

# Miocene Palaeoclimates in Kalimantan

High resolution Stable Isotope and Trace Element Geochemical proxies  
and Strontium Isotope Statigraphy

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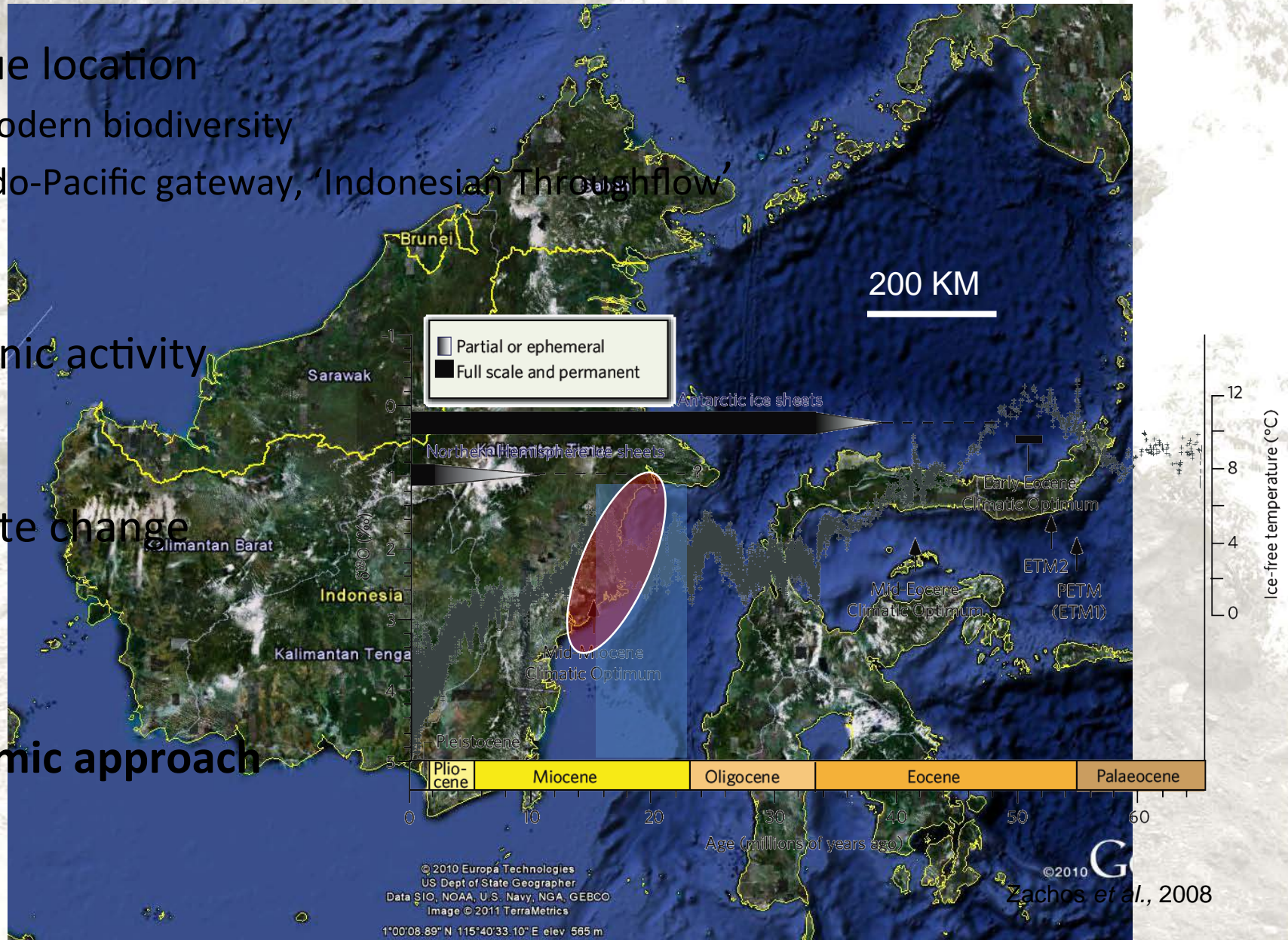
# Kalimantan, Indonesia

