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The View From out on a Limb, or Confessions of a Generalist

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ABSTRACT

The papers of this symposium demonstrate the value of the Dye-Komori technique, a new tool for the analysis of suites of radiocarbon dates. If we accept the argument that radiocarbon annual frequency distributions are isomorphic with demographic history, then application of this technique to the Hawaiian archaeological data makes it possible to address a broad range of issues including colonisation, intensification, limits on agricultural growth, and the rise of sociopolitical complexity. The symposium papers together with previously collected data indicate a remarkably consistent precensal demographic sequence throughout Hawai'i, with early colonisation of all eight main islands followed by a rapid increase in population to a peak around A.D. 1450, a slow decrease for some 150 years, and a precipitous decline after about A.D. 1600.

Keywords: HAWAI'I, RADIOCARBON DATING, DEMOGRAPHY, CULTURAL PHASES, SOCIOPOLITICAL COMPLEXITY, CHRONOMETRICS, AGRICULTURE, VOLCANIC GLASS DATING, INTENSIFICATION, CONTRACT ARCHAEOLOGY.

This symposium marks the arrival of a new and valuable analytical tool, developed by Tom Dye and Eric Komori, for the interpretation of suites of radiocarbon age determinations. Individually, each of the papers offers insights into the history of a wide variety of regions and ecological zones of Hawai'i before Western contact. Taken collectively, the papers offer novel ways of seeing and interpreting the radiocarbon data to illuminate the history of the whole archipelago.

Perhaps because of the importance of detail to the practice of our profession, archaeologists sometimes have difficulty appreciating the forest for the trees. By nature a generalist, I have often had somewhat the opposite problem as I have made my way up a tall but skinny sapling of data and out on to a slender, trembling limb attempting to view the broad sylvan vista.

Around 1976, I was casting about for archaeological data that would illuminate some ideas about the development of sociopolitical complexity in the Hawaiian archipelago. The limited in-depth archaeological work focusing on religious structures and elite habitation sites had yielded little useful information, a situation that, with a few notable exceptions (e.g., Kolb 1991), has not changed in intervening years. Demographics and evolving settlement patterns, represented by dated archaeological sites, seemed to offer a way of investigating processes that might be related to the rise of complexity in Hawai'i.

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The graphs that I constructed in this pursuit were based primarily on estimates of occupation spans of sites dated by hydration rind analysis of volcanic glass artefacts (Hommon 1976). I suggested that this thin, crude database was, more or less, a direct reflection of the demographic and settlement history of the research areas and perhaps of the Hawaiian archipelago as a whole. The insubstantial nature of the limb I had edged out on, particularly considering the breadth of vision sought, would be laughingly obvious to archaeologists in Hawai'i today, in part because volcanic glass is currently out of favour as a chronometric tool (cf., e.g., Graves and Latefoged 1991).

In 1976, the available data appeared to support a four-phase scheme. During Phase I (A.D. 500–1400), the population was evidently small, rapidly growing, and mostly limited to the coastal zone. Phases II (1400–1550) and III (1550–1650), appeared to exhibit reduced rates of overall growth, with rapid increase in the inland zone accompanied by slow growth in the coastal zone. Phase IV (1650–1778) was characterised by curves that, depending on the interpretation of the data, seemed to show at least a substantially slowed rate of population increase and at worst, precipitous decline. In general outline, many of the graphs we have seen presented in the symposium papers speak of a demographic history resembling the one that I sketched 16 years ago.

Dye and Komori (this issue; Dye ms.) present a cogent argument for isomorphism of the radiocarbon annual frequency distribution diagrams and Hawai'i's demographic history. In the discussion that follows, I accept their argument, although I think that the late pre-contact data may be problematical.

