SOCIAL TRANSFORMATION IN OLD HAWAI'I: A BOTTOM-UP APPROACH

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A bottom-up approach based in structuralism and Marxism cast in the "old language of rights" is used to explain traditional Hawaiian import of metric tons of poor-quality oven stone to the Waimanalo Plain, and to explain decline in the traditional use of tree firewood. The presence of poor-quality oven stones and the pattern of tree firewood use are linked to a long-term decline in the importance of rights of person and a concomitant increase of rights of property associated with the demise of lineage organization and the development of social stratification. It is argued that a bottom-up approach is more productive in the current archaeological situation than a top-down approach based in functionalism and neoevolutionary theory.

Algunos sitios arqueológicos del llano de Waimanalo, Isla de Oahu de las Islas Hawaianas, contienen toneladas métricas de piedra de cocinar de mala calidad, toda importada desde afuera. Un enfoque basado en estructuralismo y en Marxismo es utilizado para explicar estos datos. Es decir que es un caso social de "abajo hasta arriba" fundida en la "vieja lengua de derechos" y que sirve para promover una hipótesis que resulta en el descubrimiento de la disminución en el uso tradicional de leña. La presencia de piedra de cocinar de mala calidad y la trayectoria del uso de leña son vinculadas a una disminución de largo plazo de la importancia de los derechos de la persona y un aumento de los derechos de propiedad asociado con la desaparición del poder de linaje y el desarrollo de la estratificación social. La propuesta es que un enfoque de estructuralismo es más productivo para explicar la situación arqueológica que un enfoque de "arriba hasta abajo" basado en funcionalismo y la teoría de neo-evolución.

Archaeologists are rightly interested in the historical trend toward inequality in the social relations instituted by ancient societies. The subject is inherently complex. People are intensely interested in others; they use considerable ingenuity and persistence to negotiate relationships that are pleasing and favorable. Ethnographers and historians, who have more or less direct access to the actions and thoughts of individuals, might capture the full range of this complexity. Archaeologists lack this direct access but have the potential advantage of tracking change over time spans inaccessible to either the ethnographer or the historian. Tapping this potential poses a fundamental problem for the archaeologist: how can the refractory materials yielded by archaeological excavation be associated with changing social relations?

One requirement is a theory or model of social relations that reduces the complexity of the social situation in an analytically useful way. In the Pacific, and especially Polynesia, these models have developed in the context of a strong comparativist tradition that has two broad trends. One model with foundations in functionalism and neoevolutionism (Fried 1967; Service 1962) had an early expression in Polynesia and the Pacific (Sahlins 1958, 1963), and has spawned a large and interesting archaeological literature (Earle, ed. 1991; Earle 1997; Hommon 1986; Kirch 1984, 1990). The other model, which developed in the more diffuse traditions of structuralism and Marxism, was introduced somewhat later (Friedman 1981; Goldman 1970) and has developed mostly outside of archaeology (Biersack 1991; Hage and Harary 1983, 1991, 1996; Hooper and Huntsman 1985; Kirch and Sahlins 1992; Sahlins 1981, 1985; Valeri 1985b).

In the Pacific, studies espousing of both models typically take their analytic units from emic categories that are well-described in a rich

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ethnographic literature. For Hawai'i this involves a distinction between *ali'i*, the leaders of traditional Hawaiian society, and *maka'āinana*, their followers. The structuralist and Marxist studies differ from functionalist and neo-evolutionist studies in other respects: (1) emphasis on the relations between categories rather than on the categories themselves; (2) conceptualization of change as transformative rather than stadial; (3) belief that change is inherent to the social situation rather than a result of some outside stimulus; and (4) development of theory that is specific and local rather than abstract and universal. In Hawai'i, as elsewhere (Robb 2005), functionalist, neo-evolutionist studies—with their local focus on the progressive transition from chiefdom to state and increasing degrees of power and control exercised by novel institutional arrangements—direct inquiry to the top of the social structure. This results in what has been called a top-down view (Gilman 1998). In contrast, approaches with roots in structuralism and Marxism, which appear in archaeology under a variety of guises (e.g., Dobres and Robb 2000; Miller et al. 1989), can view the problem from either end of the social relation, but are often implemented from the bottom up. Clearly, views from the top and bottom are needed to comprehend the full complexity of social relations. In the archaeological literature, preference for one over the other is often based on politics or a particular social theory; the concern with archaeological practice is how it might change to suit the theory. The argument advanced here attempts to isolate qualities of theory that suit archaeological practice. It is concluded that the bottom-up view helps formulate archaeologically useful hypotheses in ways the top-down view cannot.

This paper investigates a transformation of traditional Hawaiian society first theorized by Hommon (1976), in which functions of corporate kinship groups of a type found throughout Polynesia were replaced by managers appointed by and/or related to powerful *ali'i*. The analysis here, following structuralist and Marxist practice, isolates a particular subset of social relations—in this case, the nature of rights used to structure access to productive resources—and elaborates with an economic model the ways in which changes in this set of relations altered patterns of behavior. The approach is from the bottom up; its focus is on the quotidian tasks performed by *maka'āinana*, whose material remains dominate the archaeological record of Hawai'i. This approach was developed to explain a particular characteristic of the local archaeological record that initially seemed to indicate irrational behavior: the import of metric tons of poor-quality cooking stones to traditional Hawaiian sites on the southeastern coast of O'ahu Island.

