Growth and demise of the coral reef at the Eilat Port reflecting sea level history and local tectonics

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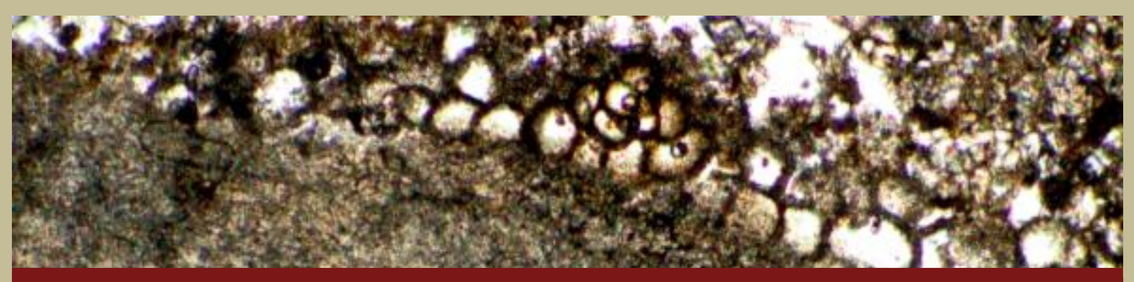


1. Introduction

A fossil coral reef discovered in drill holes within Eilat port area sheds light on the environmental history during the Holocene. Changes in sea level and the local tectonics are investigated.

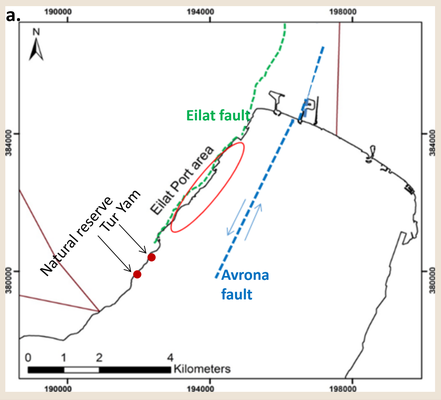
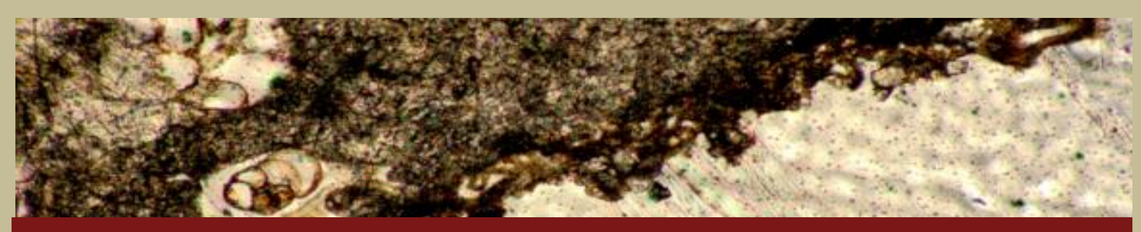


Figure 1: a - Northern Gulf of Aqaba. The red ellipse encloses locations of cores. The blue dashed line is the dominant Avrona left strike slip fault (2-3 mm/yr) and in green, Eilat normal fault. b – Schematic illustration of fault partitioning, oblique extension which is the combination of faults movement in the northern Gulf of Aqaba (Jones and Wesnousky, 1992).

2. Research goals

- ❖ Contribution to the understanding of Holocene sedimentary and morphological environment in northern Gulf of Aqaba.
- ❖ Reconstruction of Holocene sea level changes in the northern Gulf of Eilat, a sensitive global gauge.
- ❖ Contribution to mitigation of fault rupture and earthquake shaking hazards.



3. Materials and Methods

- ❖ Inspection of 25 geotechnical cores drilled in Eilat's port area [fig. 1]. Twenty one cores penetrated a fossil coral unit [fig 2].
  - Radiocarbon and U-Th dating of fifty coral samples [fig. 5a].
  - Coral samples identified to the family level [fig. 3].
- ❖ Bathymetric survey with Echo-sounder at the port area [fig. 6].

4. Results

- ❖ Corals are found ~5-28 meter below sea level [fig. 2]. The delicate structure of the reef has been maintained.
- ❖ Radiocarbon dates of 23 coral fragments from eight cores span ~2 to 9 ka [fig. 5a] , corroborated by U/Th dates.
- ❖ Twenty corals identified on the family level (predominantly *Faviidae*, a few *Pocilloporida* and *Lobophylliidae*) [fig. 3] . The corals have cunstructed a fossilized reef [fig. 4] overlying a sequence of clastic sediments, possibly representing a fan delta deposit. The reefal unit is overlain in places by sands [fig. 2].

