

Understanding the long-term corrosion mechanisms of iron in an anoxic environment is essential in the field of the preservation of archaeological heritage artefacts and nuclear waste management. Corrosion mechanisms have been assessed by examining nails 400 years old from the archaeological site of Glinet. This chapter provides an overview of the characterisation of the entire corrosion system environment/samples through coupled multiscale analytical tools. The environment is anoxic, calco-carbonated and water-saturated. Three corrosion patterns composed of ferrous carbonates (siderite and chukanovite) and magnetite have been identified. Depending on the connection between the phases and their location, the electronic properties of the corrosion layers have been established. The electrochemical behaviour of the corrosion system shows that water reduction at the metallic interface is negligible. Furthermore, the electron consumption sites are mainly localised on the external part and the precipitation sites on the internal part of the corrosion layer. The corrosion rate is estimated to be less than 2?m/year and a corrosion mechanism is proposed based on a decoupling of the anodic and cathodic sites and on the existence of a nanometric corrosion layer at the metallic interface.

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