

# Imaging the 20<sup>th</sup> century tropical Indian Ocean thermocline through a sclerosponge archive

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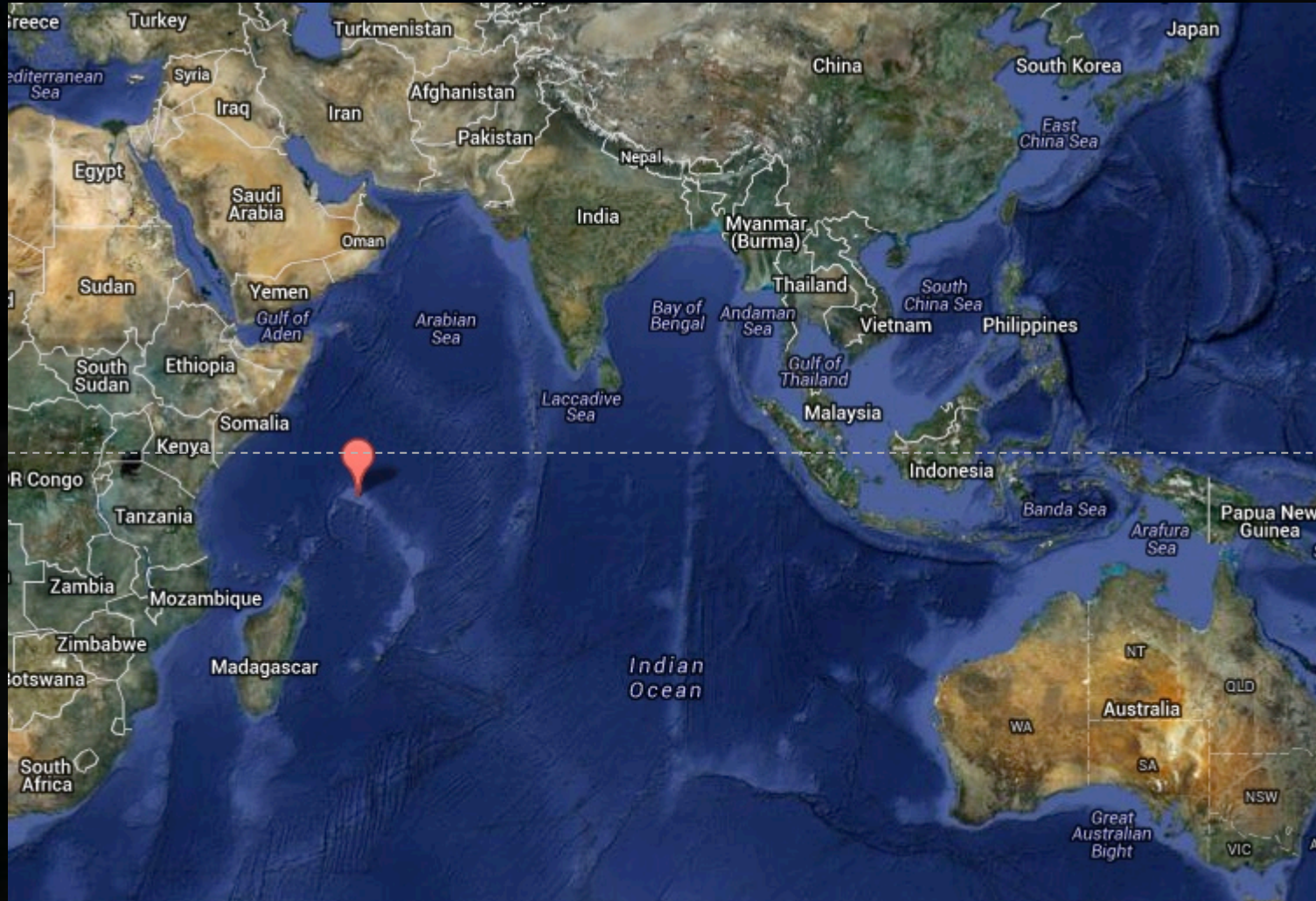
# Outline

- Motivation for our study
- Discussion of sclerosponge collection
  - General characteristics
  - Chronology
  - Stable isotope trends
- Summary

# Motivation

- Weak record of modern Indian Ocean subsurface
- Sea level projection conflicts
- Subsurface cooling (or warming?)
- Strong need to augment & extend record

# Sclerosponge collection



# Scleosponge collection

- Several dozen gathered in 2007 off the Seychelles bank
- 80m, 100m, 130m ( $\pm 10-30$ )
- Average size of 3-6cm
- Genus *Acanthocheatetes*
- Grow in reef caves



# Sclerosponge collection

- Mid-19<sup>th</sup> century to modern
- Skeleton is high-Mg calcite
- No concentric banding
- Growth rate of ~1-1.5 mm/yr
- Vital effects?
  - No symbionts
  - Slow growing

