CORPUS PUBLISHERS

Journal of Mineral and Material Science (JMMS)

ISSN: 2833-3616

Volume 7 Issue 1, 2026

Article Information

Received date : March 11, 2026

Published date: April 06, 2026

*Corresponding author

Semeniuk V, V & C Semeniuk Research Group, Warwick, USA

DOI: 10.54026/JMMS/1134

Opinion

Sequences of Patina Structures on Glass Developed Experimentally and on Decades Old to 100-Year Old (Natural) Examples

Clifford P[1,2] and Semeniuk V[1*]

[1]*V & C Semeniuk Research Group, Warwick, USA*

[2]*School of Arts & Sciences, The University of Notre Dame, Fremantle, USA*

Opinion

Patina is developed as a thin crust on glass (Concise Oxford Dictionary of Archaeology 2008) in Western Australia partially buried in carbonate-and-quartz soil environments through water-driven weathering wherein weakly acidic rainwater in contact with $CaCO_3$ grains evolving in the vadose zone to alkaline meteoric water is in contact with metastable glass. The weathering involves dissolution of SiO_2 in the glass by a film of silica-dissolving vadose waters and the precipitation of silica-rich crust as a film along the water film that penetrates along the glass-vadose-water contact. In the early stages, fungal borings are also evident. We document here patina developed on glass in experimental conditions through to progressively older naturally developed weathering in the field, and are able to trace the development of patina structures from simple to complex. In addition to the complications developed by solution and precipitation of SiO_2, there is also the vadose-water-delivery of clay- and silt-sized exogenic grains (derived from the soil) that are mixed in with the newly developed patina.

The climatic setting and environmental setting for the patination is as follows: Year 5 experimental: simulating a humid climate in sandy carbonate-bearing soils. Year 20 (natural): patination naturally developed in a humid climate in sandy carbonate-bearing soils in Gwelup. Year 100 (natural): patination naturally developed in an arid climate in sandy carbonate-bearing soils in Cossack. The progressive development of patina is shown in Figures 1-3 below. Locations of field sites are described in [1].

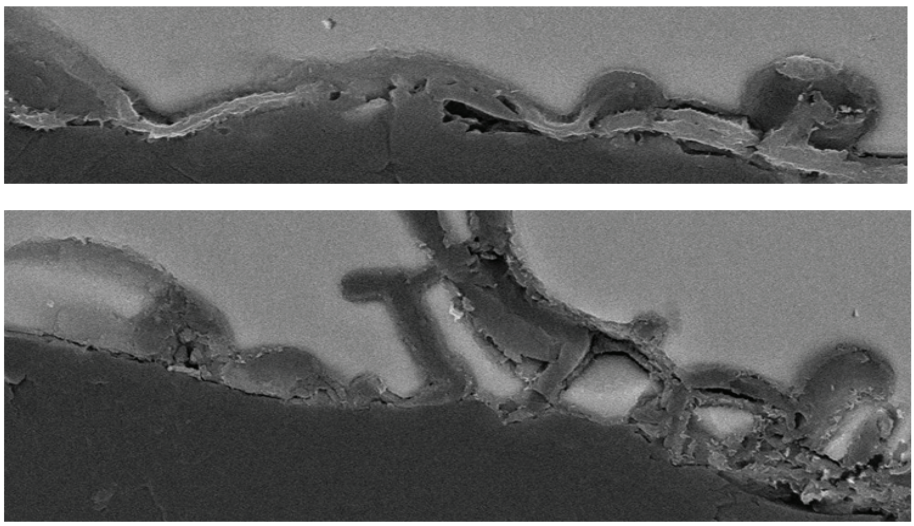

Figure 1: length of image = 15 µm; the surface of the glass is etched: upper - experimental early stage patination with thin films of SiO_2 precipitated on the etched glass surface; lower - experimental early stage patination with fungal borings and weakly developed laminar patina in the bore interiors.