Statement of the Problem

Archaeological excavations for cultural resources management at traditional Hawaiian sites on the coastal plain of Waimānalo on the windward side of O'ahu Island have yielded surprisingly large quantities of poor-quality cooking stones (Figure 1). Most of the sites on the plain date to the seventeenth and eighteenth centuries (Dye 2000), although site 4852 near the mouth of Puhā Stream, which is not known to have poor-quality cooking stones, dates as early as the tenth century (Tuggle and Spriggs 2001). Archaeological deposits on the plain are relatively thick and rich near the shore, indicating considerable effort was spent cooking and eating marine invertebrates collected from shallow nearshore waters and fish caught with hooks and presumably nets. Away from the shore the deposit is characterized by isolated fire pits used primarily for cooking fish and shellfish, around which a light scatter of cultural material can be recovered from the surface of the paleosol. None of the sites reflect year-round habitation; it is likely that all or most of the people using the Waimānalo Plain kept residences farther inland, near their gardens (Tuggle 1997).

Although ornaments from an undated burial of a young woman near the mouth of Puhā stream have been identified as high-status items (Pearson et al. 1971), the plain lacks the walls and other architectural features typically used in traditional Hawai'i to separate the sacred space of *ali'i* from the secular space of *maka'āinana*. The archaeological deposits yield materials associated with *maka'āinana* activities and it is reasonable to infer that the poor-quality cooking stones were brought to the plain and used there by *maka'āinana*. Although the task of engendering Hawaiian archaeology has just begun (Van Gilder 2001), the activities represented in the deposits reflect fishing that was usually carried out by men, shellfishing prac-

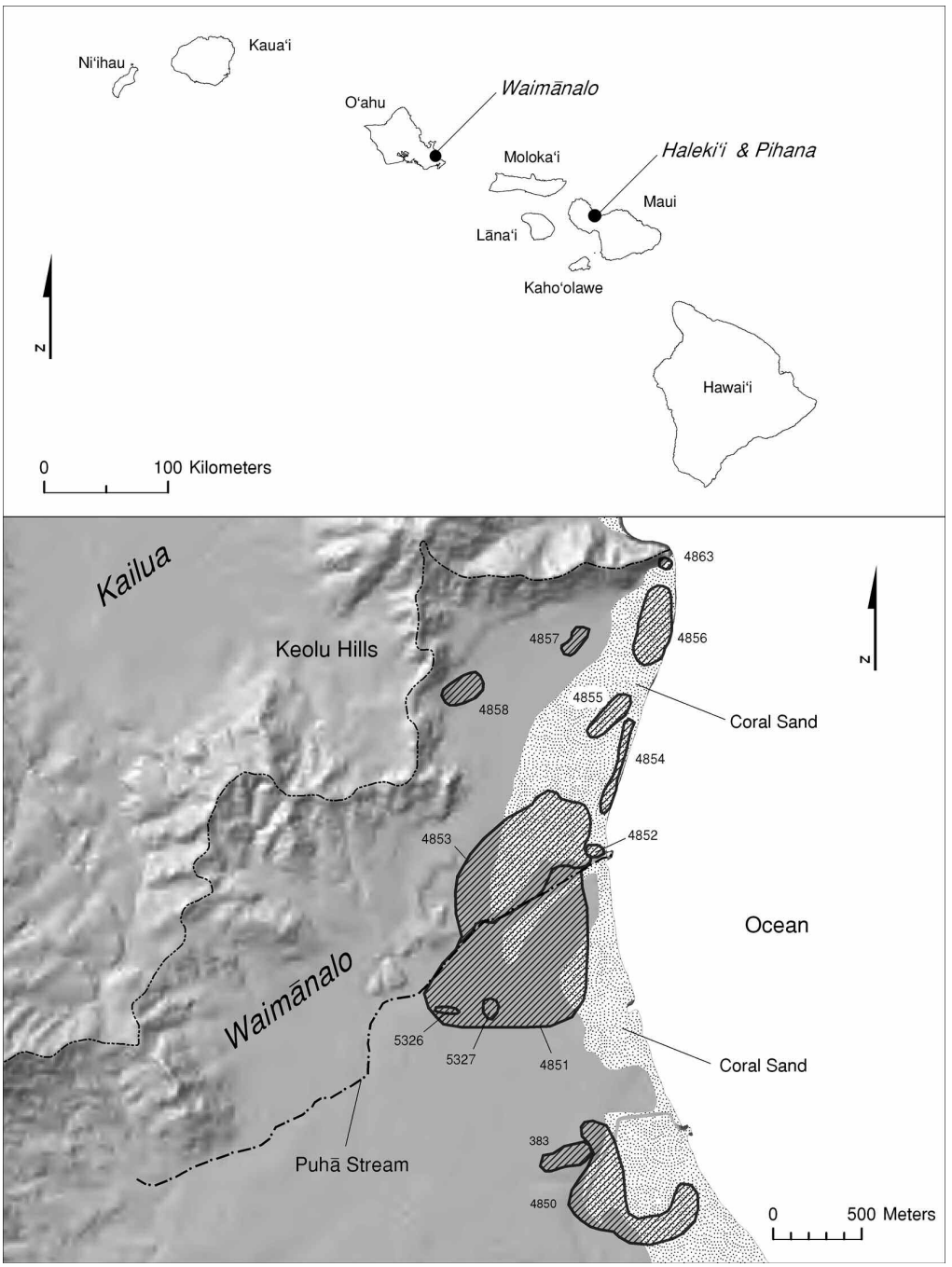

Figure 1. Traditional Hawaiian archaeological sites on the coastal plain of Waimānalo. Site boundaries reflect grading for construction of a military facility in the twentieth century as much as they do patterns of traditional Hawaiian use, which were likely more nearly continuous than the site map indicates. Site numbers from the Hawai'i Inventory of Historic Places were assigned by Tuggle (1997). Map prepared by Eric Komori.

ticed primarily by women and children, and casual cooking, which might have been done by either men or women.

