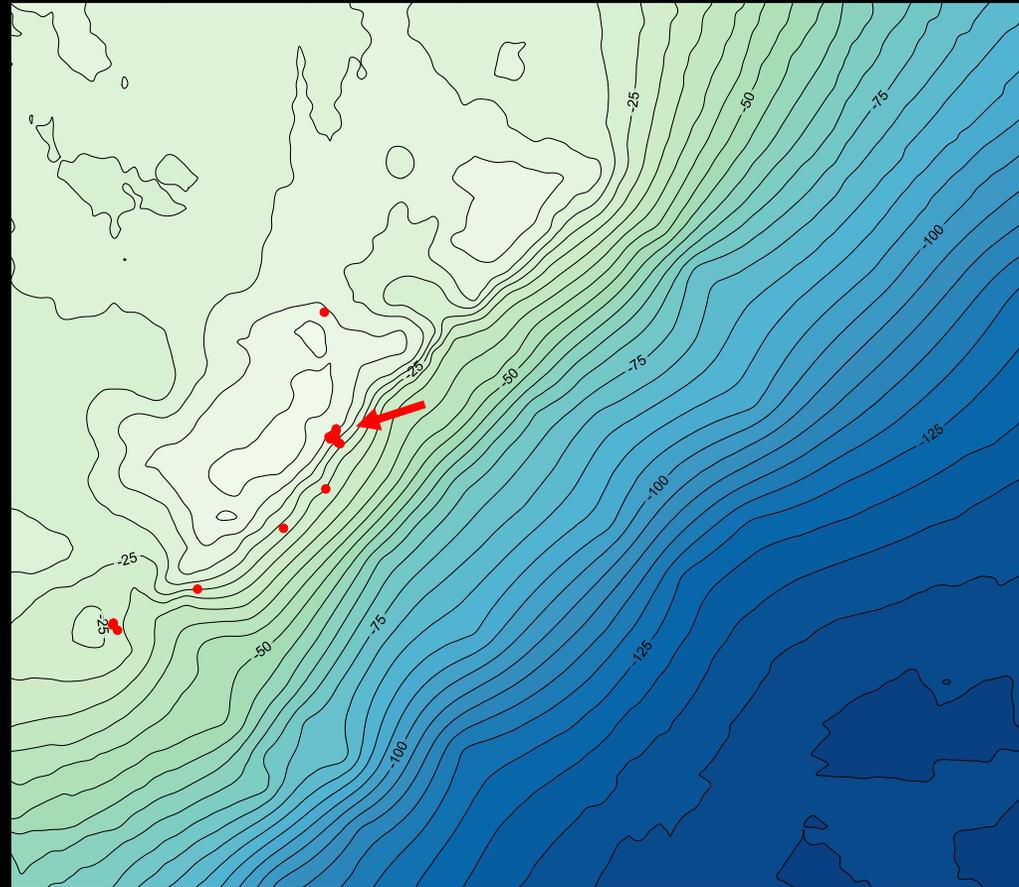


An underwater photograph showing a diver in the upper center, another diver on the right, and a boat wreck on the left. The foreground is a rocky reef. A semi-transparent blue box with a red border contains white text.

**MAHS Field School 2018
Pickles Reef
Florida Keys National Marine Sanctuary**

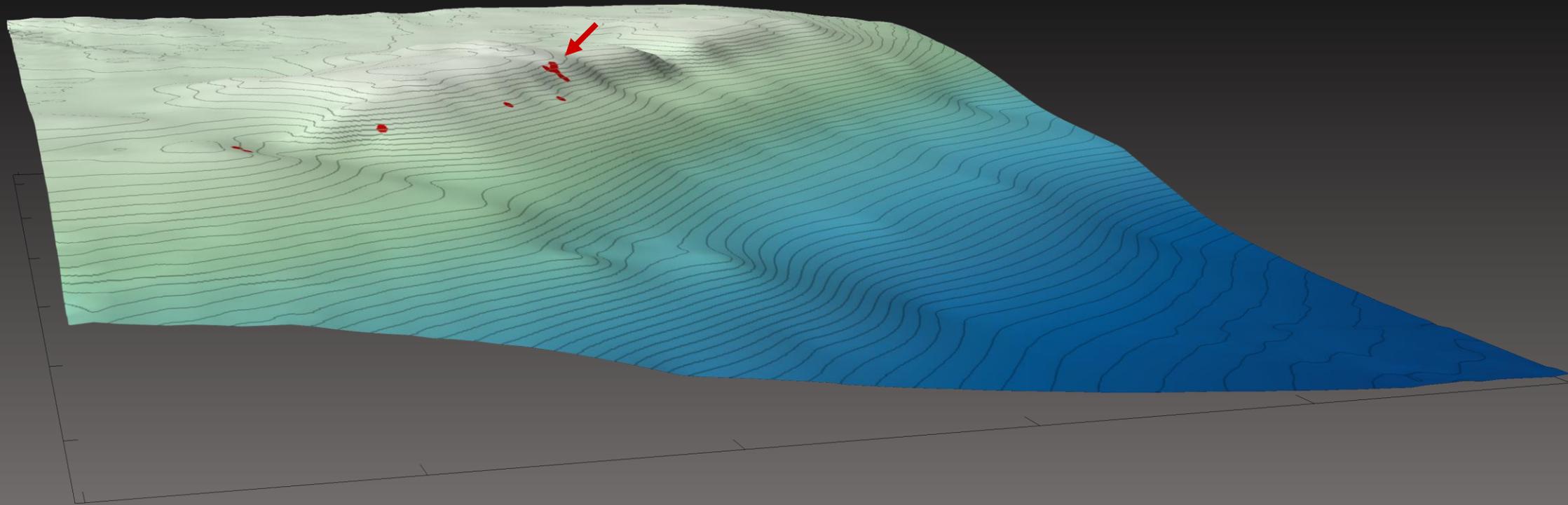


MAHS returned to Pickles Reef in June of 2018 to hold its annual field school.



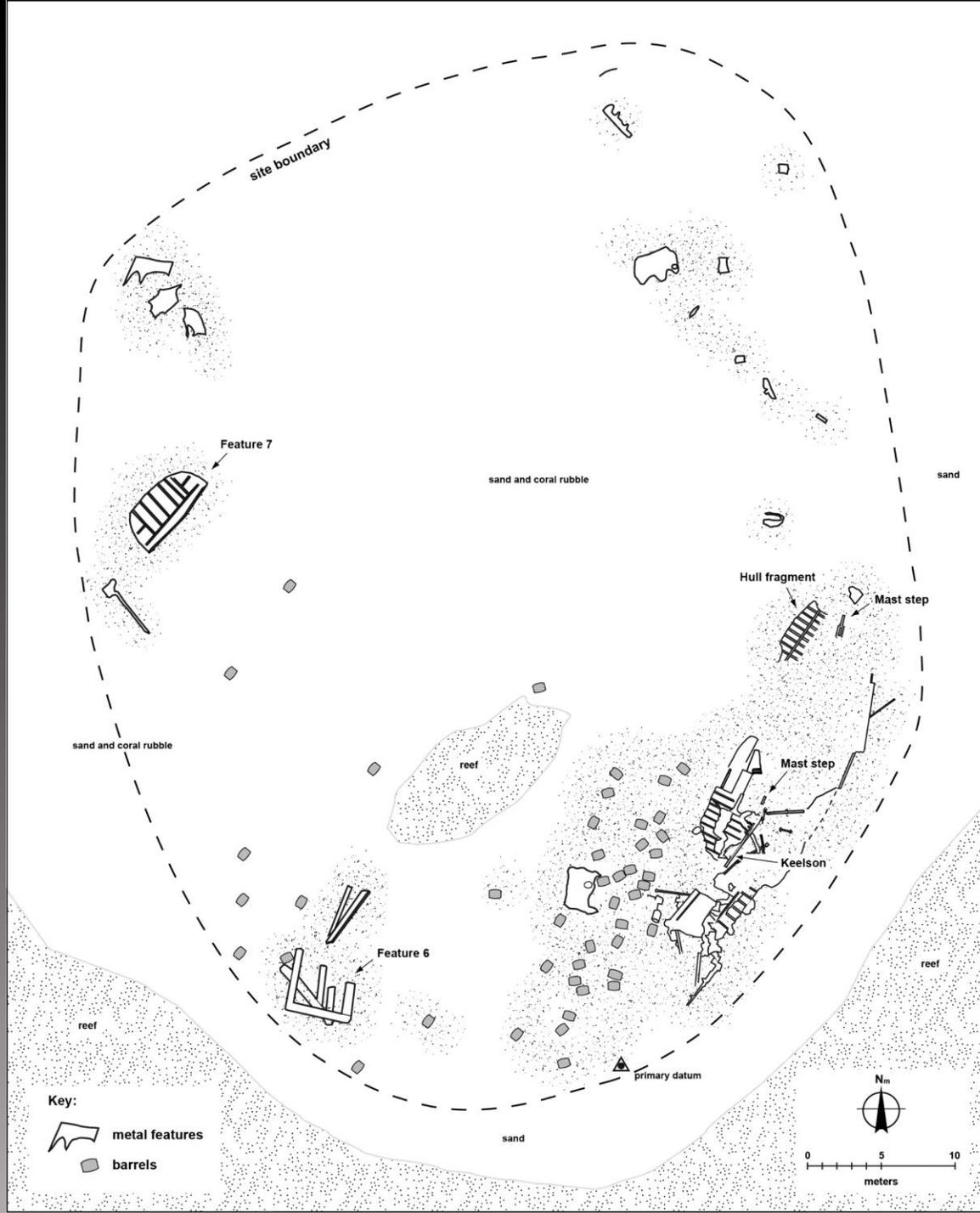
Pickles Reef is a small outer reef on the edge of the Florida Straits, where the current runs close to the continental shelf.

The contour map above was generated from a digital elevation model (the contour interval is 5 feet). The red dots represent GPS data collected during the project. The cluster indicated by the arrow is the Barrel Wreck Site we've been working on.