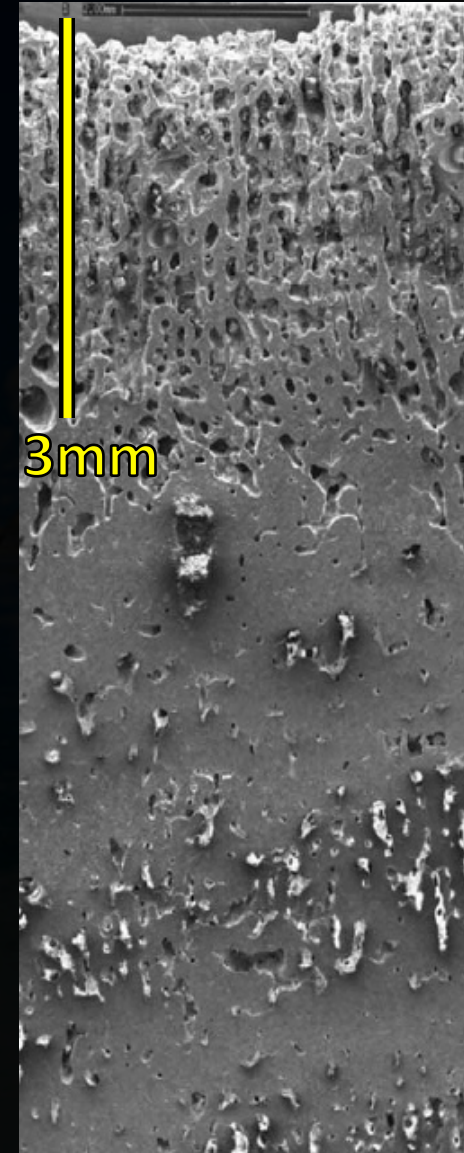
# Sclerosponges

mm-scale rules appended



# Scleosponge collection: backfill?

- *Acanthochaetetes*: some species backfill, some don't
- If they backfill, best res of  $\geq 1$  yr
- If not, much higher res possible
- High-res proxy analysis will help
  - Seasonal signal present?



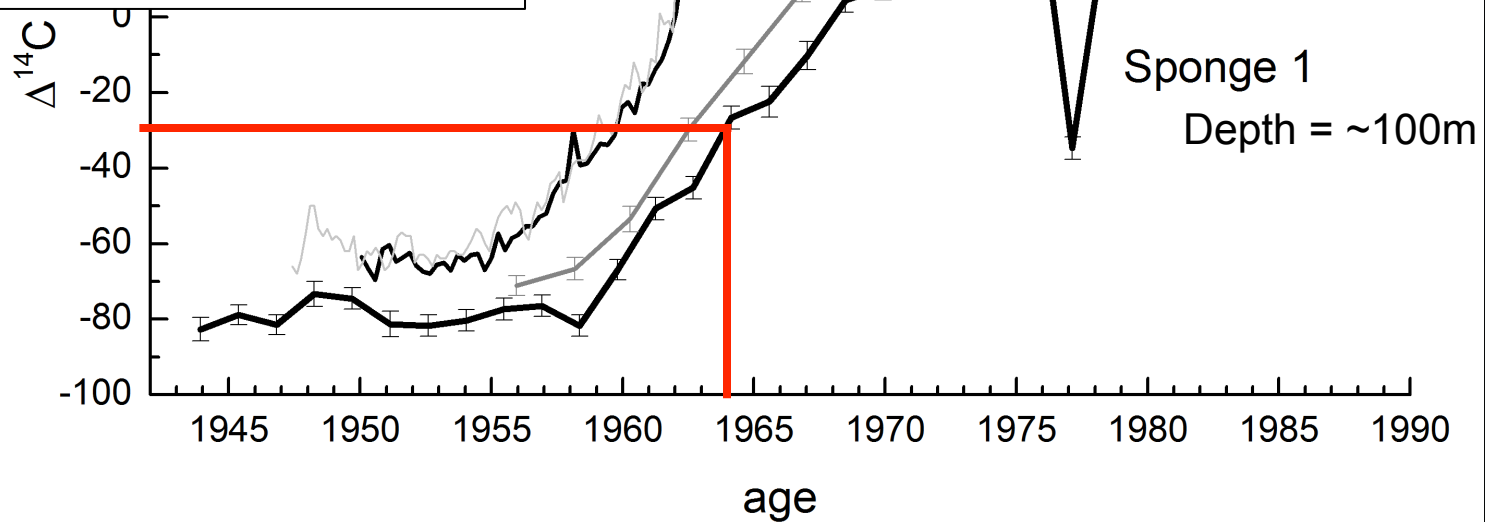
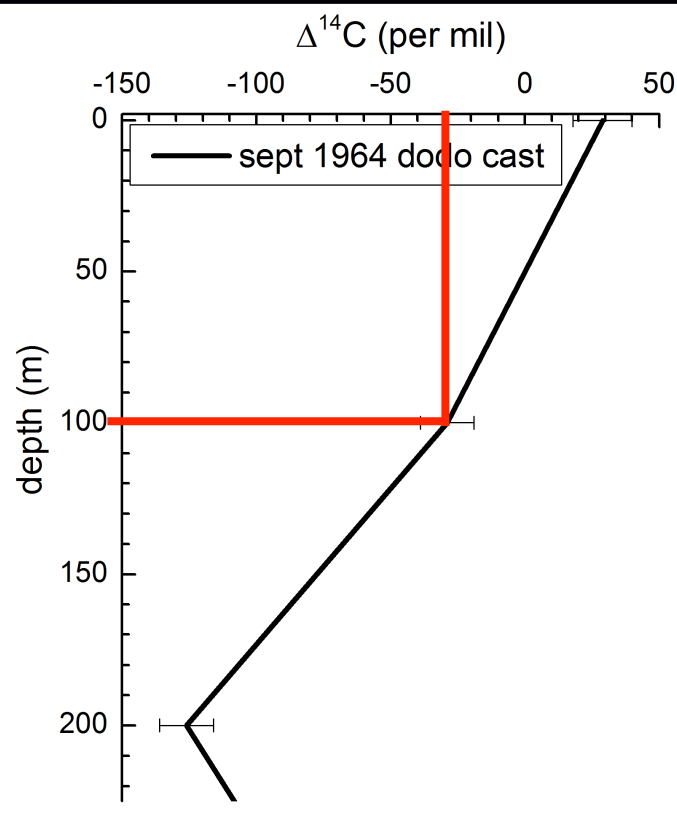
SEM of *Astroclera willeyana* from Fallon et al. 2005



