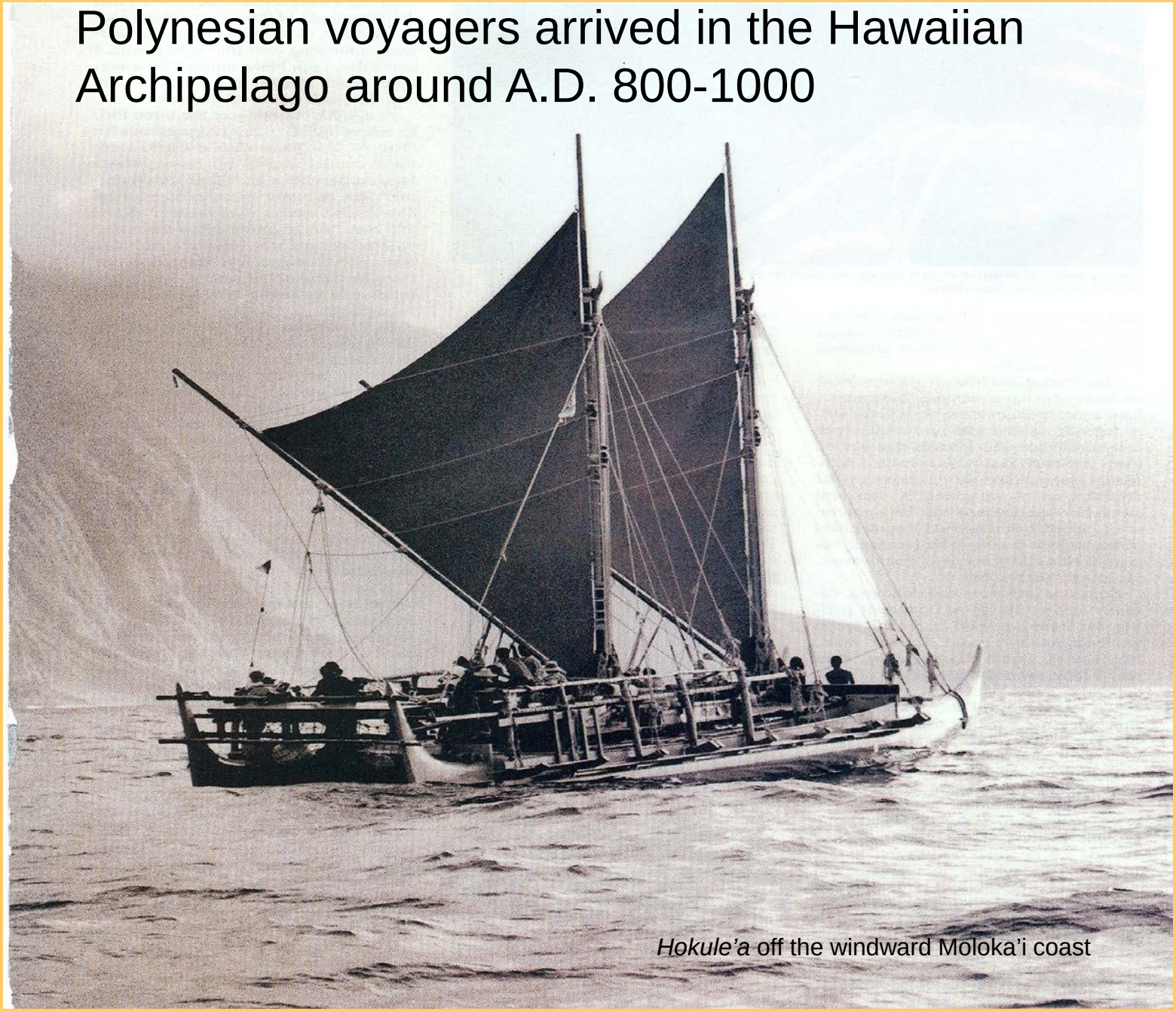
Hawaiian State Emergence

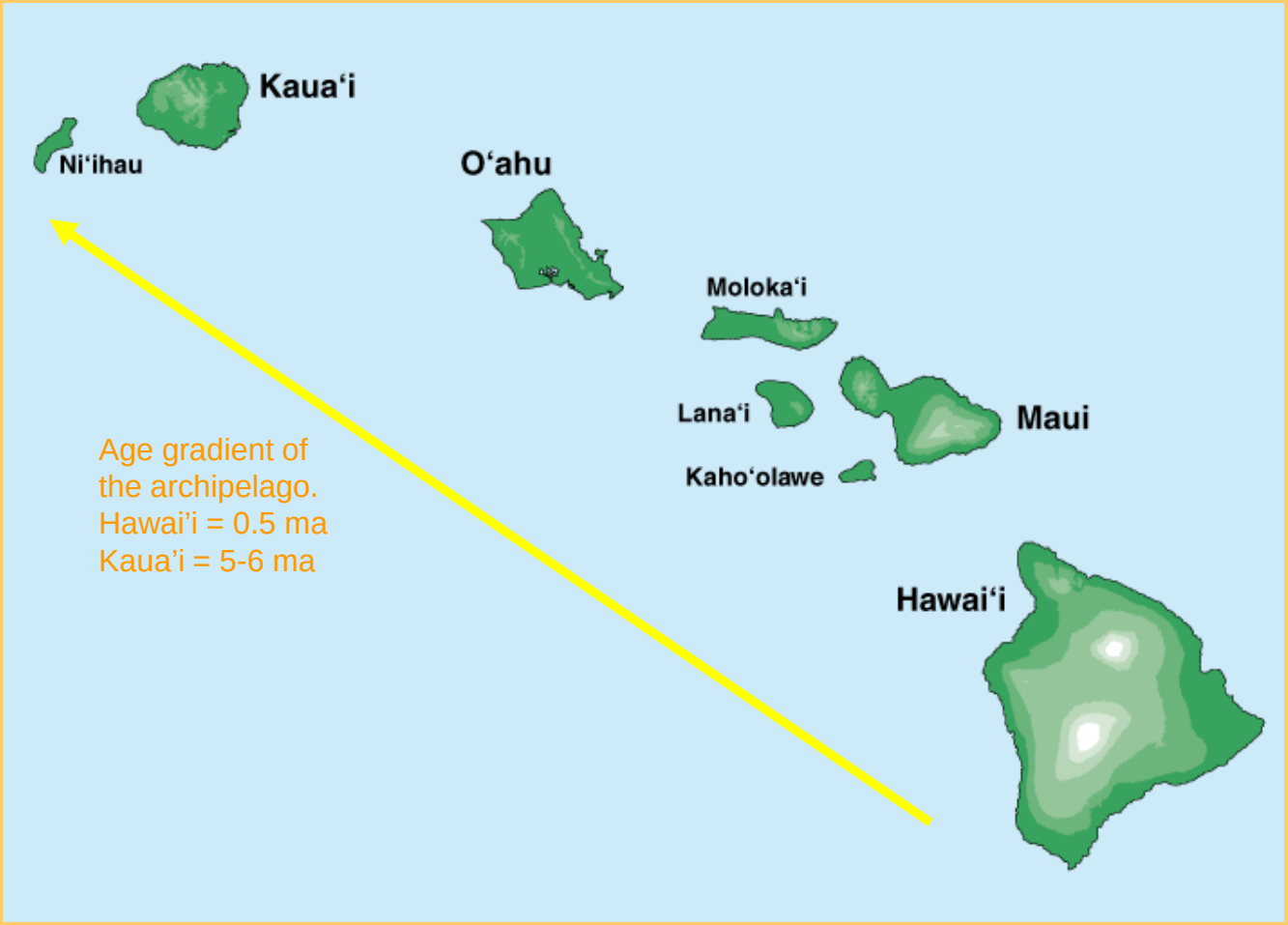
Patrick V. Kirch

Polynesian voyagers arrived in the Hawaiian Archipelago around A.D. 800-1000