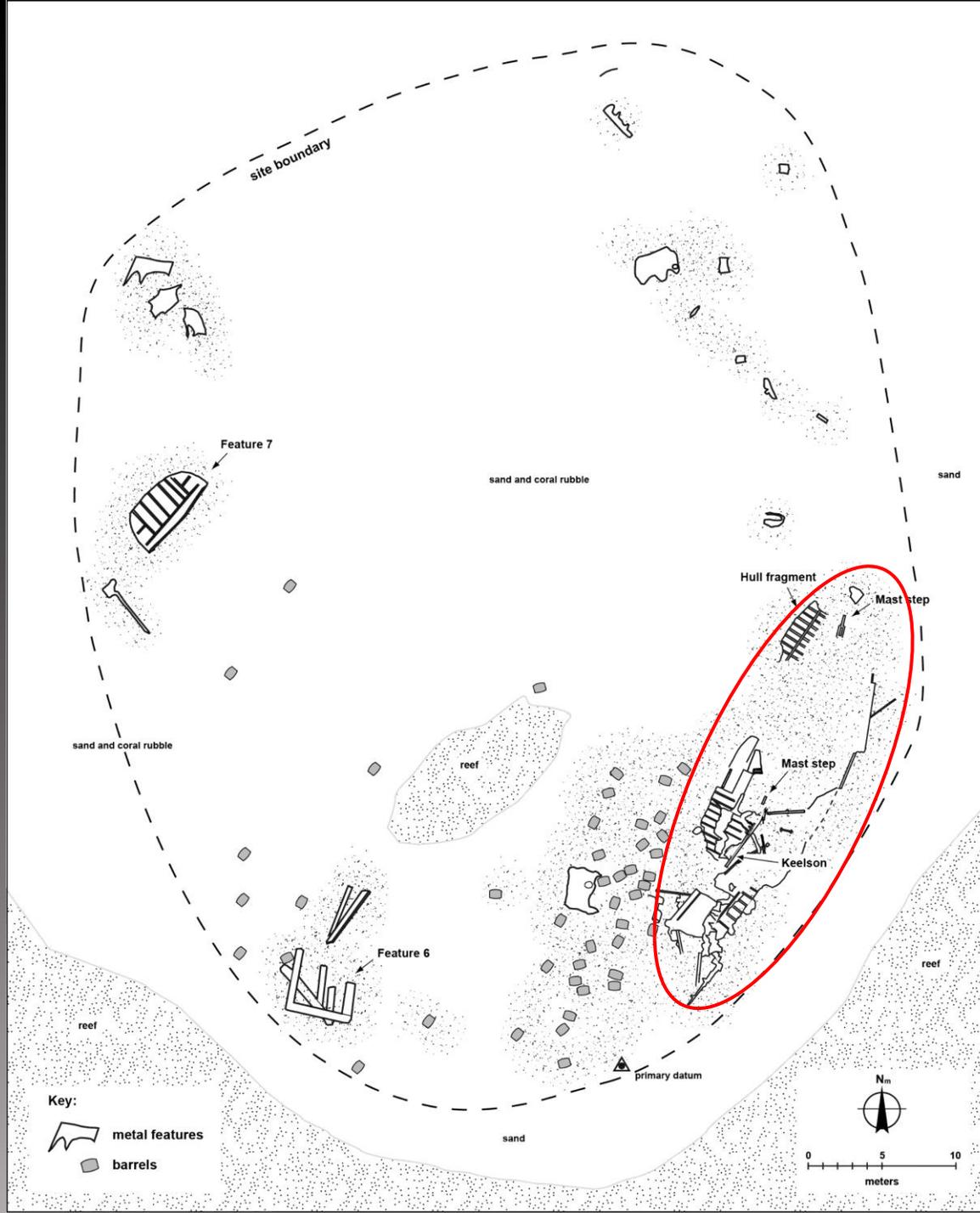
Rising sharply from deep water, the reef represents a hazard to shipping that sails too close on its way to and from the Gulf of Mexico.

Surface rendering of the digital elevation model. Vertical exaggeration for emphasis is approximately 10x.

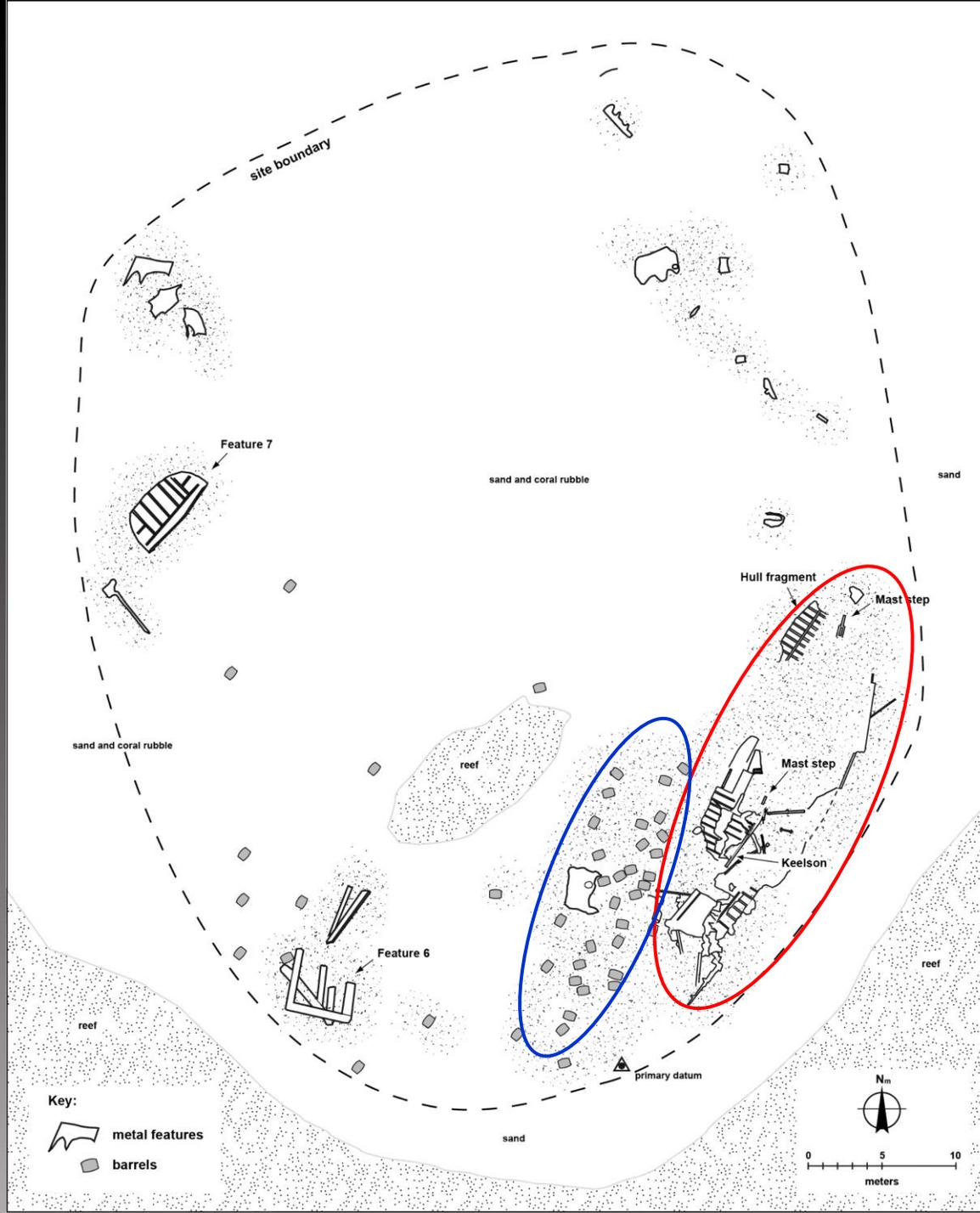


This is a map of the Barrel Wreck Site as it appeared in 2016, the last time we visited the site.

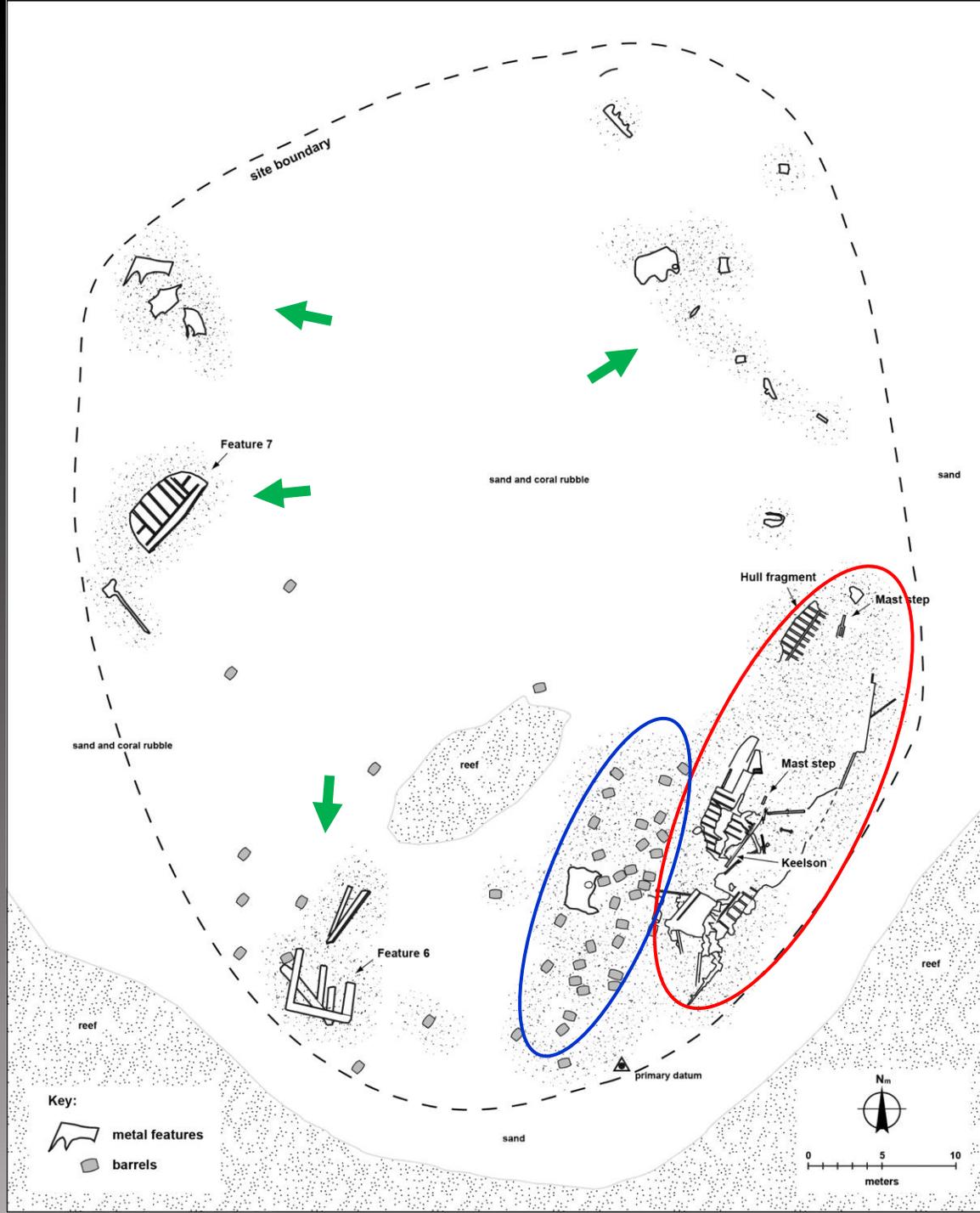
The site consists of three main elements.