As with any tool, especially a powerful one, we must be sure that we take the time and effort to learn how to use the Dye-Komori technique properly. For example, Dye (pers. comm.) has recommended, once we have generated an annual frequency distribution diagram, that we pin it to the wall, walk to the other side of the room and look at it with eyes slightly out of focus. Characteristics of the curve that are still visible when we follow these directions should tell us something useful about the archaeological record and Hawai'i's precensal tale. This is what I call the 'step back and squint' procedure, or 'squintosis', a technique of generalist intuitive statistics which I have often found useful.

In the present case, the most obvious and significant result of the application of squintosis is a marked similarity among the various curves presented in these papers, beginning with a slow increase, followed by a sharp rise, and ending with a long-term, uneven decline. With exceptions noted by the various authors, these curves are considered to reflect to a significant extent the demographic history of the areas, regions, and islands from which the radiocarbon samples were collected.

Hawaiian history as outlined by these curves can be considered as a succession of five cultural phases, which are briefly summarised below with approximate dates for the archipelago as a whole. During what I call the *Pioneer Phase* (a few generations around A.D. 200 ± 300), Polynesian voyagers established the first successful colony. We have no clear evidence of this phase and it is little discussed in the symposium papers.

The early portions of many of the graphs presented in the symposium correspond to the beginning of logistic curves that appear to signify the presence of a small but growing population thinly distributed throughout much of the Hawaiian archipelago by about A.D. 1000. Some of the archaeological sites of these early centuries may represent temporary or seasonal camps of fishermen, collectors, and exploring expeditions. However, the widespread distribution of these sites, together with the evidence from succeeding centuries, indicate that during this *Colonisation Phase* (*ca.* A.D. 200 ± 300–1000), established communities were founding permanent colonies on all eight major Hawaiian islands.

The only areas of those described in the symposium papers for which we have no evidence before A.D. 1000 are the Mauna Kea adze quarries and mid-slope workshops (Streck this issue) and North Hālawa Valley (Spear this issue). The absence of pre-1000 evidence at North Hālawa, on the leeward side of O'ahu, appears to be an example of the often repeated observation, strongly supported by Allen (this issue), that leeward regions of Hawai'i tended to be colonised up to 200 years later than windward regions.

For more than a decade, the results of radiocarbon analyses have suggested to archaeologists that the fifteenth century was a period of unprecedented growth in Hawai'i. Application of the Dye-Komori technique has greatly sharpened our focus on the *Expansion Phase* (A.D. 1000–1450), which culminates in a population peak around the mid-15th century. If the radiocarbon curve for habitation sites accurately reflects the demographic curve as indicated by Dye and Komori (this issue), the final doubling of population took place within a single human lifetime.

Evidence presented in the symposium papers by Allen, Williams, Spear, Cleghorn, Streck, and Athens, Ward, and Wickler supports previous studies regarding the sequence of settlement of windward and leeward regions. In windward regions studied by symposium authors, rapid population growth, including large-scale expansion into and intensification in inland zones, appears to have been common between about A.D. 1200 and 1450; in leeward areas such as North Hālawa valley, O'ahu, the same process took place some 150 to 200 years later.

Information in several of the symposium papers provides valuable insights into the Expansion Phase. Allen's discussion of the production and distribution of charcoal in agricultural fields is essential to an understanding of their ages and functions. In contrast with the windward-leeward dichotomy discussed by Allen and others, Spear's data from leeward Hālawa Valley and Williams' from the windward Kāne'ohe display some interesting similarities. In both inland areas, situated on opposite sides of the Ko'olau Mountains of O'ahu, temporary campsites appear to have preceded permanent habitations by some 150 to 200 years. The establishment of these early temporary or intermittently-occupied sites may represent a continuation of the exploration and initial clearing and cultivation of the inland zone begun during earlier phases. The subsequent appearance of permanent housing appears to provide evidence of population growth, agricultural intensification, and a major shift in settlement pattern.

