

High-Resolution Magnetometer Survey of the Cattewater Wreck

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The lower reaches of the River Plym, known as the Cattewater, have been used as an anchorage for ships since at least the medieval period. In 1973 a dredger being used to deepen the south side Cattewater brought up timber wreckage and parts of some iron guns. An underwater investigation of the site that year produced a provisional site plan and the more controlled recovery of loose wreckage. The hull structure was the lowest section of hull from one end past the midships area, where the dredging work had caused extensive damage. Based on the assessments the site was recommended for designation under the new Protection of Wrecks Act (1973) and the site was designated under order No 1. Further recording and excavation work on the site was carried out between 1974 and 1978, documented in 'The Cattewater Wreck - The Investigation of an Armed Vessel of the Sixteenth Century' by Mark Redknap in 1984.

The name of the vessel remains unknown and the site was not fully understood as very little of the debris field was investigated. In 2006 a new phase of fieldwork was commenced for the licensee, Martin Read of the University of Plymouth, to determine the full extent and the current condition of the site. This work formed part of an on-going project to collect geophysical and mapping information about the many shipwrecks in Plymouth Sound.

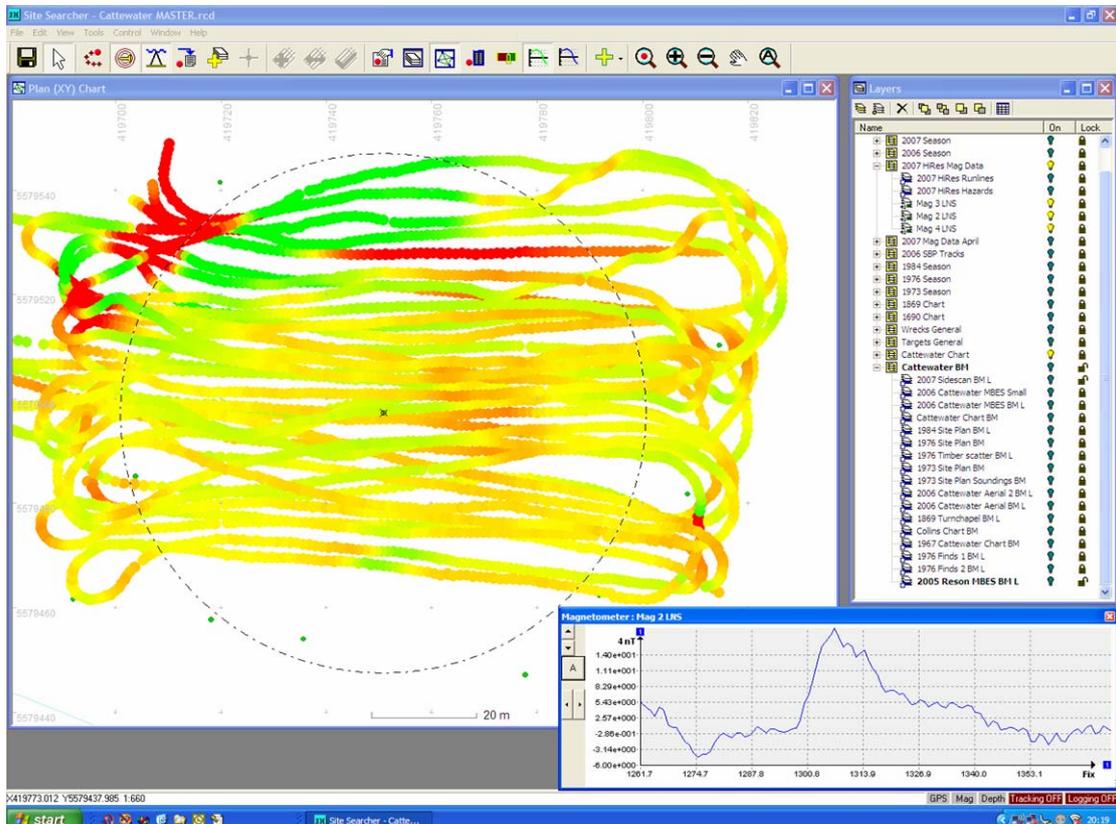


Figure 1: Magnetometer data in Site Recorder

In 2006 a Hydrography Masters student from the University of Plymouth, Amelie Thebault completed a survey over the site using an Innomar SES-2000 sub-bottom profiler with the kind assistance of Innomar GmbH. Analysis of the sub-bottom data suggested that the remains of the hull lie some 20m from the centre of the designated area.

In 2007 the project was taken on by Elizabeth Swann, also a Hydrography Masters student from the University of Plymouth in partnership with Ashley Gould, Maritime Archaeology & History Masters student from the University of Bristol. Work completed in 2007 included a multibeam echo sounder (MBES) survey along with a sidescan and further sub-bottom profiler surveys. A towed magnetometer survey was completed with the aim of detecting any iron artefacts and material but the data was sparse and lacked detail, so a high resolution magnetometer survey was planned.

The site is surrounded by mooring buoys with their associated anchors and ground chains. The area has been used as a haven for ships for centuries contains the debris and shipwreck remains accumulated over this period. Towing a magnetometer between the boats and moorings is difficult as they limit the areas over which you can operate and there is the danger of snagging a mooring with the very expensive towfish. In addition, the position of the towfish is difficult to determine to metre accuracy without using an even more expensive acoustic positioning system. For these reasons we wanted to try a different approach and attach the magnetometer to the boat itself, this way we would obtain the highest position accuracy and be able to sail in amongst the moorings in (relative) safety.



