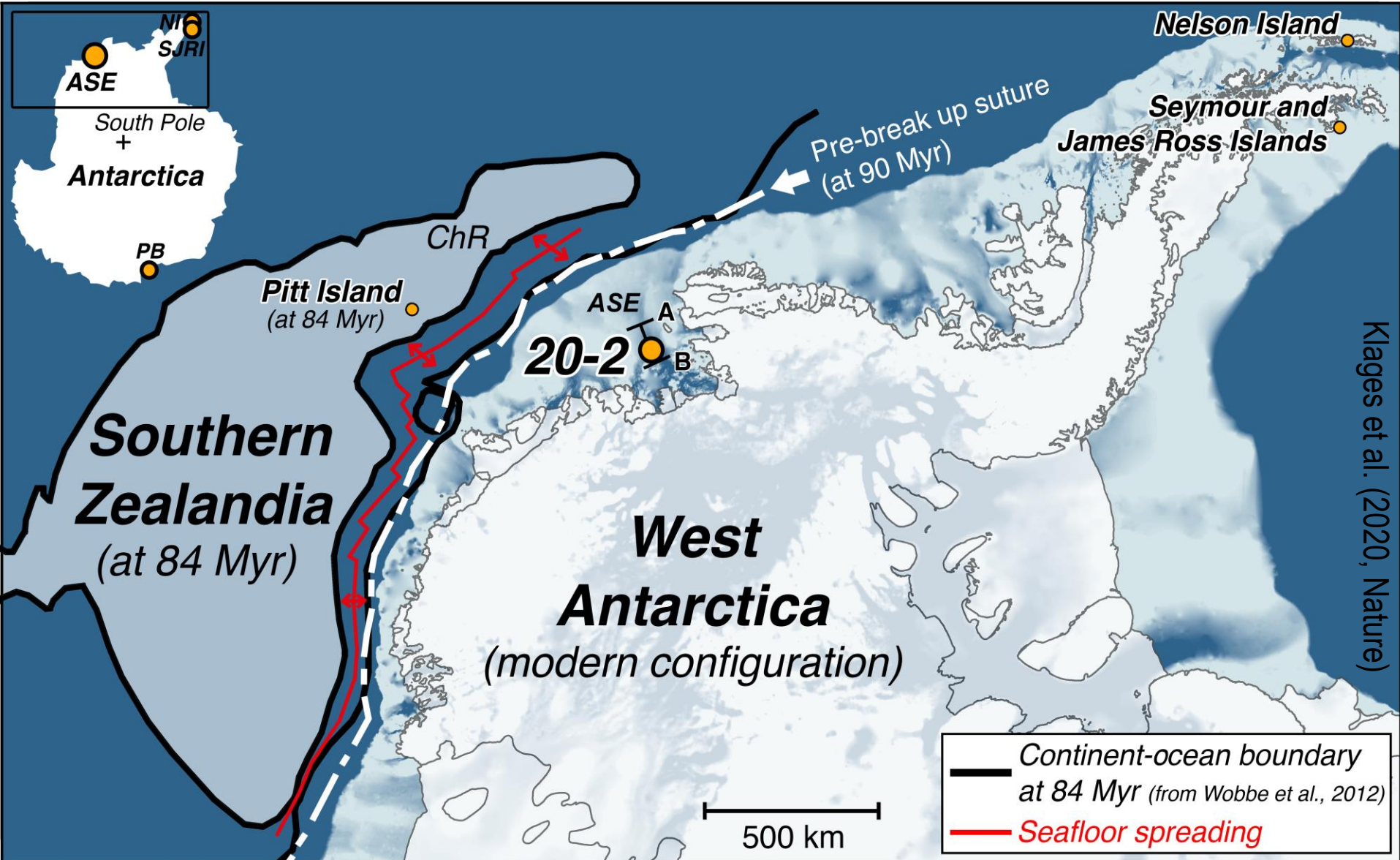
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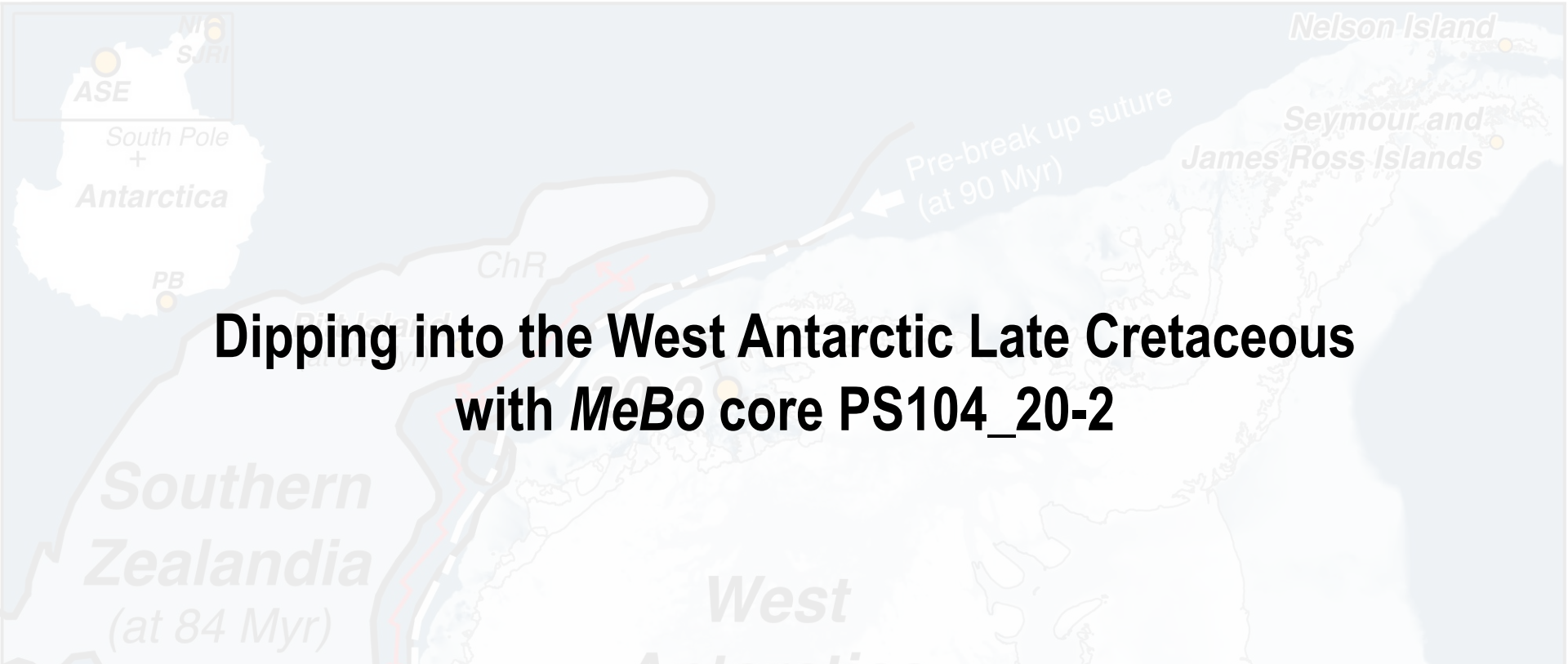