First identified by Michael Desilets in the late 1990s (Desilets and Dye 2002), the poor-quality volcanic cooking stones are definite imports to the Waimānalo coastal plain, which is composed of calcareous sands laid down since the sea retreated from its mid-Holocene +1.8 m high stand (Fletcher and Jones 1996). The stones are found in association with traditional Hawaiian fire pits and earth ovens used to cook fish, shellfish, and, in rare instances, pig. Some of them exhibit the discoloration and spall fractures associated with thermal alteration. All of the stones can be distinguished from the fine-grained, homogeneous rock that was used to make tools and which is found in small quantities in sites on the Waimānalo coastal plain. They all lack the vesicles characteristic of good cooking stones, and their broken condition attests to the fact that they performed poorly in the oven, breaking into pieces in the heat.

Cooking stones are extremely common in archaeological sites on the plain. Excavation of 154 m^2 at site 4853 yielded an estimate that the site as a whole contains 500,090–679,830 kg (Desilets and Dye 2002). Based on a ^{14}C-derived occupation period of 200 years, this works out to 7–10 kg imported daily. A similar pattern is found at site 4856, where excavation of 15.5 m^2 yielded 655 kg of poor-quality cooking stones (McElroy et al. 2006).

The large quantity of poor-quality cooking stone is surprising because an alternative stone requiring less effort was available; earth ovens stocked with a small quantity of high-quality cooking stones are used for years elsewhere in Polynesia. Indeed, this is the practice today in Waimānalo and elsewhere in Hawai'i where the earth oven is still used to *kālua*, or bake, meats such as pork or turkey. Poor-quality cooking stones could be gathered from the Keolu Hills immediately inland of the Waimānalo plain (only a few hundred meters from the sites), while high-quality stones were found somewhat farther away, in the lower reaches of Puhā Stream before it enters the sandy plain, where they are collected today by the people of Waimānalo (Figure 1). Still, the extra effort required to import more than 500-metric tons of poor-quality cooking stone raises the question of why it was done. One possible answer is rooted in the *maka'āinana* transformation of traditional Hawaiian society in which access rights were fundamentally altered.

Theoretical Background

Marshall Sahlins' work with Dorothy Barrère on mid-nineteenth-century Hawaiian land records revealed that traditional Hawaiian social relations governing *maka'āinana* access to resources were unique in Polynesia, in which the difference was of kind rather than degree. In Sahlins' (1992) words:

> Everything looks as if Hawaiian society had been through a history in which the concepts of lineage—of a classic Polynesian sort, organizing the relations of persons and tenure of land by seniority of descent—had latterly been eroded by the development of chiefship. Intruding on the land and people from outside, like a foreign element, the chiefship usurps the collective rights of land control and in the process reduces the lineage order in scale, function, and coherence [Sahlins 1992:192].

The questions of when and how the transformation occurred have been taken up by archaeologists, all of whom either advocate (Cordy 2004) or implement a top-down approach (e.g., Hommon 1976, 1986; Earle 1997, 1998) . Implementations of the top-down approach first identify in the ethnographic or historical record an element of *ali'i* control with a material expression that persists in the archaeological record. The development and elaboration of this material element, revealed through archaeological investigation, is then used as an index of the development and elaboration of *ali'i* control. In Hommon's (1976, 1986) case, the material element was the traditional *ahupua'a* land division administered by contact-era *ali'i* as a tax unit. The formation of this unit, Hommon (1976, 1986) argued, is visible in the archaeological record as the establishment of inland settlement throughout the islands by the early fifteenth century. In Earle's (1997, 1998) case, this material element was the agricultural facility, in particular the irrigated taro pondfields that were the most productive components of the traditional Hawaiian agricultural system, the use rights to which *ali'i* controlled in the contact-era. In Earle's (1997, 1998) view, *ali'i* control over these and similar

facilities was in place by the fifteenth century, after which their rapid expansion was a means to "institutionalize the financial structure of the new chiefdoms" (Earle 1997:86).

The top-down approach applied in this way to archaeological materials is limited in its ability to investigate changes in social relations. Its focus on *ali'i* ignores *maka'āinana* agency; however, *maka'āinana* agency must be acknowledged to establish the indexical relationship between the material element and *ali'i* control. What mechanism does the top-down approach rely on to guarantee that social relations developed in tandem with the material indicators of *ali'i* power? The inland settlement that Hommon (1976, 1986) proposed as the archaeological definition of the *ahupua'a* tax unit, and the agricultural facilities that are the focus of Earle's (1997, 1998) analysis could both have originated and developed within the social context of lineages of the classic Polynesian sort; only later, after social relations had begun to change and *ali'i* exercised more control, these settlements were managed as a tax unit or had their use rights wrested from local control. The best that can be expected from the top-down approach applied in this way are *termini ante quem* for the *maka'āinana* transformation. These are useful data, but lacking a theoretical connection, they fall short of directly investigating transformational processes at work in traditional Hawai'i.

