

MARITIME STRATEGIC EVALUATION FOR ISRAEL 2017/18

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The Past is Alive – and Sailing: The Story of the *Ma'agan Mikhael* // Ship (the Replica) and Plans for Its Future

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The ancient ship from Ma'agan Mikhael

This ancient shipwreck was discovered in 1985 about 70 m from the shore of kibbutz Ma'agan Mikhael by a kibbutz member, Ami Eshel. It was in shallow water at a depth of 1.5 m under a layer of sand about 1.5 m thick, with its bow pointing toward the shore. The initial examination of the finds indicated that it was an ancient merchant ship, about 14 m long. The ship, which was relatively new, ran aground in the late 5th century BCE. The three-season (1988–1989) excavation of the site was carried out by a team of maritime archaeologists from Israel and abroad, with the assistance of staff of the Leon Recanati Institute for Maritime Studies.¹ The late Dr. Elisha Linder, founder of the Institute for Maritime Studies and the Department of Maritime Civilizations at the University of Haifa, directed the project; Jay Rosloff of Texas A&M University led the excavation team; and the late Prof. Yaacov Kahanov of the Leon Recanati Institute for Maritime Studies directed the conservation, research and reconstruction of the ship at the Hecht Museum of the University of Haifa. Many researchers and students participated in the study of the ship and the finds, and the project has resulted in three books, and dozens of articles and presentations at international conferences.

As well as being ancient, the Ma'agan Mikhael shipwreck was unique in the almost perfect preservation of the bottom of the hull – to a length of 11.15 m, width of 3.11 m and depth of 1.5 m. The parts of the hull which survived were the keel, false keel and keelson, parts of 14 full frames, sections of strakes – 12 on the starboard side and 7 on the port side, the mast-step, knees in the stem and stern and various internal components. These timbers were of Calabrian pine (*Pinus brutia*), except for tenons, pegs and the false keel, which were of oak (*Quercus* spp.)². Altogether the hull and the finds were made from 13 wood species indigenous to the eastern Mediterranean. The hull was built by the 'shell-first' method, meaning that the strakes were connected edge-to-edge by closely spaced mortise-and-tenon joints locked by tapered pegs. The planks were also sewn at bow and stern to the keel, knees, and endposts. After the planks were assembled to form the hull, the frames were fixed into it with double-clenched copper nails.

1 Yaacov Kahanov, 2011. Ship reconstruction, documentation, and in situ recording. In *The Oxford Handbook of Maritime Archaeology*, eds Alexis Catambis, Ben Ford and Donny L. Hamilton, Oxford University Press, Oxford: 161–181.

2 Yaacov Kahanov, 2003. The Hull. In Elisha Linder and Yaacov Kahanov, *The Ma'agan Mikhael Ship. The Recovery of a 2400-year-old Merchantman: Final Report Volume 1*, Israel Exploration Society and University of Haifa, Jerusalem: 53–129; Yaacov Kahanov, 2011. Ship reconstruction, documentation, and in situ recording. In *The Oxford Handbook of Maritime Archaeology*, eds Alexis Catambis, Ben Ford and Donny L. Hamilton, Oxford University Press, Oxford: 161–181.

The ship carried 12.5 tons of stone, mostly blue schist with some gabbro (basalt), laid on a bed of dunnage. The source of the blue schist was the island of Euboea, near Athens, and the gabbro was from Cyprus. A unique single-arm type of anchor made of oak was found near the bow. The hawser was still attached to the eye of the anchor at its top, and a trip rope (to free the anchor if trapped on the seabed) was attached to the crown at the bottom. Among the finds were food remains; about 70 pottery plates, bowls, jugs, etc., which were apparently for everyday use by the crew (The origin of the pottery vessels was mainly Cyprus and/or the Levant, although some items were East Greek from Asia Minor); a basket of carpenter's tools, which included bow drills, rulers and a square, wooden nails and ready-to-use tenons; several sizes of ropes of various plant fibres; a lead ingot; and decorative wooden boxes apparently used for cosmetics.³ The finds made it possible to reconstruct some facets of daily life on board, although not definitely to identify the origin of the ship or her ports-of-call, since tools and objects were traded from place to place.

