Investigating long-term climate change and rising sea levels in Israel:

Preliminary report of the Joint SCMA/UCSD-Maritime Civilization/Haifa field school, advanced research and student exchange, July 1-August 3, Tel Dor

Abstract:
How does research and teaching concerning climate and environmental change in Israel contribute to solving these problems in the present? A recent project funded in great part by the Murray Galinson San Diego – Israel Initiative, the Liz Anne and Phokion Potamianos Family, Scripps Institution of Oceanography, and other supporters is paving the way for showing how Israel’s past contributes to the world’s future. The project contributes to the global scholarly community who are striving to tackle issues of climate and environmental change using Israel’s ancient coastal cities and anchorages as case studies. This transdisciplinary (team science) project is a partnership between the newly established University of California San Diego Scripps Center for Maritime Archaeology (SCMA) and the Department of Maritime Civilizations at the University of Haifa. It aims at investigating the impact of long term climate change and rising sea levels on the cultures of the eastern Mediterranean - especially those along the coast of Israel. During the four and a half week mission in the coast of Tel Dor, the partnership, headed by Prof. Tom Levy of UC San Diego’s SCMA and Prof. Assaf Yasur-Landau of University of Haifa, completed in full three of the main goals stipulated in their project research design and proposal:
(1) Establish a Joint UC San Diego – University of Haifa underwater archaeology field school (for college credit), with undergraduate and graduate students from Haifa and UCSD gaining hands on experience working at a more than 3,000-year-old port in the ancient bays surrounding Israel’s Biblical site of Tel Dor in July 2017, for three weeks.
The marine archaeology field school provided instruction in advanced underwater techniques for archaeological work and environmental underwater sampling to enable students to participate in underwater archaeology fieldwork and subsequent lab work. Thanks to the Murray Galinson San Diego – Israel Initiative 12 UC San Diego students were awarded grants that enabled them to participate on this unique marine archaeology program. This included eight undergraduates and four graduate students. As part of the program, Prof. Levy led the student and faculty group on a 2 ½ day tour of Jerusalem where the group experienced the richness of Israel culture including Mahane Yehudah, Yad Vashem Holocaust Museum, behind the scenes at the City of David Excavations, the Church of the Holy Sepulcher, the Old City Moslem, Christian, Armenian and Jewish Quarters and much more.

The joint UC San Diego – University of Haifa marine archaeology team on the beach at Tel Dor, Israel.
Students and staff push the newly designed barge out to sea; it holds the excavation dredge pump which is the size used on a fire truck.
Rich Walsh, UC San Diego Scripps assistant diving safety officer (left) and Udi Arkin Shalev, University of Haifa graduate student give morning pre-dive briefing to students on the beach.

UC San Diego students excavate using a dredge pump underwater in the North Bay, Tel Dor, Israel.
The underwater excavations took place near numerous submerged stone ashlar blocks near the northern coast of the South Bay where the ancient mound of Tel Dor merges with the sea. These are finely dressed, cut and worked, stone blocks that are usually rectangular in shape and over 1 meter in length. These are precisely cut and are capable of producing thin joints between the blocks they are stacked one on the other, demonstrating a sophisticated architectural tradition. In the southern Levant, these are common during the Iron Age (ca. 1200 – 500 BCE). Until this field season, it was assumed these blocks were accidently dropped by boats transporting them in antiquity. The new excavations indicate that the extensive distribution of the submerged ashlar blocks may be part of well-built structures connected to the Iron Age port that collapsed due to processes we still do not understand. During the course of the excavations, we also discovered a cluster of boulders that may be part of a ballast pile from a Roman or Crusader period boat. Another exciting find was more than eighty lead weights which served as sinkers for a fishing net, perhaps from the Roman period. The ability to find, identify and leave the small weights in position so they can be photographed underwater using 3D photogrammetry was an important contribution to the technology of data recording for underwater archaeology.

Undergraduate Patricia Galicia-Carmona and other UC San Diego students excavate on land at Biblical Tel Dor along the coast during a day when the sea was too rough for diving.
Ashley Nicoll (left), UC San Diego undergraduate with University of Haifa team members before their dive to excavate submerge Iron Age port at Tel Dor, Israel.

Students setting up the barge and dredge pump in the South Bay, Tel Dor, Israel.
Distribution of lead sinkers from a Roman period (?) net found on the sea floor near Tel Dor, Israel. The metal stick is scale in 20 cm long intervals.

The field training took part in the forward camp on the coast at Tel Dor. The base camp included diving equipment for 30 divers, a specialized barge and pump, as well as a tent in which daily briefings took place, and a shade for cooking. The diving aspect of training as practical training of excavating underwater was carried out by the diving officers of the Recanati Institute of UH, Amir Yurman and Moshiqo Bachar and the assistant safety diving officer of Scripps Institution of Oceanography (SIO) Rich Walsh. Diving Safety Officer Christian McDonald also participated at the end of the expedition to finalize the science diving collaboration between the two institutions. Undergraduate diving students were supervised by graduate students who directed work underwater, including Ehud Arkin Shalev (field director) Brigid Clark, Sara Lantos and
Roey Nickelsberg (shift supervisors). UC San Diego graduate student Tony Tamberino was responsible for Underwater photogrammetry and drone photography. The first week of the training was dedicated to familiarize the UC San Diego students with the water dredge system. They were then joined by University of Haifa students for two weeks of joint excavations, with San Diego and Haifa students diving side by side, and directed by staff from both Universities.

UC San Diego underwater excavators in the waters of Biblical Tel Dor, Israel.