RV *Polarstern* Expedition PS104 “ASE-MeBo” to the Amundsen Sea Embayment (Jan-Mar 2017)

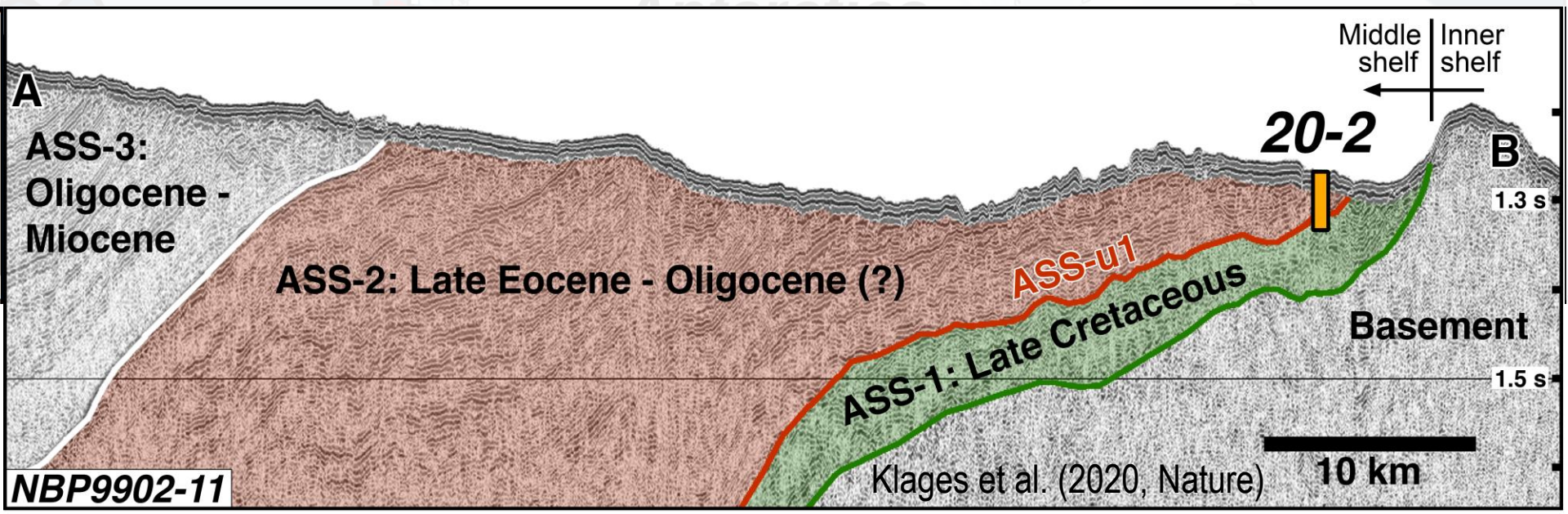




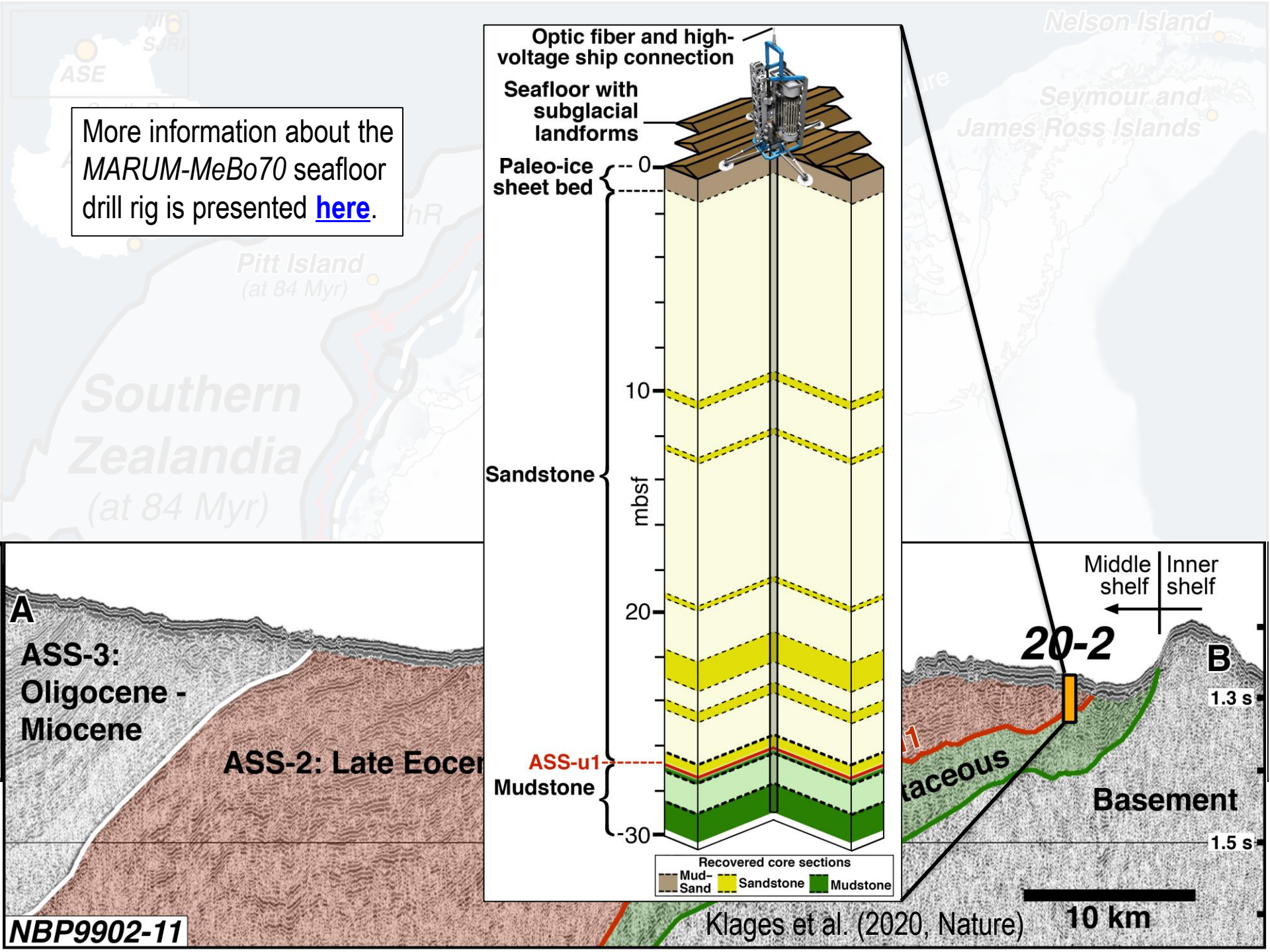