After the hull was excavated and all of its finds and contents retrieved, it was dismantled under water. The parts were transferred to freshwater tanks on shore and then to the conservation laboratory at the University of Haifa. The 8.26-m-long keel was taken from the sea in one piece in a container designed for its transportation and conservation. As the wood was waterlogged and internally decayed, the method chosen for conservation was by using 100% polyethylene glycol (PEG) 3350 to displace the water and restore to the timber the strength it had lost over the centuries. The conservation process lasted seven years, and on its completion the timbers were moved to the Hecht Museum at the University of Haifa, where a special wing had been built for the ship. The ship was reassembled over a period of three years, accompanied by a thorough documentation and research process. The ship has been on public display at the Museum since 2002. In 2006, a new permanent metal support frame was built to display the ship.⁴ The outline of the frame gives visitors an idea of the shape of the original ship (Figure 1).

The excavation, research, conservation, and preparation of the Ma'agan Mikhael ship for display was made possible by the support of Lord Anthony Jacobs of London. In addition, the project was supported by Kibbutz Ma'agan Mikhael, which hosted the members of the excavation team, the Israel Science Foundation, which financed the research and reconstruction of the ship, the Hecht Foundation, Sammy Ofer and the University of Haifa.

3 Yaacov Kahanov, 2011. Ship reconstruction, documentation, and in situ recording. In *The Oxford Handbook of Maritime Archaeology*, eds Alexis Catambis, Ben Ford and Donny L. Hamilton, Oxford University Press, Oxford: 161–181.

4 Yaacov Kahanov, 2004. Conservation. In Yaacov Kahanov and Elisha Linder, *The Ma'agan Mikhael Ship. The Recovery of a 2400-year-old Merchantman: Final Report Volume 2*, Israel Exploration Society and University of Haifa, Jerusalem: 195–206; Yaacov Kahanov, 2011. Ship reconstruction, documentation, and in situ recording. In *The Oxford Handbook of Maritime Archaeology*, eds Alexis Catambis, Ben Ford and Donny L. Hamilton, Oxford University Press, Oxford: 161–181.



Figure 1 – The ancient ship from Ma'agan Mikhael on display at the Hecht Museum (photo by A. Efremov).

The replica project – *Ma'agan Mikhael II*

The final stage of the project which began with the discovery of the ancient ship and the realization of Dr. Linder's vision, was the building of a replica of the Ma'agan Mikhael ship that could actually sail. This was the first project of its kind in Israel and its rationale lies in the practical building of an ancient ship based on archaeological data and using 2400-year-old technology and shipbuilding methods. The construction of the replica was a research project carried out by the University of Haifa, directed by Prof. Kahanov. Participating in the project were researchers, carpenters, youth, students and volunteers. The working assumption was that only the actual construction would make it possible for the first time to understand the problems and challenges faced by the shipwrights – from choice of trees, felling season, design of the hull components, bending and finishing planks, making mortise-and-tenon joints, and designing and assembling the mast, sail and rigging.

The replica project was financed by private donations and assistance from the Israel Science Foundation and the Honor Frost Foundation. The traditional ceremony for the laying of the keel took place on 10th July 2014 in the presence of donors, maritime professionals and others interested in the project.

The replica project has three goals:

1. Construction of a replica of the ancient Ma'agan Mikhael ship – The construction of the ship requires practical research and devising technological solutions related to the building of ancient ships in the 5th century BCE.
2. Learning how to sail such a ship, with emphasis on destinations against the prevailing winds, and to understand the seamanship during that period and life on board. This is accomplished by actually sailing the replica. Although it is thought that we understand how ancient ships sailed using a square sail, it is clear that these are key questions for which there are still no clear practical answers.
3. Teaching youth and students about various aspects of ancient shipbuilding and the sailing of ships in the Mediterranean in ancient times.

The construction of the replica was carried out at the Nautical Officers School in Akko. The search for suitable trees was carried out by the replica team together with staff from Keren Kayamet LeYisrael (JNF). After the trees were felled, they were brought for initial sawing at the Eucalyptus carpentry shop in the Tiberius Industrial Area. The sawn timbers were brought to the workshop in Akko, where carpenters cut and shaped them into components of the replica. Each stage of the reconstruction was based on the archaeological find and had to be identical to it. Unlike the builders of the original ship, the carpenters of the replica did not have any discretion, and had to be faithful to the original. The dismantling of the hull of the original ship into its component parts at the end of the excavation was vital for the research into the understanding of sailing vessels – each piece of wood was drawn, down to the level of wood grain; and every part of the ship was studied and documented thanks to the direct and convenient access to the timbers. In places where the wood did not survive, the replica was based on a reconstruction of the ship based on archaeological and iconographic sources from the period, combined with models and computer design.⁵ The construction of the various parts of the ship was challenging, and the problems encountered were solved by the team through research, building of models and consultation with experts in Israel and abroad (Figure 2).