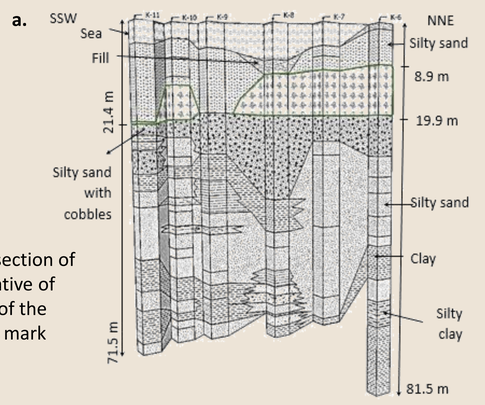


Figure 2: a- Stratigraphic section of the south Jetty, representative of parallel sections. b – Map of the south jetty area. Blue dots mark core locations.

5. Data analysis

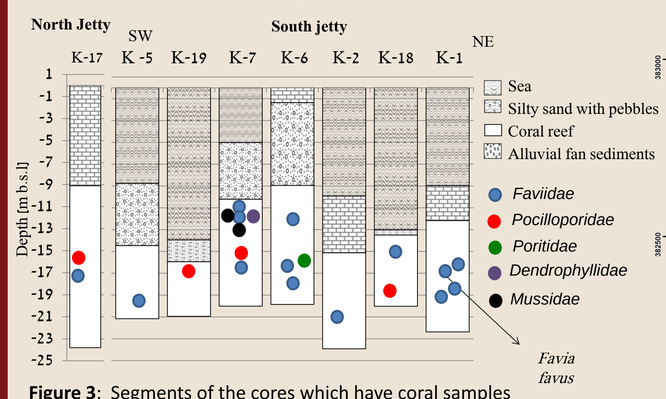


Figure 3: Segments of the cores which have coral samples identified to the family level. The circles with the different colors represent the families.

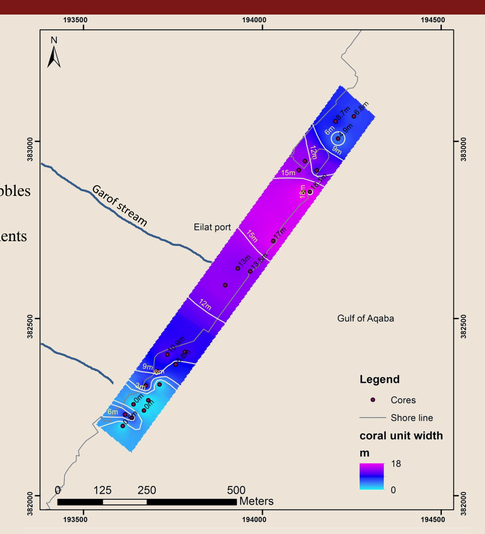


Figure 4: Isopach map of the coral reef. The reef is a Domal (massive, head) coral assemblage. Stream channels in blue lines.

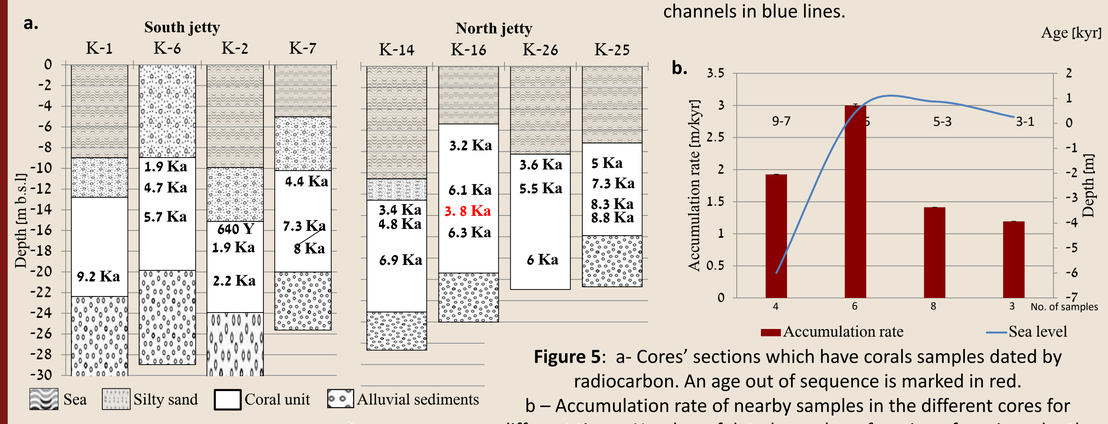


Figure 5: a- Cores' sections which have corals samples dated by radiocarbon. An age out of sequence is marked in red.
b – Accumulation rate of nearby samples in the different cores for different times. Number of dated sample as function of age is under the histograms. In blue line sea level curve of the north Gulf of Aqaba.