Simplified tectonic configuration ~90 million years ago.



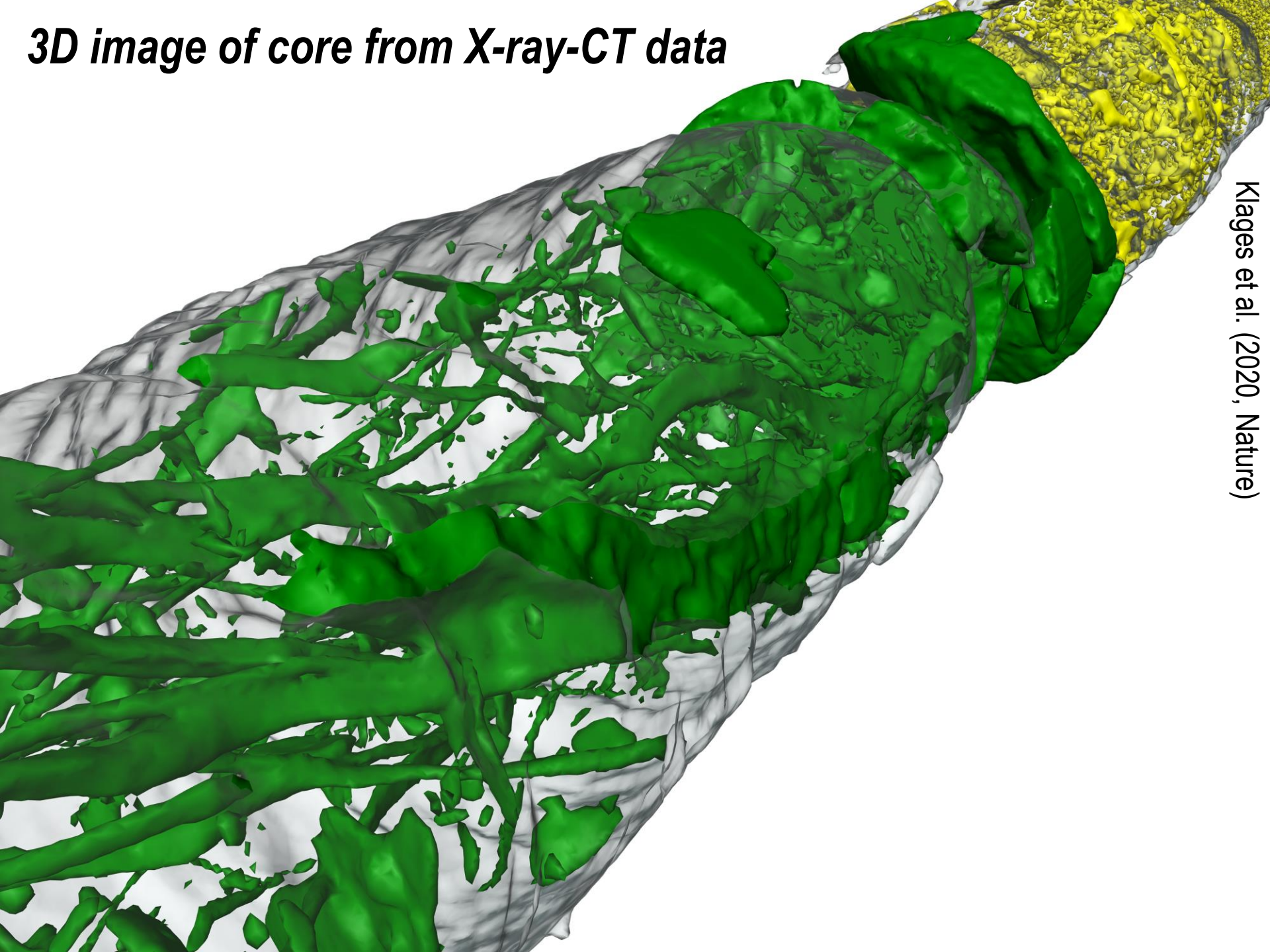
Dipping into the West Antarctic Late Cretaceous with *MeBo* core PS104_20-2