Hokule'a off the windward Moloka'i coast

The Hawaiian Archipelago



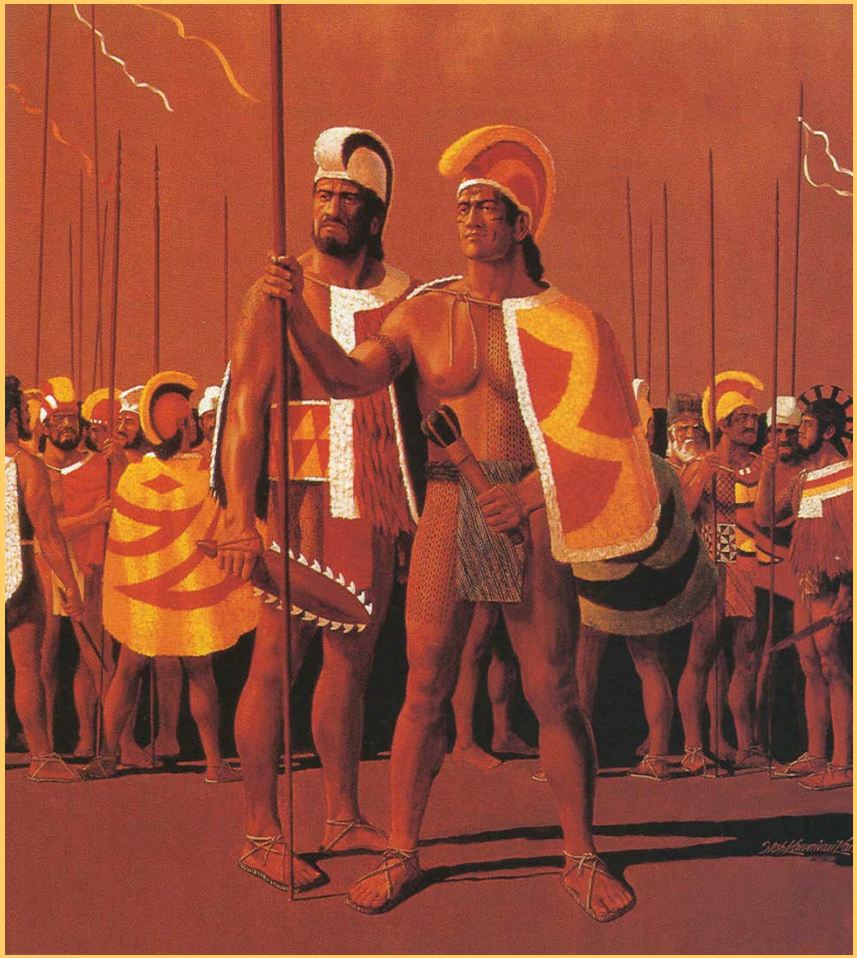
Emergent Cultural Complexity in Late Pre-European Contact Era

