

HYDRODYNAMICAL MODELLING AS A TOOL FOR SCATTERED SHIPWRECK SITES IDENTIFICATION AND PROSPECTING: THE “FOUGUEUX” SITE CASE

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Abstract – A shipwreck site located in Camposoto beach (Cadiz, Spain) and containing 31 iron guns and a large anchor was protected and included in the General Catalogue of the Andalusian Historical Heritage in 2008. The archaeological remains relate it to the Battle of Trafalgar identifying it with the “Fougueux”, a Téméraire class 74 gun French ship of the line. Available information (including ships’ logbooks weather observations and other documents) establishes that a dismantled French ship ran aground on 22nd October 1805, and broke up into pieces on 25th due to tempestuous weather. Making use of all available information and of a set of numerical models (ocean circulation, meteorological and transport) we have simulated different scenarios in order to establish the most probable areas for finding the remains of the “Fougueux” accounting for the uncertainty of the available information. The relative contribution of the dominant oceanographic processes to the dispersion of the remains was evaluated as well. Those areas were surveyed in 2009 resulting in the discovery of 4 additional sites containing 35 guns and a large anchor whose characteristics and dating are similar to those of the previously known site. These additional sites are located closer to the coast forming an imaginary line parallel to it. The results of our study point out the potential of hydrodynamic modelling as a tool for identification and prospecting of scattered shipwreck sites.

Keywords – hydrodynamical modelling, shipwreck, underwater archaeology, Andalusian Coast.

1. INTRODUCTION

In maritime archaeology it is accepted that physical processes dominate site formation in the early stages [1], which is very evident in the case of highly energetic environments. Energetic indeed can be considered the Atlantic Andalusian Coast which comprises the Strait of Gibraltar and the Gulf of Cádiz. The gulf and the strait can be thought of being geographically divided by the meridian crossing the Cape of Trafalgar. It was precisely in the waters of the Gulf of Cádiz, a few miles South-West off the coast and close to the cape where the epic Battle of Trafalgar took place on 21st October 1805. Following the defeat of the Franco-Spanish fleet, the heavily damaged ships had to face a severe storm with strong winds and high seas from the South-West [2]. As a result, many of the damaged and/or dismantled ships drifted ashore where they were wrecked or ran aground. Such was the case of “Fougueux”, a Téméraire class 74 gun French ship of the line which according to the existing documentary evidence [3] ran aground between the 22nd and 23rd October and broke up into pieces on 25th October. The main “Fougueux” shipwreck site was known; it was protected and included in the General Catalogue of the Andalusian Historical Heritage in 2008. The site is located at Camposoto beach (Cadiz, Spain), about 1 km from the coast at 10 m depth and contains 31 iron guns and a large anchor along with other minor remains, corresponding mostly to the middle third of the ship (see Fig. 1).

2. HYDRODYNAMIC SIMULATIONS AND FIELD SURVEYS

Under assumption that the main site corresponded to the location where “Fougueux” ran aground and from where it was broken up into pieces, we used already existing ocean circulation and transport models ([4], [5]) to simulate ocean conditions resembling those taking place from 22nd to 29th October 1805. Knowing that the ocean circulation in this area is dominated by wind and tides, and having documentary information about the meteorological conditions during and after the Battle of Trafalgar and about the time of the “Fougueux” grounding, we used that information for prescribing the tidal and wind forcing in the simulations. Fig. 2 shows the dispersion pattern of a passive tracer released at the main site location under a SW wind of 20 m/s (gale force). The dispersion pattern clearly indicates a drift to and along the coast with a strong northward component, pointing out the areas with highest probability of find-

ing large remains from the “Fougueux”. In summer 2009 those areas were extensively surveyed by means of Side Scan Sonar imaging, high resolution magnetometry and in situ diving, resulting in the discovery of 4 additional sites containing 35 guns and a large anchor whose characteristics and dating are similar to those of the previously known site (Fig. 1) [6]. The location of the additional sites matches the modelling results, consistent with the main site as a tracer source and a SW gale force wind induced current and waves. Noteworthy, the additional sites are nearly aligned with the 8 m isobath at almost fixed distance of 400 m from the present coastline forming an imaginary line identified as the position of the coastline in 1805 [7]: Smaller pieces with shallower draft were able to drift almost to the shoreline.

4. CONCLUDING REMARKS

We have made utilized validated ocean circulation and transport models to simulate the dispersion pattern of “Fougueux” remains. The ocean circulation of the shipwreck area is determined mainly by tides and wind. Therefore, a precise timing of the accident (in order to properly establish the tidal conditions) and knowledge of the weather conditions at the earlier shipwreck stages are needed. Unfortunately for the ships and crews taking part in the Battle of Trafalgar, the came under an unusual severe storm from the SW after the end of the firefight. It was a storm of such unusual strength, that, fortunately for us, diverse documentary sources provide ample information on it. This allowed us to prescribe adequately the tidal and wind forcings obtaining a coherent dispersion pattern which has been validated by the findings of subsequent surveys. The results of our study point out the usefulness of hydrodynamic modelling as a tool for identification and optimization of resources in prospecting scattered shipwreck sites.