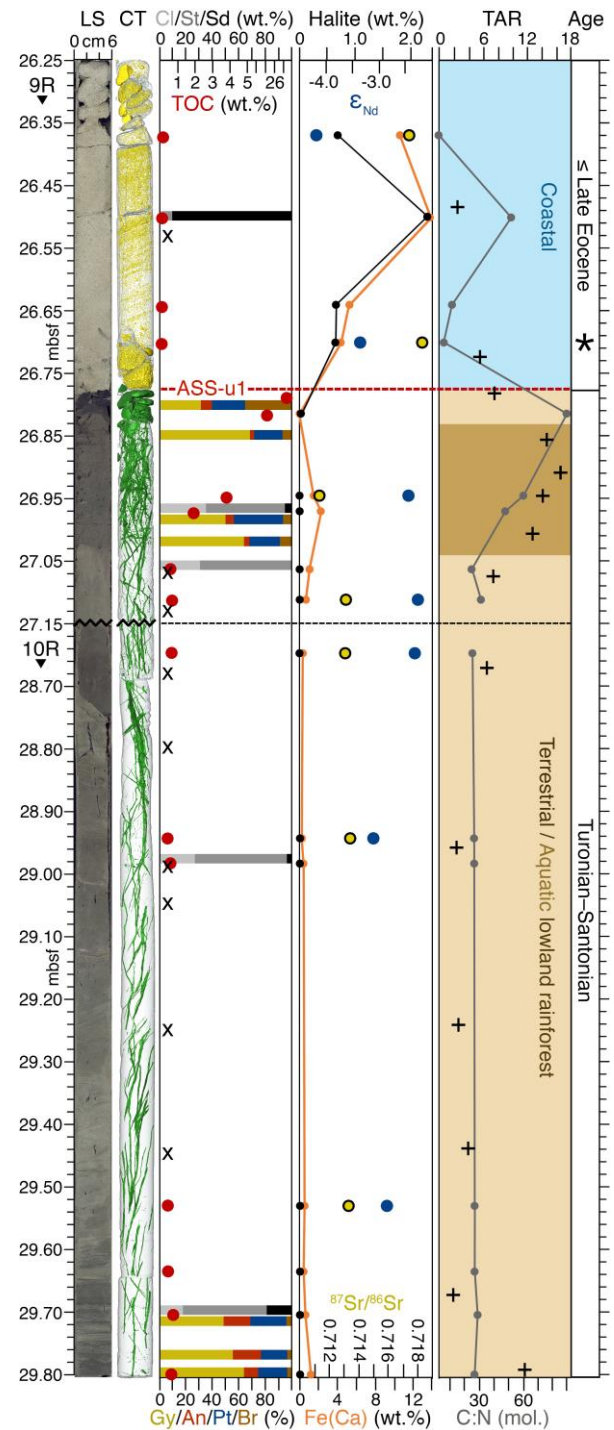
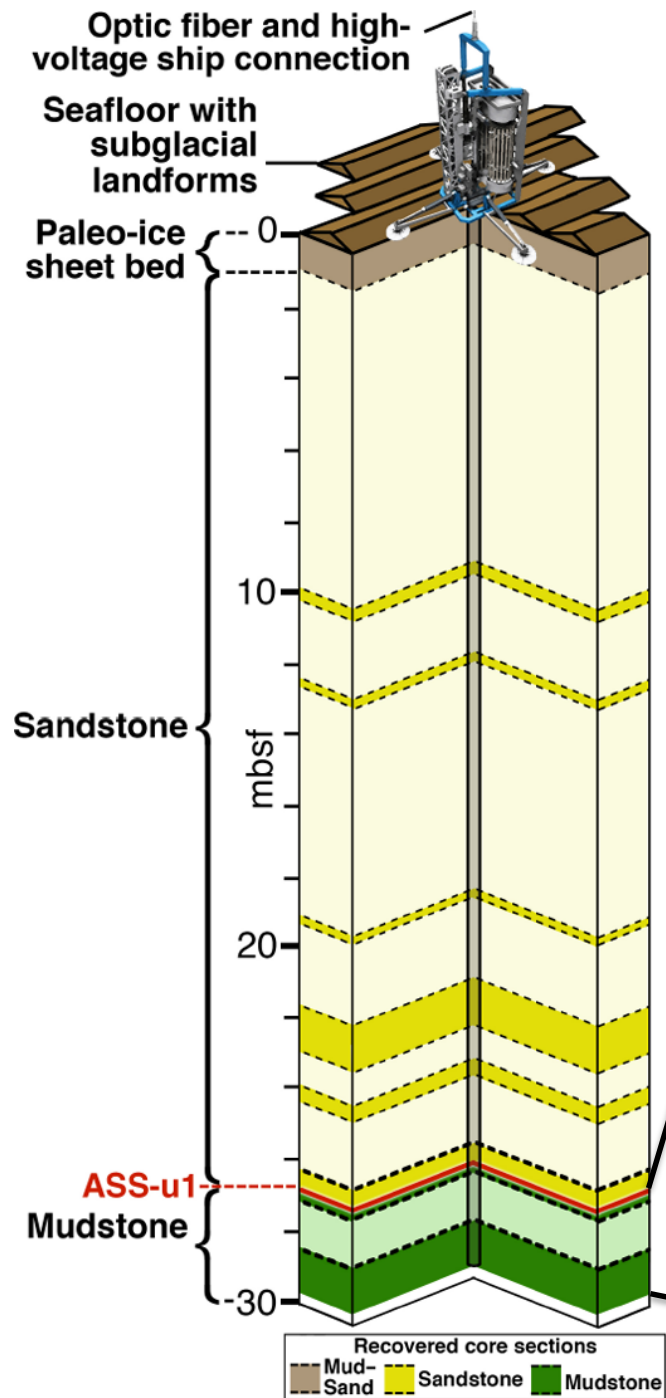
More information about the MARUM-MeBo70 seafloor drill rig is presented [here](#).