# Current state of the archive

- Radiocarbon
  - Sponges mostly 19<sup>th</sup>/20<sup>th</sup> century
  - 2 sponges straddle bomb spike
  - Weak chronology

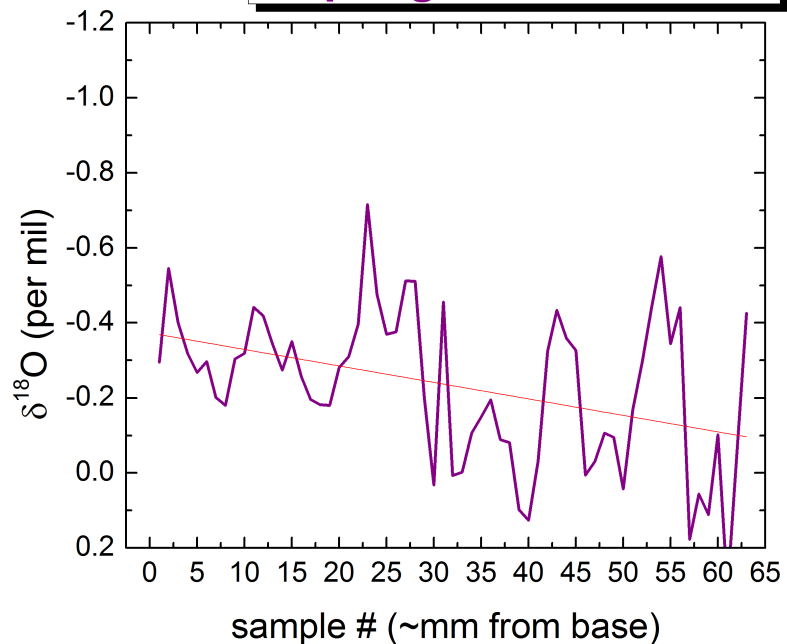
# Carbon & Chronology



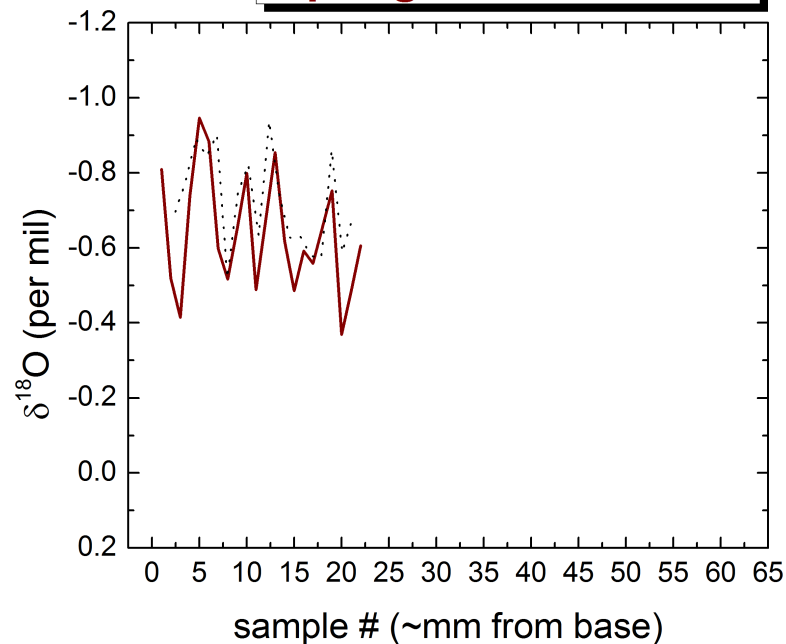
# Current state of the archive

- Radiocarbon
  - Sponges mostly 19<sup>th</sup>/20<sup>th</sup> century
  - 2 sponges straddle bomb spike
  - Weak chronology
- Stable isotopes
  - Interannual variability
  - Subsurface cooling

