

INTRODUCTION

Aluminium has proven itself as lightweight, durable and affordable material that allows naval ships to go faster speeds, carry bigger payloads and travel longer ranges [1-4]. The catamarans, are an example of high speed craft category entirely built in aluminium, more precisely, aluminium alloy, which activity may be performed in both marine and estuarine environment, as in the case of passenger transport. The aluminium - magnesium (Al - Mg) alloy, particularly the AA 5083, is one of the aluminium alloy commonly used in shipbuilding where density materials, good mechanical properties and better resistance to corrosion are desired [5].

This work, which is part of a National Joint Industry Project (PROTEJO) on corrosion protection for ships built entirely in aluminium - catamarans, presents the results of 2 years of the 3 years of natural exposure test performed in estuarine environment. The aim of this long-term exposure test was the characterization of the corrosion behavior of the alloy AA5083 in splash and immersion zones, and also the assessment of the microbiological influence on the corrosion process.

EXPERIMENTAL

At the end of 2 years of exposure 12 test panels of alloy AA5083 were removed (6 samples for each of the different exposure zones). The panel's surface was cleaned and dried with cold air. A visual assessment of the test panel's surface was performed with the aim to select the samples (surface and cross section) for scanning electron microscopy (SEM) observation to allow representative morphological analyses. The SEM observation was performed using a Philips FEG-SEM, mode XL30 microscope coupled with qualitative microanalyses performed using an energy dispersive spectrometer (EDS). Before observations the surface and cross section samples were coated with a sputtered layer of gold (Au) in order to reduce charging effects.

RESULTS & DISCUSSION

SEM observations and EDS analysis of the samples exposed in the splash and immersed zones revealed:

- The presence of pitting corrosion on AA 5053 surface exposed in the splash zone not covered with biofouling (SQ1/SQ2), in opposite to the regions of the surface where it was observed the presence of biofouling, as green and some brown algae (SQ5/SQ6).

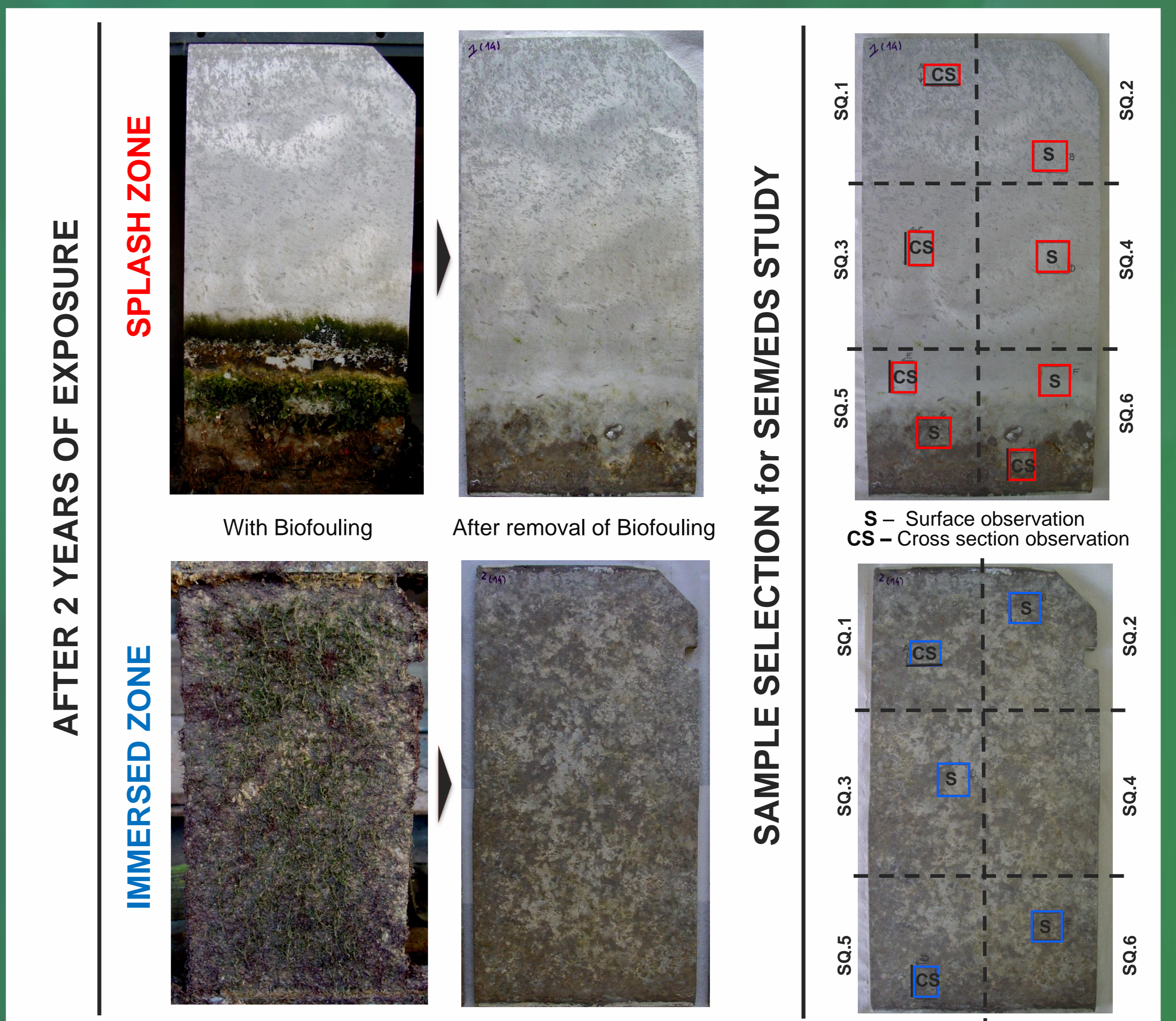
- The presence of calcareous deposit on the alloy surface exposed in the immersed zones indicates a biomineralization process (SQ5/SQ6). The formation of pitting has not been observed on the surface totally covered by a biofouling layer consisting mainly by adherent brown and red algae.