3D image of core from X-ray-CT data

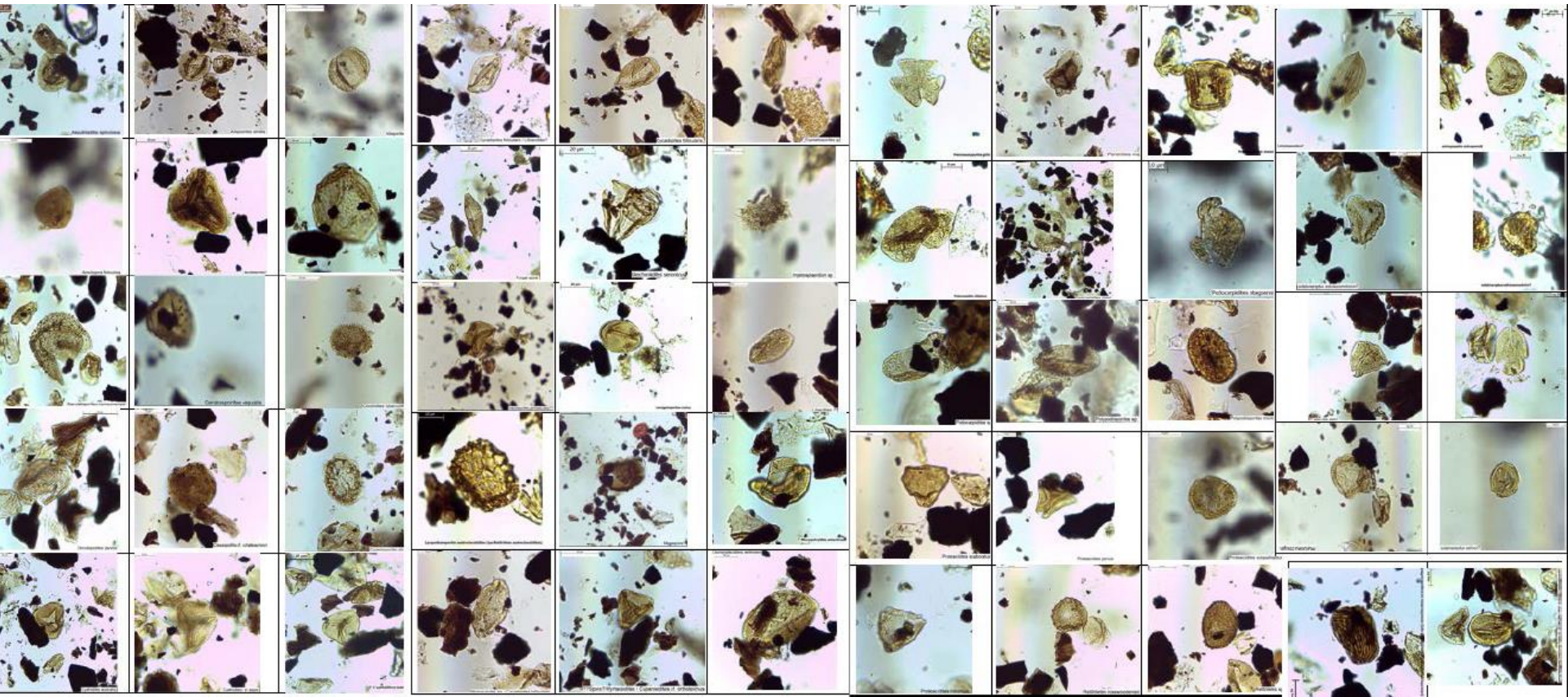


Klages et al. (2020, Nature)



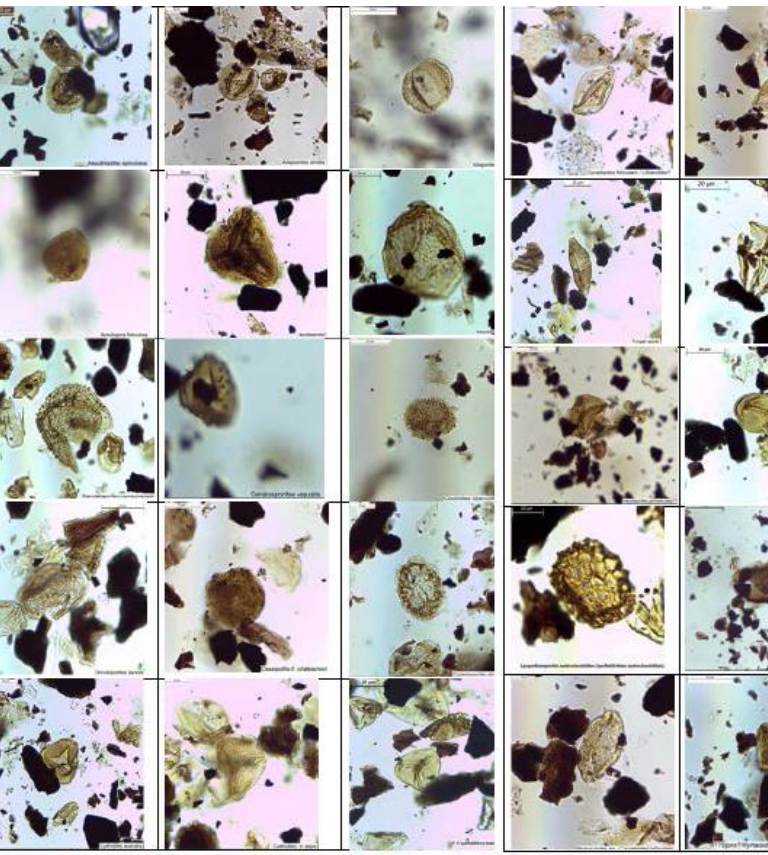
PS104_20-2: Environment and Age

**100% terrestrial assemblage with high diversity (>65 taxa),
no indication for reworking, and well-preserved fossil-plant
remains**



