Science Diver in the Blue Economy Era - International Conference

20-21 April 2023 – Valletta, Malta

Molecular and skeletal fingerprints of scleractinian coral biomineralization: From the sea surface to mesophotic depths

T. Mass[1], A. Malik[1], S Einbinder[1], S Martinez[1], P. Zaslanski[1], J. Stolarski[3]

[1]*Department of Marine Biology, The Leon H. Charney School of Marine Sciences, University of Haifa, Mt. Carmel, Haifa 3498838, Israel* tmassa@univ.haifa.ac.il
[2]*Center for Dental and Craniofacial Sciences, Charite - University Hospital, Berlin, Germany*
[3]*Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818, Warsaw, Poland*

Keywords: Biomineralization, Mesophotic reef, Morphology plasticity

ABSTRACT

Reef-building corals, the major producers of biogenic calcium carbonate, form skeletons in a plethora of morphological forms [1]. Here we studied skeletal modifications of Stylophora pistillata (clade 4) colonies that adapt to increasing depths with decreasing ambient light. Understanding the reef coral physiological plasticity under a rapidly changing climate is of crucial importance for the protection of coral reef ecosystems. Most of the reef corals operate near their upper limit of heat tolerance. A possible rescue for some coral species is migration to deeper, cooler mesophotic depths [2]. However, gradually changing environmental parameters (especially light) along the depth grdient pose new adaptative stress on corals with largely unknown influences on the various biological molecular pathways.

S. pistillata show characteristic transitions from spherical morphologies (shallow depths, 5 m deep) to flat and branching geometries (mesophotic depths, 60 m deep) [3]. Such changes are typically ascribed to the algal photosymbiont physiological feed- back with the coral that host them. We find specific fine-scale skeletal variability in accretion of structure at shallow- and mesophotic depth morphotypes that suggest underlying genomic regulation of biominer- alization pathways of the coral host. To explain this, we conducted comparative morphology-based analyses, including optical and electron microscopy, tomography and X-ray diffraction analysis coupled with a comprehensive transcriptomic analysis of S. pistillata . The samples originated from Gulf of Eilat in the Red Sea collected along a depth gradient from shallow to mesophotic depths (5 to 60 m). Additional samples were experimentally transplanted from 5 m to 60 m and from 60 m to 5 m. Interestingly, both morphologically and functionally, transplanted corals partly adapt by exhibiting typical depth-specific properties. In mesophotic depths, we find that the organic matrix fraction is enriched in the coralla, well matching the over representation of transcripts encoding biomineralization “tool-kit" structural extracellular proteins that was observed. These results provide insights into the molecular mechanisms of calcification and skeletal adaptation that repeatedly allowed this coral group to adapt to a range of environments presumably with a rich geological past.

Science Diver in the Blue Economy Era - International Conference

20-21 April 2023 – Valletta, Malta

Digital Formats: Any image file format that can be imported into this file will be acceptable for publication; to avoid technical problems, we suggest using TIFF (.tif) or GIF (.gif) files for photographs, and encapsulated PostScript (.eps) or Windows metafiles (.wmf) for line drawings.

References:

[1] J.E.N. Veron , Corals of the World, Australian Institute of Marine Sciences, Townsville, 2000 .

[2] Bongaerts, P., Ridgway, T., Sampayo, E. M. & Hoegh-Guldberg, O. Assessing the ‘deep reef refugia’ hypothesis: focus on Caribbean reefs. Coral Reefs 29, 309–327 (2010).

[3] S. Einbinder , T. Mass , E. Brokovich , Z. Dubinsky , J. Erez , D. Tchernov , Changes in morphology and diet of the coral Stylophora pistillata along a depth gradient, Mar. Ecol. Prog. Ser. 381 (2009) 167–174 .