In-situ conservation of historical metallic shipwrecks: complementary approach from on-site global measurements to multiscale characterization

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Thousands of historic metallic wrecks are lying underwater along the European coasts, as testimonies of the industrial revolution and especially the two World Wars conflicts. Until now, few attention has been given by academics to those vessels leading to severe looting and degradation. Beyond the loss of our modern cultural heritage, the collapse of these structures also provokes the release of polluting compounds, e.g. oil, toxic compounds from chemical weapons, with drastic consequences for the marine environment. The ***Save Our Shipwrecks*** project (SOS) proposes to implement cathodic protection treatments on two shipwrecks lying off the French Mediterranean (Marseille) and Channel coasts (Dieppe), respectively. Cathodic protection (CP) is widely practiced for uncorroded metals but its application on bio-colonized and corroded structures constitutes a real scientific and technical challenge.

This work presents the innovative methodology and the first results obtained **1)** to understand the corrosion mechanisms, including microbiologically induced and anaerobic corrosion, and **2)** to assess the effectiveness of CP on shipwrecks, by combining:

- on-site measurements of electrochemical corrosion potential and metal residual thickness with the prototype Triton©;
- biodiversity analysis on historic samples and surrounding environment;
- multiscale characterization of corrosion layers and concretions carried out in anoxic conditions
- electrochemical tests on samples surface and on each corrosion layer