The construction of the ship took about two and a half years. The replica is 16.6 m in overall length and 4.3 m in beam, with a displacement of 22.9 tons. The ship was lowered into the sea at Israel Shipyards on 16th December 2016 and towed to the Shavit fishing wharf (HaKishon) in Haifa. Over a period of two weeks, the ship was prepared for its Ministry of Transportation certification of seaworthiness. The preparations included a check by an inspector from the Ministry of the necessary equipment and tests of the ship's stability. After the ship received certification, the replica team carried out a series of trial sailings in Haifa Bay. The goal of the sailings was to acquaint the crew with the ship and study her capabilities at sea, handling the square sail and steering oars,

5 Adina Ben Zeev, Yaacov Kahanov, John Tresman and Michal Artzy, 2009. *The Ma'agan Mikhael Ship, Volume III: A Reconstruction of the Hull*, Israel Exploration Society, Leon Recanati Institute for Maritime Studies, University of Haifa, Jerusalem.

manoeuvring and anchoring. Participating in the sailings were volunteers from the replica team and visitors who had supported the project and came along to see the ship in action. In addition, there were also sailings with the guides from the Hecht Museum, students from the Department of Maritime Civilizations at the University of Haifa, and cadets from the Nautical Officers School in Akko. One goal of these sailings was to formulate a teaching plan for schoolchildren in various grades to learn in practice about an ancient square-sailed vessel.



Figure 2 – The replica under construction, May 2016 (photo by A. Efremov).

The official launch of the ship took place on 17th March 2017 at the Shavit wharf. Present at the launching ceremony were donors, maritime professionals and the Board of the University of Haifa. During the ceremony, the ship was officially named *Ma'agan Mikhael II*. In parallel with the short trips within Haifa Bay, the crew of the ship, led by her skipper, Yochai Palzur, started a series of sailings along the coast of Israel. The first voyage – from Haifa to Yaffo and back – took place in August 2017. The passage to Yaffo – a distance of 53 nautical miles – took about 19 hours, at an average speed of 3 knots (nautical miles per hour). The return passage to Haifa was divided into three legs: Yaffo-Herzliya; Herzliya-Hadera; and Hadera-Haifa, also at an average speed of 3 knots. During this voyage, the crew gained experience in sailing the ship for an extended period of time, including maintaining a sailing routine, watch-keeping, and dealing with the changing situation of wind and sea. The northward return passage under sail confirmed the practicability of sailing north along the Israeli coast during the summer, even against the prevailing north-westerly winds (Figure 3).



Figure 3 – The Ma'agan Mikhael II under sail (photo by A. Efremov)

Evaluation of the project and plans for the future

The direct outcome of this project is a ship that can actually sail. This represents the completion of a vital stage of a unique research project which began with the discovery of the shipwreck in 1985. The project has aroused great interest in Israel, and has resonated in the international scientific community as well. In our opinion, the completion and proving of the construction has strengthened Israel's academic position as a leader in the study of ancient sailing vessels.

The voyage of the *Ma'agan Mikhael II* along the coast of Israel was planned to accumulate experience in the operation of a square sail system, and to better understand the seamanship and life on board a ship of that period. Although we already have initial conclusions, the next stage will be to sail the ship in the open Mediterranean to destinations against the prevailing winds (such as Cyprus and Greece), with the goal of providing a practical answer to the question of how ancient sailing vessels operated using a single square sail.

The replica project is a fitting platform on which to advance academic and educational excellence. This is the first project of its kind in Israel and one of the very few of its kind anywhere, and will strengthen the status of Israel at the forefront of global academic research. We are maintaining an open-door policy to the local community with lectures for

the public (such as in the framework of the 'Night of the Scientists' series at the University of Haifa) and by including youth in the work (for example, cadets from the Nautical Officers School in Akko and the Sea Scouts). We help young researchers to combine theoretical and practical research in various fields (archaeology of sailing vessels, history and the sciences, including metallurgy and the preparation of waterproofing materials), and strengthen their connection with the Mediterranean and its culture. We believe that in the long run, the participation of youth and students in the construction, sailing and research of this vessel will open a new window onto the academic world and maritime research, and will encourage them to continue their studies and contribute to the community.

In view of the growing importance of the sea in Israel's economy and society, it appears that this unique project, which connects the region's maritime past and present, is helping to increase the importance of the maritime domain in all its aspects, in public discourse, as well as its exposure among diverse audiences.