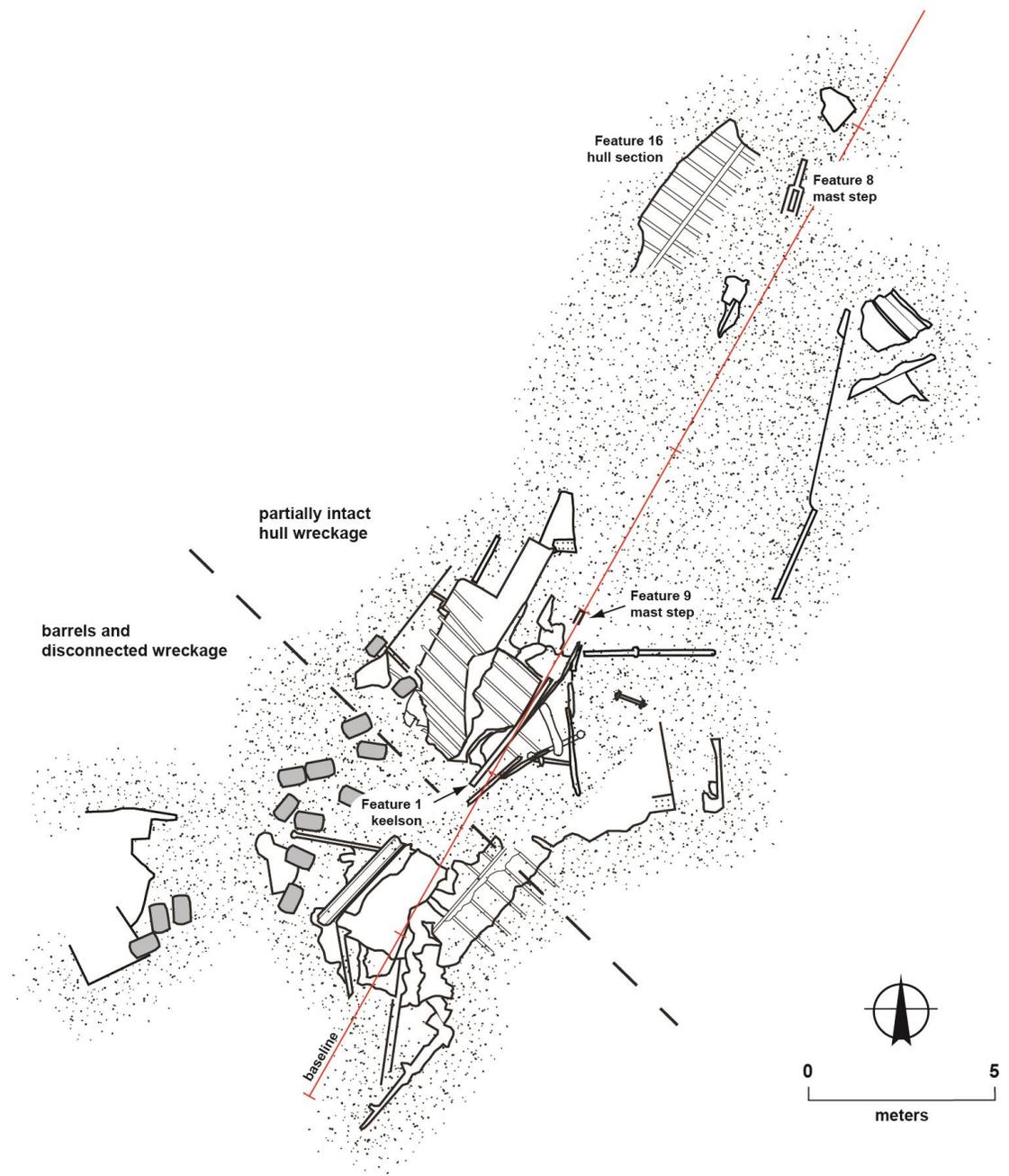
The first is the remains of a metal-hulled sailing ship. We don't have a name or date for the vessel yet, but several lines of evidence suggest that it wrecked sometime around the turn of the 20th century.



The second part of the site consists of a group of cement barrel casts that documentary evidence strongly suggests were discarded by a steamer that grounded on the reef in 1914.



The final part of the site includes a widespread distribution of miscellaneous features to the north and west—fragments of hull plate, deck framing, a bulkhead, additional barrel casts.



This is the final map of the metal-hulled sailing ship as it appeared in 2016.

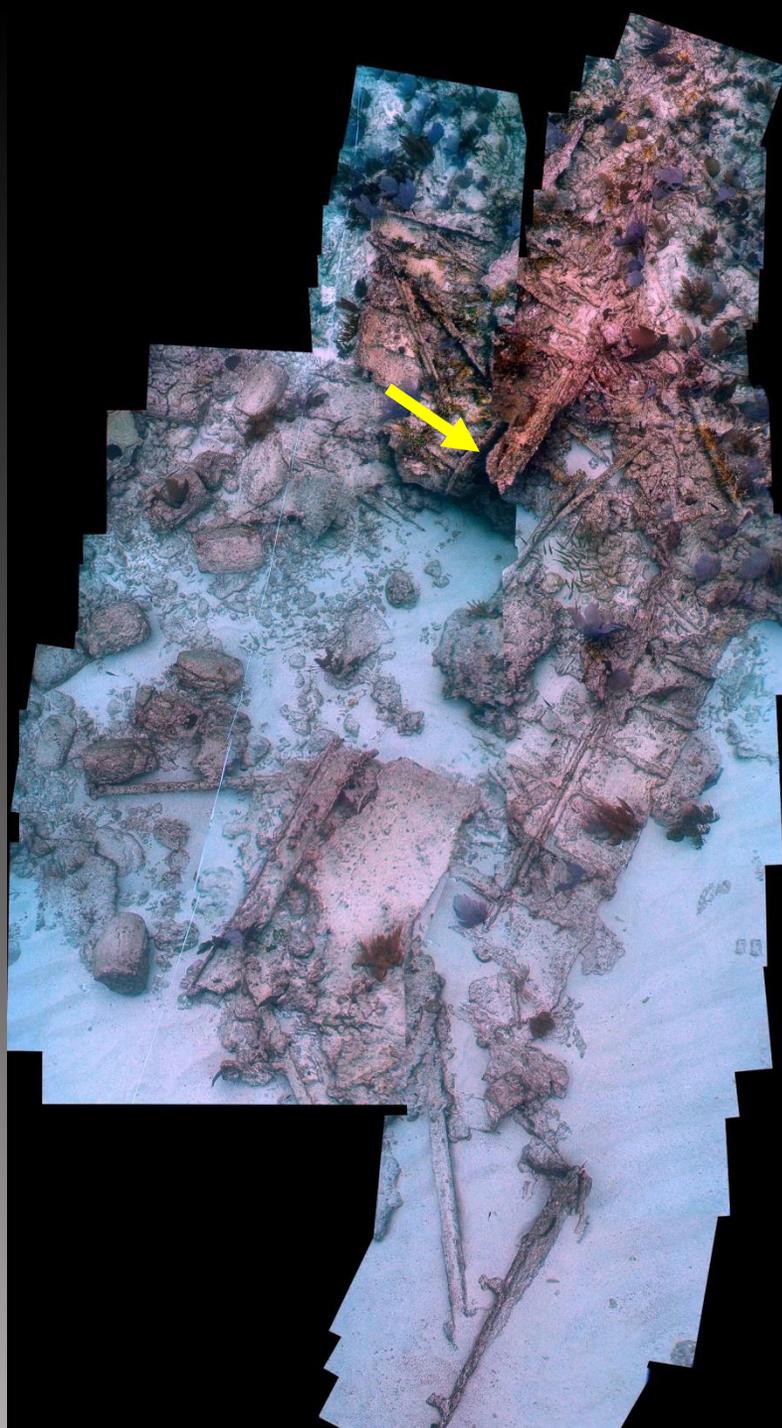


Some of the features.



Mast Step

Hull Fragment



Over the years we've constructed several photomosaics of parts of the wreck. This image is of the south end showing the truncated end of the keel assembly, which is indicated by the arrow and has been used by divers for orientation.

Various disarticulated debris lies to the south, in the bottom part of the image.

A satellite image of Hurricane Irma, a Category 4 storm, striking the Lower Florida Keys. The storm is shown as a large, swirling white cloud mass with a distinct eye, moving over the dark blue ocean. The Florida peninsula is visible in the upper left, and the Florida Keys are seen as a chain of small islands in the lower right. The text is overlaid in the upper right quadrant.

On the morning of September 10, 2017, Hurricane Irma struck the Lower Florida Keys as a Category 4 storm with sustained winds of 130 mph, causing widespread destruction throughout the island chain.