Hommon (1976, 1986), Earle (1997, 1998), and Cordy (2004) all recognize this limitation of the approach and each turn to oral traditions to bolster their revised accounts. The oral traditions that were collected in the nineteenth century come to us through the filter of the Kamehameha dynasty, which was ascendant at the time of Captain Cook's visit in 1778 and, under the leadership of Kamehameha I, established hegemony soon after with the aid of firearms, large ships, and western military advisers (Cordy 2000; Fornander 1916–1919; Hommon 1976; Kamakau 1992; Kolb 1994; Kuykendall 1968; Sahlins 1992). An important tradition, brilliantly analyzed by Valeri (1985a), concerns an *ali'i* named 'Umi who lived nine generations before Kamehameha, a time dated genealogically to the mid to late sixteenth century (Hommon 1976:124). 'Umi is credited with forcefully re-uniting the rebellious chiefdoms of Hawai'i Island and with being the first *ali'i* to redistribute conquered lands, a practice consistent with the contact-era situation, by which time *ali'i* had usurped the collective rights of land control. Taken at face value, the tradition indicates that the *maka'āinana* transformation was completed by the time of 'Umi. The problem with this use of tradition is the possibility that practices common in the Kamehameha era were, consciously or unconsciously, projected on a distant past that lacked them. To a certain extent, this is a natural process in the oral transmission of information, where categories of the past are interpreted with modern definitions (Goody and Watt 1963), but a propagandist use of tradition is documented for many societies and has been practiced at least since classical Antiquity (Flower 2002; Hobsbawn and Ranger 1983; Rawson 1969). It would be a mistake to think that Hawaiian tradition was somehow immune to natural processes of semantic change or that it was not interpreted by *ali'i* and their agents to legitimize contemporary social relations. The traditions are a valuable source of information about old Hawai'i, but as a chronological basis for the study of social relations they should be used with caution. Fortunately, difficulties linking top-down theory with archaeological materials are not shared by a bottom-up approach.

Theory from the Bottom Up

A central question in a bottom-up view of the *maka'āinana* transformation is how access to resources changed with the erosion of lineage functions by the development of *ali'i* power. One approach to this question is through comparative ethnography, an analytic method that has been fruitfully applied to Polynesian history (e.g., Kirch and Green 2001). Ideally, descriptions of how access to resources was structured in Hawai'i and several other Polynesian societies would yield a list of features unique to Hawai'i, which likely developed locally. Unfortunately, Polynesian ethnographers paid relatively little attention to the admittedly complex relations governing access to resources (Crocombe 1974). The only firsthand, detailed description of how a functioning Polynesian society structured access to resources is from Tikopia, a small island at the other end of Polynesia from Hawai'i (Firth 1965). This description can be supplemented with reconstructions of extinct social relations in the Society Islands (Oliver 1989;

Panoff 1971;) and the Marquesas (Thomas 1990)—the original homelands of the Hawaiian people (Emory 1959; Kirch 1985; Sinoto 1970)—and New Zealand (Firth 1972). General propositions about access to resources in these societies where lineages structured access to resources can be contrasted with the situation in Hawai'i to formulate propositions about changes in the behavior of *maka'āinana* on the Waimānalo Plain during the transformation period.

Throughout Polynesia, outside contact-era Hawai'i lineages established rights of prior possession to particular resources, which were use rights assigned to group members that allowed them uncompromised access to improved and unimproved land, trees, and the sea. The members managed a variety of rights with respect to these resources, including rights of direct use, indirect gain, control, transfer, identification, and reversionary interest (Crocombe 1974). Importantly, rights held by lineage members were rights of person, rather than rights of property (Bell 1998:34 ff.). A right of property is a claim that others can be excluded from the use or enjoyment of some thing; a right of person is a claim that one cannot be excluded from such a use or enjoyment (Macpherson 1985:77). Typically, a right of person cannot be alienated by the person who holds it. Such rights are revoked only under extraordinary circumstances. In Polynesia, rights of person were transmitted to heirs, a process that gave the lineage continuity on the land.

Characteristics of the Waimānalo Plain—the low productivity and undependability of its coral soils for traditional Hawaiian agriculture and the slim possibilities the soils hold for improvement or intensification—have been proposed as universal indicators of lands likely to have been held in common (Netting 1976:144). This view of the plain as former common land is supported by the fact that when fee simple title was instituted in the mid nineteenth century, a process known in Hawai'i as the *Māhele*, most of the plain went unclaimed and the few small claims that were made were located along the banks of Puhā Stream (Tuggle 1997). From an economic point of view (Ostrom 2000), *maka'āinana* before the transformation would have enjoyed rights of person in the commons, including: (1) rights of *access* to the land and its resources; (2) rights of *withdrawal* of resources for use and enjoyment; (3) rights of *management* to transform the resource by making improvements; and (4) rights of *exclusion* to participate in the determination of who else would share access and withdrawal rights. In a property rights regime, economists call individuals with this bundle of rights *proprietors* (Ostrom 2000), although this designation inverts the true relation that lineage members had with the land. In the context of rights of person, they made members of the lineage people who belonged to a place (Peters 1998:360).

The traditional Hawaiian tenure system has been discussed extensively (Cannelora 1974; Chinen 1958; Dole 1892; Earle 1978; Hommon 1976; Kame'eleihiwa 1992; Kelly 1956; Sahlins 1992) and there is widespread agreement on its basic elements: (1) the Hawaiian tenure system was a property rights regime; (2) rights held by *maka'āinana* were revocable at the pleasure of *ali'i* and their agents; (3) rights of access to, withdrawal from, and management of house lots and garden lands were granted to individuals by *ali'i* or their agents—*maka'āinana* were *claimants* (Ostrom 2000) of these lands; and (4) rights held by *maka'āinana* to other lands in the *ali'i*'s domain were limited to access and a few forms of withdrawal (Hawaii 1994)— *maka'āinana* were *authorized users* of these lands (Ostrom 2000).

Viewed from the bottom up, the *maka'āinana* transformation meant that people whose ancestors once exercised an inalienable right to access, withdraw, and manage the resources of the Waimānalo Plain, and within the context of the lineage, to decide how and where others could do so, found themselves with rights of access and with limited rights of withdrawal that could be revoked by an *ali'i* at any time. Their ancestors had been people who belonged to the Waimānalo Plain. After the transformation, *maka'āinana* needed authorization from someone unrelated to them to use former lineage lands, and claims they might make to intrinsic rights could be contested.