Athens, Ward and Wickler document a broad spectrum shift in the pollen record at Kawainui Marsh, indicating a rapid decline in *Pritchardia*, *Dodonaea viscosa* and other taxa beginning about A.D. 1000, followed within the next two centuries by a substantial increase in grasses and cheno-ams and other evidence of land clearing and cultivation. These dramatic changes closely parallel the evidence of agricultural expansion from the archaeological sites inland of the Marsh (Williams, Allen, this issue).

Cleghorn's conclusion that most of the adzes whose ages he was able to determine dated from the period A.D. 1200 to 1500 is consistent with the evidence for expansion; we would expect that the clearing of virgin lands on an unprecedented scale would require cutting tools in large numbers. The same reasoning applies to the radiocarbon data from the Mauna Kea adze quarries and workshops graphed by Streck (this issue), which suggest that adze-making and related activities peaked between A.D. 1250 and 1450. Streck's data from the upland saddle region of Hawai'i Island display curves that are similar to those of regions of lower elevation, supporting the observation that during the centuries immediately preceding A.D. 1450, growing populations were expanding rapidly into new areas and intensifying exploitation activities.

The data presented in this symposium strongly support an archipelago-wide process of expansion and intensification that appears to have begun around A.D. 1000 and lasted about 450 years. Clearly, however, the processes described here vary from region to region. It is important that we recognise both general process and regional variants. This is one of three reasons why it is useful to consider Hawaiian pre-contact history as a series of phases (to emphasise cultural process) rather than periods (which tend to be defined by inflexible beginning and ending dates and specific durations). The data presented in this issue indicate, for example, that the Expansion *Phase* began during an earlier *period* on the windward side of O'ahu than on the leeward side. The second advantage of a phase system is that the chronological boundaries (both archipelago-wide and locally) can be more easily shifted as more data come to light.

The third reason is that phases can be added (or deleted) as information accumulates or is reinterpreted. For example, in revised versions of my 1976 scheme (Hommon 1986, ms.a., ms.b.), the radiocarbon data (when represented in bar chart or histogram form) seemed to indicate that population growth and thus the Expansion Phase continued until about A.D. 1600. However, without exception, the distribution diagrams presented in the symposium papers appear to demonstrate that around A.D. 1450 the Hawaiian population in the subject areas and regions, as well as that of the archipelago as a whole, began a relatively slow decline that lasted until about A.D. 1600.

Traditional historical accounts of Hawai'i seem to support a name such as 'Early Dynastic' (cf. Hommon 1976, 1986, ms.b.) for this fourth phase. With some justification it might also be termed the Consolidation or Stabilisation Phase. For present purposes, I intend to go out on a limb and call it the *Intensification Phase* (1450–1600), because for the first time in the Hawaiian sequence, economic development appears to have been based largely on increased productivity of already settled areas rather than the colonisation of new territory.

In a recent paper, Dye (ms.), compared two independent data sets, as represented by the agriculture summary curve (Allen, this issue, fig. 2a) and a slightly revised version of the summary population curve in Dye and Komori (this issue, fig. 4). Although very similar, the two curves exhibit illuminating differences. Dye (ms.) points out that we should expect to sample and date more charcoal from the establishment of new fields than from their subsequent maintenance, since initial forest clearing would produce more charcoal than would the clearing of secondary growth from already established fields. It is noteworthy that the evidence seems to indicate that new fields were being established at the most rapid rate in the pre-contact sequence almost exactly at the same time (about A.D. 1200–1450; the late Expansion Phase) that population was growing at its most rapid rate. It may also be significant that this rapid agricultural expansion into presumably virgin forests appears to precede the parallel population increase by about 50 years.

During the Intensification Phase the decline of the agriculture curve is considerably steeper and deeper than that of the population curve. This segment of the agricultural curve may indicate that agricultural activity during the Intensification Phase consisted mainly of maintenance of already existing fields and perhaps the initiation of intensification measures that were in evidence at Western contact.

