Journal of Archaeological Science 40 (2013) 1194–1202

Contents lists available at SciVerse ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

X-ray fluorescence analysis and intra-island exchange in the Society Island archipelago (Central Eastern Polynesia)

Jennifer G. Kahn [a,*], John Sinton [b], Peter R. Mills [c], Steven P. Lundblad [d]

[a] Anthropology Department, The College of William and Mary, Washington Hall, Room 103, 241 Jamestown Rd., Williamsburg, VA 23185, USA
[b] Department of Geology and Geophysics, University of Hawai'i, Manoa, 1680 East West Road, Honolulu, HI 96822, USA
[c] Department of Anthropology, University of Hawai'i, Hilo, 200 W. Kawili St., Hilo, HI 96720, USA
[d] Department of Geology, University of Hawai'i, 200 W. Kawili St., Hilo HI 96720, USA

ARTICLE INFO

Article history:
Received 28 May 2012
Received in revised form
3 October 2012
Accepted 4 October 2012

Keywords:
Society Islands
Eastern Polynesia
Stone tool production
Adzes
Prestige goods
Exchange
X-ray fluorescence
Chiefdoms

ABSTRACT

We apply X-ray fluorescence (XRF) geochemical analysis to a collection of 'Opunohu Valley lithic artifacts from Mo'orea island to investigate the local scale of raw material procurement, adze production, use, and exchange within the Society Island archipelago. We use these data to document the distribution of non-local *versus* local volcanic artifacts in 'Opunohu Valley house sites, ritual sites, and specialized sites, as a means for establishing intra-site production and consumption patterns, and access to exotic, possibly superior, stone resources, and how these two themes correlate with site function or household wealth and status. Overall, 30% of the artifacts analyzed via WDXRF derive from non-local sources, notably two other islands in the archipelago outside of the political boundaries of Moorean chiefdoms. Our case study thus provides the first direct material evidence of intra-archipelago trade and exchange in the Society Islands. Intra-archipelago trade in adzes was certainly in place by as early as A.D. 1350, if not earlier, and continued up until the time of European contact. In addition, our analyses have identified a local adze production locale in the Afareaitu district of Mo'orea island. The patterns of local *versus* non-local adze production and exchange strongly suggest that dual interaction spheres were involved. The correlation between adzes and adze-related debris produced from off-island sources and sites with specialized use, which were often reserved for the social, ritual, and political elites in Ma'ohi society suggests that some of the exotic adzes derived from gift exchange between Mo'orea and ruling elites in Tahiti and the Leeward Islands. These adzes from afar would have solidified socio-political and ideological alliances between elites in the Windward and Leeward sectors of the archipelago.

In Polynesia, compositional studies of adzes and adze-related artifacts have grown in popularity, particularly as a means for assigning artifacts to their geological origin. Stone sourcing studies have been used to test migration models and theories of island settlement and to identify patterns of prehistoric inter-island and intra-archipelago exchange, communication, social interaction, and post-settlement contact (e.g. Best et al., 1992; Walter and Sheppard, 1996; Weisler, 1993, 1997, 1998, 2002; Weisler and Kirch, 1996; Weisler and Woodhead, 1995). Geochemical studies in Central Eastern Polynesia (Cook, Society, Tuamotu, Marquesas, Austral, and Gambier Islands) have often focused on the regional scale, documenting the movement of adzes (or raw materials) between archipelagoes (Collerson and Weisler, 2007; Sheppard et al., 1997; Weisler, 1998; Weisler et al., 2004). In contrast, few researchers have taken a local scale approach, documenting exchange within or between islands in particular archipelagoes, yet analyses such as these are becoming more commonplace (Allen and Johnson, 1997; Bollt, 2008; Rolett, 1998; Sheppard et al., 1997; Walter and Sheppard, 2001; Weisler, 1995, 1996, 1997; Weisler and Green, 2001), most recently in Hawai'i (Kahn et al., 2009; Kirch et al., 2011; Mills et al., 2010, 2011; Mintmier et al., 2012).

We apply X-ray fluorescence (XRF) geochemical analysis to a collection of 'Opunohu Valley lithic artifacts from Mo'orea island to investigate the *local scale* of raw material procurement, as well as adze production, use, and exchange within the Society Island archipelago. A primary goal is to delineate the nature of locally available rock on Mo'orea for stone tool production. Analysis of geological samples from Mo'orea and their comparison with published geological data from the few known sources in the Society

* Corresponding author. Tel.: +1 8083498747.
E-mail addresses: jgkahn01@wm.edu (J.G. Kahn), sinton@hawaii.edu (J. Sinton), millsp@hawaii.edu (P.R. Mills), slundbla@hawaii.edu (S.P. Lundblad).

0305-4403/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jas.2012.10.003

Islands allows us to interpret patterns of trade and exchange within the archipelago and how these relate to the political economy of the warring Leeward (Ra'aitea, Taha'a, Porapora, Huahine, Tupai, Maupiti) and Windward (Mo'orea, Tahiti, Me'etia, Maiao) chiefdoms in the late prehistoric period (Fig. 1). Similar to Mills et al.'s studies of geochemical patterns in large samples of adze debitage from Kaua'i (2010) and the Kona District of Hawai'i (2011), if artifacts display patterned groupings that can be matched with regional geochemical patterns, these data can be used to infer likely quarries on Mo'orea, even if these have since been destroyed or have not been archaeologically recorded.