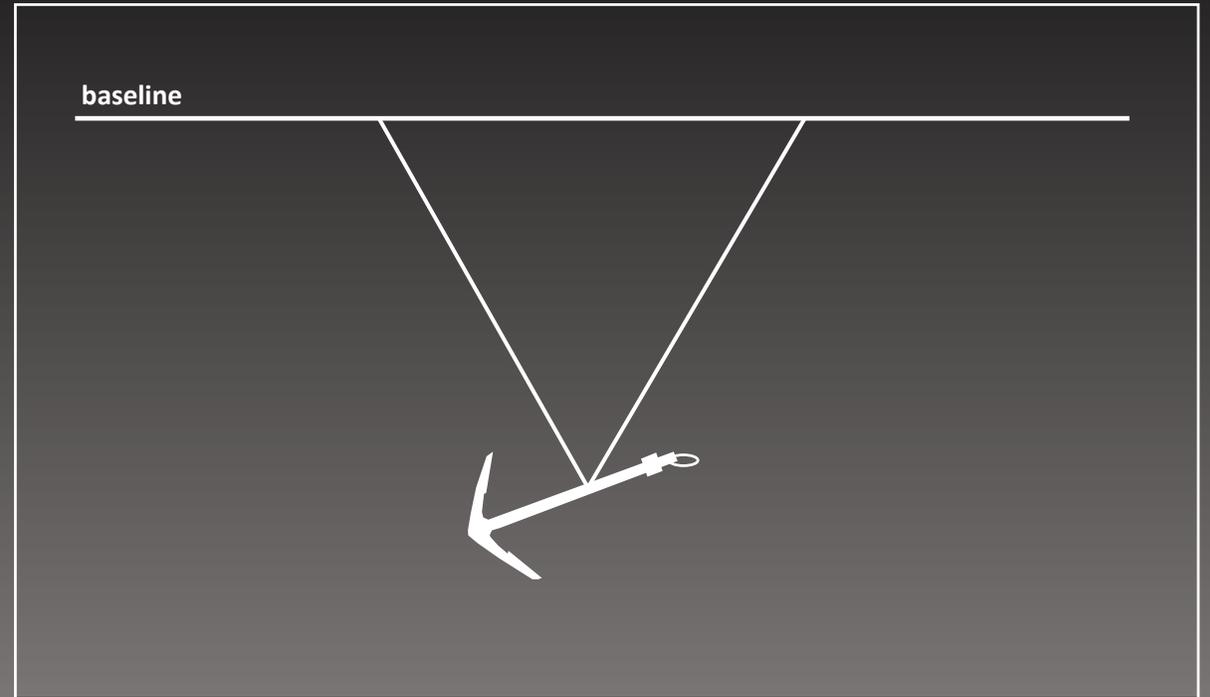
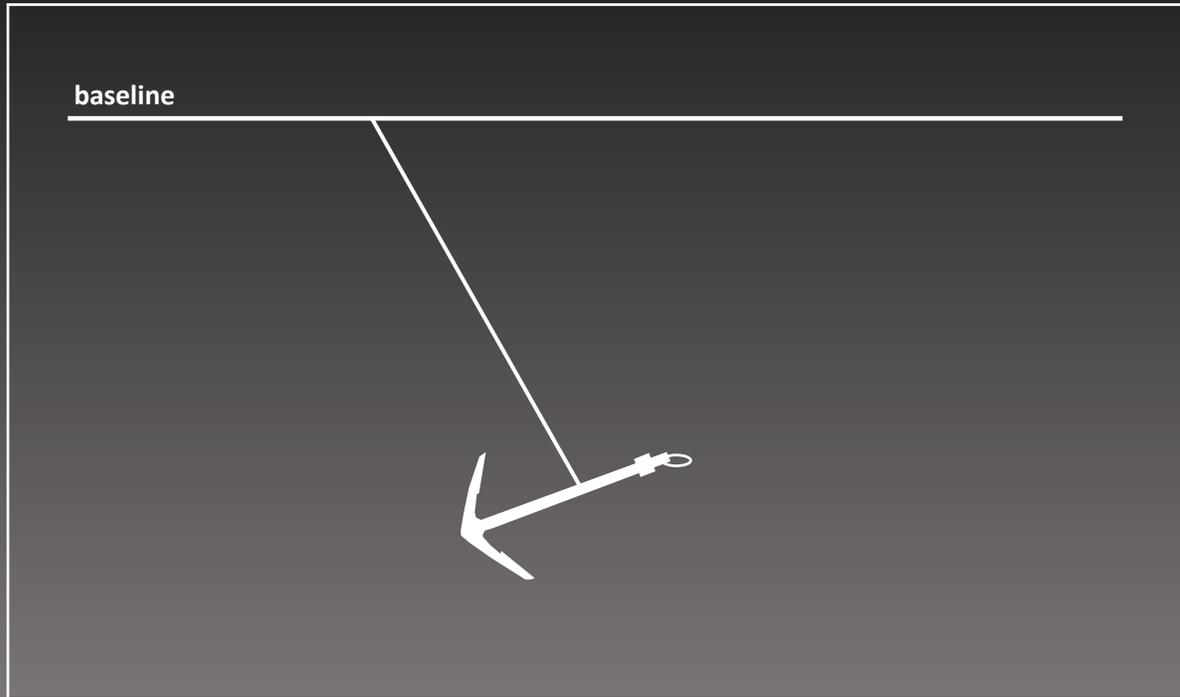
FKNMS reported extensive damage to both natural and cultural sites in the Upper Keys, including Pickles Reef. The Sanctuary asked MAHS to resurvey the Barrel Wreck to assess its condition following the storm.

These photos were taken by the Sanctuary during the winter after the storm.



To re-survey the site we used a combination of mapping and photography.

The mapping technique MAHS uses is baseline trilateration. It is a simple method, easy to understand and execute.



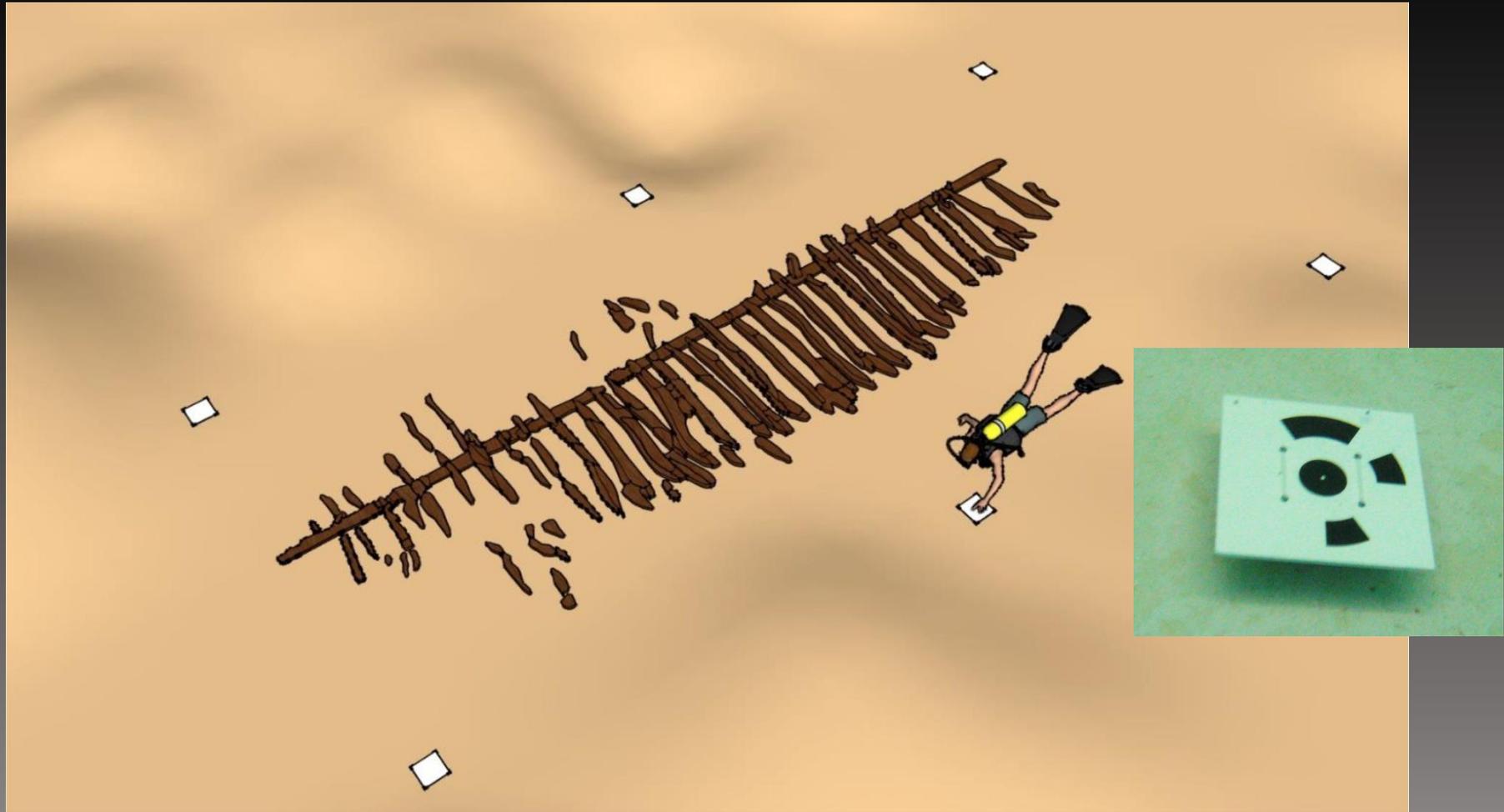
Two measurements are made from points along a baseline to each feature we want to include in our site map.

The measurements can then be reproduced on a map at any scale.



