A historic reef-coral ‘health’ baseline from the Chagos archipelago

Supervisors

Main supervisor: Dr Kenneth Johnson (The Natural History Museum)
Co-supervisor: Dr Erica Hendy (University of Bristol)

Project enquiries - Email: k.johnson@nhm.ac.uk **Contact number:** +44 (0) 2079425193

Supervisory team:
Dr Kirsty Penman (University of York)

Host Institution: Natural History Museum

Project description

Coral reefs can only persist where calcification by reef organisms exceeds losses from dissolution and bioerosion. But what does this balance look like on a healthy pristine reef? Is it one where coral are growing fast and coral cover is high? Is it one with low bioerosion rates? What is the biomass of individual coral colonies? Answers to these questions are critical -managers of parks and marine protected areas must be able to accurately monitor the health of their reefs (see Wooldridge 2014). Unfortunately, there may not be a single coral reef remaining in a pristine ecological state where these measures can be established. Reef ecosystems are declining worldwide, due to a wide range of anthropogenic stressors (over-fishing, coastal sediment discharge and eutrophication, global warming and ocean acidification). Today's rapidly warming and CO2-absorbing oceans are likely to be changing the balance on even the most remote protected reefs, such as those preserved within the world's largest no-take marine protected area that includes the Chagos Archipelago.

The aim of this PhD project is to establish a historic baseline of coral skeletal growth, bioerosion rates and colony health from a reef in a near-pristine state 50 years ago. The PhD student will use the Natural History Museum's irreplaceable collection of coral skeletons of more than 160 different Scleractinian species collected in the 1970s from the Chagos archipelago. To put the scale of this collection into context, this is a fifth of all scleractinians known to science, and half of those recorded in the Indian Ocean. These beautiful intricate skeletons contain a wealth of information, including skeletal growth characteristics and the biomass of living tissue that was 'normal' for a coral on an unperturbed reef. The project will primarily involve the development of a high-throughput digital pipeline based on non-destructive X-Ray computed tomography to reconstruct skeletal extension, density and calcification rates (see Roche et al. 2011 for an example). The extent and diversity of bioerosion agents, and the level of inorganic cementation in corals will also be quantified. A component of the project will also involve training in state-of-the-art and minimally destructive organic geochemistry techniques to monitor skeletal composition as a measure of colony health to complement tissue thickness measurements. These datasets will provide a unique baseline for future studies comparing changes since the coral were collected in the 1970s to compare with new samples collected in the coming years.

Background reading:

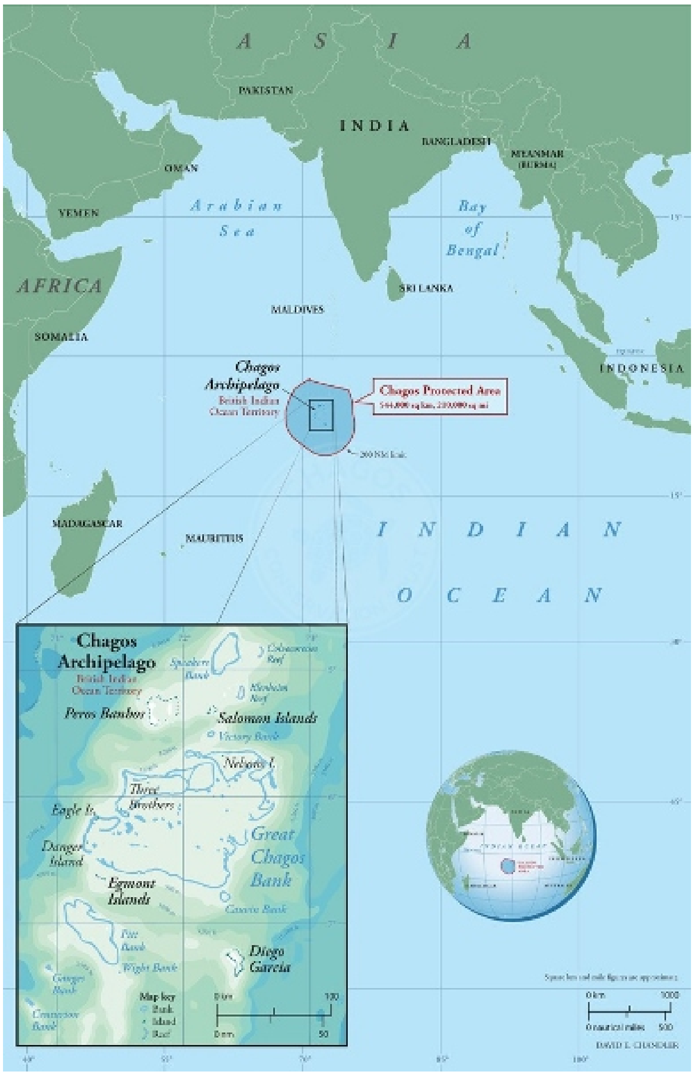
Wooldridge, S.A. (2014) Assessing coral health and resilience in a warming ocean: Why looks can be deceptive. *Bioessays* 36. http://onlinelibrary.wiley.com/doi/10.1002/bies.201400074/full