Emergence of a highly stratified society out of chiefdom cycling; marked by **kingship** and its correlates (“archaic state”)

Class endogamy and land alienation from commoners (territorial land system)

Economic specialization and agricultural intensification

Organized surplus extraction and corvée labor



Hawaiian elites elaborated the symbols and privileges of chiefship and kingship

The highest ranked chiefly lines were said to be descended from the gods.

The *pi‘o* chiefs were “gods, fire, heat, and raging blazes, and they conversed with chiefs and retainers only at night”.

S. M. Kamakau, *Ka Po‘e Kahiko*, p. 4

PPN **kainanga*

In Ancestral Polynesia, a land-holding or controlling group, exogamous, probably unilineal, tracing “ascent” from a founding ancestor.

PEP **mata-kainanga*

Merges PPN **mata*, a vague-defined social group (“community” ?) with **kainanga*.

HAW *maka’ainana*

Commoner, populace, people in general.

PPN **kaainga*

In Ancestral Polynesian society, a social group controlling rights to an estate, along with the principal dwelling or house site of that estate; a residential group.

HAW *ʻaina*

Land, earth (in general).

PPN **qariki*

In Ancestral Polynesia, the senior, male, titled leader of the **kainanga* social group, who inherited his position patrilineally within the senior ranked line of this group, and who acted as the group's secular as well as ritual leader.

HAW *ali'i*

Chief, chiefess, ruler.

HAW *moi*

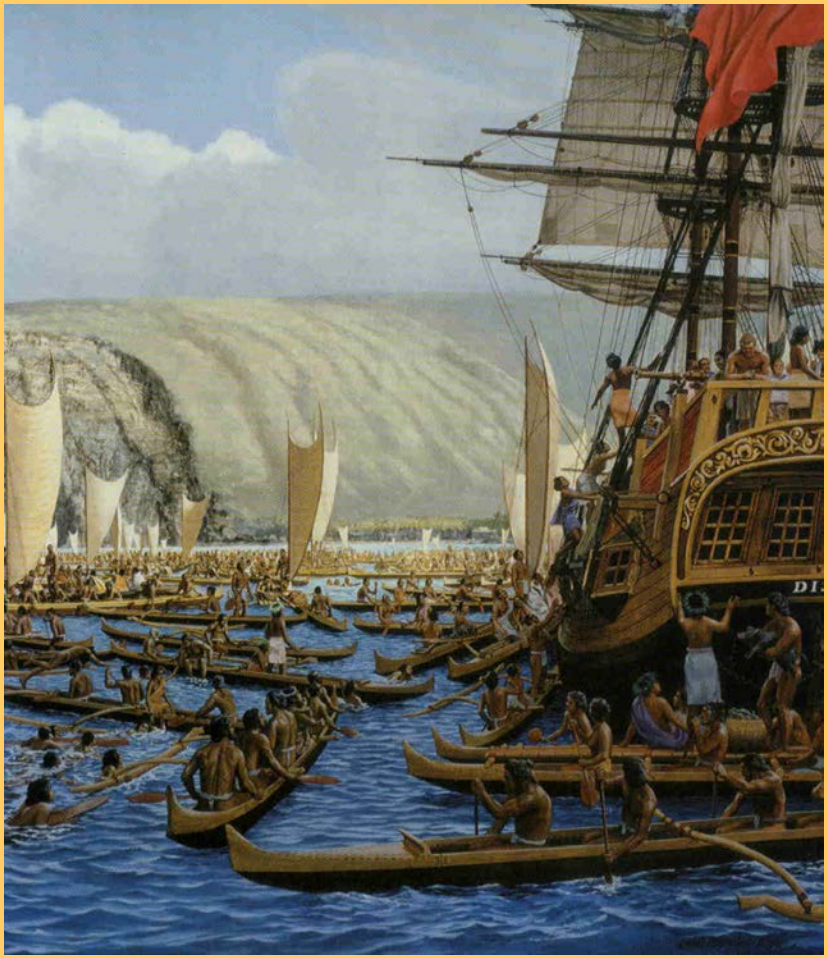
King. An innovation in Hawaiian social terminology (not a retention from PPN).