- Unique location
  - Modern biodiversity
  - Indo-Pacific gateway, 'Indonesian Throughflow'

- Tectonic activity

- Climate change

- Dynamic approach

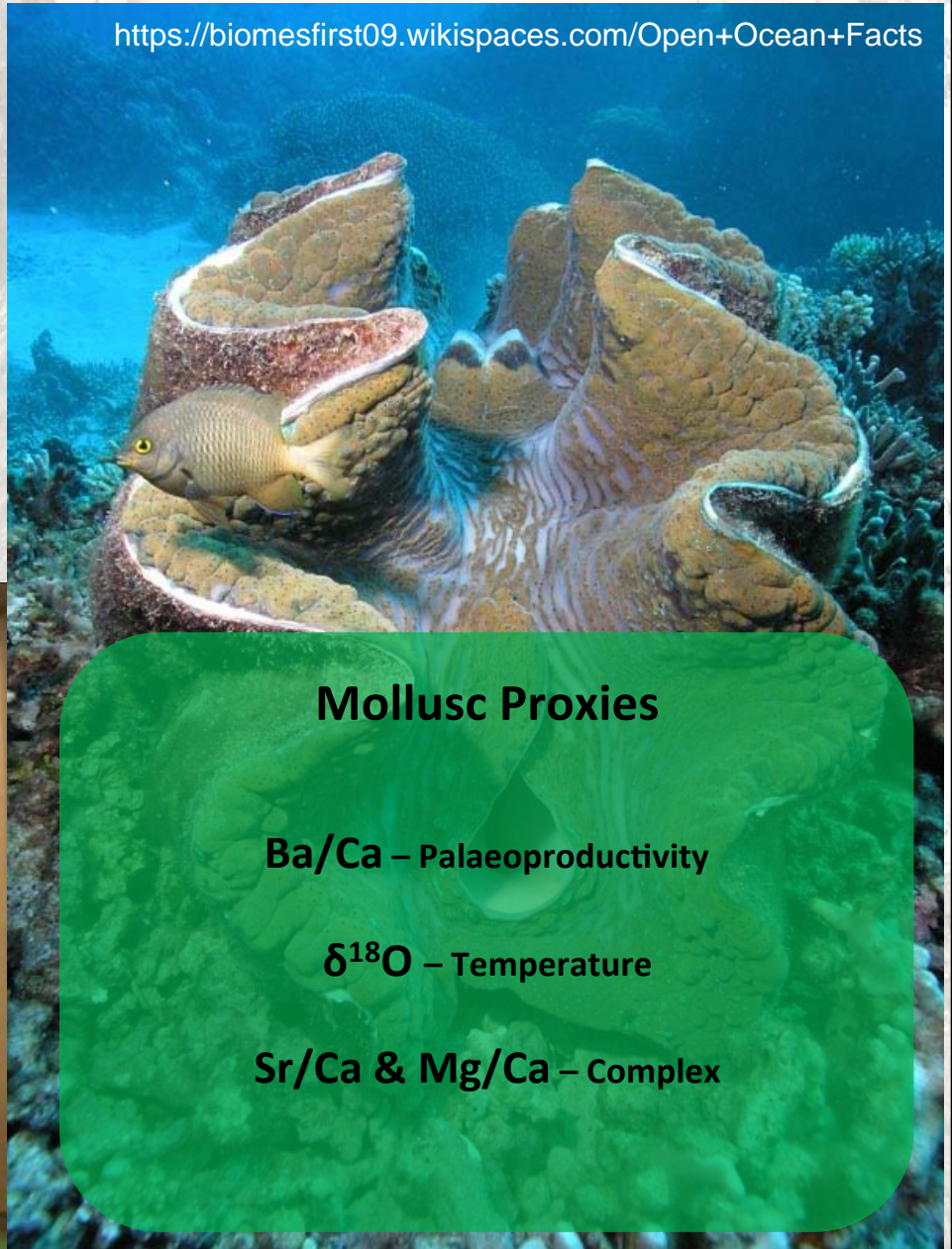


# Fossils and Proxies



- Original carbonate
- Tridacnid molluscs
- Corals
- Larger benthic foraminifera

<https://biomesfirst09.wikispaces.com/Open+Ocean+Facts>



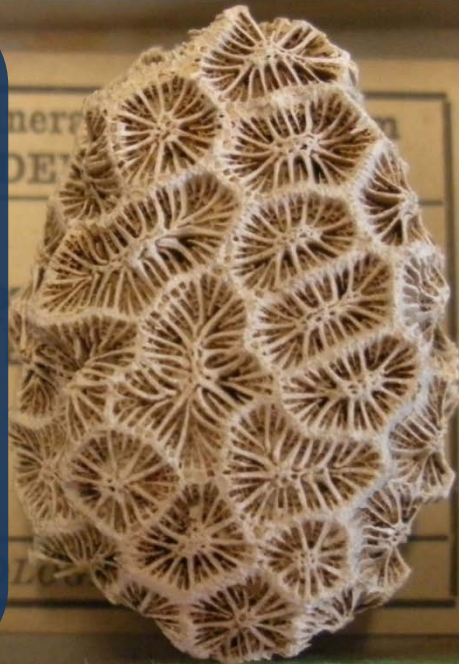