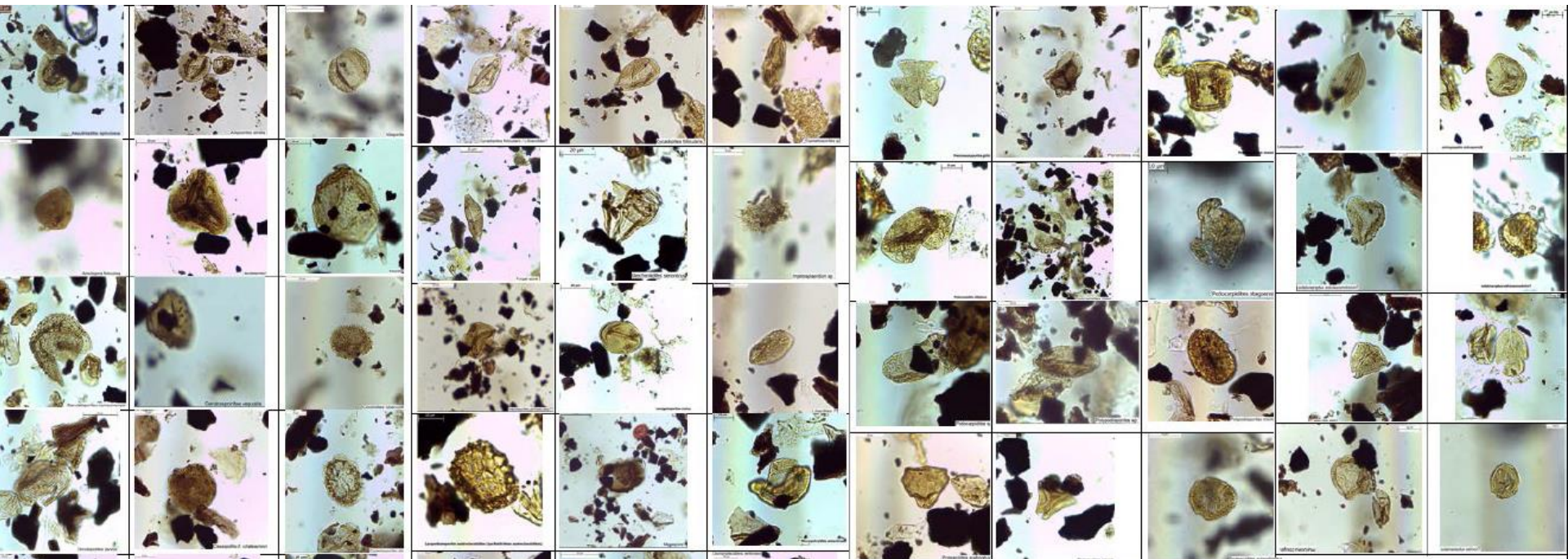
PS104_20-2: Environment and Age

- Abundant conifers: *Podocarpus*, *Araucaria*, and *Phyllocladus*
Absence of *Nothofagus* (Southern Beech)
- Highly diverse assemblage of (tree)ferns and mosses