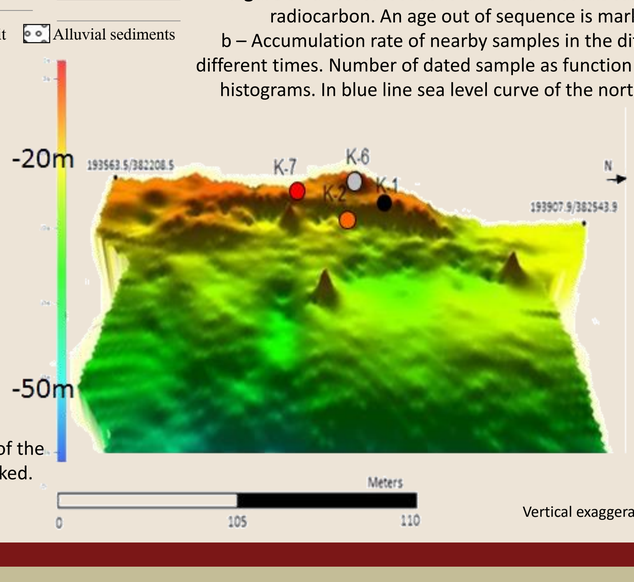


Figure 6: 3-D bathymetric map of the south jetty. Dated cores are marked. Note Step structure.

Vertical exaggeration 1.25

6. Conclusions

- ❖ A few corals are dated to 8.5-9.1 ka [fig. 5a,b], corresponding to early colonization of post-glacial coral reefs.
- ❖ Most coral ages lie in the time interval between ~7-3.5 ka [fig. 5a,b], overlapping with the period of high and stable sea-level [fig. 7].
- ❖ No corals were dated in the Eilat Port from a few hundred years later [fig. 5b], possibly suppressed by sediment cover; coral-growth resumed at ~ 2 ka BP.
- ❖ Only a single coral age ~700 years, corresponds to the subsequent period. The decline of the reef post 2 ka could be a result of the subsidence on Eilat normal fault and associated sediment waves.
- ❖ The western Australia sea level curve [fig. 7] is very similar to the Gulf of Aqaba curve [fig. 5b], both are reliable proxies of the global sea level.

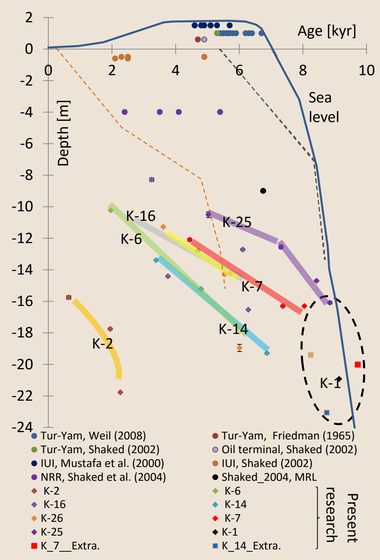


Figure 7: Each colored curve interpolates depth-age data for each core (diamond marks). Adding the settlements of the coral units by extrapolation (based on carbon dating, square marks) approximates sea level (in dashed circle). Previous studies in the Gulf of Aqaba - circles. Curves of vertical reef accretion from fringing reefs from Indo-Pacific reef province are presented (orange and grey dashed lines) (Montaggioni, 2005)

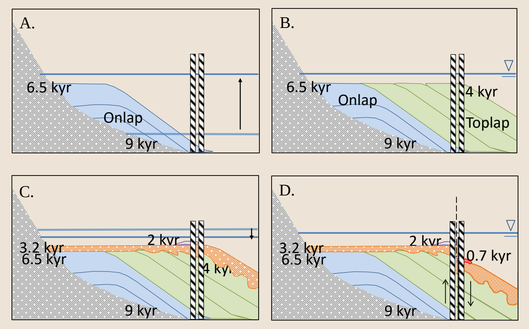


Figure 8: Schematic illustrations of the history of the coral reef. vertical bars represent locations of drill holes.
A - The first development of the reef. Slow development when sea level rises. B - Higher growth rate when the sea level stabilizes. C - A small drop of sea level and sediment cover. Renewal of development (Knolls) until 2 ka. D – Sea floor subsides and a small renewal of the reef.

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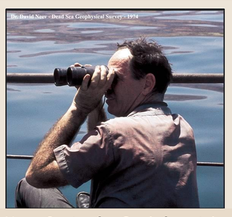

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