## Coral Proxies

**Sr/Ca** – Temperature

**B/Ca** – Temperature

**Ba/Ca** – River Runoff

**$\delta^{18}\text{O}$**  – Temperature /  
Salinity



## Mollusc Proxies

**Ba/Ca** – Palaeoproductivity

**$\delta^{18}\text{O}$**  – Temperature

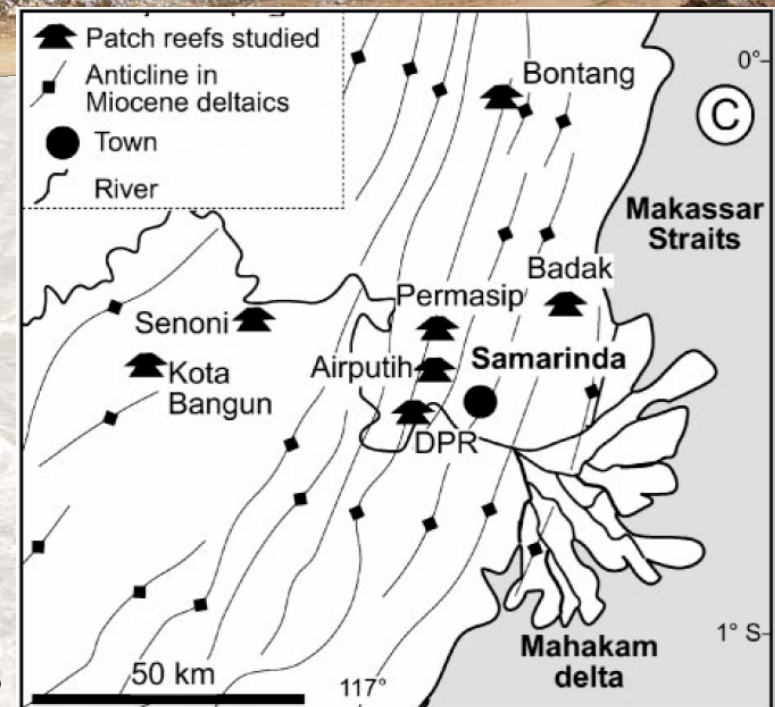
**Sr/Ca & Mg/Ca** – Complex

# Fieldwork – East Kalimantan 2010



- Ridge reef systems
- Majority of Wilson's localities utilized
- Shallow marine environments (Bontang)
  - Well preserved fossils!

