Barnacle Attachment and Its Corrosion Effects on the Surface of the Yangtze Estuary II Shipwreck

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Abstract: Wooden shipwrecks submerged in underwater environments are susceptible to physical and biological corrosion. This study investigates the microscopic morphology and structural composition of barnacles and the wooden surface of the Yangtze Estuary II shipwreck. Analytical techniques, including optical microscopy (OM), scanning electron microscope equipped with an energy dispersive spectrometer (SEM-EDS), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Fourier infrared transform spectroscopy (FTIR) and photoluminescence spectroscopy (PL), were employed to analyze the corrosion processes. The findings have unveiled a distinct pattern of black corrosion, prominently concentrated within the interface region where barnacles attach to the wooden shipwreck. This corrosion primarily consists of FeS, FeS_2 and Fe_3S_4 and exhibits a notable tendency to expand along the wooden surface to interior region. Additionally, a striking ultraviolet fluorescence phenomenon emanates from the barnacle cement within the adhesion region of barnacles and the wooden surface. This observation has led to the hypothesis that the origin of this black corrosion is intricately linked to the barnacle cement, its role in biological corrosion, and subsequent biomineralization processes. To conclude, this study provides an intricate account of the microbial corrosion process influenced by barnacle cement in the context of the wooden shipwreck. The research findings offer valuable insights that can serve as a point of reference in identifying the sources of disease and implementing protective measures for waterlogged wooden cultural relics.

Keywords: Yangtze Estuary II shipwreck, microbial mineralization, corrosion process

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