Calcification Accretion Units (CAUs)

- Ocean Acidification may hinder calcifying organisms in forming their skeletons
- Physical structure of coral reef is at risk
- **Net calcification rate (g/cm²/yr)** is one indicator of how coral reefs are responding to ocean acidification
- Net weight gain of CaCO₃ on CAUs is an indicator of Net Reef Accretion
- CAUs secured to the substrate using a stainless stake and left on the reef for 3 years
CAU Locations

• American Samoa
  40 Sites, 5 Islands
  200 CAUs

• Pacific Remote Islands
  44 Sites, 7 Islands
  240 CAUs

• Hawaiian Archipelago
  40 Sites, 8 Islands
  200 CAUs

• Guam & the CNMI
  40 Sites, 8 Islands
  200 CAUs
CAU Processing Overview

1. Thaw frozen CAU for at least 12h
2. Disassemble and place each plate in dish with sw
3. Photograph both sides of each plate
4. Place plates in glass dishes and decalcify in 5% HCl for >12h
   - Scrape fleshy materials from PVC plate, oven-dry (24h) and weigh
   - Frequent mushing and pulverizing of calcified materials; add new acid as needed
5. After 24h, weigh each CAU plate; continue to oven-dry at 24 h intervals until the change in weight is less than 0.1 g
   - After 24h, weigh filtered fleshy material; continue to oven-dry at 24 h intervals until the change in weight is less than 0.1 g
6. Oven dry for 24h
7. Air dry for 24 h
Net CaCO$_3$ Equation

CAU PLATE Dry Weight *

Fleshy material Dry Weight *

PVC Plate Dry Weight

* Weight (g) after multiple oven-drying periods (wherein change in weight is less than 0.1 g)
1. Thaw each batch of frozen CAUs for at least 12h

2. Disassemble and place each of the two CAU plates into a glass dish filled with saltwater

2. Photograph each side of the plate
4. Rinse each CAU plate in fresh water and place on pre-weighed paper trays (“plate assembly”)

4. Place each plate assembly onto cooling racks and air dry for 24h

5. After 24h, place plate assembly in the oven at 60°C for 24h

6. After 24h, weigh the plate assembly

7. Continue to oven-dry the plate assembly at 24h intervals until the change in weight between current and one taken 24h prior is less than 0.1g
CAU Processing Steps

9. Place each CAU plate onto a glass dish and pour 5% HCl to dissolve CaCO$_3$ materials. Allow to sit in acid solution for 12-24h.

10. Mush and pulverize intact calcified materials (e.g. coral, CCA, shell). If needed, decant and add more acid solution until all CaCO$_3$ have dissolved.

11. Scrape remaining fleshy materials from the CAU PVC plate. Rinse PVC in fw, oven dry for 24h and weigh.
CAU Processing Steps

12. Vacuum filter the acid bath and remaining fleshy material of each CAU plate through a Buchner funnel and pre-weighed filter paper

13. Place fleshy material residue on a pre-weighed paper tray (“filterpaper assembly”) and air dry for at least 24h

14. Oven-dry the filterpaper assembly at 60°C for 24h

15. After 24h, weigh the filterpaper assembly

16. Continue to oven-dry the filterpaper assembly at 24h intervals until the change in weight between current and one taken 24h prior is less than 0.1g

17. Place filterpaper assembly in pre-labeled re-sealable bags for archival

* Refer to CAU Lab Analysis SOP for more info
Bioerosion Monitoring Units (BMUs)

- Bioerosion is the biological destruction of hard structures, such as coral skeletons.
- If rates of bioerosion are higher than those of calcification, healthy reef habitats can fall apart.
- BMUs are constructed of an exactly measured piece of calcium carbonate mounted on a PVC base.
- They are deployed on the seafloor collocated with CAUs.
- After 3 years in the ocean, BMUs are collected for analysis of changes in **density, volume, and mass**, which provide an indication of bioerosion rates.
BMU Processing Steps

1. Dry BMU in oven at 60°C for until dry, may take 24-96hrs.
2. Weigh dry BMU using analytical balance.
3. Place BMU in a 15% diluted hydrogen peroxide solution for two hours to remove non-calcified organics (Kobluk & Risk, 1977).
4. Rinse with fresh water to remove hydrogen peroxide.
5. Dry BMU in oven at 60°C for until dry, may take 24-48hrs.
7. Measure all dimensions and volume (3D scanning).
8. Remove PVC base plate from coral block.
BMU Processing Steps

9. CT scan block using Skyscan 1174 microCT configured with the CT scan parameters noted in the BMU SOP.
10. Check for CT Scan drift by using calibration standards at least once throughout the course of BMU analysis.
11. Reconstruct the scanned images into 3D image stacks.
12. Volumetrically partition secondary accretion, external bioerosion, and macroboring.
13. Using a consistent and unbored region of interest, compare attenuation coefficients of pre and post-scans, calibrated with carbonate density phantoms to calculate microboring.