As I have indicated elsewhere (Hommon 1976, 1986, ms.a., ms.b.), conquest warfare and other indicators of sociopolitical complexity become apparent in the traditional histories during about the last two centuries before Western Contact, the *Competitive Phase* (A.D. 1600–1800). The application of the Dye-Komori technique to the radiocarbon data of these two centuries appears to reveal a sharp decline in the distribution curve. If we accept the isomorphism of radiocarbon annual frequency distributions and demographic history, we set ourselves the task of explaining the decline in the radiocarbon distribution curve and thus of population that begins around A.D. 1450 and becomes much more extreme after A.D. 1600. Let us consider three possible explanations of the late pre-contact decline in the radiocarbon distribution curves: depopulation by disease, the effects of limited agricultural land, and problems in the database.

Dye and Komori (pers. comm.) have suggested that the overall decline preceding Captain Cook's arrival in Hawai'i in 1778 might be attributable to diseases introduced by Europeans or Asians arriving in the seventeenth century. Such a hypothesis is certainly worthy of continued testing, especially in light of possible evidence, noted by Dye and Komori, of pre-Cook contact, such as the young Hawaiian woman with congenital syphilis (a disease generally thought to have been absent in pre-contact Hawai'i) who was buried at Barbers Point, O'ahu sometime between A.D. 1422 and 1664 (Davis 1990).

Dye and Komori (this issue) summarise the contrasting views of Kirch (1985) and Earle (1978) regarding the development of intensification in pre-contact Hawai'i. I have suggested (Hommon ms.b.) that both "limitations of agricultural land" (Kirch 1985: 287) and "political competition" (Earle 1978: 183) played significant and interrelated roles in the pre-contact history of Hawai'i. For example, the initial colonisation of all eight islands of the archipelago evidently had been accomplished by about A.D. 1000. This colonisation process took place at a time when the Hawaiian population was still small, and therefore long before population pressure would be expected to be an important motivating factor. Given the presumed hierarchical nature of the Ancestral Polynesian culture (cf. Kirch 1984: 62–67) of the settlers of Hawai'i, it seems reasonable to suggest that the relatively rapid dispersion throughout the islands was accomplished by colonists led by younger and otherwise disadvantaged chiefs seeking a degree of independence from their elder relatives.

Politics also played an important role in the Competitive Phase, during which the traditional histories cite competition for scarce resources as a major factor leading to wars of conquest (Kamakau 1961: 45–46, 62, 106, 185, 198; Hommon 1976: 153–160). In addition, a considerable body of archaeological and documentary data supports the contention that well before Western contact the Hawaiian population was reacting to limitations on agricultural expansion (Hommon ms.b.).

The evidence for agricultural limits includes the following elements. First, hundreds of archaeological surveys throughout the archipelago have yielded no extensive areas cultivable by indigenous Hawaiian techniques that were not so used. Second, evidence of extensive agriculture is found in many large, marginally productive areas, where sweet potato and other unirrigated crops would have failed frequently because of lack of rainfall, suggesting that lands more suitable for cultivation were already occupied. Third, accounts of famine and the identification of an array of plants as 'famine foods' indicate that crop failure may have been frequent in pre-contact Hawai'i (Hommon 1986: 66; ms.b.). Fourth, a wide array of measures such as flood-water irrigation in areas without permanent water sources and the maintenance of large tracts of grassland to provide mulch for fields indicate the emphasis on intensification, which would be of increasing importance to growing populations in regions where areal expansion is no longer possible.

Yen (1973: 79) has pointed out that the ancient Hawaiians had not begun terracing steep hillsides or otherwise reached the limits of their technology. I suggest that a limit need not have been permanent or absolute to be effective. The population growth of the late Expansion Phase (*ca.* A.D. 1400–1450) may have been so rapid, for example, that new labour-intensive techniques such as slope terracing could not be perfected before population began to drop in response to food scarcity during the Intensification Phase.

A third interpretation of the decline in the annual frequency distribution curves after A.D. 1600, and possibly as far back as A.D. 1450, is that they do not accurately reflect population growth and decline because of a problem with the database itself. Roughly one third of the radiocarbon age determinations used by Dye and Komori are indistinguishable from the modern standard and thus could not be calibrated.