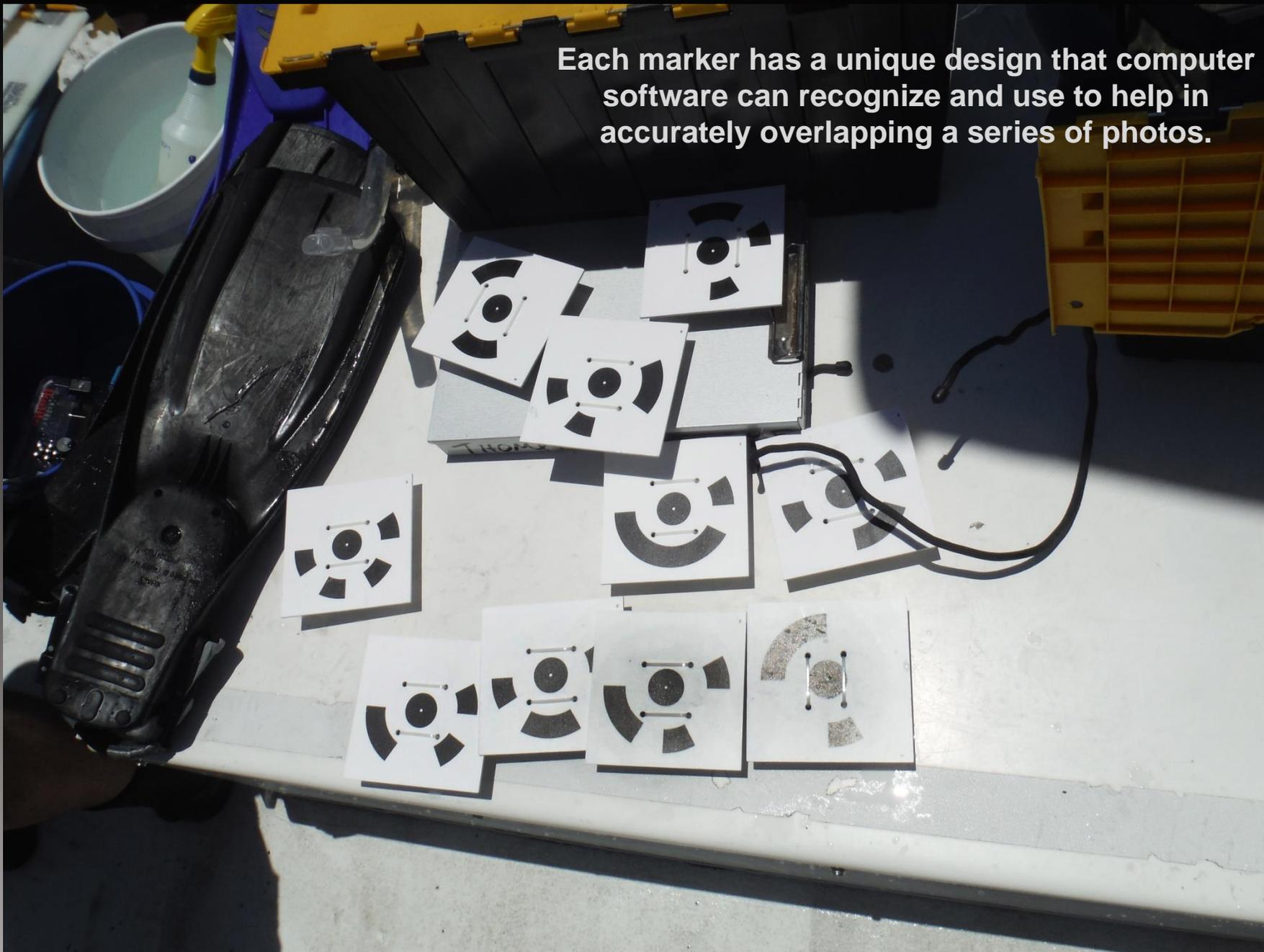
We begin the field school training with a dry-land walkthrough of the trilateration procedure. It's a chance to practice before going into the water to be sure we all understand the process.

We supplemented the mapping with a photogrammetric study of the site conducted by Matt Thompson.



Photogrammetry is rapidly becoming an important method of site documentation in archaeology. It can be a fast and accurate process, and so it is particularly useful in underwater investigations due to the time constraints imposed by diving. Control points, like the marker in the inset, are placed around the site to assist in combining photos taken from various angles.

Each marker has a unique design that computer software can recognize and use to help in accurately overlapping a series of photos.

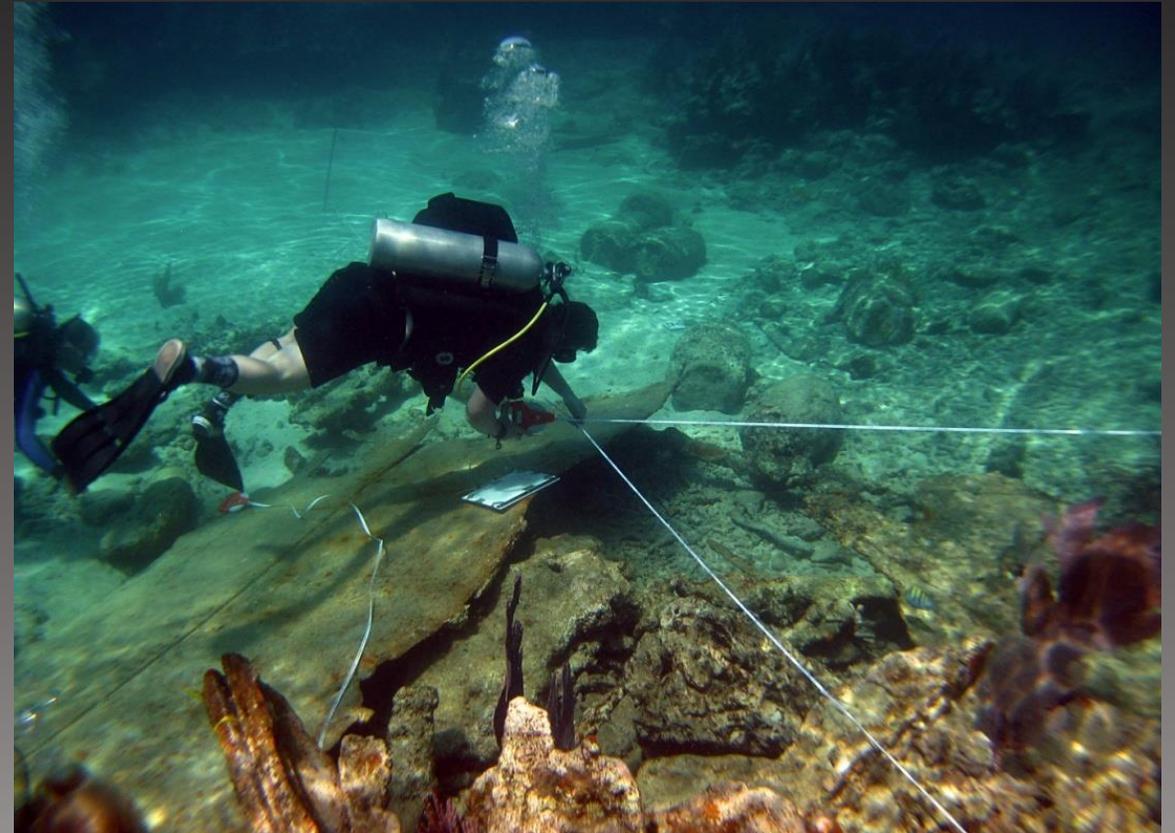


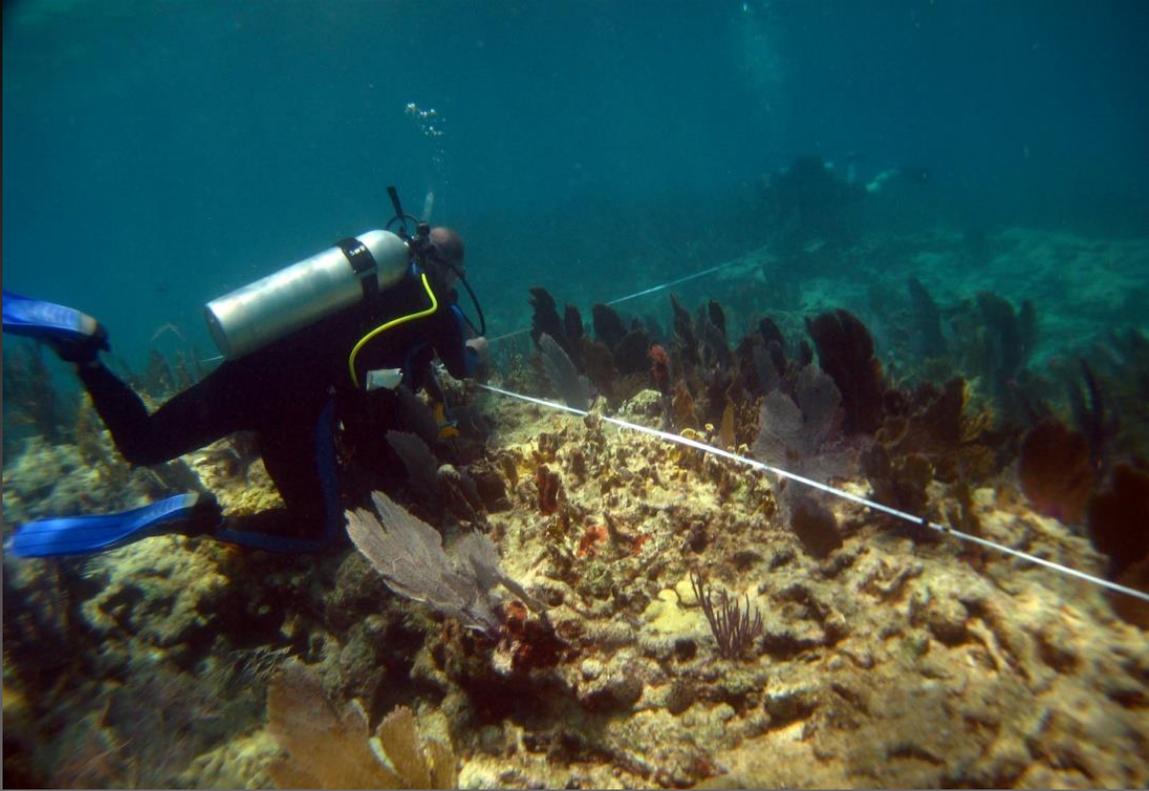


OK, enough preliminaries. Off we go.