An Explanation and Elaboration

Changes in *maka'āinana* status during the transformation affected their activities on the former common lands of the Waimānalo Plain, as predicted by economic theory. Private property proponents have long argued that investment in land requires

Table 1. Radiocarbon Ages of Fire Pit Features from Site 4856.

Laboratory	Fire pit	Material	$\delta^{13}C$	CRA*
Beta-208589†		*Chenopodium oahuense* wood charcoal	-26.6	140 ± 40
Beta-208590†		*Sida* cf. *fallax* wood charcoal	-24.9	90 ± 40
Beta-208591†		*Aleurites moluccana* nutshell	-25.7	140 ± 40
Beta-246786‡	Feature 4	*Sida* cf. *fallax* wood charcoal	-25.4	380 ± 40
Beta-251245‡	Feature 5	*Chenopodium oahuense* wood charcoal	-24.5	260 ± 40
Beta-251243‡	Feature 9	*Aleurites moluccana* nutshell charcoal	-24.9	350 ± 40
Beta-251244‡	Feature 10	*Sida* cf. *fallax* wood charcoal	-24	250 ± 40
Beta-251242‡	Feature 12	*Sida* cf. *fallax* wood charcoal	-24.4	200 ± 40
Beta-251246‡	Feature 17	*Chenopodium oahuense* wood charcoal	-21.9	240 ± 40
Beta-251247‡	Feature 22	*Cordyline fruticosa* wood charcoal	-22.6	450 ± 40
Beta-251248‡	Feature 23	*Aleurites moluccana* nutshell charcoal	-25.6	390 ± 40

*Conventional ^{14}C age (Stuiver and Polach 1977).
†McElroy, Dye, and Jourdane (2006).
‡Lebo, Dye, and Dye (2009).

that users with rights of property possess a full bundle of rights—access, withdrawal, management, exclusion, and alienation—and that they be *owners* in the fullest sense. Economists have discovered that, under certain circumstances, the full bundle of rights is not needed to spur investment. Proprietors, who lack the right of alienation that would make them owners, often make similar levels of improvements to their lands (Ostrom 2000). Beyond this, however, there is a threshold where investment slows or stops. When users lack the security of tenure required to expect a reasonable return, they curtail their investments.

Given the insecurity of tenure afforded authorized users in a property rights regime, it is reasonable to hypothesize that *maka'āinana* did not invest the time and effort needed to bring high-quality cooking stones to the Waimānalo Plain after the transformation. Lacking rights of management and exclusion now claimed by *ali'i*, *maka'āinana* could not expect that an oven's worth of high-quality cooking stones would be found where they had been left. The shift from rights of person to rights of property that defines the *maka'āinana* transformation meant that the institutional framework of the lineage that would identify and sanction a thief was no longer at the disposal of *maka'āinana*. With little expectation that high quality cooking stones could be used a second time, *maka'āinana* instead hauled down poor-quality stones from nearby hills to serve the task immediately at hand. This practice, repeated over and over, is responsible for the metric tons of poor-quality cooking stones recovered from archaeological sites.

Because the poor-quality cooking stones are associated with cooking pits and earth ovens, it is possible to date with confidence when they were brought to the plain. Twenty-three features associated with poor-quality cooking stones have been dated with wood charcoal selected to minimize the effects of in-built age. Twelve of these radiocarbon dates—Beta-120317 through Beta-120328—from site 4853 have been reported elsewhere (Dye 2000). The other eleven radiocarbon dates from site 4856 are reported here (Table 1). The radiocarbon age determinations were calibrated using Bayesian methods (Buck et al. 1999). A single phase model was developed in which the age determinations were assumed to be a random sample from a uniform distribution. The calibration estimated phase boundaries; the early boundary represents an estimate of the onset of poor-quality cooking stones on the plain. The 95.4 percent highest posterior density region for the early phase boundary is A.D. 1414–1611. There is a 93 percent probability that the poor-quality cooking stones were being transported to the plain before the seventeenth century. Behavior theoretically consistent with post-transformation social relations was thus almost certainly in evidence on the Waimānalo Plain in the late sixteenth century.

The model yielded by this analysis posits an early period when the lineage structured access to the resources of the Waimānalo Plain. During this period, cooking was done in a few fire pits and earth ovens that used high-quality cooking stones over long periods of time in a behavioral pattern typically followed elsewhere in Polynesia and in Hawai'i today. Sometime before A.D. 1611, *maka'āinana* found that they could no longer keep

their high-quality cooking stones from being stolen. They grew tired of selecting and transporting high-quality cooking stones to the plain and instead gathered low-quality cooking stones from the closest source, hauling down new stones each time they anticipated cooking on the plain.

To date, there are no archaeological data to support the posited early period, but there are plausible reasons why this might be so. Excavations of early period deposits were carried out in the 1960s and 1970s, before poor-quality cooking stones were identified in the 1990s. Excavators could not have known that it would later become important to characterize cooking stones, which were typically not collected at that time. Also, the model posits the import of relatively few high-quality cooking stones; they would be rare finds in any case. Nevertheless, the lack of demonstrated change leaves the model open to criticism based on equifinality of the archaeological record. Equally plausible alternative hypotheses might readily be imagined. Clearly, the model would be strengthened by a record of change ostensibly related to the *maka'āinana* transformation.

