Methodological Issues in the Geochemical Characterisation and Morphological Analysis of Stone Tools: A Case Study from Nuku Hiva, Marquesas Islands, East Polynesia

Andrew Joseph McAlister

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ABSTRACT

In this thesis, three methodological issues pertaining to the geochemical analysis and characterisation of stone tools were investigated. The first consisted of evaluating the potential of Portable X-Ray Fluorescence (PXRF) analysis as a means of characterising archaeological basalt adzes. Several of the methods currently used to analyse stone tools require the partial destruction of specimens and are comparatively expensive, factors which tend to impose limits on the quantity of specimens that can be analysed. In contrast, PXRF technology is relatively inexpensive and non-destructive. The initial testing of the PXRF instrument was unsatisfactory and found the in-built calibration software to be the main limiting factor. Substantially improved results were obtained by processing the raw spectra data independently.

The second part of this study assessed multivariate methods of discriminating among volcanic stone sources. Two techniques, Discriminant Function Analysis (DFA) and Classification Tree (CT) analysis were examined. The implementation of CT analysis developed in this study incorporated Support Vector Machine (SVM) algorithms to determine optimum node divisions. Both of the techniques performed well. However, CT analysis was found to possess several advantages over DFA; it was more robust to unequal and skewed data distributions and the tabular and graphical results were conducive to interpretation and evaluation.

The third part of this research involved applying the methodological findings to investigate the distribution of stone tools on the Marquesan island of Nuku Hiva in East Polynesia. Stone adzes collected from late-prehistoric (i.e., post — A.D. 1600) contexts at four valleys on Nuku Hiva were geochemically and morphologically analysed. The assemblages were found to have derived from six distinct stone sources, five local Nuku Hiva sources and one on Eiao, an island approximately 100 km to the north. Almost one-half of the adzes were imported from Eiao and were common in all of the valleys. In contrast, tools made from local stone were not widely distributed far from their source areas. The morphological analysis found that, while the full range of forms were made from both local and imported materials, stone from Eiao appears to have been preferred for some adze forms that are thought to be functionally distinct.

Keywords: archaeology; Marquesas; Polynesia; interaction; stone tools; geochemistry, PXRF; discriminant function analysis; classification tree; support vector machine

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