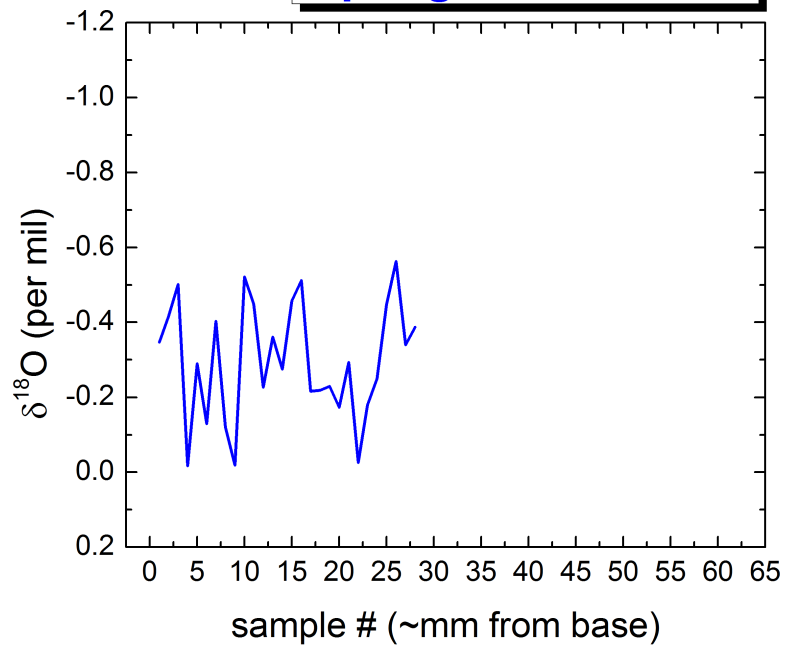
**Sponge 1** depth = 90-105m



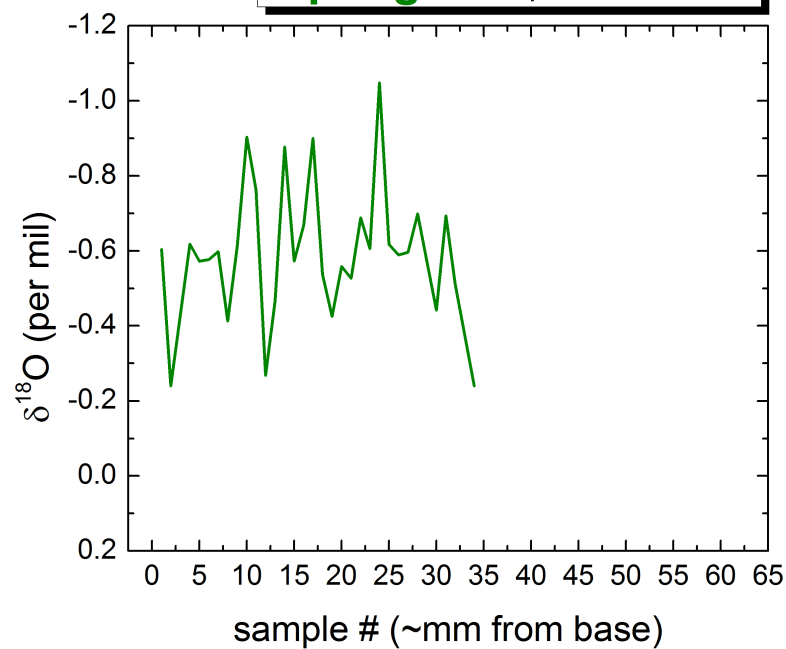
**Sponge 4** depth = 105-160m

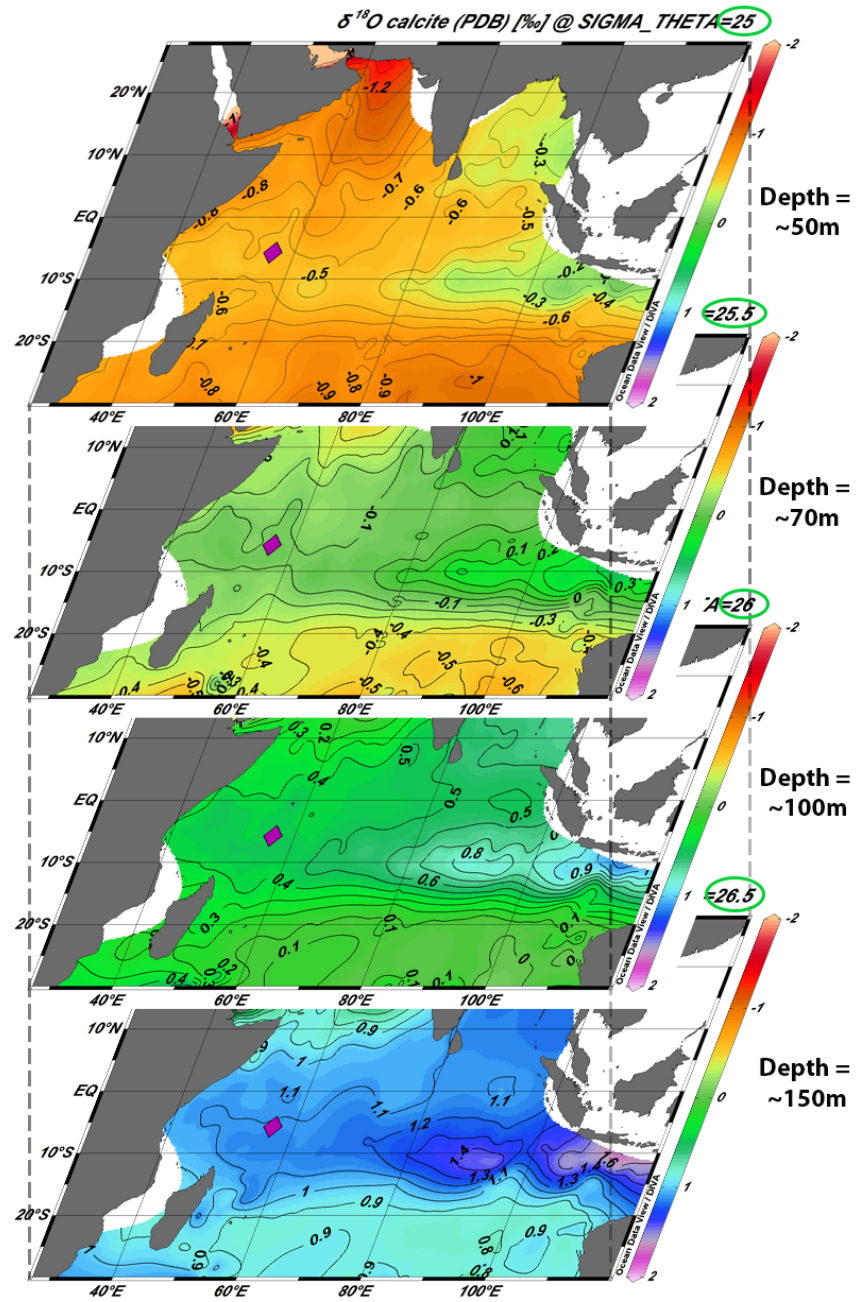