One place to look for change is suggested by laws of the Hawaiian kingdom, which document negotiations between *ali'i* and *maka'āinana* over access to firewood. The so-called Kuleana Act of 1850, which offered *maka'āinana* fee simple title to residential and garden lands, recognized that *maka'āinana* depended upon customary access to undeveloped lands for their livelihood and sought to preserve access for those who left customary tenures for fee simple titles. This provision of the Act, which survives in modern law as Hawaii Revised Statutes 7–1, provides in part that "where the landlords have obtained, or may hereafter obtain, allodial titles to their lands, the people on each of their lands shall not be deprived of the right to take firewood, house-timber, *aho* cord, thatch, or *kī* leaf, from the land on which they live (Hawaii 1993:276)." The Act's concern with preserving *maka'āinana* access to firewood was not new; it was one subject of laws enacted by King Kauikeaouli Kamehameha III a decade earlier within the context of the customary tenure system. These laws intended to restrain the exercise of property rights by agents of *ali'i* and to protect customary *maka'āinana* gathering rights. On November 9, 1840, the King signed a law that (1) limited the timber that could be made *kapu* to one kind; (2) kept the sandalwood and "all large trees such as one man cannot clasp (Hawaii 1994:35)" for the King; and (3) prohibited the kindling of fires to "burn up all the verdure of the mountain (Hawaii 1994:35)." This law was only partially effective and a clarification signed by the King six months later prohibited *ali'i* or their agents from making *kapu* any "article except timber (Hawaii 1994:54)," including (1) "those things which are lying on the top of the ground (Hawaii 1994:54)"—an apparent reference to deadwood, (2) "the fruit of the trees (Hawaii 1994:54)," (3) "roots growing in the ground (Hawaii 1994:54)," and (4) "the *ō'hi'a lehua* [a tree, *Metrosideros polymorpha*] which one man can clasp (Hawaii 1994:54)."

Analysis indicates that there is archaeological evidence of negotiations like these in the detailed record of the wood charcoal from traditional Hawaiian fire pits on the plain (Murakami 1997, 1998, 2002, 2009). Charcoal has been identified from 26 fire pits; these include the fire pits with poor-quality cooking stones discussed above and fire pits where the cooking stone quality was not reported. Identified charcoal included wood, roots, stems, nutshells, nut kernels, bark, twigs, parenchyma, and bits of tubers (Table 2). Of these, the woods, nutshells, and rind of a gourd were identifiable to one of 21 native plants, five Polynesian introductions, and one wood, *Pinus* sp., alien to Hawai'i but often present as driftwood on Hawaiian beaches, including the beach fronting the Waimānalo Plain (Strong and Skolmen 1963).

The identified plants were mostly trees, but included six different shrubs, five shrub-trees that varied in habit between large shrubs and small trees, as well as pieces identified as fern, vine, and grass. The weights of charcoal pieces identified as trees, shrubs, shrub-trees, nutshells of the tree *Aleurites moluccana*, and a residual "other" category that contained ferns, vines, grasses and charcoal that could not be identified sufficiently to determine habit were presented for each of the fire pits in Table 3, which also gives the conventional radiocarbon age of charcoal of a short-lived taxon collected from the fire pit. Most of these radiocarbon ages are reported in Dye (2000); the eight radiocarbon ages not reported there are presented in Table 3.

Table 2. Taxa Identified in Fire Pit Charcoal.

Family	Taxon	Hawaiian	Origin	Habit	Part
	Monocotyledoneae				root
	Monocotyledoneae				stem
	Pteridophyta			fern	stem
Agavaceae	*Cordyline fruticosa*	*kī*	Poly. intro.*	shrub	root
Agavaceae	*Cordyline fruticosa*	*kī*	Poly. intro.	shrub	wood
Amaranthaceae	*Nototrichium* sp.	*kulu'ī*	native	shrub-tree	wood
Apocynaceae	*Rauvolfia sandwicensis*	*hao*	native	tree	wood
Arecaceae	*Cocos nucifera*	*niu*	Poly. intro.	tree	nutshell
Arecaceae	Palm sp.			tree	wood
Asteraceae	*Bidens* sp.	*ko'oko'olau*	native	shrub	wood
Chenopodiaceae	*Chenopodium oahuense*	*'āheahea*	native	shrub-tree	wood
Cucurbitaceae	*Lagenaria siceraria*	*ipu*	Poly. intro.	vine	rind
Ebenaceae	*Diospyros sandwicensis*	*lama*	native	tree	wood
Euphorbiaceae	*Aleurites moluccana*	*kukui*	Poly. intro.	tree	nutshell
Euphorbiaceae	*Aleurites moluccana*	*kukui*	Poly. intro.	tree	cf. kernel
Euphorbiaceae	*Aleurites moluccana*	*kukui*	Poly. intro.	tree	wood
Fabaceae	*Acacia koa*	*koa*	native	tree	wood
Malvaceae	*Abutilon* sp.	*ma'o*	native	shrub	wood
Malvaceae	*Hibiscus* sp.	*aloalo*	native	shrub	wood
Malvaceae	*Gossypium tomentosum*	*ma'o*	native	shrub	wood
Malvaceae	*Hibiscus tiliaceus*	*hau*	native	shrub-tree	wood
Moraceae	*Artocarpus altilis*	*'ulu*	Poly. intro.	tree	wood
Myrsinaceae	*Myrsine* sp.	*kōlea*	native	tree	wood
Myrtaceae	*Metrosideros polymorpha*	*'ōhi'a lehua*	native	tree	wood
Oleaceae	*Nestegis sandwicensis*	*olopua*	native	tree	wood
Pinaceae	*Pinus* sp.		alien	tree	wood
Pittosporaceae	*Pittosporum* sp.	*hō'awa*	native	tree	wood
Poaceae	Poaceae			grass	stem
Rhamnaceae	*Colubrina oppositifolia*	*kauila*	native	tree	wood
Rosaceae	*Osteomeles anthyllidifolia*	*'ūlei*	native	shrub	wood
Rubiaceae	*Bobea* sp.	*'ahakea*	native	tree	wood
Rubiaceae	*Canthium odoratum*	*alahe'e*	native	shrub-tree	wood
Sapindaceae	*Dodonaea viscosa*	*'a'ali'i*	native	shrub-tree	wood
Scrophulariaceae	*Myoporum sandwicense*	*naio*	native	tree	wood
Solonaceae	*Nothocestrum latifolium*	*'aiea*	native	tree	wood
	unidentified				bark
	unidentified				twig
	unidentified				stem/root
	unidentified				parenchyma
	unidentified				tuber
	unidentified				wood

*Polynesian introduction.