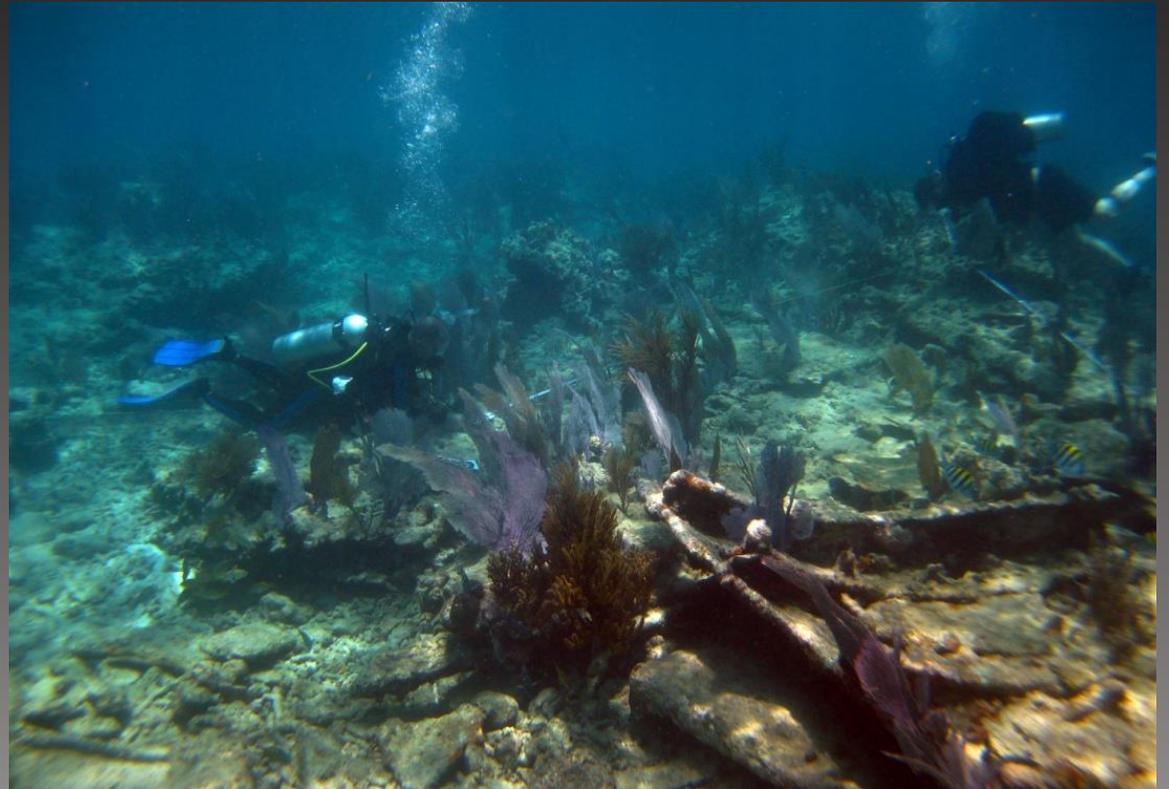


After setting a baseline, the first order of business was to plot the locations of the control points.





This task provided plenty of practice at trilateration mapping.





Plenty of practice ...





By recording the GPS coordinates of the control points we can place the site in a real-world coordinate system.

Because the site is in shallow water we could, as in previous work at the site, record GPS data by floating a hand-held unit on the surface connected to a down-line placed over each point by a diver.



We also re-measured and re-drew some of the large features that were separate from the metal wreck. Here divers are working on a section of deck framing.



Between dives there's discussion of conditions and findings, allowing us to refine plans for the next round of dives.



While much of the site appeared to be intact after the storm, there were some substantial changes noted. For example, this very large section of hull plating was found off the end of the keel. The feature was not in that location previously, and we're not sure at this point where it came from.



The broken end of the keel assembly, noted earlier as an orientation point, is shown by the arrow below the diver.



Here are some before and after images of the same area, with arrows again indicating the end of keel.

Above is a pre-Irma view showing miscellaneous metal features. The image to the right is a post-Irma view showing the area from a slightly different angle. Many of the features appear to have moved or to have been covered by the large section of hull plating.





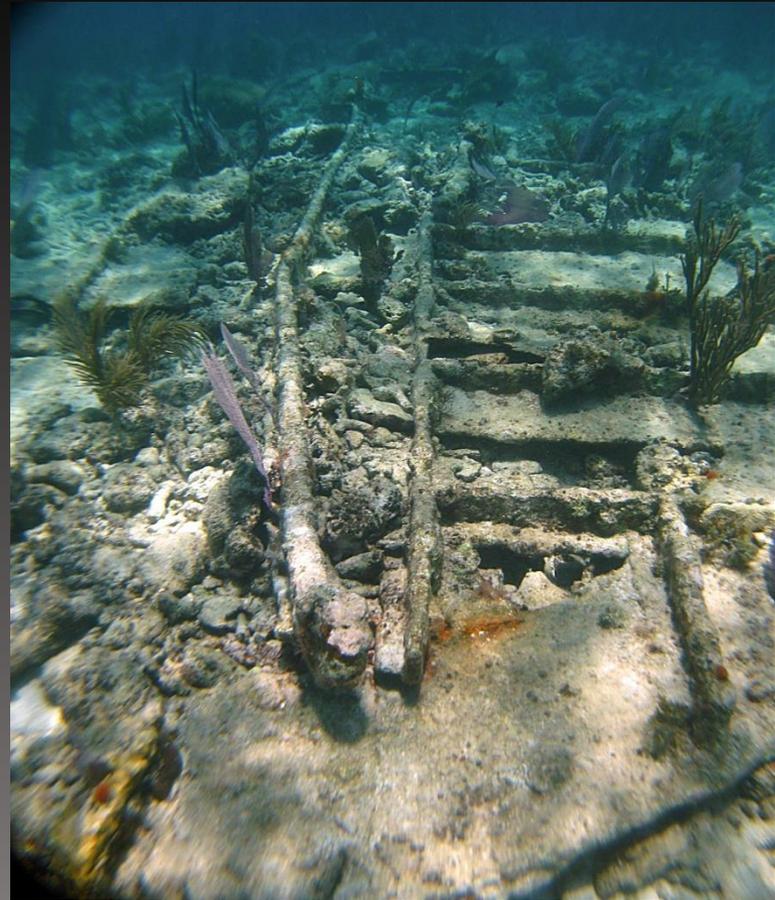
The end of the keel assembly itself had been damaged somewhat.

In the pre-Irma image on the left, the feature looked like a single metal beam. Some of the frames are visible perpendicular to the beam in the foreground and background.

The post-Irma image on the right shows the keel to have a laminated structure and to be separating longitudinally along the joints, presumably after being exposed and battered during the storm. The frames are still visible, although some of the rubble in the foreground has been scoured away.