Wilson, 2005



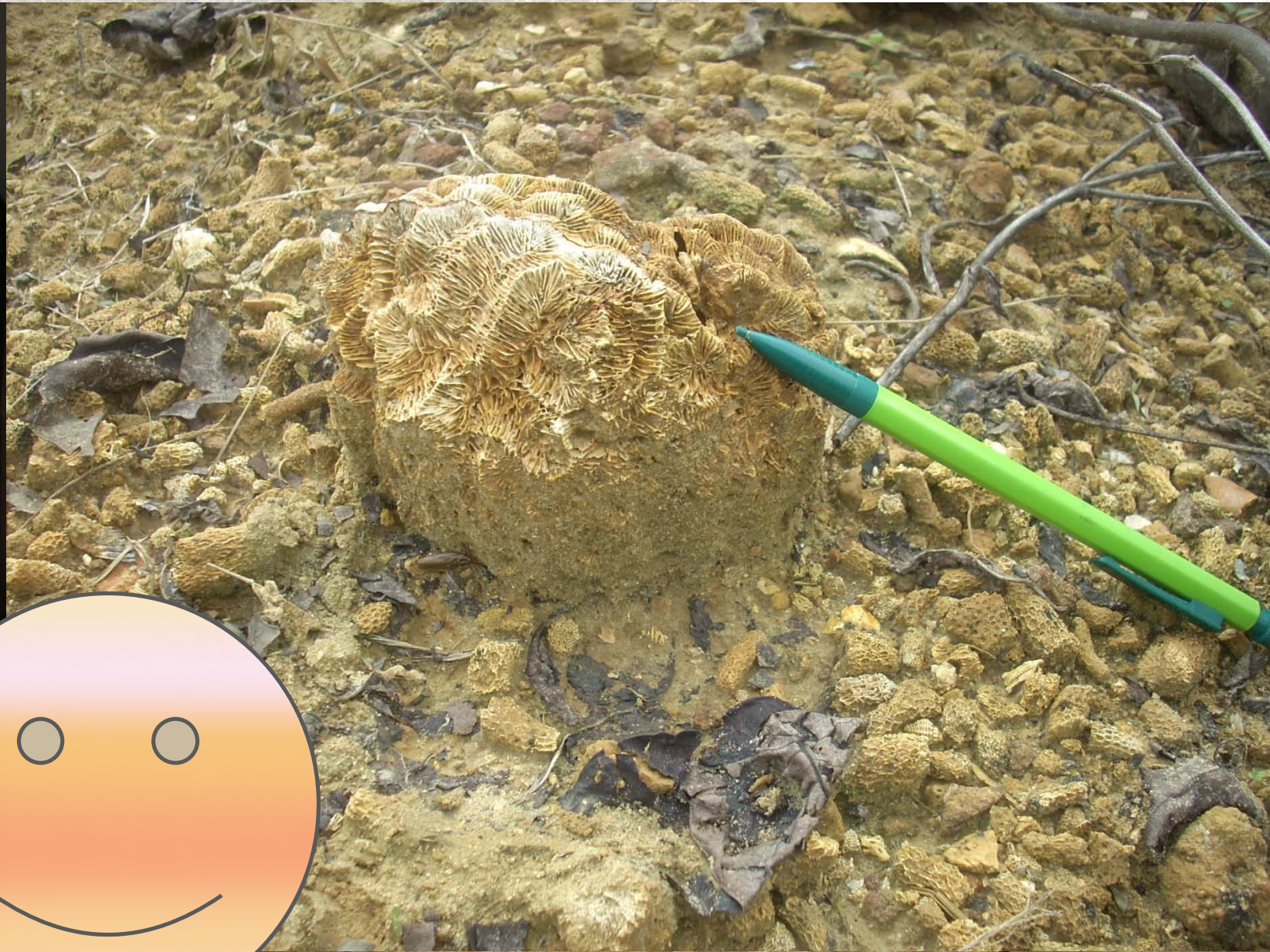
# Samarinda and surrounds



# Bontang and