**Sponge 2** depth = 71-91m



**Sponge 6** depth = 105-160m





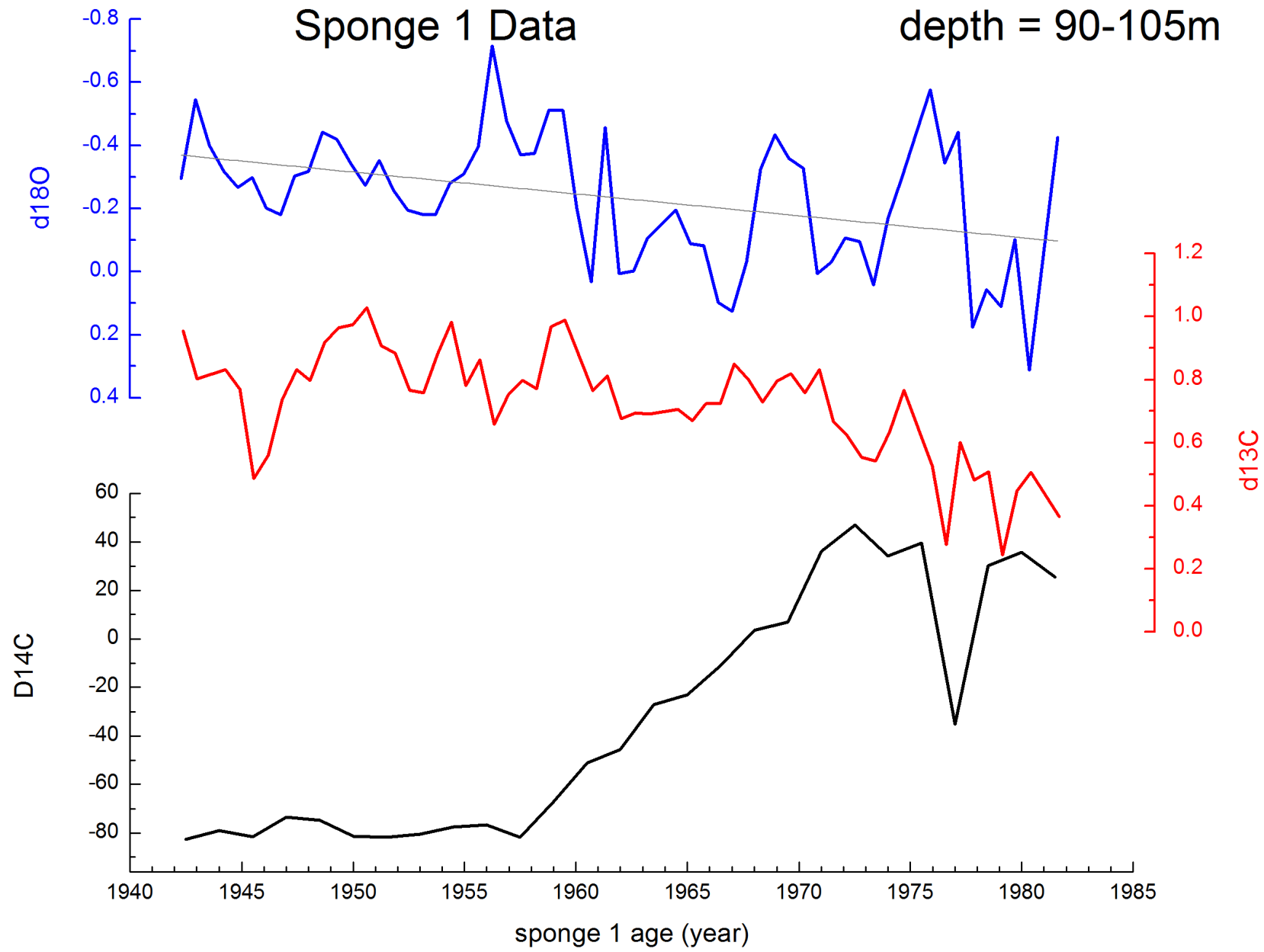
LeGrande and Schmidt;  $\alpha = 0.16$

# Further work

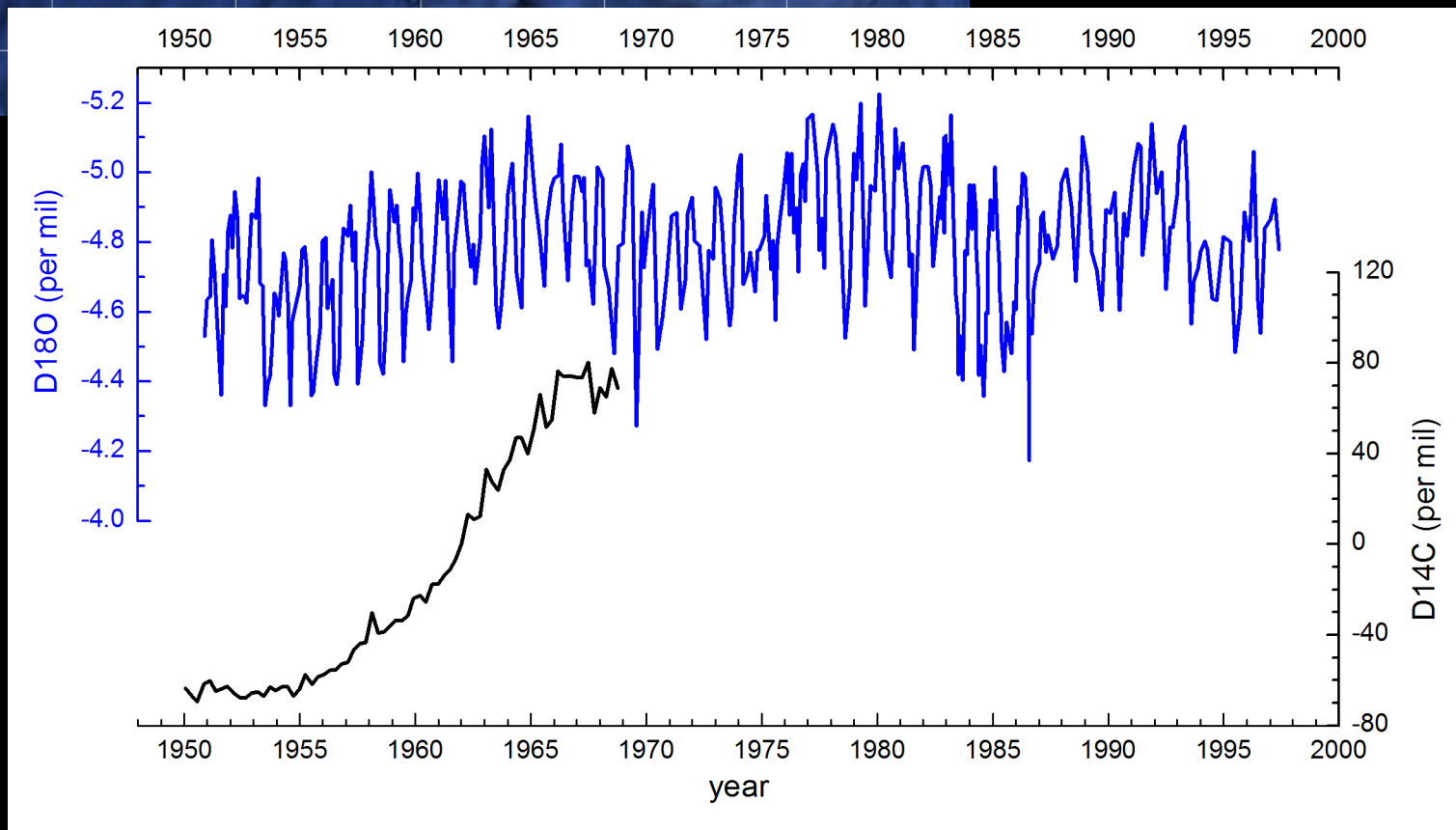