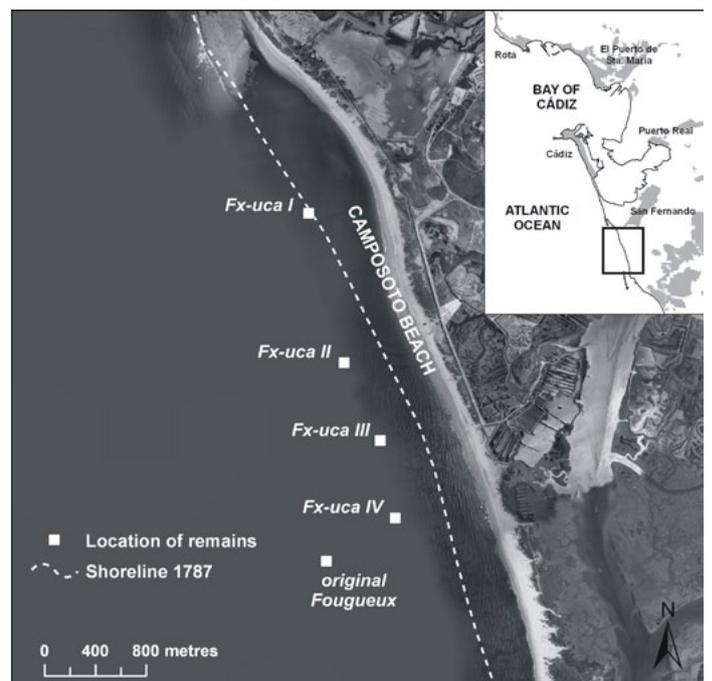


Figure 1. Location of the “Fougueux” archaeological remains on the basis of a 2002 orthophoto. Dotted line is the 1787 coastline, georeferenced with respect to Vicente Tofiño map (1787).

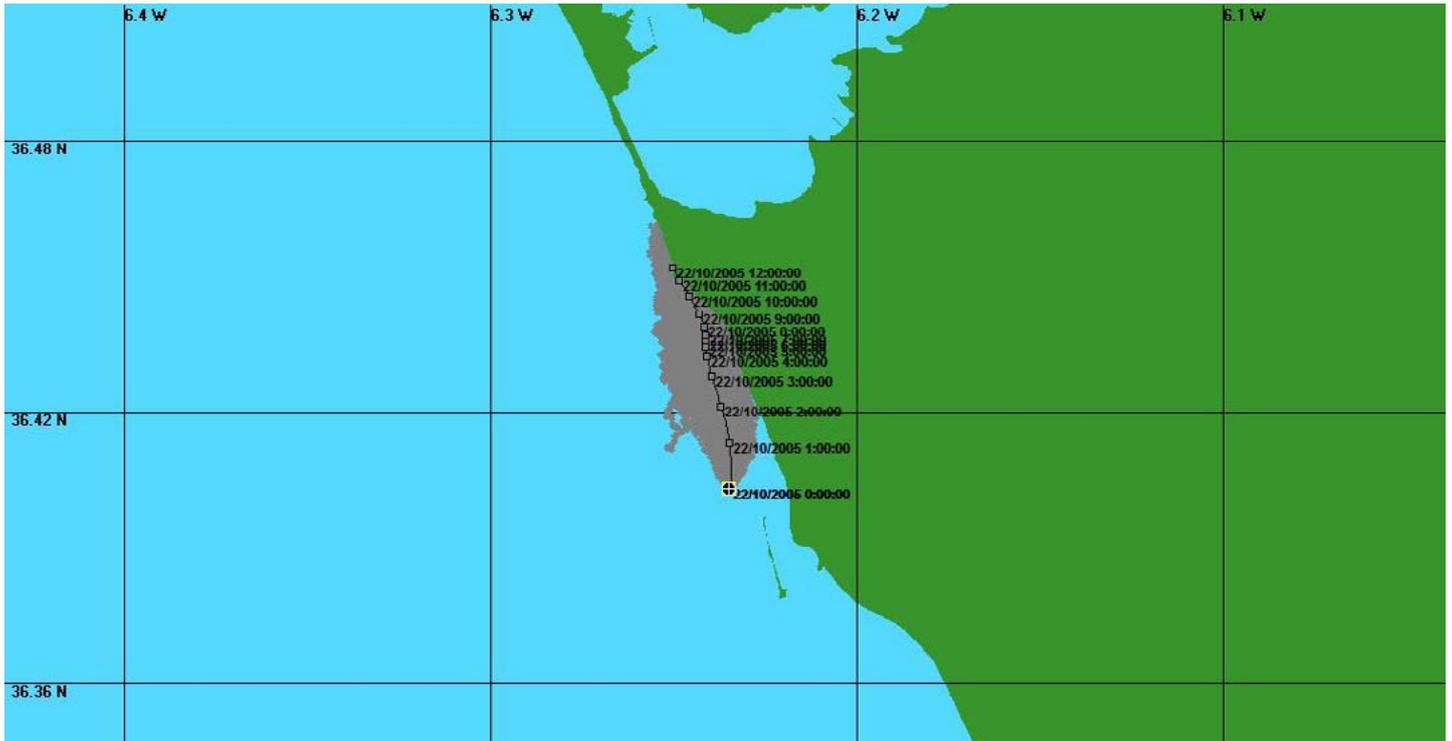


Figure 2. Dispersion pattern of a passive tracer released as a continuous source located at the main shipwreck site. The simulation was forced by a constant homogeneous wind of 20 m/s from the South-West.

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