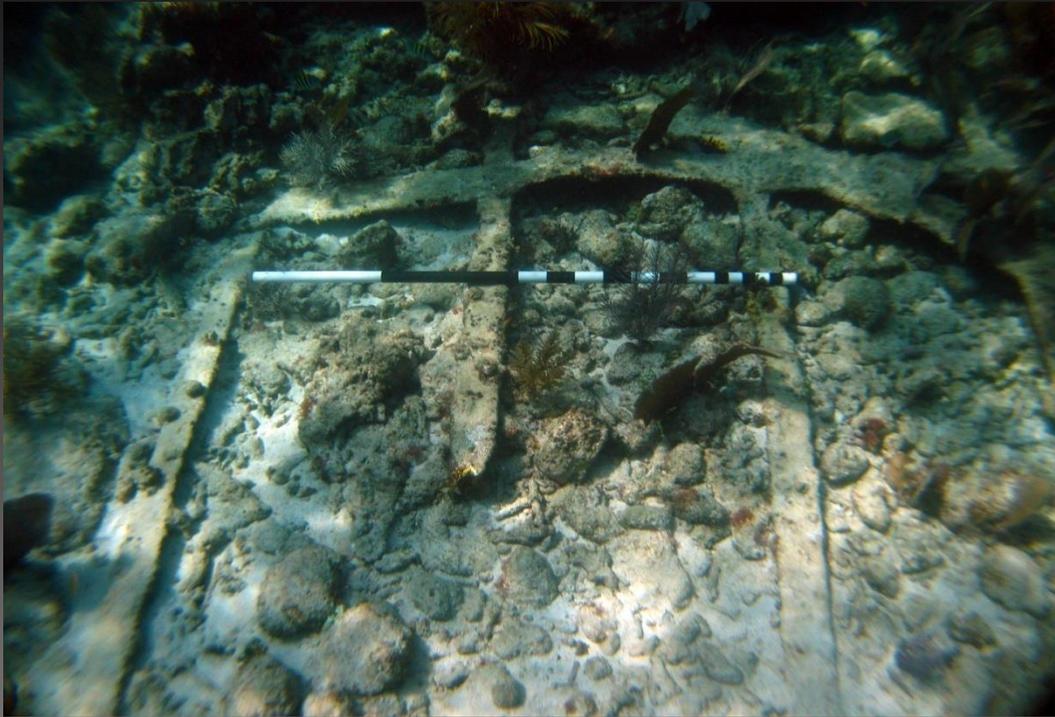


pre-Irma

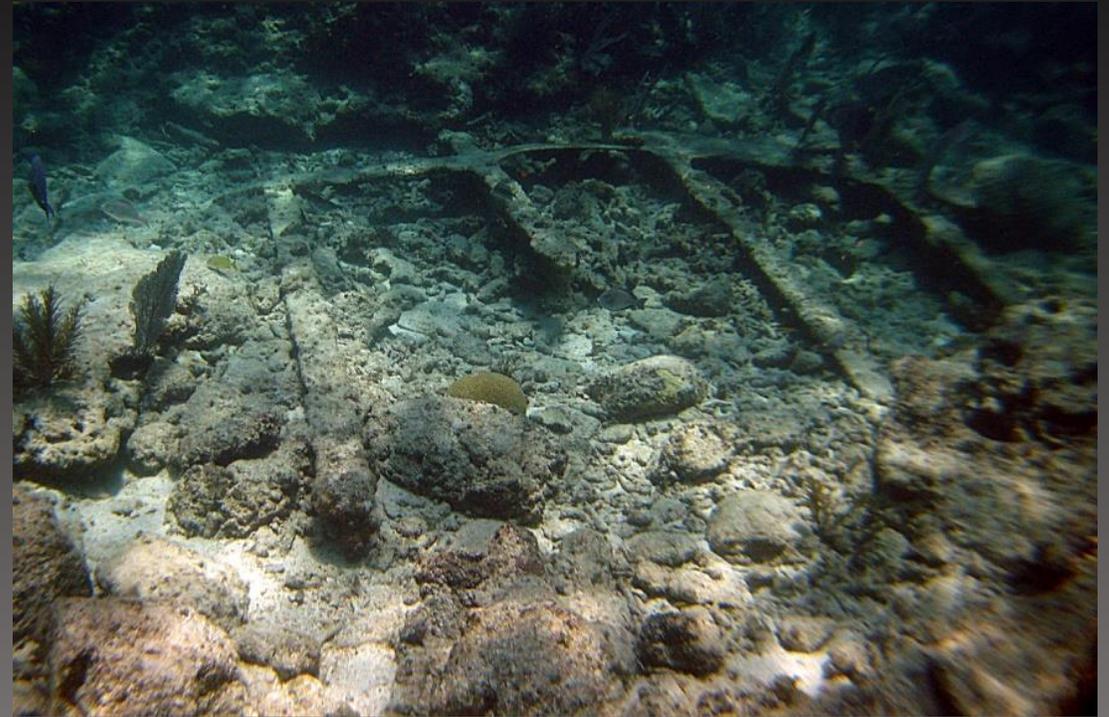


post-Irma

Large features west of the metal wreck, such as this bulkhead, showed little change.

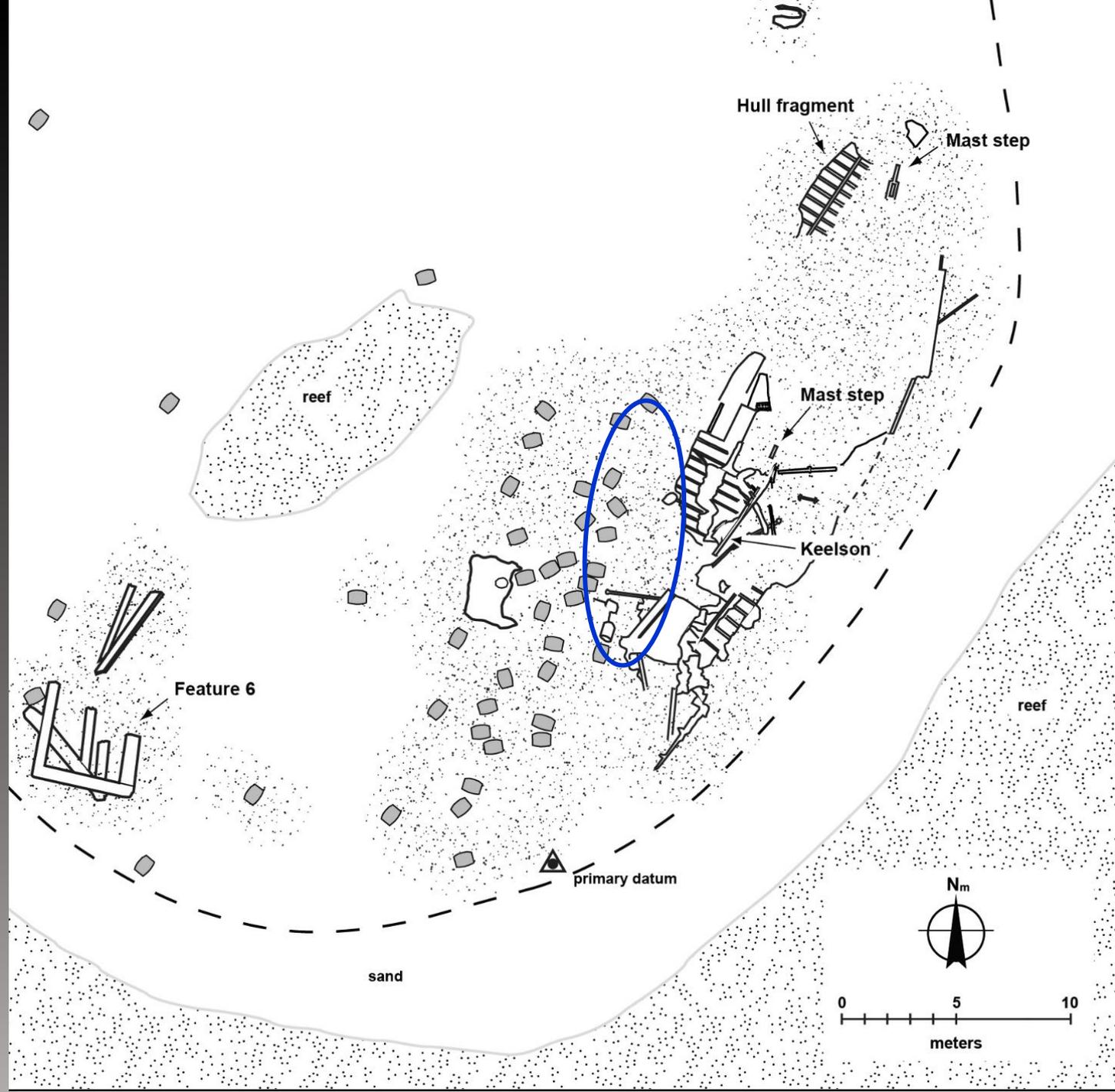


pre-Irma



post-Irma

This section of deck framing also showed little change. Some of the smaller rubble had been rearranged, but the feature itself appeared largely unaffected.



The photo-mosaics in the following slide show before and after images of barrels and metal fragments just south and west of the wreck.

The location of the transects is approximated by the blue oval.

pre-storm

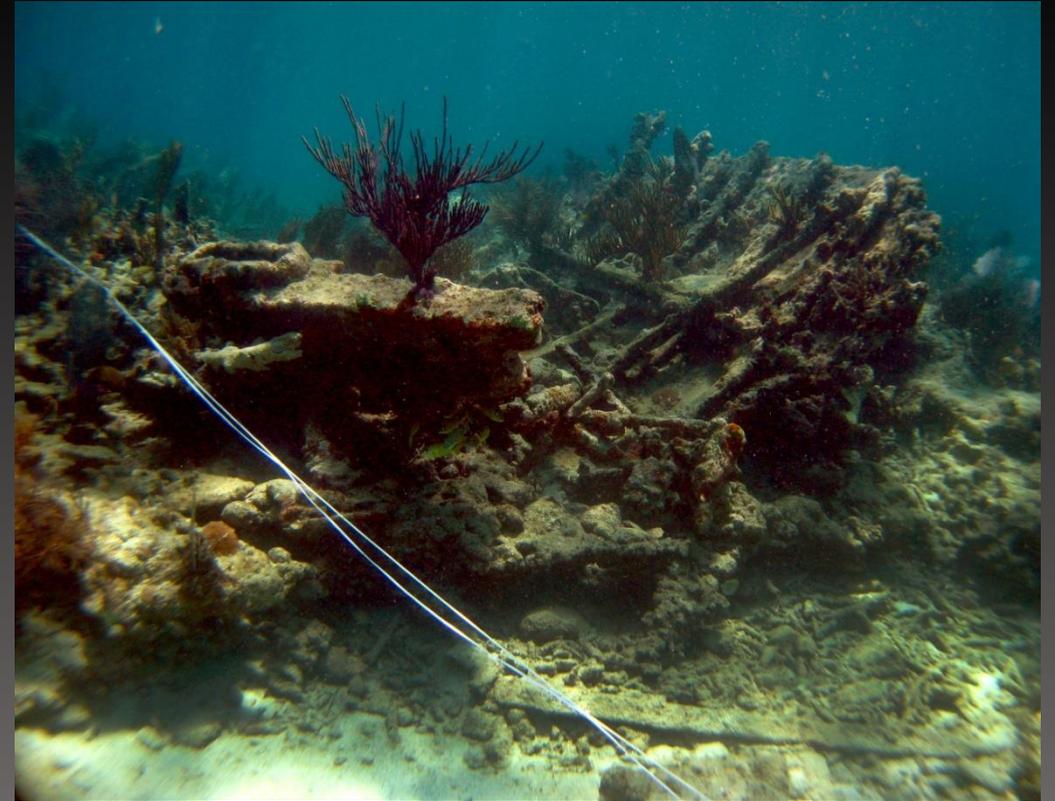


The same area after the hurricane. A few barrel casts remain in place while others, along with loose metal debris, have been moved by the effects of the storm.



The effects on the natural environment were varied.