Population growth: An “ultimate” factor in the transformation of Hawaiian society

In 1779, Captain James Cook was greeted by immense crowds at Kealakekua Bay.

Lt. King, based on careful consideration of village size and area of shoreline, estimated the archipelago-wide population at 400,000.

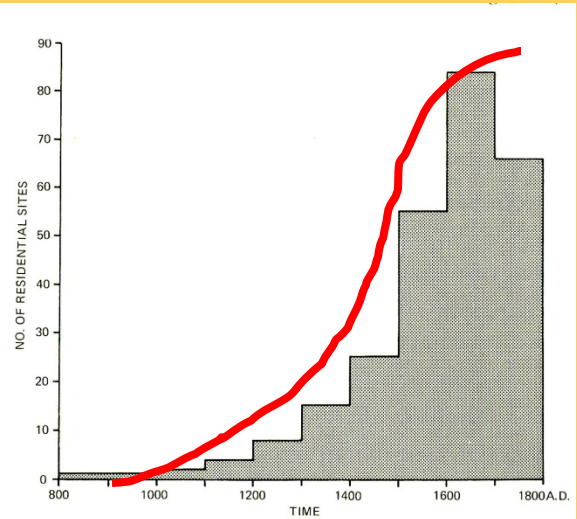
Recent archaeological work suggests King’s estimate may be close to reality.



Artist’s reconstruction of Cook’s arrival. Painting by Herb K. Kane.

Hawaiian population grew from small founding propagule to ~500,000+ over 800 years

Site frequency growth curve based on data from Hommon, Cordy, and additional dated sites.
N=170 sites from West Hawai'i Island



28. Site frequency histogram for the West Hawai'i region.

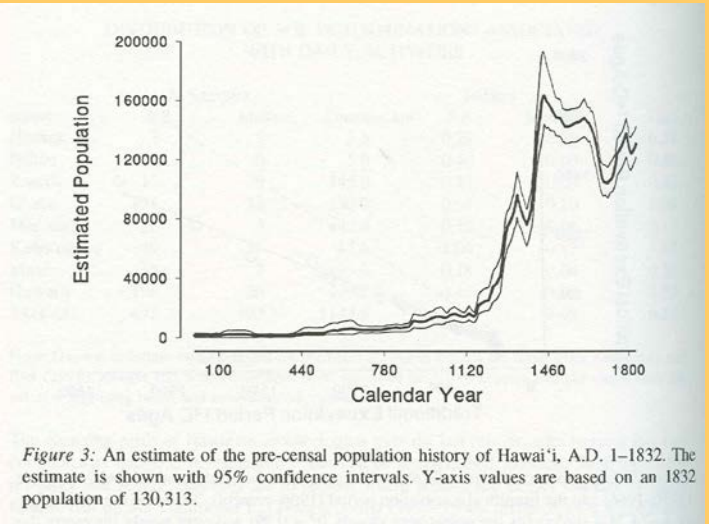
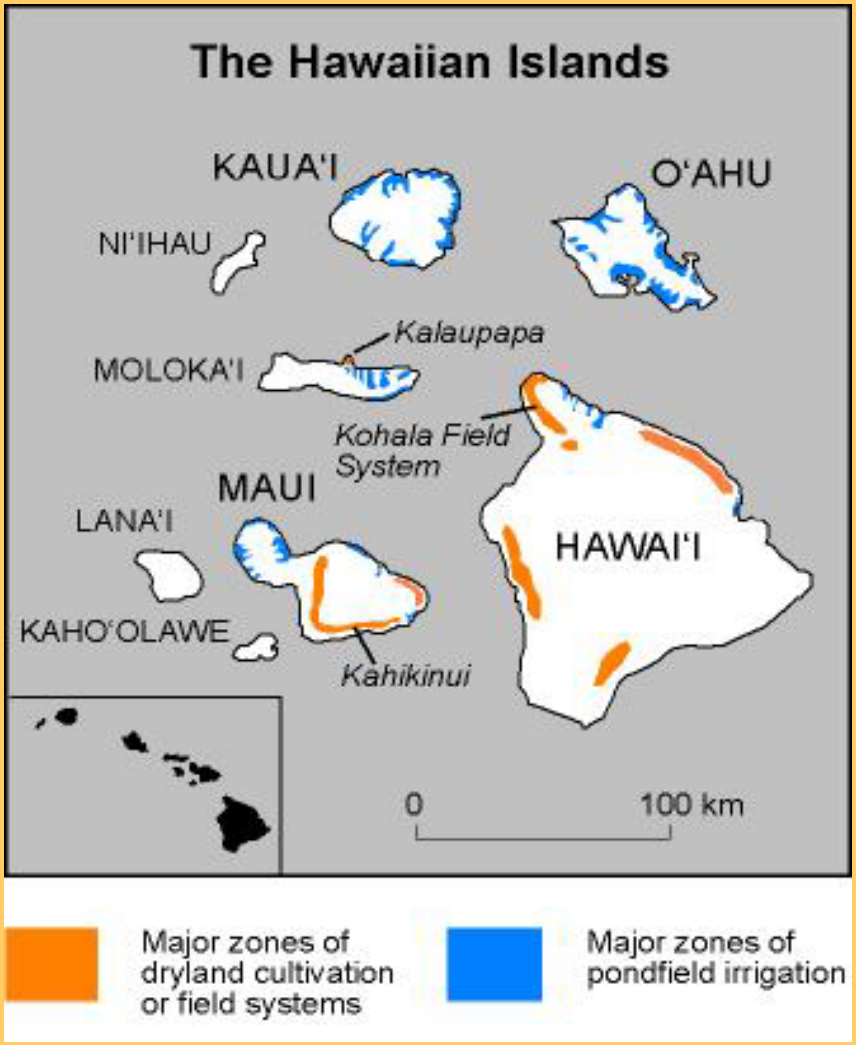


