Preindustrial to modern variability of sea surface temperatures and CO_2 uptake in the South Pacific

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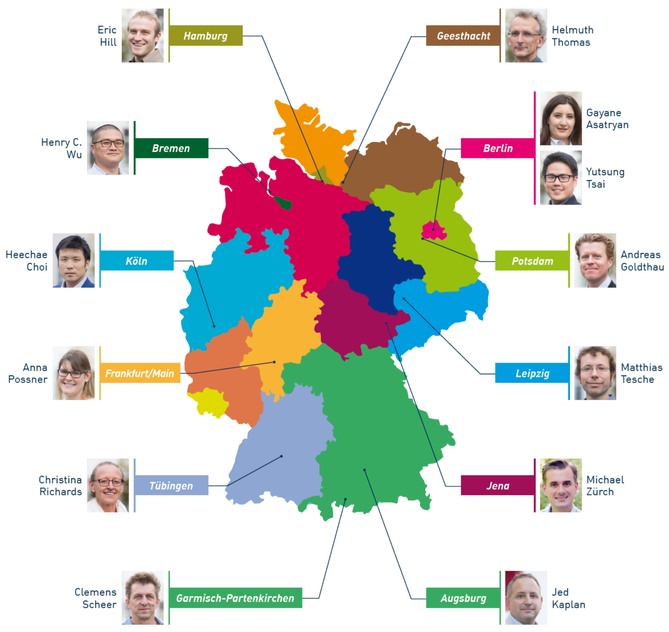

Make Our Planet Great Again

The "Make Our Planet Great Again" research initiative – 2017 – France and Germany, 55 projects, three main fields of research:

1. Functioning of the Earth system (incl. **project OASIS**);
2. Climate Change;
3. Energy Transition.

(from MOPGA Booklet "Kick Off Conference - The Laureates October 1st 2019).

OASIS - Ocean Acidification CriSIS

The modern rate of increase in atmospheric CO_2 is warming our surface oceans. The absorption of this excess CO_2 by the oceans decreases seawater pH - ocean acidification (OA).
Project OASIS studies OA and changes related to it in the tropical oceans (Indonesian Throughflow, Southwest Pacific, Caribbean) by reconstructing past climate from coral cores.

Preliminary results

Modern climate change is impacting natural variability of important interannual and interdecadal climatic cycles and atmospheric phenomena originating in the Pacific which in turn have pivotal role in modulating global climate.
Instrumental climate records in the Pacific are short and spatially sparse. Massive scleractinian corals are great archives of environmental data to reconstruct and extend these records.

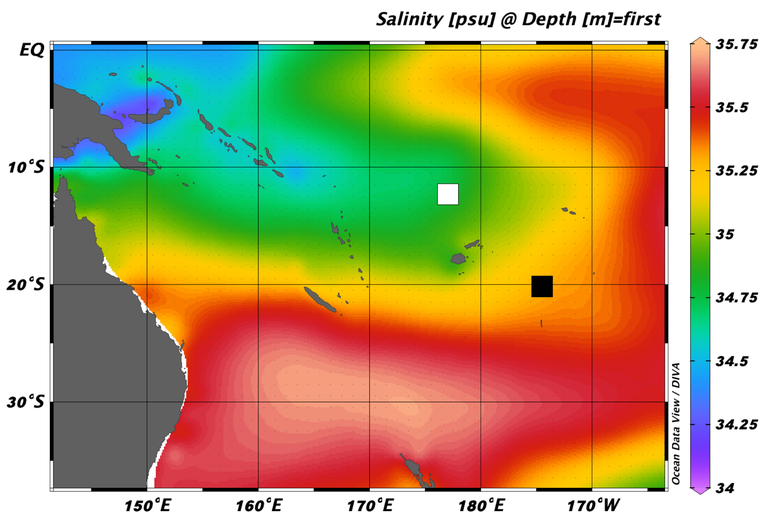

Figure 1 – Rotuma (white), and Tonga (black) are one of our coral core locations (Schlitzer, R., Ocean Data View, https://odv.awi.de, 2018).

Methods

Figure 2 – Sampling of the coral slab (L), and ICP-MS analysis of the samples (R).