TF108



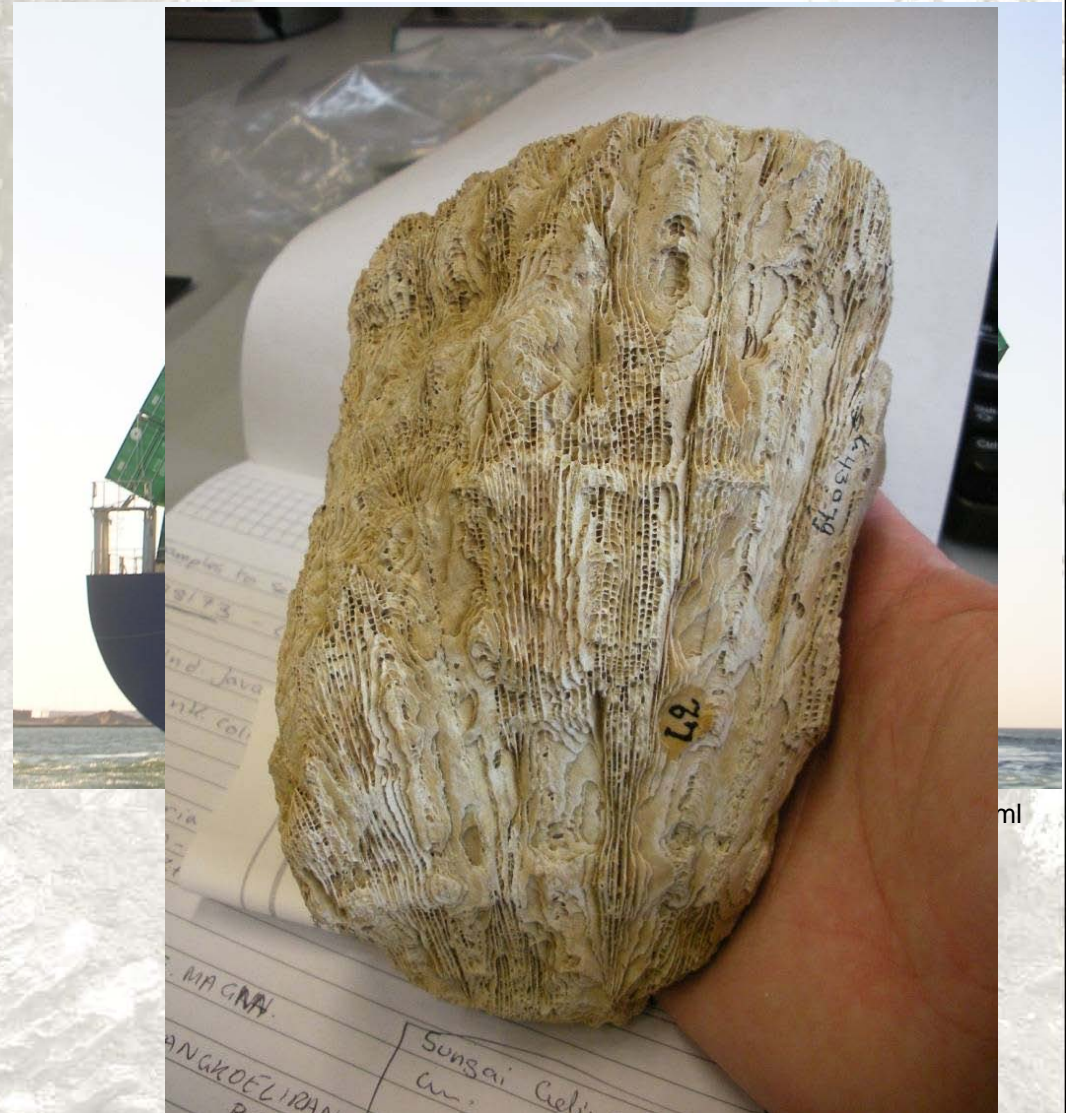
Royal Holloway  
University of London