Figure 3: An estimate of the pre-censal population history of Hawai'i, A.D. 1–1832. The estimate is shown with 95% confidence intervals. Y-axis values are based on an 1832 population of 130,313.

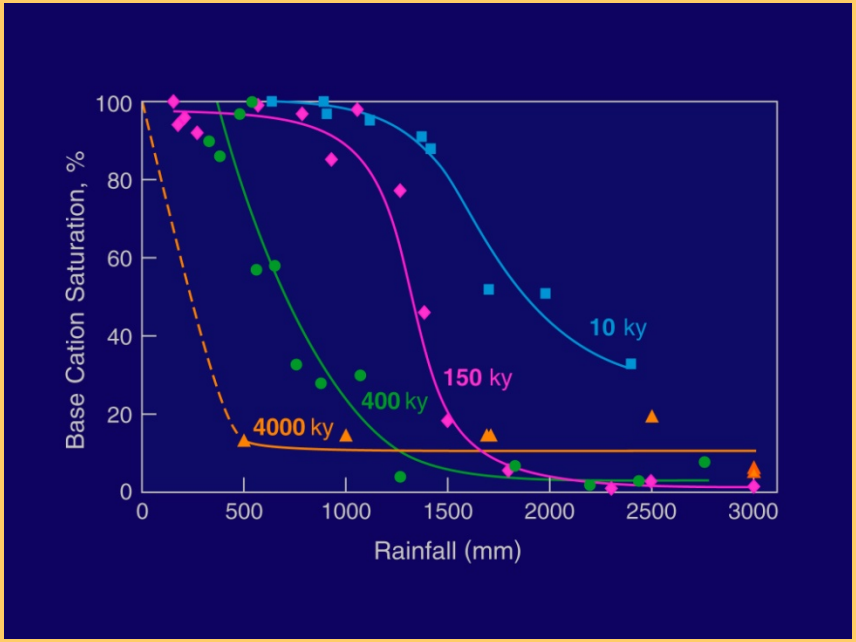
Frequency distribution of 000 radiocarbon dates from throughout the Hawaiian Islands indicates exponential growth rate from A.D. 800-1400.

Dye and Komori (1992) *New Zealand Journal of Archaeology*, fig. 3

Intensification of dryland agricultural systems in Hawaii constrained by biogeochemical gradients

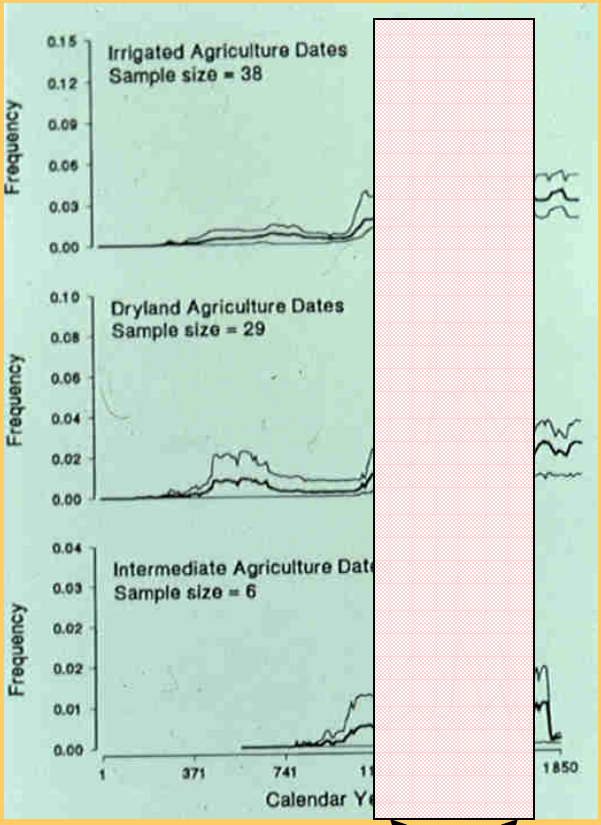


Nutrient status of a particular substrate is a function of age and rainfall.
Hence, dryland field systems were restricted to younger islands of Hawai'i and Maui.