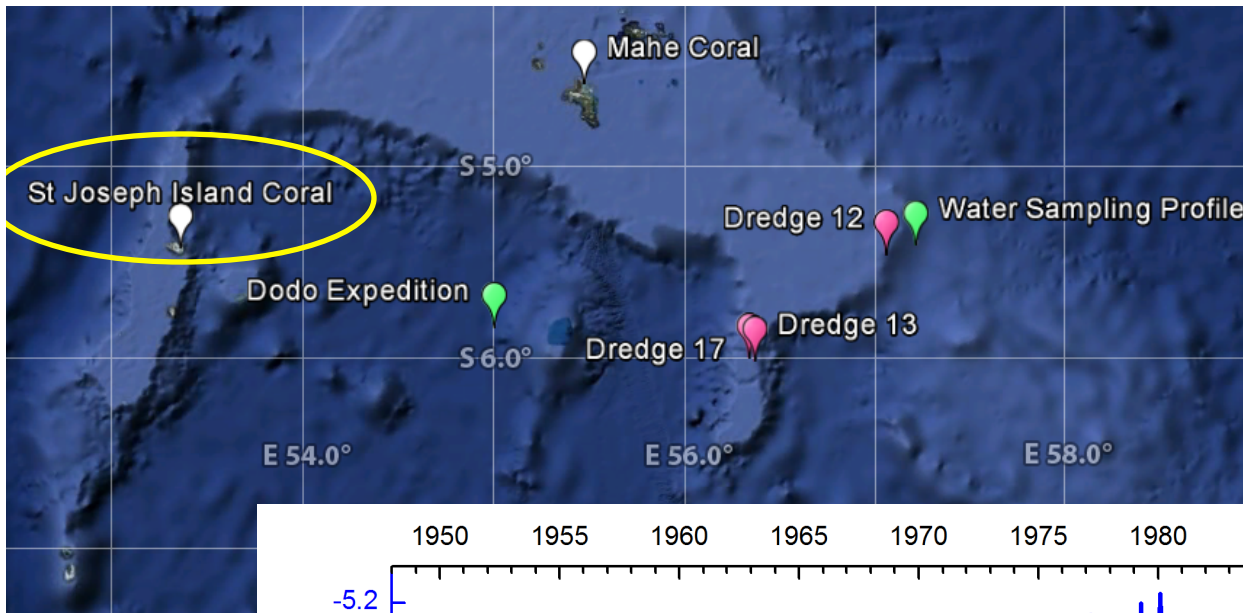
- Full characterization of the sponges
  - Growth mechanism
  - Skeletal chemistry
- Tighten chronology
  - Pb content, volcanic signals
- Minor/trace elements
  - Temperature proxies