These data support the determination (Mosteller and Tukey 1977:21) that the contribution of tree wood to the fires built on the Waimānalo Plain declined over time (Figure 2). The data appear to reflect a behavioral change in fire-making. Fires made solely with shrubs have a long history on the Waimānalo Plain; examples span the entire period. In contrast, fire pits with large proportions of tree wood charcoal become increasingly rare over time and the proportion of tree wood charcoal in these pits declines. This pattern appears to reflect several centuries of negotiation over access to firewood leading up to the laws of the early Hawaiian Kingdom.

Discussion

Traditional Hawaiian archaeological sites on the Waimānalo Plain yield two lines of evidence associated with the *maka'āinana* transformation. The presence of large quantities of poor-quality cooking stones by A.D. 1414–1611 is hypothesized as

Table 3. Charcoal Identifications by Weight (g).

Fire pit	Beta-	CRA*	Tree	Shrub	S/T†	Nut‡	Other	Total
Site 50–80–11–4856								
Feature 4††‡‡	246786	380 ± 40	.03	1.09	.03	2.32	.14	3.64
Feature 5††‡‡	251245	260 ± 40	.01	.63	.33	.17	.02	1.17
Feature 9††‡‡	251243	350 ± 40		.18	.11	1.67	.04	2.00
Feature 10††‡‡	251244	250 ± 40	.01	1.03	.10	.15		1.30
Feature 12††‡‡	251242	200 ± 40		5.13				5.13
Feature 17††‡‡	251246	240 ± 40	.01	.09	.06	.14	.09	.39
Feature 22††‡‡	251247	450 ± 40	2.04	.76			.16	2.96
Feature 23††‡‡	251248	390 ± 40	.54	.28		.36		1.18
Site 50–80–15–4851								
Trench 4, Feature 2§¶	111024	140 ± 60	1.43	1.07	.36	.04	1.08	6.27
Trench 4, Feature 3§¶	111023	310 ± 40	.34	.07	1.35		.16	2.97
Site 50–80–15–4853								
Feature 1§‖	120317	140 ± 50	.53	.25	.03		3.19	4.10
Feature 5§‖	120318	150 ± 50	.50	.21	.38	.46	2.52	4.07
Feature 9§‖	120319	350 ± 80	7.79	2.20	2.35	.20	3.35	15.89
Feature 13§‖	120320	230 ± 50	9.13	2.82	4.06	20.72	6.76	43.55
Feature 15§‖	120321	110 ± 70	1.32	1.27	1.00	5.34	2.17	11.10
Feature 16§‖	120322	310 ± 60	17.24	.50	7.86	3.32	3.59	32.51
Feature 17§‖	120323	170 ± 60	.55	.07	.64	1.64	.27	3.17
Feature 18§‖	120324	250 ± 50		.44	.04	93.23	.14	93.85
Feature 19§‖	120325	270 ± 70	2.34	.24	2.33	5.45	2.24	12.60
Feature 20§‖	120326	330 ± 60	3.58	3.21	4.98	2.60	2.91	17.28
Feature 24§‖	120327	400 ± 70		1.91	.08	3.99	.24	6.22
Feature 25§‖	120328	220 ± 50		1.12	.61	1.36	.07	3.16
Trench 5, Feature 1§	111022	150 ± 40	5.29	7.63	4.57	.16	.99	22.23
Unit BT-23, Feature 10§**	101872	680 ± 40	4.31	.26				4.57
Unit BT-23, Feature 9§**	101871	720 ± 40		.67			.02	.69
Unit BT-5, Feature 6§**	101869	230 ± 60	.15	.02	.07		.05	.29

*Conventional ^{14}C age (Stuiver and Polach 1977).
†Shrub-tree.
‡*Aleurites moluccana* nutshell.
§Dye (2000).
¶Dye (1998).
‖Desilets and Dye (2002).
**Addison (1997).
††Lebo et al. (2009).
‡‡See table 1.

a rational economic response by *maka'āinana* to a loss of management and exclusion rights on lands of the Waimānalo Plain after lineage functions were usurped by *ali'i* property right claims. The decline in tree wood charcoal in fire pits is hypothesized as the result of negotiation between *ali'i* and *maka'āinana* over rights to withdraw firewood from formerly common lands. Where the poor-quality cooking stones evidence the outcome of a process associated with the *maka'āinana* transformation, the decline of tree wood charcoal establishes a pattern of change that tracks one aspect of that transformation. The two lines of evidence support and corroborate one another. Theorized in the context of an economic model of changing local social relations, this is Polanyi, Arensberg, and Pearson's (1957) approach to analysis of the nonmarket economy as "instituted process." The process makes sense because it is situated within its historically specific institutional framework of access rights to productive resources and not because it is a putatively general characteristic of society at a particular stage of development.