Chronology of agricultural landscapes

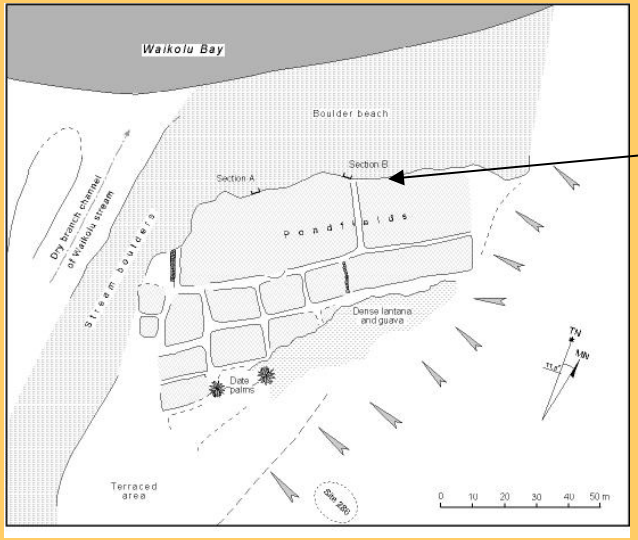
- Beginning around A.D. 1200, a major phase of agricultural expansion and intensification commenced.
- Agricultural systems included pondfield irrigation (for taro) on the geologically older islands with suitable water sources, and dryland field systems (for sweet potato and taro) on leeward slopes.
- Radiocarbon dates bracket the time period of this major phase of agricultural development.

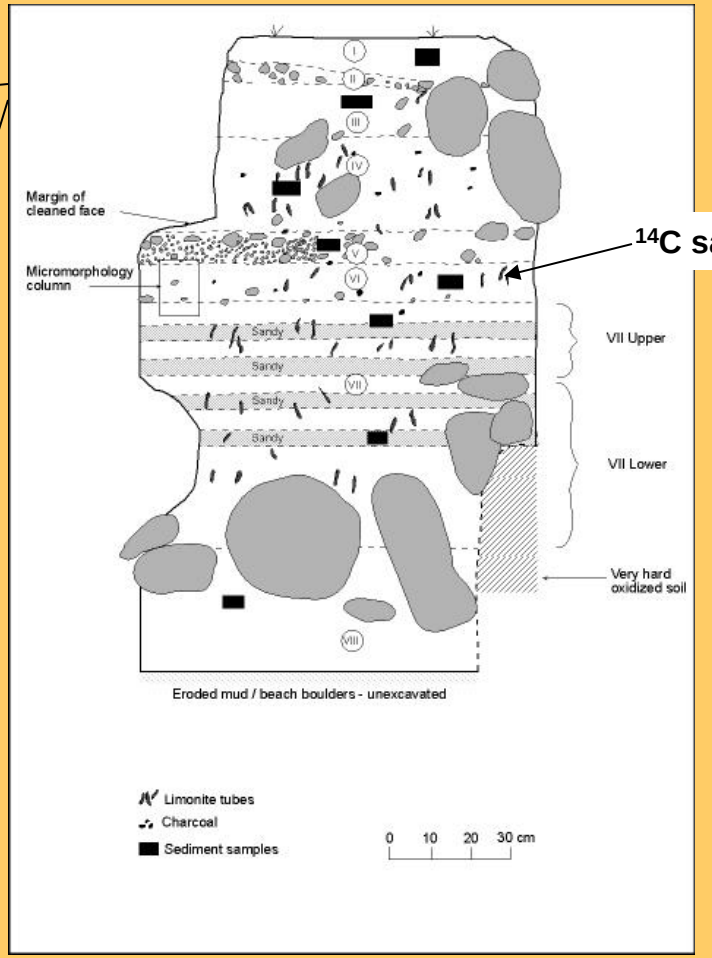


Major phase of expansion and intensification of agricultural systems

Chart from J. Allen (1992), *New Zealand J. Archaeology* 14.

Irrigation systems constructed in windward valleys beginning in the 13th century





Waikolu Valley, Moloka'i—14C date indicates 13th century construction of fields.

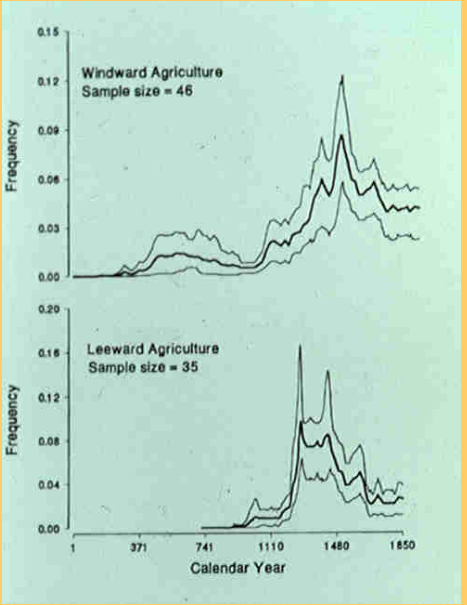
Beta-153426
770 +/- 40 BP
A.D. 1240-1280

Pondfield irrigation systems expanded over valley bottoms and coastal plains

Taro pondfields in various stages of cultivation at Keanae, Maui.
Photo by P. V. Kirch.