# Lab Sample Preparation

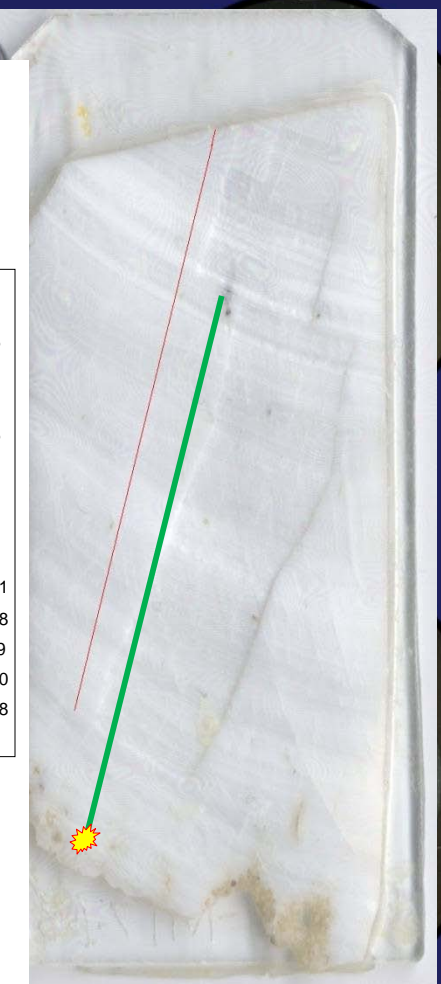
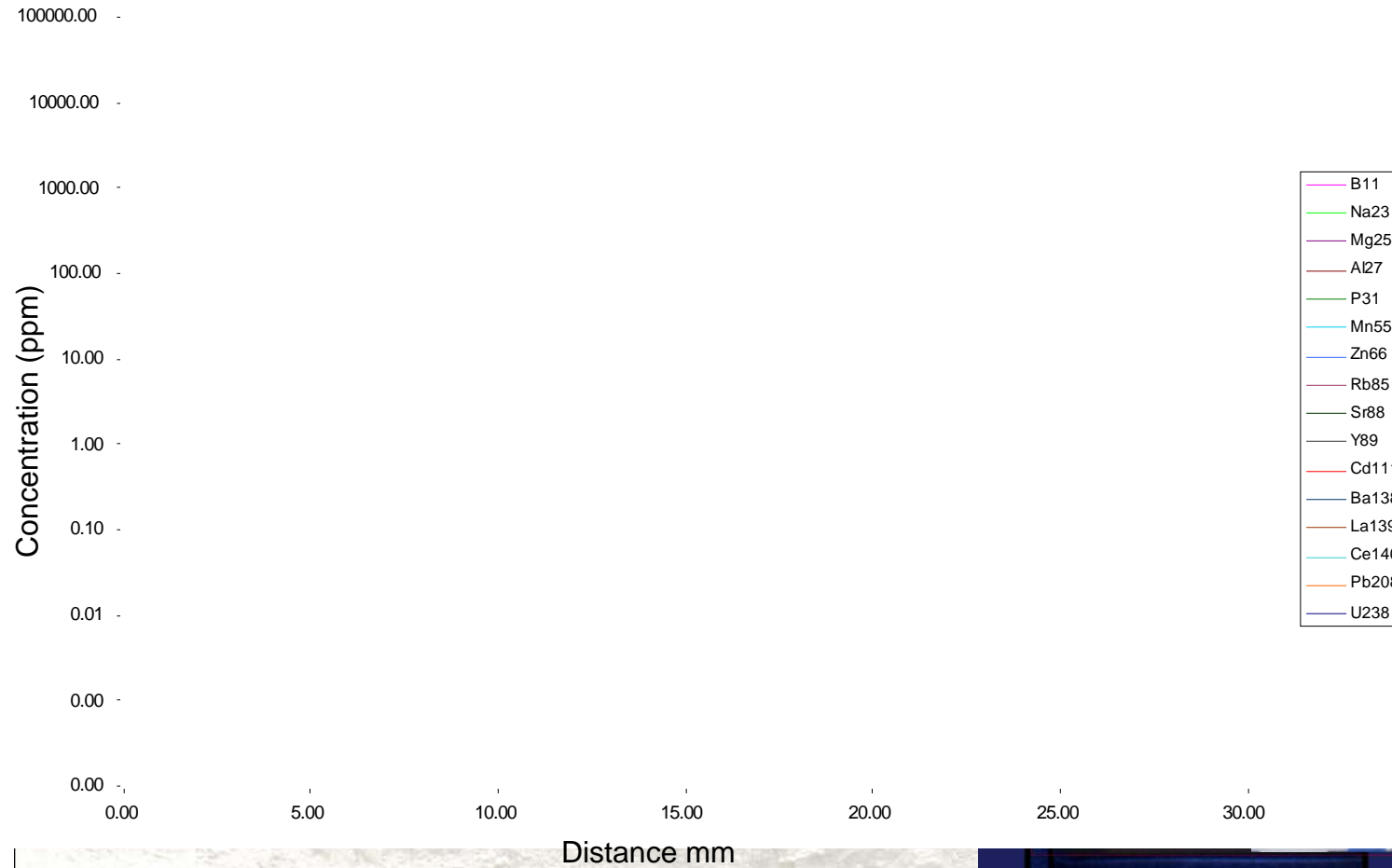