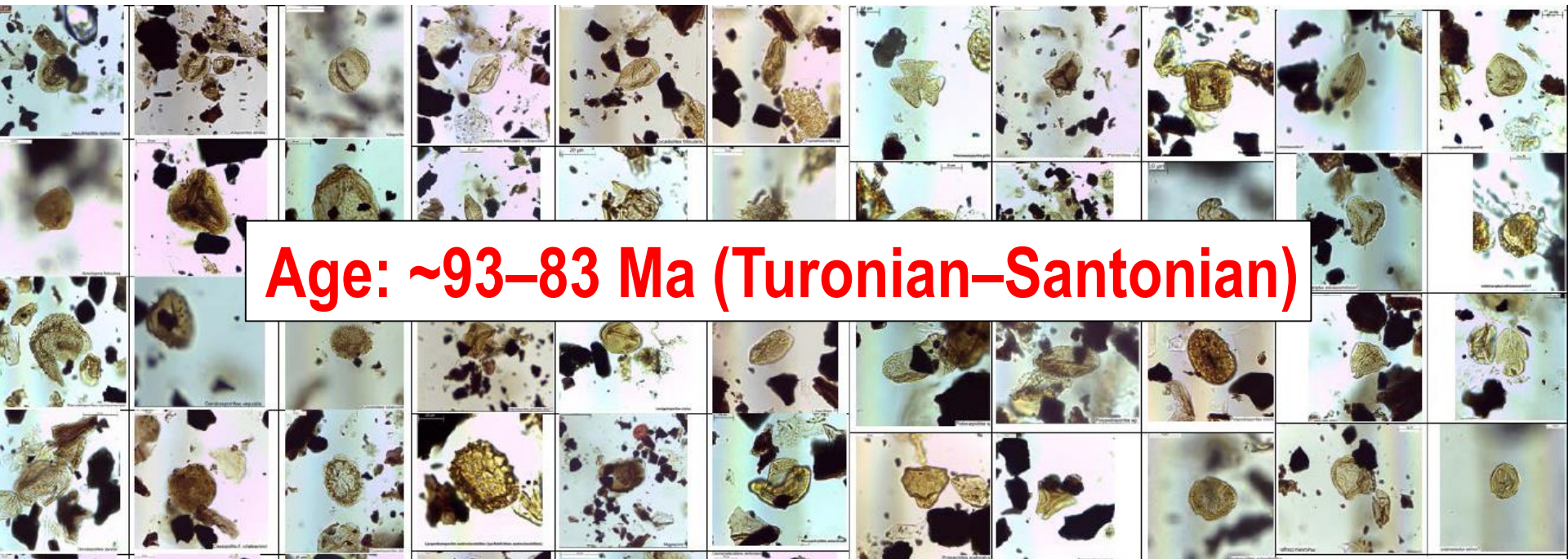
PS104_20-2: Environment and Age

- Close resemblance to Cretaceous Prydz Bay assemblage and Tupuangi Formation, Chatham Islands (New Zealand)
- Age indicative: *Trichotomosulcites* spp. (dominant), abundant *Phyllocladites mawsonii* with numerous angiosperms (“flowering plants”)
- Absence of *Nothofagus* (Southern Beech)



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Age: ~93–83 Ma (Turonian–Santonian)

PS104_20-2: Environment and Age

- Coexistence Likelihood Estimation: $\sim 12^{\circ}\text{C}$ mean annual temperatures with mean warmest summer month temperatures of $\sim 19^{\circ}\text{C}$
- Results from the heterocyst glycolipid-based molecular palaeo-thermometer (HTI_{30}): 19.9°C mean summer lake/river surface water temperature

