Title
The Natural History of Red Sea Giant Clams

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The Natural History of Red Sea Giant Clams

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Earth and Planetary Sciences
Reefs are Under Threat
Research objective and rationale

- Overharvesting known to reduce giant clam populations
- What impact has pollution had on their biology?
- Proposal: Giant clam growth has been stunted through time due to their high reliance on photosymbiosis
Giant clams are at risk

- Important component of reefs
- Harness symbiotic algae to accelerate their growth
- Particularly vulnerable to pollution
Taba Crossing (Sinai specimens)

IUI (modern and fossil)

Tur Yam (6 kyr)

National Aquaculture Center

MSS

Fossil Reef (2 kyr)
Conservation Paleobiology
Temps recorded in Sinai T. maxima

![Graph showing temperature (°C) against shell length (cm) for T. maxima in Sinai.](image)
“Band Width” throughout the shell

- Width (mm)
- Band Number (Days?)
Growth (mm)

Shell H1 cumulative growth

Band 730: ~45 mm

Temps recorded in Sinai T. maxima
Rates of growth in fossil and modern clams

- Fossil
- Modern

Sample: H1, 52, J40, J38, 74, TY1, TY4, TY6

Growth rate (mm/day)

Locations:
- National Aquaculture Center
- Tur Yam (6 kyr)
- IUI (modern and fossil)
- Taba Crossing (Sinai specimens)
- MSS
- Fossil Reef (2 kyr)
How will we know if pollution is to blame?

• Hypothesis is that clams’ growth is reduced by lower water clarity.
• We can test this by tracing the pollution source: nitrogen sourced from sewage and fertilizers.
• Nitrogen from sewage and fertilizers has significantly higher $\delta^{15}N$ value than normal ocean values.

Black et al, 2017
Significance

• Seems that past giant clams are growing more slowly.
• If that decline can be attributed to human pollution, we’d know that efforts to protect the reefs are not sufficient.
• Conservation paleobiology has great potential to place the present health of marine communities in long-term context.
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- Tariq Al-Najjar
(the end)
• Red Sea hosts northernmost population of *Tridacna*: three species
• Vary in their degree of symbiosis and habitat
• Most symbiont-dependent species, *T. squamosina*, is the most threatened
  • Was up to 80% of pre-human assemblages, now a remnant population
• *T. maxima* and *T. squamosa* have broader range of habitats and utilize filter-feeding more than *T. squamosina*
Conservation Paleobiology

• We can compare width of bands in ancient and modern times to determine whether average growth rate has declined.

• Doing so, we will have a metric comparing health of ancient and modern populations.

• Hypothesis: giant clam growth rate is slower in the modern compared to preindustrial specimens.

• This change is likely due to growth suppression caused by reduced water clarity due to pollution.
\(\delta^{18}O\) of a modern Sinai *T. maxima*
Work to be done!

<table>
<thead>
<tr>
<th>Count</th>
<th>Continue to count bands.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corroborate</td>
<td>Corroborate the timing of those bands with $\delta^{18}$O-based temperature data.</td>
</tr>
<tr>
<td>Compare</td>
<td>Compare rates of species- and site-specific growth in pre-industrial and modern times for Israel and Jordan.</td>
</tr>
</tbody>
</table>
TY1, 6 kyr

78, Fossil, Unknown age