We then use these data to document the distribution of non-local *versus* local volcanic artifacts in 'Opunohu Valley house sites, ritual sites, and specialized sites. Our goal is to establish intra-site production and consumption patterns, and access to exotic, possibly superior, stone resources, and how these two themes may correlate with site function or household wealth and status. Early studies in Eastern Polynesia posited that elite house sites would have differential access to exchange wealth, which would be represented by higher concentrations of specialized goods, including foreign objects such as adzes produced from off-island sources (Earle, 1987; Weisler and Kirch, 1985). While numerous Hawaiian case studies have illustrated the degree to which elite households had increased access to preferential food stuffs (Field et al., 2010; Kirch and O'Day, 2003), whether or not elite households had increased access to exotic stone tools is still an open question. A recent case study from Maui found that non-local lithic artifacts were most strongly correlated with ritual sites such as temples or priests' residences (Kirch et al., 2011), although at least one elite house site had a high number of non-local artifacts.

Contemporary studies of archaeological exchange illustrate that access to resources at the local level can correlate with household rank as well as with social networks. Exchange items can move within multiple interaction spheres, including prestige spheres (linking elites or perhaps skilled craftsmen), and local-level exchange spheres, where relatively low value or utilitarian goods can move between elites and dependants and between socially close, economically cooperative parties, as a method of gift exchange (see Leach, 1993: 40–41; Peterson et al., 1997). Thus, assessing whether elites had differential access or control over the resources and products of specialized craftsmen as well as determining the value of the exchanged item are equally important.

There is an on-going debate concerning control and access to high-quality basalt sources and craft production of adzes throughout Polynesia. Most generalized models of craft specialization posit that everyday utilitarian goods with broad distribution will be produced by independent specialists, rather than elite-sponsored specialists (Brumfiel and Earle, 1987; Costin, 1991). Adzes are often considered everyday utilitarian items, however, both ethnohistoric and archaeological data indicate that they may represent high value utilitarian craft items (Cobb, 1996; Costin and Earle, 1989; Smith, 1987) or in certain contexts, their production or use may have had ritual importance (Leach, 1993; McCoy, 1990).

The latter is an example of wealth finance, where specialized objects such as prestige goods are used as political currencies (Earle, 1997). Procurement of objects of symbolic value, such as adzes made from off-island sources and traded via exchange, can translate into social power, serving as an avenue for accessing material resources as well as social alliances (Helms, 1979). Thus, we may expect there will be differential patterns of adze consumption between elite and commoner residences and residential *versus* specialized use sites, as a diverse range of elites (priests, warriors, chiefs, members of the high status fertility cult) would have used certain specialized sites as dwellings, activity areas, meeting areas, and ritual locales (Kahn, 2003, 2005; Oliver, 1974). Following this, we investigate whether lithic assemblages at specialized adze production and use locales, essentially areas associated with craft specialists, differ in their source compositions from assemblages at other site types. These data can help establish whether craft specialists had preferential access to highly valued non-local source materials, allowing us to test whether specialization in lithic production and use was related to increased access to high quality or imported raw material. In turn, this relates to our research question concerning the relationship between access to volcanic rocks as raw materials and household wealth and status. If, indeed, there was increased control or preferred access to adzes made from fine-grained volcanic rock sources within certain social spheres of the Society Islands chiefdoms, we may infer that high status residences or specialized sites associated with elite occupational specialists (e.g., priests, craft specialists) should have more abundant high-quality, non-local imports in their adze assemblages, in contrast to the more common use of local raw materials at other excavated house sites.

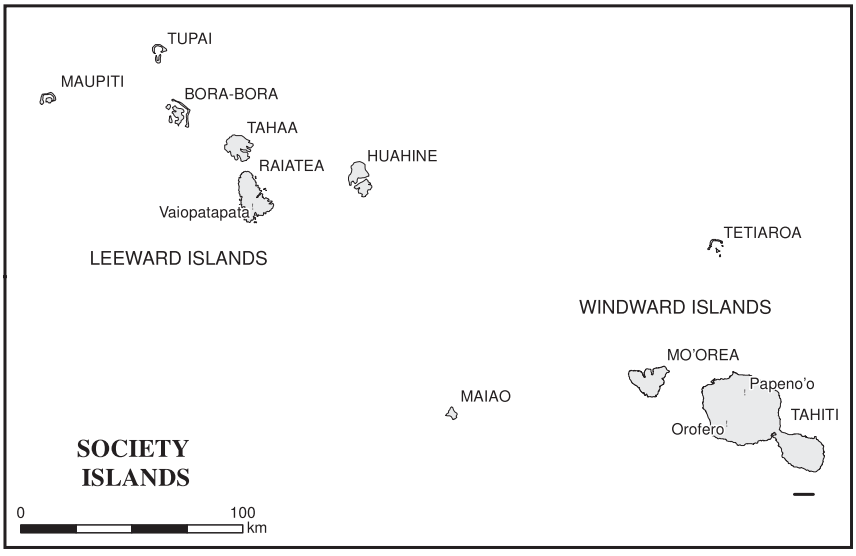

Fig. 1. Society Island Archipelago.