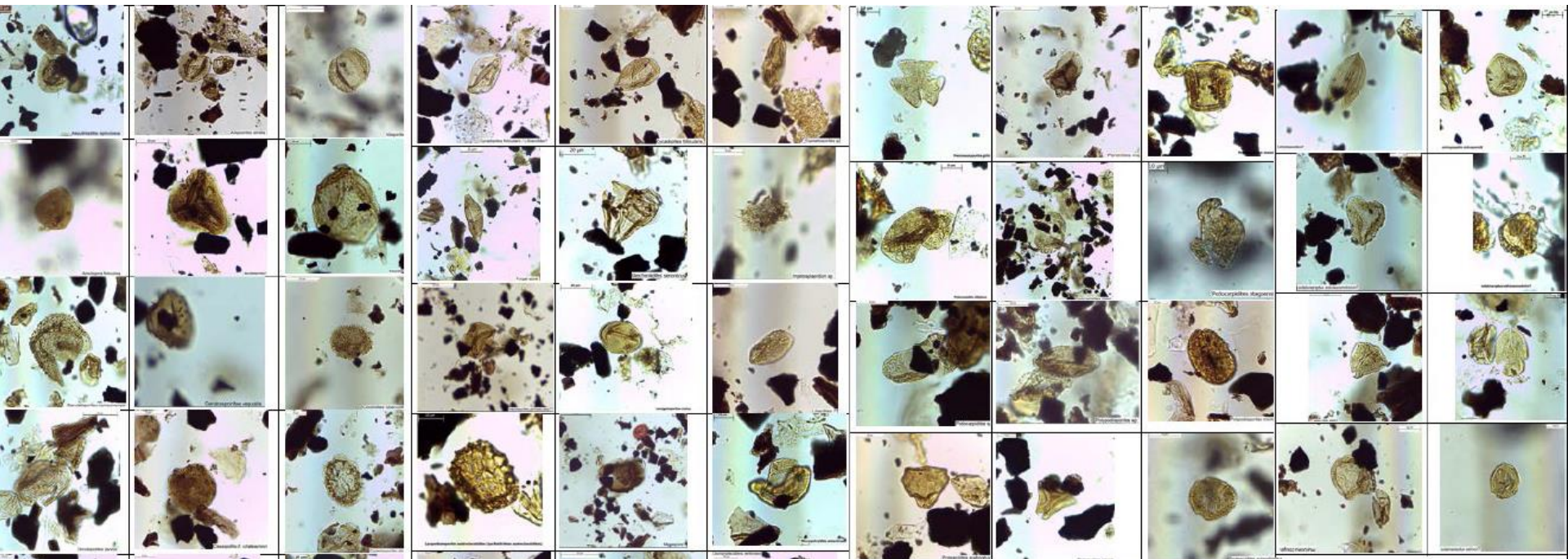
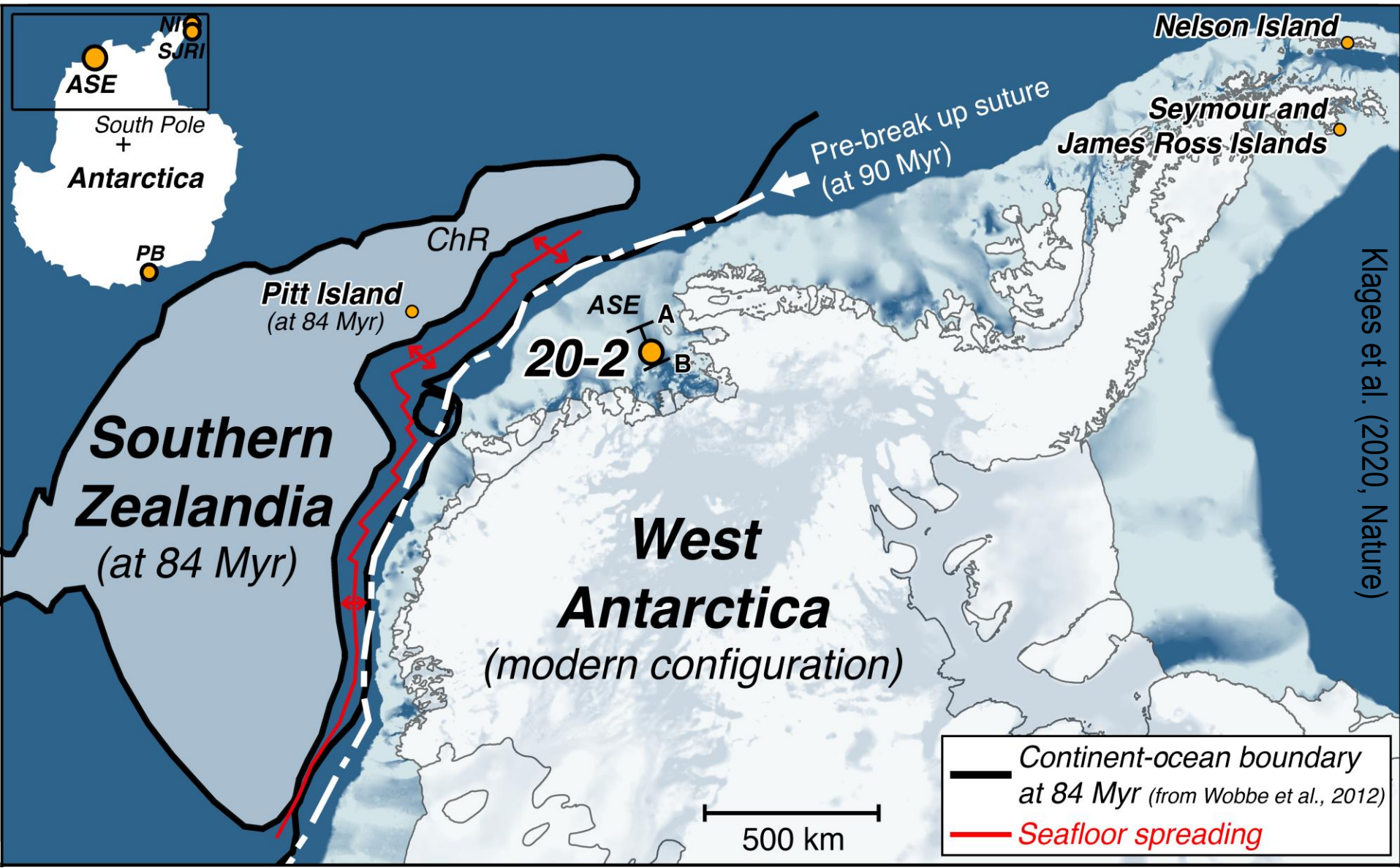
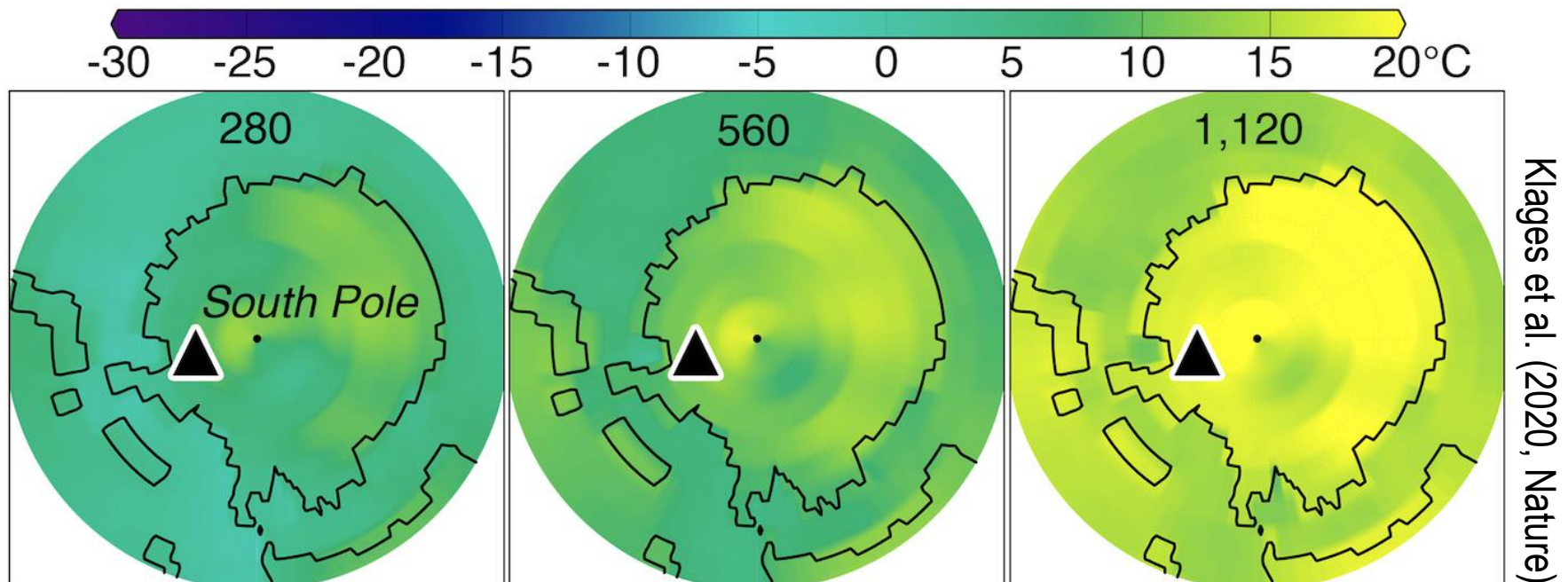


Plate rotational and polar wander path reconstructions indicate a $\sim 82^\circ\text{S}$ palaeolatitude for site PS104_20-2 at 90 Ma



PS104_20-2: Environment and Age

- Simulating mean summer surface air and water temperatures of $\sim 19\text{-}20^{\circ}\text{C}$ at $\sim 82^{\circ}$ palaeo-latitude requires a CO_2 forcing of min. 1120 ppmv, dense vegetation, and absent major Antarctic glaciation
- Southernmost palaeo-temperature and –vegetation constraint of Late Cretaceous ‘greenhouse world’



Artists's impression of the Turonian–Santonian West Antarctic temperate rainforest based on our data



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***THANK YOU FOR
YOUR ATTENTION !***

Klages et al. (2020), **nature**