Investigating Rock Surface Coatings – an integrated environmental and archaeological approach

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A fundamental problem confronting archaeologists specialising in rock art is the need for a reliable method for dating. Our research aims to test the reliability of the uranium-series method for dating ancient rock art that is naturally covered by mineral coatings (rock varnish and travertine deposits), and to examine the biogeochemical mechanisms under which rock varnishes form.

For rock varnishes, selective extraction techniques (as well as total dissolution and laser ablation) have been used to determine the type and concentration of metals (such as U and Th) that are retained in each mineral phase, and also their potential environmental significance. Results indicate that some trace and major elements are considerably enriched in rock varnish and that these elements may serve as important tools for environmental monitoring in arid and semi-arid regions. Preliminary results further indicate that the amorphous Fe-oxyhydroxides/Mn-oxides phase could form a closed system for U and Th. However, U-series dating has been inconclusive because of interfering molecular species that have been incorporated during the chemical treatment and subsequent MC-ICPMS analysis of samples. Future work is planned to source and eliminate these interferences.

For travertine deposits, a test art sample was collected from Lene Hara cave in East Timor. Previous archaeological excavations at this site have revealed two levels of human occupation; a lower level dating to between 35,000 ka and ~30,000 ka and an upper level with Neolithic deposits containing pottery dating to ~3,000 ka. Recent excavation and dating of other areas within this extensive cave indicate that a more complete occupation sequence is likely to be forthcoming. Rock paintings are visible today in the cave and are attributed to the second, younger phase of occupation. They occur on a relatively thick (~2.5 mm) and heavily layered travertine deposit, which partly covers some of the paintings. The results of U-series dating indicate the visible paintings are younger than 6,800 ka. A distinctive red layer was also observed within the deposit beneath the younger red paintings. This red layer may be related to an earlier painting episode, and has been bracketed in age to between 25,600 and 30,300 ka. Laser ablation ICPMS analyses of trace metals further indicate that the chemistry of the heavily layered travertine deposit could be used to understand palaeoenvironmental changes.

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