- Fossil sectioning
- X-Ray Diffraction
  - Initial chemical analysis
  - Original carbonate needed
- Scanning electron microscopy
  - Evaluation of cementation
  - Imaging
- Laser Ablation Inductively Coupled Mass Spectrometry

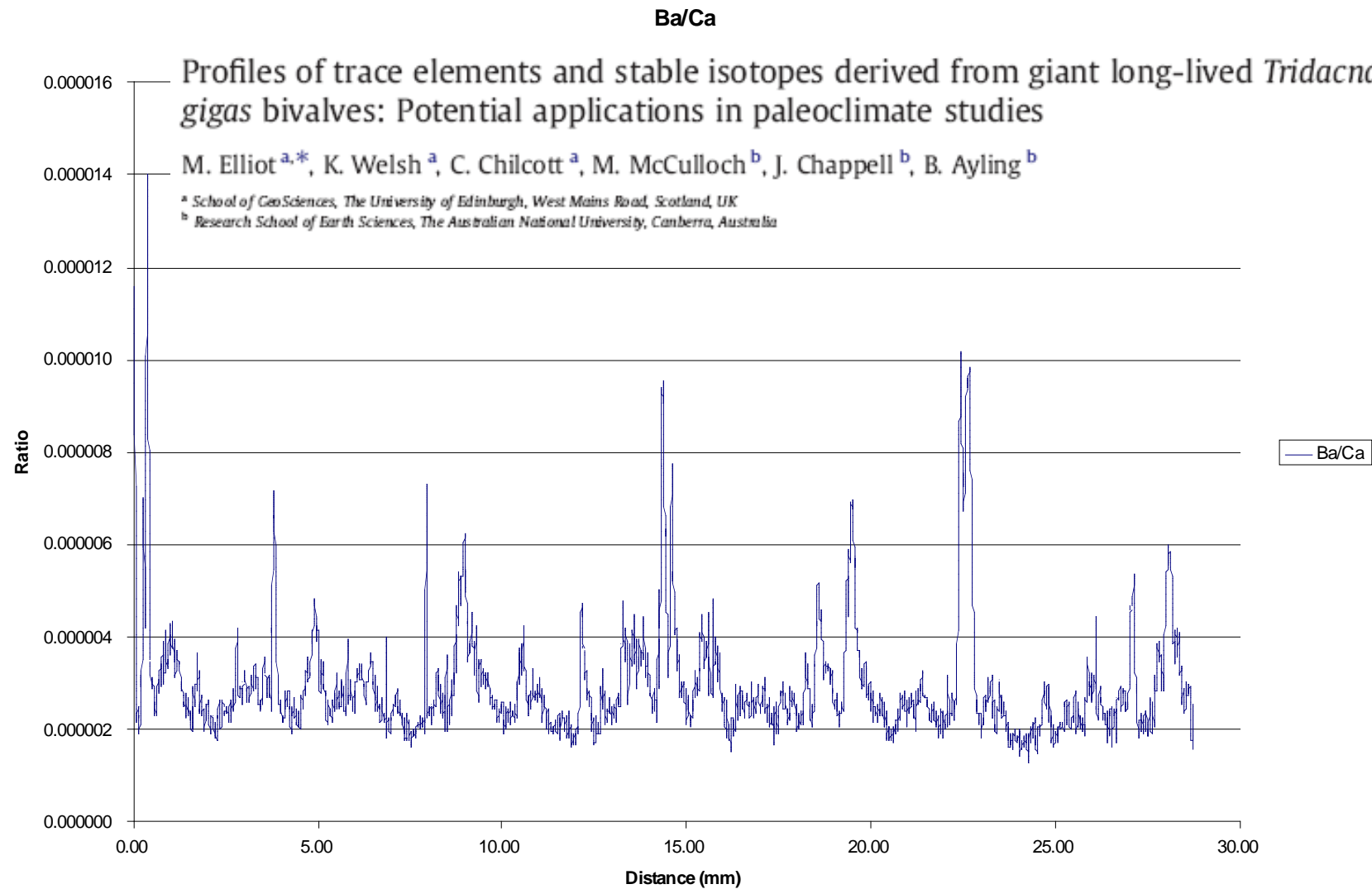


Coral from NCB Naturalis, Leiden, The Netherlands

# LA-ICPMS example





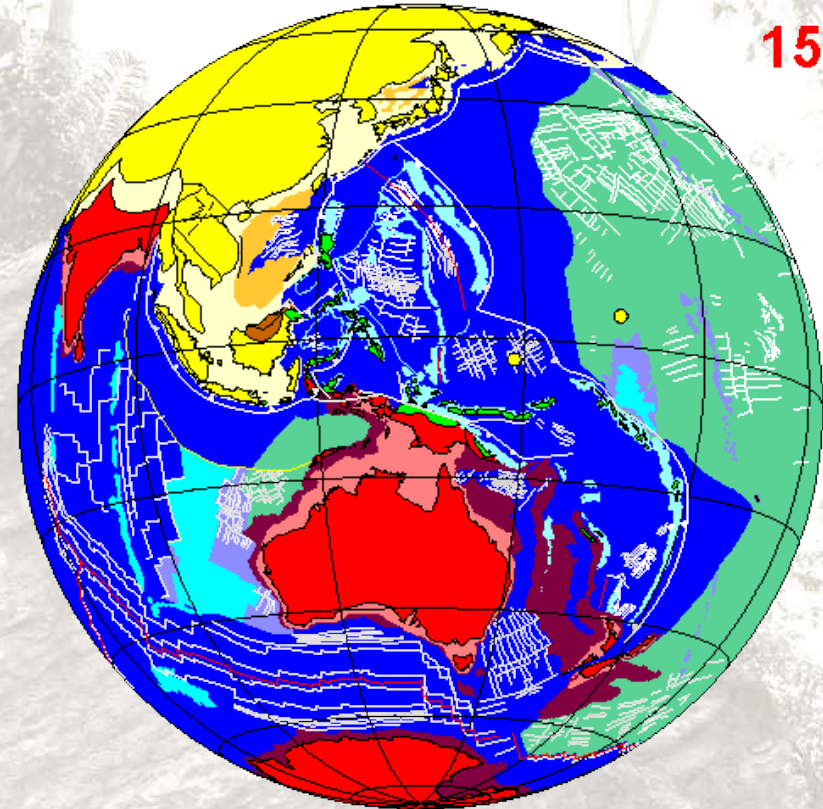


**Ba/Ca – Palaeoproductivity**

# Seasonality



- Shallow environments
- Closure of the Indonesian 'Throughflow'
- Biotic response to changes
- Parameter reconstruction
- Assessment of seasonality and forcing
- Palaeoceanographic modelling input
- Modern anthropogenic climate change



## Done 😊

- Visit to current collection in Leiden, The Netherlands
- Outreach with NHM
- Training on LA-ICPMS
- Initial field training
- Fieldwork (1<sup>st</sup> session)
- Field report, January 2011
- Initial planning for next fieldtrip
- Individual project/collaboration plans

## To Do...

- XRD, SEM and X-Ray Tomography
- LA-ICP-MS and Stable Isotope analyses
- Development of palaeoclimate proxies
- Reconstruction of seasonality
- Fieldwork (2<sup>nd</sup> Session, June/July 2011)
- Modelling collaboration
- Publication, conferences and outreach



# Fieldwork – June 2011

- Collaborative projects
- Bontang sites
  - Further investigation
- Sites further North
  - Sangkulirang
  - Mankalihat
- Oligocene (?)
  - Model testing data
- Mapping
- Stratigraphy – Strontium Isotopes?



Pleistocene (?) coral from Sangkulirang

Funding provided by:



# Laser Ablation Inductively Coupled Mass Spectrometry



- Laser
- Gas control panel
- Sample Cell
- Beam Path
- ICP-MS



Images: Wolfgang Müller