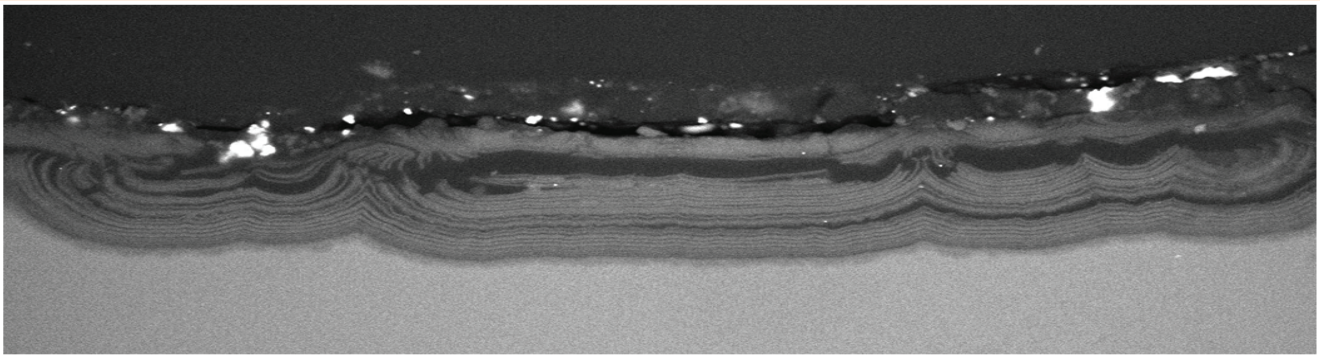

Figure 2: later stage patination (20-year old) from Gwelup with more complex precipitation of thin films of SiO_2 and episodes of solution and precipitation. Bright specks are infiltrated mineral grains. Length of image = 40 µm.

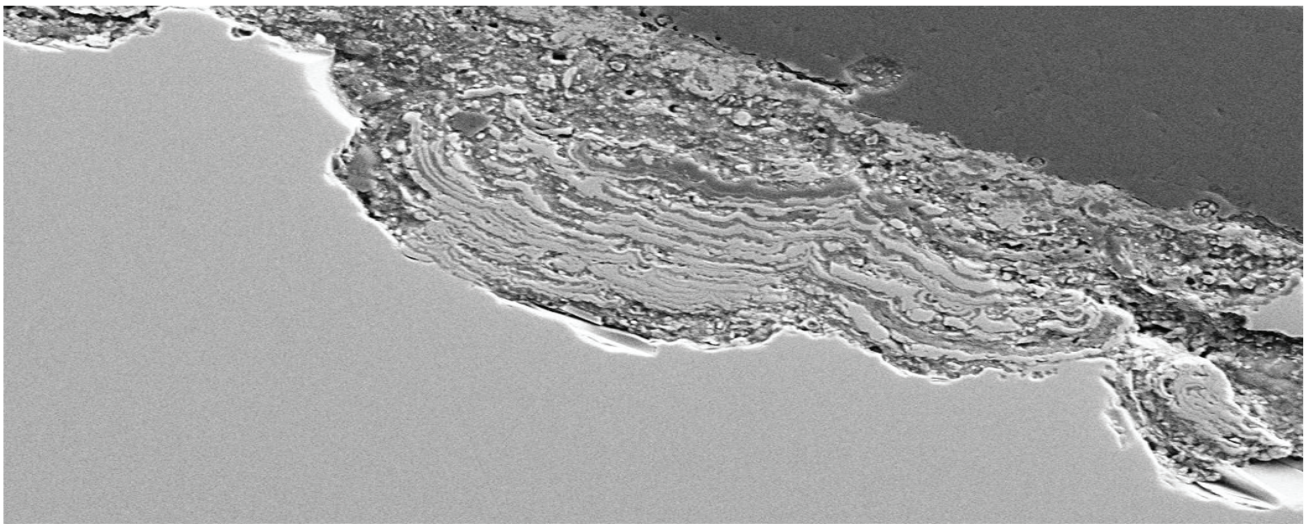

Figure 3: Natural late stage patination (100-year old) with complex episodes of solution and precipitation and micro brecciation. Length of image = 35 µm.

References

1. Clifford P, Semeniuk V (2023). Environments of glass patination in Western Australia. Journal of Mineral and Material Science (JMMS) ISSN: 2833-3616, 4(5).