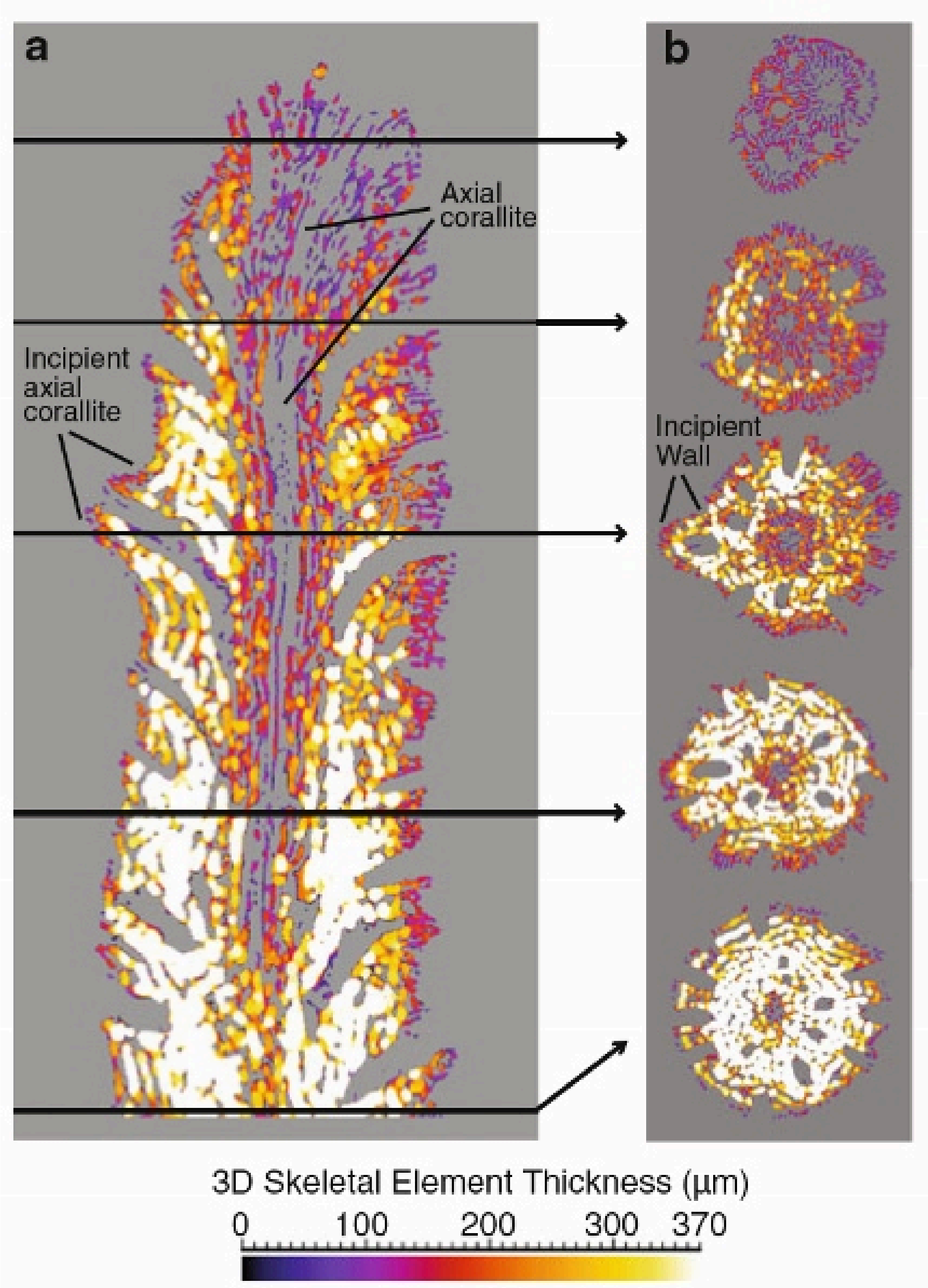
Roche, R.C., Abel, R.L., Johnson, K.G., Perry, C.T. (2011) Spatial variation in porosity and skeletal element characteristics in apical tips of the branching coral *Acropora pulchra* (Brook 1891). *Coral Reefs* 30:195-201.

Images:

1)Map of Chagos Archipelago, British Indian Ocean Territory (Image: Chagos Trust.)

2)Micro-CT reconstruction of a branch of Acropora pulchra (Roche et al. 2011)




a
b
Axial
corallite
Incipient
axial
corallite
Incipient
Wall
3D Skeletal Element Thickness (µm)
0
100
200
300
370