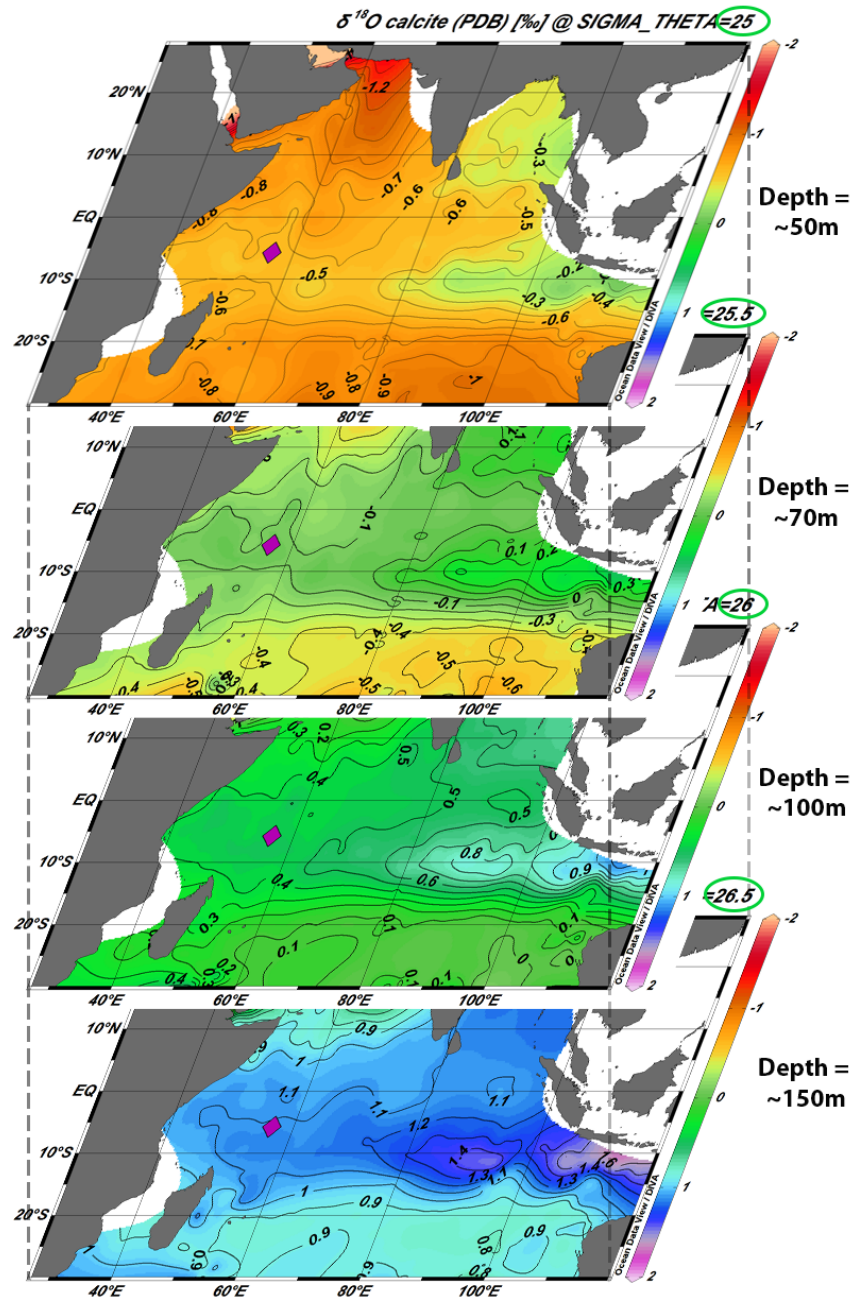
## In summary, our sclerosponges:

- Are no more than 200 years old
- Grow slowly (~1-1.5mm/yr)
- Do not exhibit strong “vital” effects
- Demonstrate strong interannual thermocline variability
- May provide a much higher resolution record

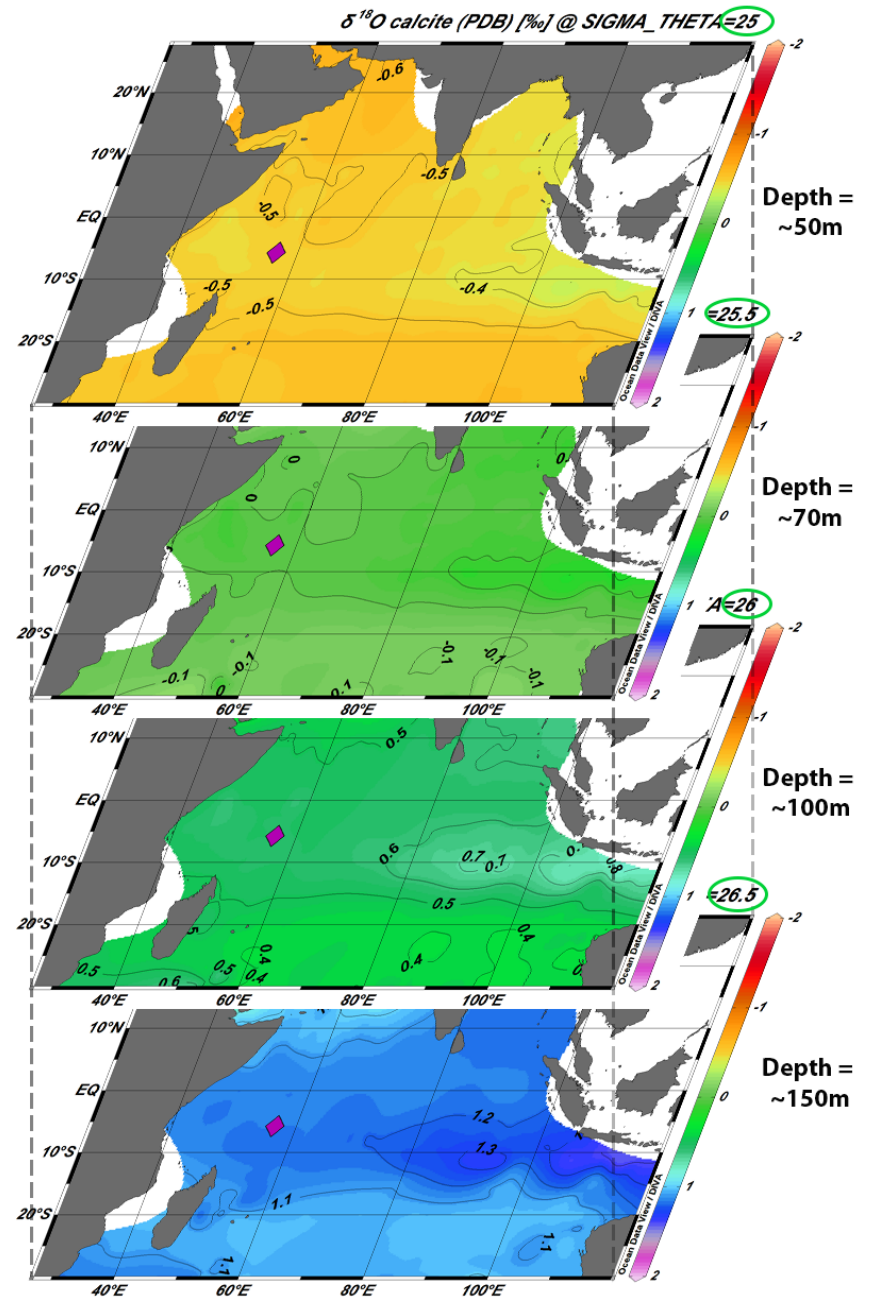








LeGrande and Schmidt;  $\alpha = 0.16$



Lynch-Stieglitz et al.;  $\alpha = 0.60$