- By late prehistory, extensive systems of irrigated pondfields, fed by streams, springs, and seeps had been constructed throughout the valleys and suitable coastal plains of the islands.
- The geologically older islands (West Maui to Kaua'i) were particularly suited to this kind of landesque capital intensive agriculture.
- These systems permanently modified valley landscapes, changing vegetation, topography, and hydrology.

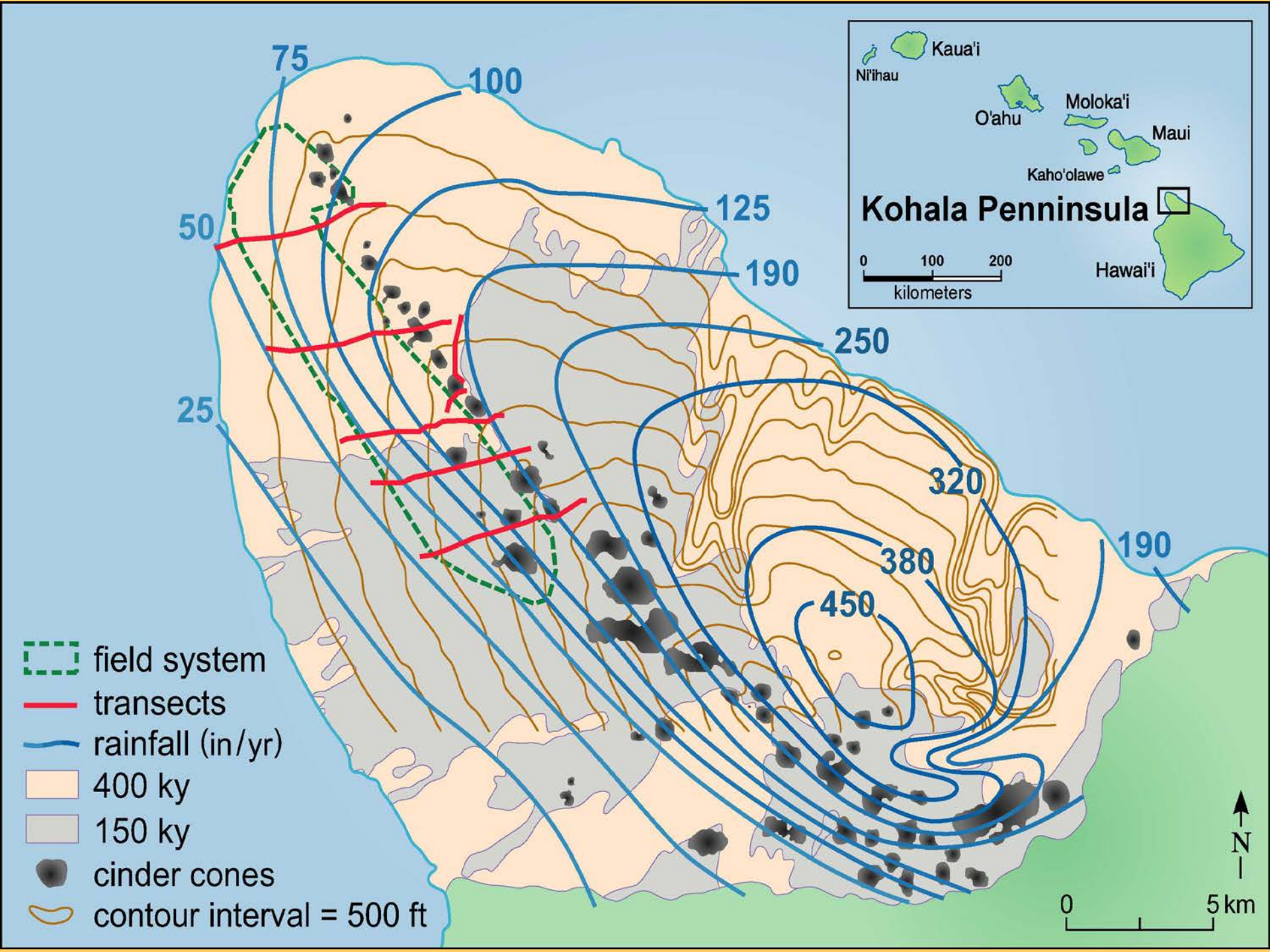
Highly intensive forms of agricultural production underwrote the Hawaiian political economy