Dye and Komori (this issue) report that deleting these 'modern' samples from the database does not substantially alter the diagram that treats them as though they are calibrated samples. Although the annual frequency distributions for the seventeenth and eighteenth century may accurately reflect population history as Dye and Komori suggest, the calibration problem makes this period the most uncertain of the sequence. One of the many benefits of the Dye-Komori technique is the identification of specific problems such as this one. The solution to this problem requires independent chronometric data. Given the continued problem posed by as much as one third of our radiocarbon data, we should search diligently for other dating techniques that may give us a clearer picture of the last phases of Hawai'i's pre-contact history.

In his typological treatment of finished Hawaiian adzes, Cleghorn (this issue) has told us that we cannot rely on adze morphology to date sites, and Dye (this issue) has noted that change in artefact styles was generally very slow. In the absence of a useful relative dating procedure based on artefact style, I suggest we take another look at that chronometric method that has been criticised and rejected in recent years by many archaeologists in Hawai'i: volcanic glass dating.

If we wish to know whether volcanic glass hydration-rind and/or alteration measurements correspond in a regular way with radiocarbon age determinations, there is a relatively simple way to find out, at least for glasses on the Island of Hawai'i. Geologists have recently dated more than 250 Hawai'i Island lava flows with radiocarbon samples from vegetation burned by each flow (Rubin *et al.* 1987). Most of the flows are less than 2000 years old. A graduate student seeking a thesis subject could secure not only an advanced degree but also the undying gratitude of Hawaiian archaeologists by collecting and analysing glass samples from these flows and comparing the results with the radiocarbon-derived flow dates. Even determining the effects of temperature and humidity on volcanic glass undergoing hydration and alteration could be accomplished with relative ease; the flows vary from 3 to 2,499 m in elevation and receive from 381 to 7,350 mm of rain annually.

Dye and Komori and the other contributors to this symposium have demonstrated a very useful new tool for the analysis of the archaeological record. The versatility of this tool is illustrated by the fact that it has been applied in these papers to problems ranging from working out the chronology of a single site to outlining the history of the entire Hawaiian archipelago. The annual frequency distribution curves reveal remarkable consistency between islands, and they are sensitive enough to distinguish between series of events separated by as little as 100 or even 50 years, as in the case of the development of agriculture and habitation sites in the early fifteenth century. It may be necessary still to crawl out on a limb for the broad view of Hawai'i's pre-contact history, but we have witnessed the growth of a high and sturdy new limb, and the view it affords is splendid.

In closing, I would like to point out that this innovative symposium is typical of Hawaiian archaeology for the past 20 years in one very important sense: the great majority of the data presented in these papers has been collected and analysed during projects supported by contract funds paid by private developers and public agencies.

Few if any archaeologists in Hawai'i would not prefer to design and conduct archaeological research purely according to ideas about how to uncover or reconstruct or construct or deconstruct Hawai'i's past rather than to have sites selected by the requirements of economic development. Yet can it honestly be said that, left to our own research predilections, we would have investigated the same broad range of sites, in the same wide geographic distribution that contract-based projects have set before us? What would have led us to dig a stratigraphic trench 3 km long and 100 m wide in upper Kāne'ohe? What would have taken us to the uplands of Hawai'i's saddle? And, on the level of crass economics, where would the funding (in excess of $100 million) have come from for the research that has produced, for example, the more than 1,500 radiocarbon dates in the Hawai'i database?

Contract archaeology certainly has its problems, not the least of which is information dissemination. But in terms of method and theory, contract archaeology in Hawai'i is not the poverty-stricken step-child of academic archaeology as some would claim (even as they make massive withdrawals from the data-bank). Rather, it is a robust prodigy, continually generating new data, techniques, and ideas, a fact that has been demonstrated by this symposium.

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