The excavations had numerous visitors, including the president of the University of Haifa, Prof. Ron Robin, and Dean of the Faculty of social sciences in UCSD, Prof. Carol Paden. Furthermore, the end of the year event for the Leon Charney school of Marine sciences took part at Tel Dor, with the participation of the head of the school Prof. Ilana Berman-Frank, and numerous professors, administrative and technical staff as well as their family from the university of Haifa. Both leaders stressed the strategic value they see in the project for the strengthening of the scientific relations between UCSD and Haifa. The joint UC San Diego - Haifa expedition played a central role in the lectures on the public outreach open-day for the local community organized by Prof. Ilan Sharon and Prof. Becky Martin of the Tel Dor expedition, that was attended by more than hundred visitors from Kibbutz Nahsholim.
Carol Padden (4th from left) Dean of Social Sciences and UC San Diego – University of Haifa team at expedition staging area on beach at Tel Dor.

The results of the excavations are still under study and assessment. Surprising finds included a previously unknown mooring point from the Roman period located in the center of the bay, which included very large ashlar stones to which ropes were tied in antiquity, to facilitate the mooring or small to medium boats. By defining different submerged and semi-submerged Iron Age architectural features and combining these data with the paleo-environmental samples collected on land and at sea described below, this joint UC San Diego – University of Haifa project is contributing to understanding changing sea levels in the eastern Mediterranean that inform scholars about long-term trends in climate change in this part of the world.
UC Students and faculty visit the Jewish Quarter in Jerusalem’s Old City as part of their marine archaeology field school experience.

(2) Launching a joint SCMA UC San Diego sampling program for studying ancient climate changes in the eastern Mediterranean region. This involved developing sampling strategies for the coring of sediments both on land and sea, determining the appropriate coring tools and machines to conduct this field work, acquiring samples of sediment and rock by on-land and underwater coring, and shipping the sediment cores (some over 21 feet long) to UC San Diego’s Scripps Institution of Oceanography, where Israeli Post-Doc, Dr. Gilad Shtienberg, has started analyses of the cores for his research, supervised by SCMA’s Prof. Tom Levy and Prof. Dick Norris. Dr. Shtienberg’s post-doc is supported by the Israel Institute in collaboration with the Murray Galinson San Diego – Israel Initiative and the UC San Diego Jewish Studies Program.
GeoProbe drill in action on the coast at Tel Dor retrieving a 7-meter-long core adjacent to the Iron Age (ca. 1100 BCE) ancient port along Israel’s Mediterranean coast.
Gilad Shtienberg, UC San Diego Post-Doc from Israel, examines sediment cores representing over 6,000 years of climate and environmental data in the Scripps Institution of Oceanography Deep Sea Drilling Lab less than 1 month after the cores were extracted in Israel.

(3) Other research activities carried out during the 2018 expedition to Tel Dor included geophysical mapping of the shore of Dor’s South Bay by SCMA Prof. John Hildebrand using a Geometrix G-858 MagMapper - a high sensitivity, fast-sampling ‘walking’ magnetometer. Similar geophysical work was carried out by Hildebrand around the Love Bay at Tel Dor in association with University of Haifa’s Prof. Michael Lazar who carried out a Frequency Domain Electromagnetic (FDEM) geophysical survey and Dr. Uri Basson of GeoSense Ltd who used a Ground Penetrating Radar (GPR). This ‘shotgun’ approach mapping sub-surface features at an archaeology site optimize the chances of identifying ancient architecture and other features at the site.

Prof. John Hildebrand with magnetometer carrying out survey along coast of the South Bay near the Biblical site of Tel Dor, Israel.
Additional significant research carried out this summer were the near-shore archaeological excavations of part of the ancient port (Area K) at Dor carried out under the direction of the University of Haifa’s Prof. Ruth Shahack-Gross, whose expertise in Geo-Archaeology helps to reveal site formation processes, stratigraphy and micro-stratigraphy of some of the buildings associated with the 11\textsuperscript{th} – 9\textsuperscript{th} century BCE port. SCMA’s Prof. Isabel Rivera-Collazo collaborated in this area by taking sediment samples from a stratigraphic section inside one of Iron Age rooms here to help identify the function of these long-abandoned room near the port.

Prof. Isabel Rivera-Collazo (right) and graduate student Mariela Declet-Perez take sediment samples from Iron Age building in Area K, Tel Dor, Israel.
The Future –

The success of the 2018 field season has encouraged our joint UC San Diego – University of Haifa teams to plan a new field season in the very near future. The following goals have been set to enhance our study of ancient climate, environmental and cultural change in Israel and the eastern Mediterranean:

The season included also preparations for the next set of fieldwork, to be conducted in February 2019:

a. During the 2018 field season, a meeting of Professors Levy, Norris and Yasur-Landau with Dr. Dafna Langutt (Tel Aviv University) and Dr. Gilad Shteinberg have set the groundwork for another series of inland coring near Tel Dor, in the area of the Kebara swamp, an area that will provide key climatic data from the Pleistocene to the present day.

b. Underwater excavations around Tel Dor, aimed to uncover a mole or quay previously unexcavated in the southern part of the bay, planned for February,
2019. These will be, as the July 2018 excavations were, conducted as a joint venture of UCSD and university of Haifa.

A geophysical survey of the Newe Yam bay (where caches of submerged Late Bronze and Iron Age copper and other metal ingots have been found) as well as coast of Dor by a boat using a variety of marine geophysical techniques including a sub-bottom profiler to measure the depth of different submerged sediment and geological layers in these coastal areas, a side-scan sonar survey of these areas to map the sea floor to identify ancient submerged architecture, wrecks and changing coastlines; An archaeological survey of the bay of Newe Yam by diving.