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Evaluation of Calcium-Based Consolidants for Wall Paintings on Dolomitic Lime Renders

Wall paintings on dolomitic lime renders face specific conservation challenges due to the fragile nature of the substrate. Unlike widely studied calcium lime, dolomitic lime mortars contain several magnesium phases (e.g., brucite and magnesium hydroxide carbonates), which can affect durability. Historically used in Italy, France, Germany, Austria, the UK, and Slovenia (especially in Baroque wall paintings), dolomitic mortars are prone to shrinkage, microcracking, efflorescence, and pigment alteration due to their high water retention and uneven carbonation. Conservation of wall paintings executed on dolomitic substrates presents further challenges, as many inorganic consolidation treatments are chemically incompatible with high magnesium content, limiting effective intervention options. Recent developments in material science have focused on carbonate-based consolidants, which penetrate well and improve substrate strength. This study evaluates the effectiveness of three such consolidants: Calcium acetoacetate (CFW), Nanorestore (NR), and NanoLaq (NL) – used individually and in combinations. Their complementary chemistry was tested on model wall painting samples (using red ochre and azurite on dolomitic lime render, lime secco technique). Applications included single treatments and combinations (e.g., CFW + NR CFW+ NL, etc.).

Samples were analysed over time (30, 90 days) using different analytical techniques. Non-invasive methods included surface hardness testing, ultrasonic velocity measurements and micro-invasive method as the drilling resistance measurement system (DRMS) to measure penetration depth and increase in mechanical properties after the consolidation.

Spectrophotometry was used to monitor colour changes after the application of consolidant. On site study has been also performed. The results show that the colours are slightly darker after consolidation with CFW and the combination of CFW and NL. In contrast, consolidation with NR and the combination of CFW and NR results in slightly lighter areas (white spots), while there is no significant colour change after treatment with NL. The measurements of surface hardness show that in most cases the values are higher compared to the untreated substrate. Similarly, DRMS measurements show increased values for CFW and NL alone, as well as for the combination of CFW with NR. The results contribute to better understanding of dolomitic lime interaction with carbonate-based consolidants and sustainable practices in preservation of wall paintings.

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