Figure 2: Rigging the survey boat

The team was joined by Kevin Camidge from CISMAS who brought with him a Geometrics G881 caesium magnetometer on loan from Martin Dean at the University of St Andrews. The University of Plymouth provided a Trimble SPS RTK GPS receiver and 3H Consulting Ltd provided a computer with a prototype version of Site Searcher geophysical survey software which was used for data collection and processing. The aim of this re-survey was to obtain complete coverage of the designated area with 5m line spacing, the highest positioning accuracy achievable and a 10Hz measurement data rate.



Figure 3: Liz Swann using Site Searcher

The boat used for this task had to be big enough to carry the equipment safely yet small enough to be work amongst the buoys, so something around 5m long seemed suitable. The boat had to have a diesel engine as petrol engines were known to create interference signal which degrades the magnetometer signal. A small hydrographic survey vessel was loaned to us by Nigel Boston from Geosa Ltd., unfortunately this did not have a wheelhouse or even a small cuddy so we had to improvise a shelter for the electronics. To get the highest position accuracy for the magnetometer measurements the GPS antenna needed to be as close to the magnetometer as

possible, but the magnetometer also had to be mounted as far from the boat's engine as possible. The solution was to fit a wooden bowsprit to the bows of the vessel to which we attached the magnetometer and GPS antenna.

Fortunately, it did not rain and the seas were calm enough so the temporary bowsprit and lashed-together electronics survived the afternoon's worth of data collection required to cover the whole site. A large tour boat was moored on a buoy over the north-west corner of the site which caused a large distortion in the magnetic field in the area but this was removed by the Site Searcher software in post-processing. Also superimposed on to the magnetometer signal was noise which appears to be caused by the pitching of the boat. Although it is possible to filter out this noise in software we will soon be investigating methods to reduce it when the data is collected. This magnetometer data was added to the other data sets already contained in the Site Recorder GIS model for the site and the results confirmed that the most significant target is 20m to the East of the centre of the designated area. This target is assumed to be the remains of the Cattewater wreck, but will need to be confirmed by divers. It is believed that part of a scaffold frame from the original excavations may still be visible on the seabed.

