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RESEARCH ARTICLE

# Laboratory and synchrotron x-ray micro–computed tomography to shed light on degradation features of corroded Roman glass

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**Abstract**

This study explores the three-dimensional structure of Roman glass through the combined use of laboratory and phase-contrast synchrotron x-ray micro–computed tomography. This original approach validates a noninvasive analytical procedure designed to enhance the understanding of glass degradation mechanisms, crucial for the preservation of historical artefacts. The high-resolution images obtained reveal the intricate internal structure and morphology of various forms of glass deterioration, including cracking, pitting, and the formation of multilayered iridescent patinas. The research provides compelling evidence of corrosion processes and interaction mechanisms with burial soil, shedding light on the chemical and physical interactions that occur over centuries. By characterizing and examining the long-term alteration of ancient glass, this work contributes to the field of archaeometry, offering insights into how different types of glass withstand the test of time in diverse environmental conditions. The findings have important implications for conservation strategies, enabling better preservation techniques for glass artefacts.

KEYWORDS

burial alteration, cultural heritage, glass corrosion, micro–computed tomography, synchrotron

## 1 | INTRODUCTION

Glass corrosion, influenced by intrinsic factors such as material composition and extrinsic agents such as environmental conditions, remains a complex and debated topic despite widespread recognition. Understanding of the degradation processes in natural environments is still progressing, and the interplay of environmental factors in glass corrosion is not entirely clear, even after extensive research.[1–6] Recent research has shown that analyzing real-life instances of prolonged glass degradation could greatly improve our comprehension of underlying mechanisms and assist in formulating effective strategies to address glass corrosion.

The ultimate aim of this study is to investigate the formation mechanisms of various degradation features observed on ancient glass, exploring how environmental interactions influence these features within