Non-Destructive, Quantitative Analysis Applied to Pre-Columbian Jade Artifacts from Central America

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Quantitative analysis of jade works of art aids in authentication and in understanding cultural and artistic values of ancient societies. The rarity and value of these highly prized carved objects precludes using destructive analytical methods traditionally applied to geological samples. In addition, visible and near-infrared spectroscopy methods used to identify jade minerals produce spectra that are too non-discriminating. Similarly, other methods, such as visual microscopic examination, although less invasive and non-destructive, are more qualitative and rely on the observer's expertise. Jade and greenstone artifacts (jadeite, nephrite, serpentinite and silica minerals) from Costa Rica and Guatamala (300-800 AD) were analyzed using three non-destructive methods: (1) scanning electron microscopy coupled with energy dispersive X-ray spectrometry, (2) specific gravity measurements, (3) stereomicroscopy. High degrees of textural and mineralogic heterogeneity in the jades presented special problems with the analyses being representative of the artifact. Useful data on crystal morphology, chemical alteration, and markings were also provided by these tests.