- **Multiproxy approach:**
  - SST - Sr/Ca, Li/Mg, Sr/U
  - SSS - $\delta^{18}O$
  - SW carbonate chemistry – B/Ca
  - CO_2 uptake – $\delta^{13}C$
  - pH – $\delta^{11}B$

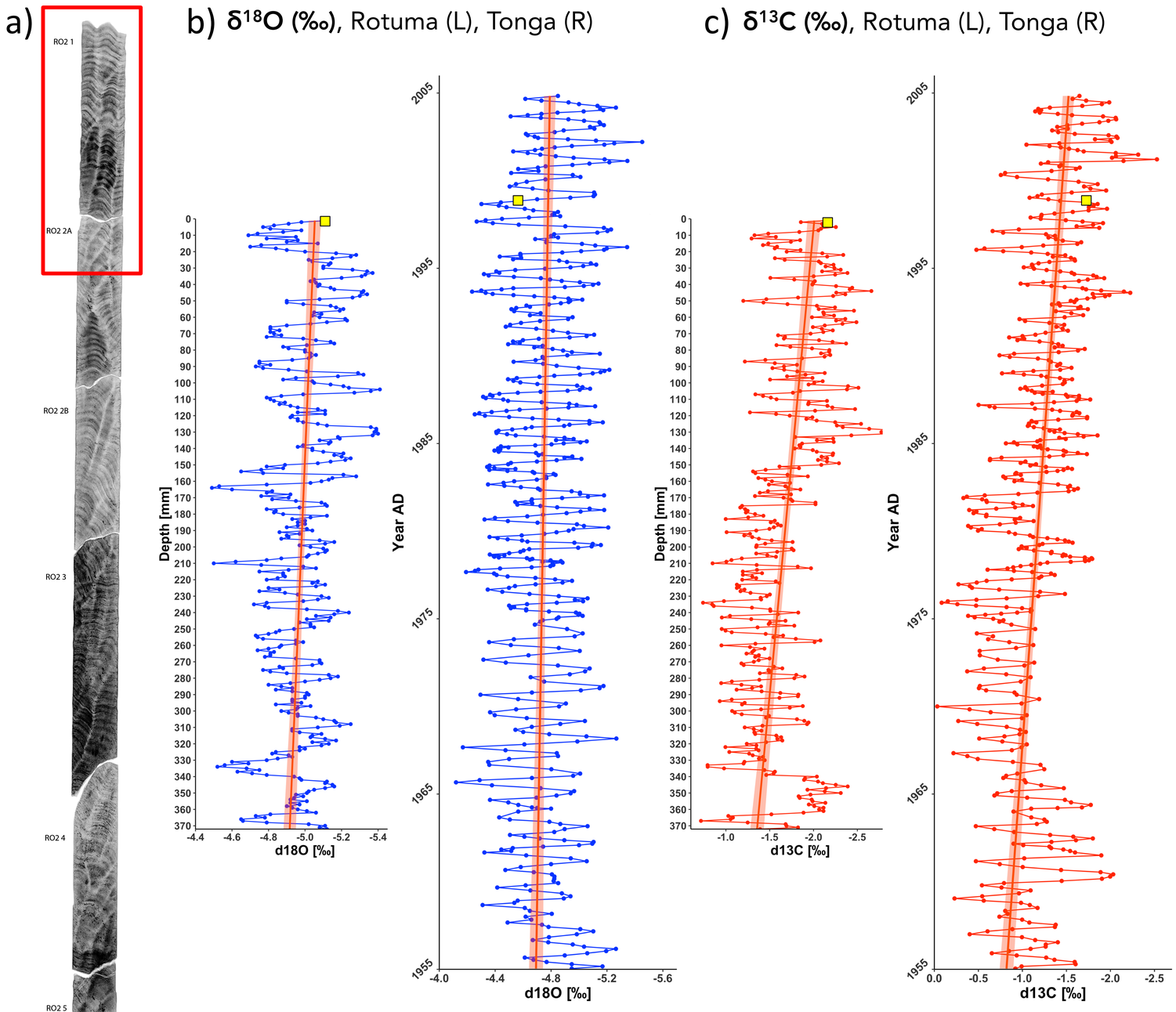

Figure 3 – a) Rotuma coral X-ray, selected portion represents analyzed data; b) preliminary Rotuma $\delta^{18}O$ data next to the published Tonga core; c) preliminary Rotuma $\delta^{13}C$ data next to the published Tonga core[1,2]. Yellow squares represent the timepoint for both cores (November 1998).

In progress:

- Age model development;
- Trace element analysis to obtain other proxies' data.

Expected outcomes

- **Greater temporal coverage** - monthly to annual data resolution reconstructions back to preindustrial times.
- **Spatial coverage expansion** - multiple massive corals analyzed, different environments.
- Impacts on El Niño Southern Oscillation, Pacific Decadal Oscillation, and South Pacific Convergence Zone extension variation.
- Exploring the influence of **interannual and decadal-interdecadal climatic fluctuations** on CO_2 absorption and pH variation.

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Literature

[1] Linsley, B.K., *et al.*, Decadal–interdecadal climate variability from multi-coral oxygen isotope records in the South Pacific Convergence Zone Region Since 1650AD. *Paleoceanography* **23**, PA2219 (2008).

[2] Linsley, B.K., *et al.*, Coral carbon isotope sensitivity to growth rate and water depth with paleo-sea level implications. *Nat Commun* **10,** 2056 (2019).

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