The persistent problem of equifinality in the archaeological record means that alternative hypotheses can be proposed for the presence of poor-quality cooking stones and for the decline in tree wood charcoal. If the poor-quality stone was

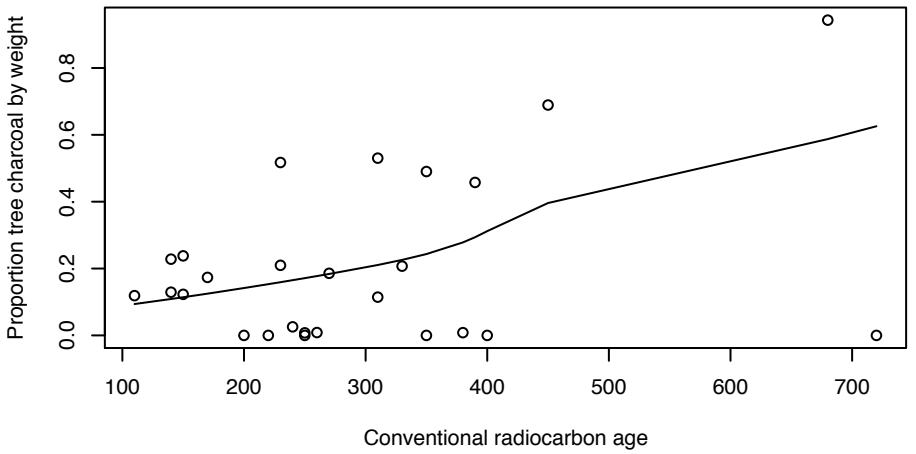

Figure 2. Proportion by weight of tree wood charcoal in fire pits of the Waimānalo Plain. The locally weighted regression line was calculated by the lowess procedure (Cleveland 1985:167 ff.) with a smoothness parameter, *f*, set to its maximum of 1.

the only kind brought to the plain in traditional Hawaiian times, then it might have had certain functional advantages that: (1) are not recognized today; (2) outweighed its obvious disadvantages; and (3) might be determined experimentally (e.g., Di Piazza 1998). Similarly, the decline of tree wood in fires might plausibly be due to a decline over time in the number of trees in the vicinity (e.g., Kirch et al. 2003).

Alternative hypotheses such as these focus the realm of inquiry outside traditional Hawaiian society. They imply that people in general were responding to objective physical conditions, such as the behavior of certain rocks under high heat or the composition of local vegetation, without regard to social conditions. By placing the impetus for behavior and change outside society, they ignore agency. A solution to the problem of gathering wood for a fire is no doubt dependent to some extent on what materials are readily at hand. The long-standing practice on the Waimānalo Plain of fueling some fires almost entirely with shrub wood clearly shows the influence of local conditions that are well-suited to the growth of shrubs. But even if the plain were not a good source of tree wood for fires, it was still, in a physical sense, within the power of *maka'āinana* to bring firewood to the plain in the same way they imported metric tons of poor-quality cooking stones. It is instructive to compare the fuels used by *maka'āinana* on the Waimānalo Plain with those used by *ali'i* living in a similar environment on windward Maui Island (see Figure 1). Fire pits excavated at the *ali'i* residence of Hale Ki'i and the nearby war temple of Pihana yielded, on average, 56 percent tree wood charcoal (Kolb and Murakami 1994), about three times more than was common in Waimānalo at the time. Clearly, even if trees were in short supply in the windward Maui lowlands, it was still possible for *ali'i* to withdraw firewood from forests; the wood charcoal evidence suggests it was less and less possible for *maka'āinana* on the Waimānalo Plain to exercise this right.

The bottom-up approach focuses on the quotidian activities of *maka'āinana* that were responsible for creation of the vast majority of the archaeological record of traditional Hawai'i. The poor-quality cooking stones and shrubs used to build fires that cooked fish and shellfish caught and collected by *maka'āinana* men, women, and children as part of their daily activities are keys to tracking the transformation of *maka'āinana* rights. This contrasts strongly with explanations formulated by the top-down approach, which often take the form of an origins narrative (Moore 1995) in which the remote past is reconstructed in terms of later periods, for which thoughts and attitudes are recorded. As an example, the fact that *ali'i* in the early historic period controlled access to agricultural facilities means that the agricultural facilities

themselves were "the structure of rights and obligations within the local community" (Earle 1998:103). This analytic move conflates things with the rights held in them and stands in the way of investigating a central problem of the *maka'āinana* transformation—how rights in productive resources change over time. It also downplays the fact that correspondence between the built landscape and *ali'i* control was never perfect. During the mid-nineteenth-century Māhele division of lands, many *maka'āinana* claims to facilities and lands were denied precisely because *ali'i* had not authorized their construction or use. Even at a time when the power of *ali'i* and their western advisers was near its zenith, rights to agricultural facilities enjoyed by *maka'āinana* varied from place to place. The top-down approach falters in the formulation of an archaeologically useful hypothesis because the archaeologist cannot hope to distinguish between an agricultural field that was established with the consent of an *ali'i* from one that was not.

What emerges from the bottom-up approach is a view of the *maka'āinana* transformation as a process in which rights were repeatedly negotiated, not as abstract principles, but through activities that reciprocally defined the agency of *ali'i* and *maka'āinana*. Losses on one front were made up, if only partially, by gains on another. Like most human affairs, the *maka'āinana* transformation must have been complex and often messy. Given the evidence in early Hawaiian kingdom law for negotiation between *ali'i* and *maka'āinana* over access to firewood and the archaeological evidence for a long decline in tree wood charcoal in fire pits on the plain, it was a long process as well. The bottom-up approach realizes archaeology's unique contribution to an understanding of the historical trend toward inequality in the social relations instituted by Hawaiian society by helping to reveal in the archaeological record the messy complexity of the *maka'āinana* transformation in the fullness of time over which it played out.

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Note

1. Hawai'i Inventory of Historic Places site numbers are used here without their usual prefixes; sites of the Waimānalo Plain use either 50–80–11– or 50–80–15–.

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