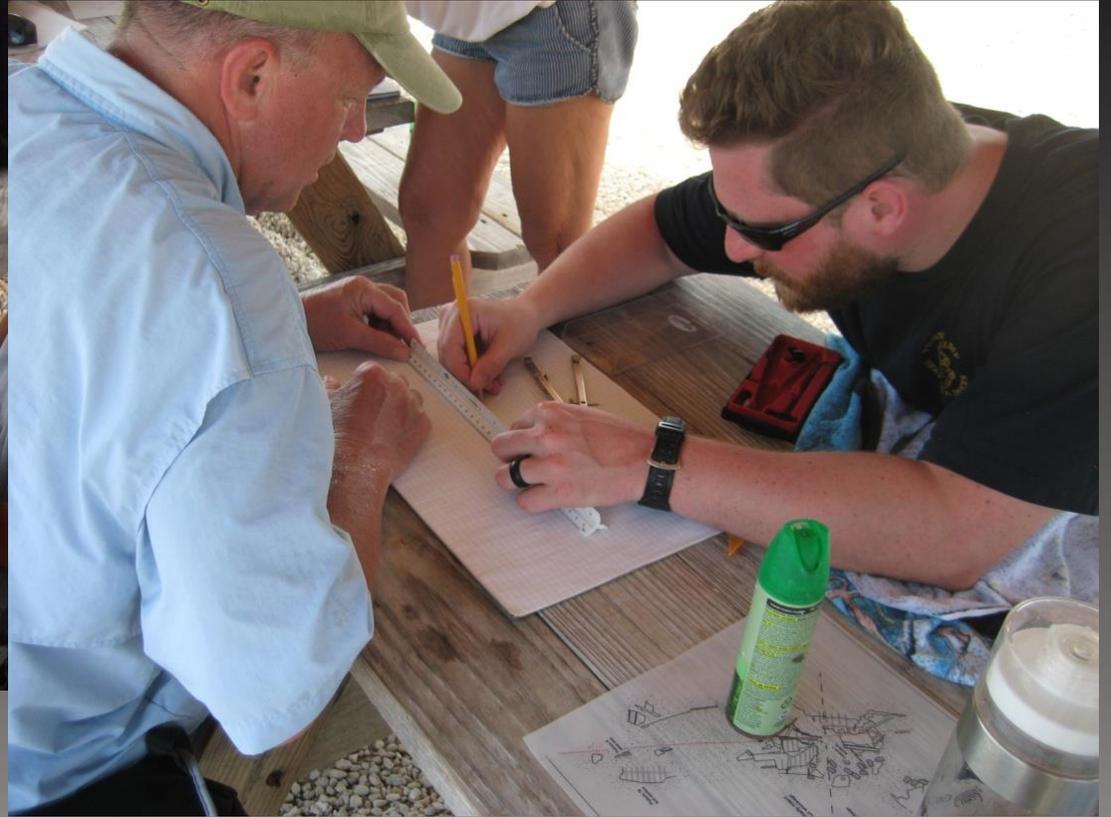
In the image on the right, a section of hull plating plate lay face down near a coral formation prior to the storm. On the left, a post-storm image shows the hull fragment turned over and an additional smaller plate present nearby, but with little apparent effect to the adjacent coral.



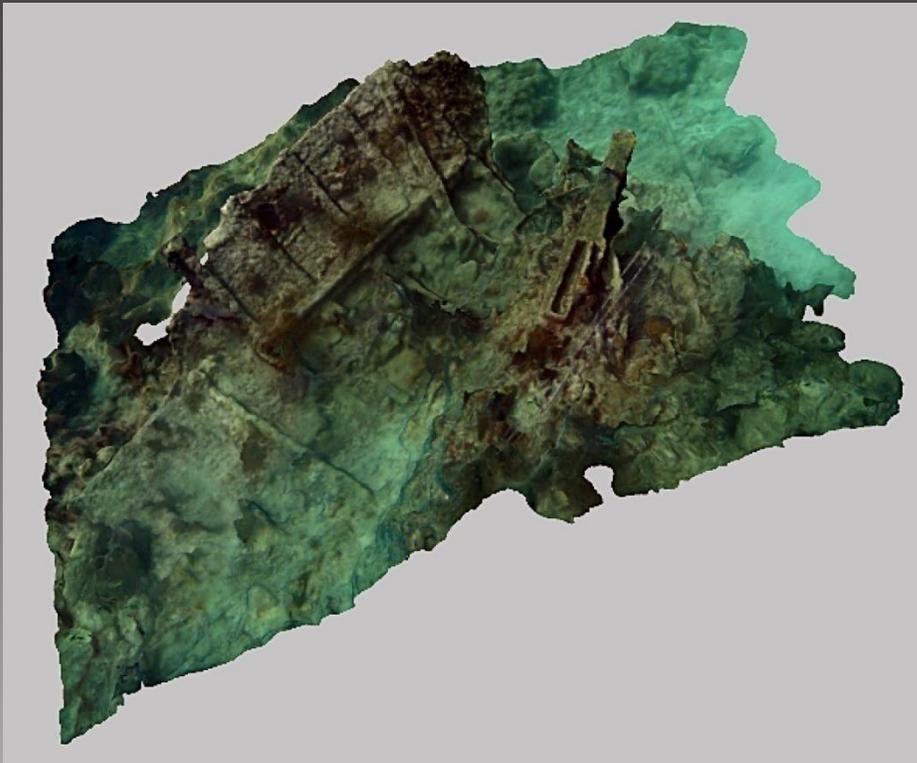
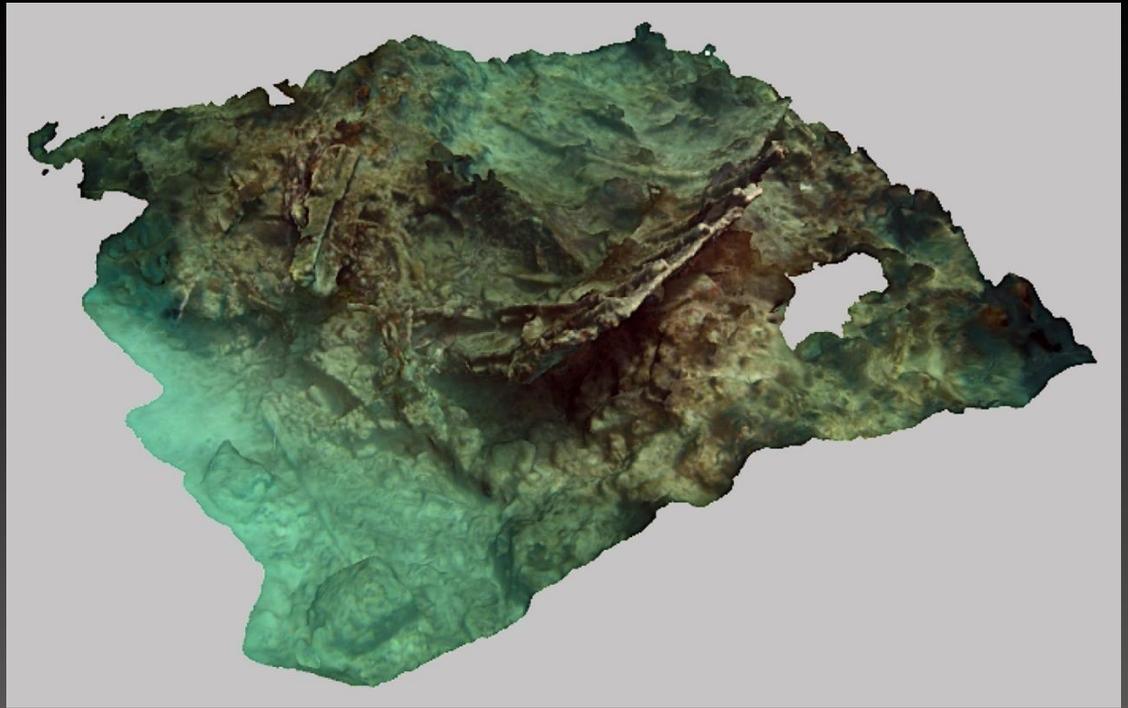
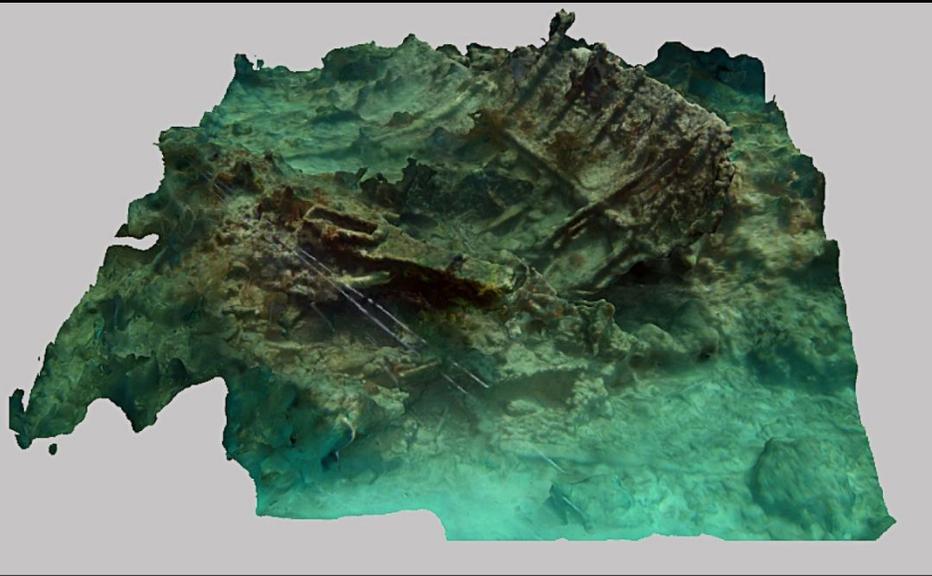
Some of the gorgonians on the site were very sturdy. These images show a mast step and hull section at the north end of the wreck.

The pre-Irma image on the left shows some large and distinctive gorgonians, one on the keel assembly near the mast step, and one attached to a stringer on the hull section in the background.

The image on the right is post-Irma and shows the gorgonians still in place.



After gathering trilateration data at the site comes the all-important step of plotting the points. Here's where the divers see their work take shape on a map and can check their results for points that may look incorrect and thus would need to be checked on subsequent dives.



These are 3-D images of the mast step and hull fragment at the north end of the wreck, some of the results of the photogrammetry work.



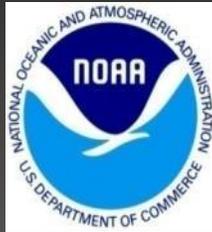
In the end we were able to document some substantial changes to the site, although portions of the metal wreck appeared relatively unaffected by the storm.

All in all, great work by a great team of divers.

The organizations involved in the project this season included:



MAHS – Maritime
Archaeological and Historical
Society, Washington, D.C.



NOAA / Florida Keys
National Marine
Sanctuary



Florida Bureau of
Archaeological Research



And special thanks again to Brenda Altmeier and Matthew Lawrence of the Florida Keys National Marine Sancturay for their continued support of the MAHS educational programs.

Dave Shaw, Jim Smailes, Brenda Altmeier, William Blodgett and Dennis Knepper contributed photos for this presentation.