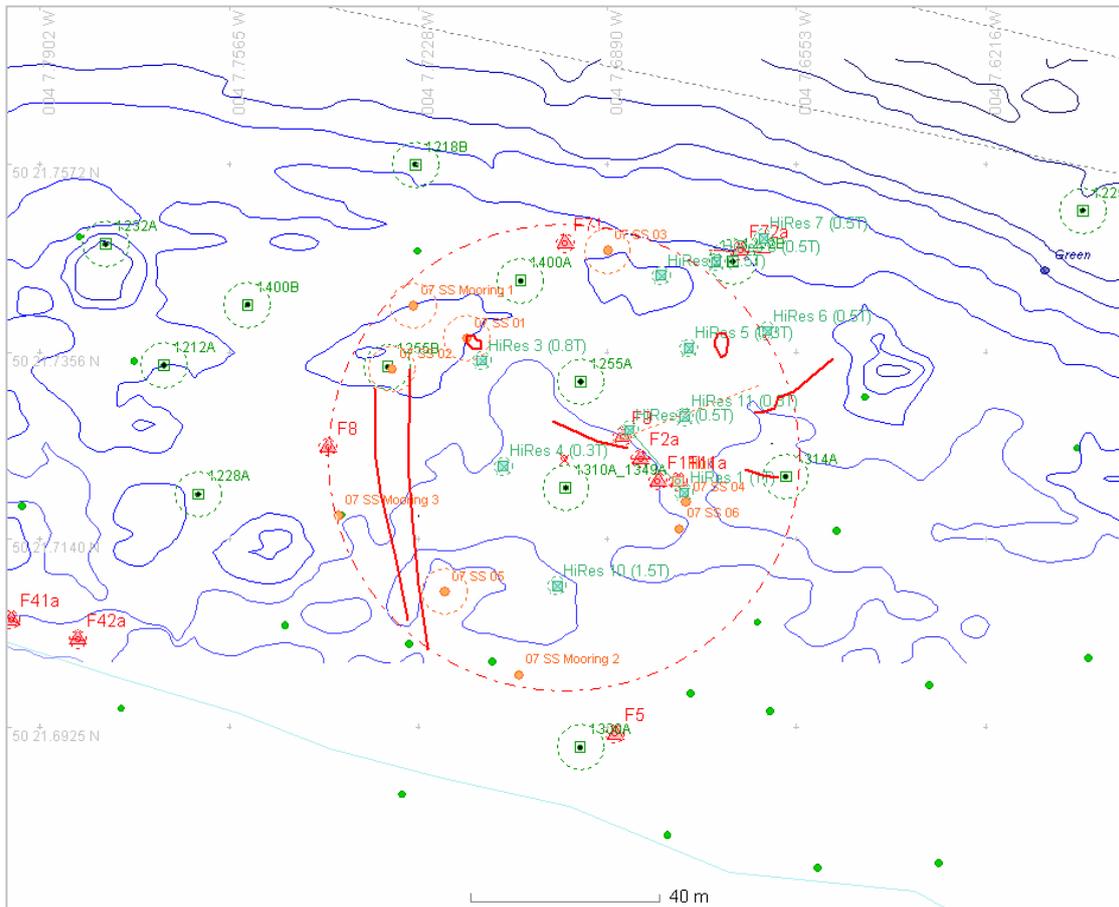


Figure 4: Targets around the Cattewater site

Part of this work involved constructing a comprehensive and integrated digital model of the site in Site Recorder 4 GIS, a model that includes all the data from previous work along with data from recent geophysical surveys. This entire dataset can be downloaded from the Web and opened using a free viewer program called Site Reader; both are available from the 3H Consulting Ltd. web site: www.3HConsulting.com/SitesCattewater.htm.

The method of collecting magnetometer data is suitable for high-resolution work on shallow sites or on sites where towing a magnetometer is impractical. We are still investigating this technique and plan on surveying the area again in 2008 using an improved method.