Based on the results obtained and summarized in this poster at this stage of the project, the following questions should be raised:

- Is the compact mineral deposit formation beneath the biofouling layer of the AA 5083 surface after long immersion period in shallow waters, the main responsible for inhibition of the corrosion process?

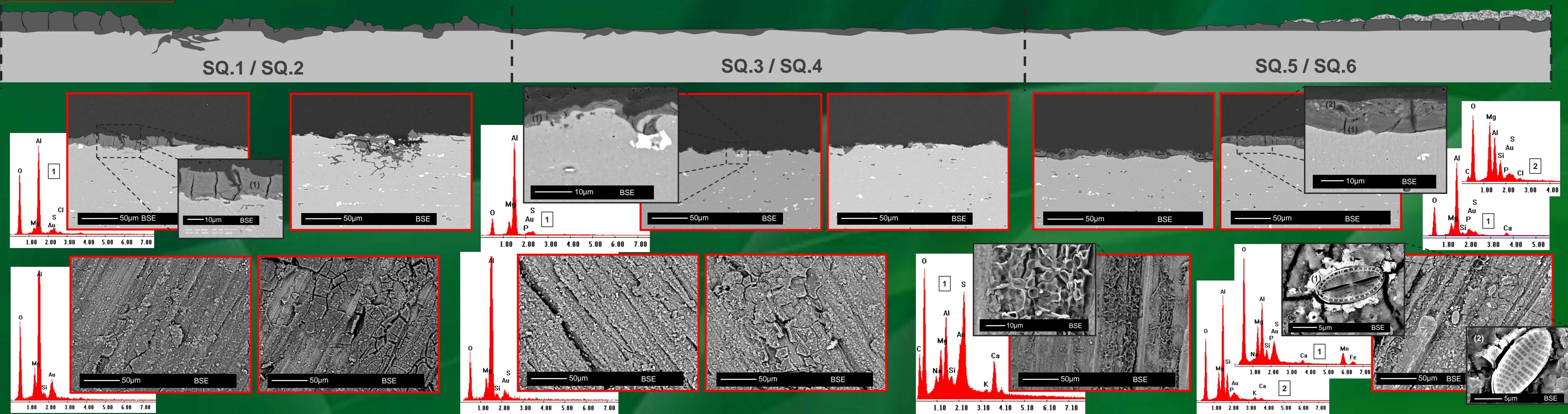
- If microbiologically induced corrosion inhibition (MICI) is confirmed, what are the characteristics of biofilm responsible for this phenomenon (characterization of microbial community structure and composition) and what type of interactions are established between the biofilm and the substratum at micro- and nano- meter scales?

Currently XRD analysis are being performed and also electrochemical tests as electrochemical Impedance spectroscopy (EIS) are being envisaged to characterize the influence of the deposit formation beneath the biofouling layer on the corrosion behavior of the alloy AA 5083. Other surface analyses techniques and electrochemical tests are necessary to complement the characterization of the compact mineral deposit on the AA 5083 surface exposed for 2 years and for the correlation with further results to be obtained for the samples exposed for 3 years.



SPLASH ZONE

Profile representation of AA5083 surface after 2 years of Estuarine exposure



IMMERSED ZONE

Profile representation of AA5083 surface after 2 years of Estuarine exposure

