



# SEAHA

CENTRE FOR DOCTORAL TRAINING IN  
SCIENCE AND ENGINEERING IN  
ARTS HERITAGE AND ARCHAEOLOGY

## Fully Funded SEAHA Studentship:

### Characterising marine archaeological iron degradation and the efficacy of treatments to date: worth a shot?

Artefacts made of iron have a strong tendency to corrode, and where they have survived in the archaeological record, their conservation represents a major challenge. The corrosion process is accelerated by the presence of chloride ions and is also dependent upon the burial environment and the initial composition of the iron. This inherent variability has made it difficult to obtain a suitably controlled sample of corroded iron where the effects of different conservation treatments may be studied. Furthermore, the unique character of much archaeological material frequently renders more intrusive forms of analysis, involving the removal of samples, undesirable. This project overcomes some of these difficulties by the analysis of material from Henry VIII's flagship *Mary Rose*, which was excavated in 1982. Among the vast collection of Tudor iron artefacts recovered are approximately 900 examples of iron shot, which have undergone various treatments to remove Cl ions, and have also experienced varied storage conditions. This project therefore exploits a unique opportunity to analyse the corrosion processes, products and treatment efficacy from a relatively uniform initial set.

**Aims and methodology:** The overall aim of this project is to fully interrogate this set of shot as well as other iron from the *Mary Rose*, for example that which has been preserved in contact with wood. It will build on this crucial information to determine a future conservation strategy for the iron from the wreck. The main research questions are:

1. How does the iron shot degradation vary in terms of products and progression into the artefact, relative to their conservation treatment and storage environment?
2. How do the corrosion rates of archaeological iron compare to modern day iron and what are the implications of this for conservation?
3. How does iron corrosion develop as part of a component in a composite material (e.g. iron fixtures in wood) and how can this be remediated?

The research will build upon the very large body of expertise The Mary Rose Trust has developed on archaeological iron from the marine environment, as well as the expertise and instrumentation available at Diamond Light Source. Using techniques including scanning electron microscopy, synchrotron X-ray diffraction and X-ray Absorption spectroscopy, the student will characterise the corrosion products on Mary Rose iron, and quantify their relative proportions and their short and long-range order. A custom cell will be designed and manufactured allowing direct measurement of the corrosion rates of iron from the ship, under varying conditions and in a range of media. The student will be supported by a heritage supervisor with strong familiarity with the Mary Rose (Dr Eleanor Schofield, a materials scientist and conservation manager at Mary Rose Trust), a supervisor from Diamond Light Source who will provide training and support in synchrotron-based analytical methods (senior beamline scientist Dr Giannantonio Cibin), an industrial supervisor (Mr Robert Turner of EURA Conservation Ltd) who will provide guidance from an applied conservation perspective and an academic supervisor (Prof Ian Freestone, University College London) who will take overall responsibility for the project and coordinate training in necessary scientific skills.





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**Academic entry criteria:** We welcome students with any good physical science or engineering undergraduate qualifications, including the scientific side of earth or environmental science, or those with a strong background in conservation or archaeological science. Please contact the academic supervisor Ian Freestone ([i.freestone@ucl.ac.uk](mailto:i.freestone@ucl.ac.uk)) if you have any queries about the project and your suitability for it.

**Further information:** The project, which is funded by EPSRC and co-funded by Diamond Light Source, is part of the EPSRC Centre for Doctoral Training in Science and Engineering in Arts, Heritage and Archaeology ([www.seaha-cdt.ac.uk](http://www.seaha-cdt.ac.uk)). SEAHA students are involved in activities ranging from residential events and group projects, to conferences and careers events. The SEAHA Studentship will cover home fees and a stipend of up to £16,726 per year (current rate) for eligible applicants (<http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/>) and a substantial budget for research, travel, and cohort activities. The student will pursue the MRes SEAHA at UCL in year 1 and then the PhD for years 2-4 of the SEAHA scholarship. It is intended that 12 months in years 2-3 will be spent at Diamond Light Source. Specialist training will be provided in the generation and analysis of data from synchrotron and more general laboratory techniques.

## How to apply:

Your application should include:

- A covering letter clearly stating:
  - Your motivation and how the course will contribute to your career development
  - Your residency status and eligibility for funding according to the information provided <http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/>, or how you intend to sponsor your studies if not eligible for funding
  - Your academic eligibility
- Names of two academic referees (or one academic and one professional if applicable)
- Proof of meeting the UCL English language proficiency requirements where necessary. For SEAHA candidates, an advanced level certificate is normally required (details of English language proficiency requirements can be found at <http://www.ucl.ac.uk/prospective-students/graduate/apply/english-language/index>)
- A short research proposal (max. 2000 words) written by taking into consideration the above research questions

The award will be subject to a Grant Agreement between University College London, The Mary Rose Trust, Diamond Light Source and EURA Conservation Ltd.

Applications should be sent by email directly to:

SEAHA Centre Manager

[manager@seaha-cdt.ac.uk](mailto:manager@seaha-cdt.ac.uk)

UCL Institute for Sustainable Heritage

**Application deadline:** Midnight (GMT), Sunday 21<sup>st</sup> June 2015.

UCL Taking Action For Equality