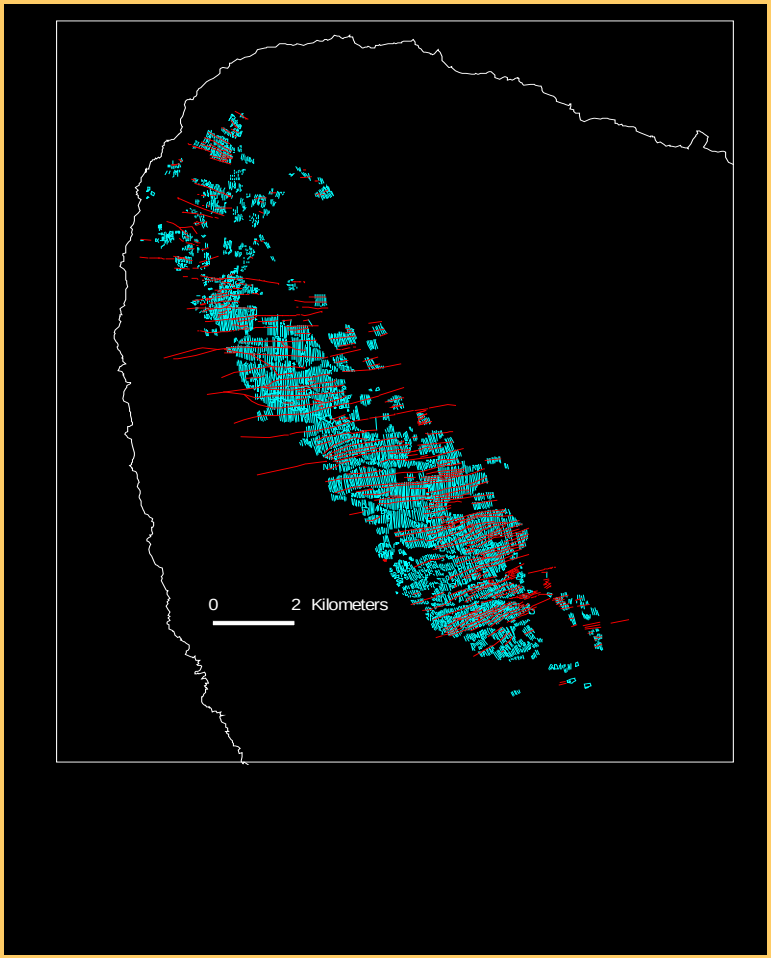
Cumulative ^{14}C probability distributions for windward and leeward agricultural sites on several islands

Irrigated terraces for pondfield cultivation of taro, in Nualolo ‘Aina Valley, Kaua’i Island.

Stone-walled fishpond for mullet and milkfish production, Moloka’i Island


75
100
125
190
250
320
380
450
190
50
25
Kaua'i
Ni'ihau
O'ahu
Moloka'i
Maui
Kaho'olawe
Hawai'i
Kohala Penninsula
0
100
200
kilometers
field system
transects
rainfall (in/yr)
400 ky
150 ky
cinder cones
contour interval = 500 ft
N
0
5 km

Kohala Field System



- Gridwork of field walls and trail boundaries
- Covers >55 km^2
- Archaeologically mapped using remote sensing combined with on-terrain GPS mapping of selected areas

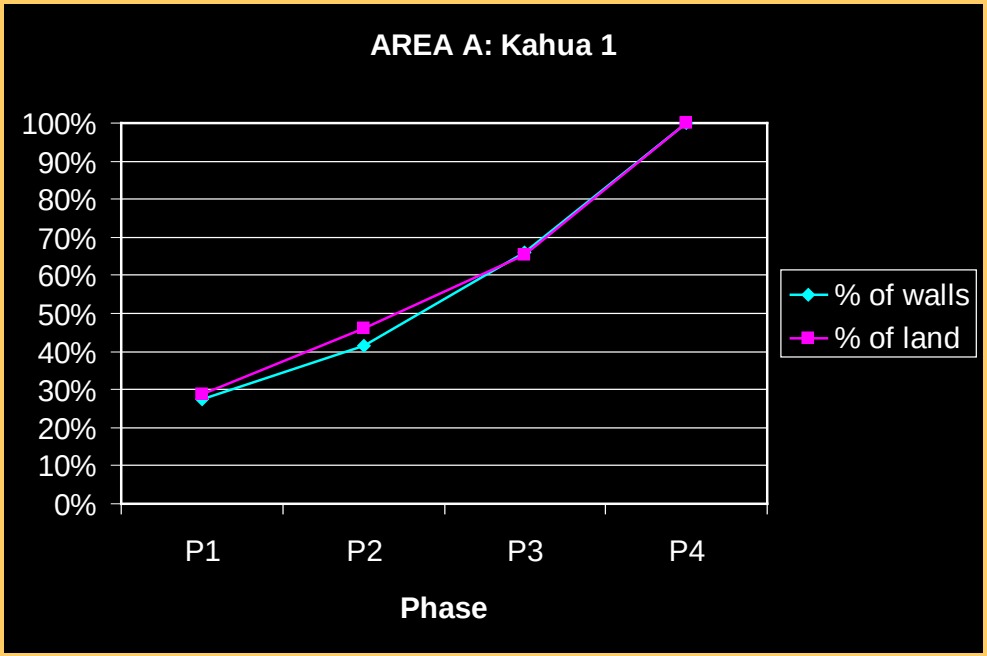
Kohala Field System

Photo T. Hunt

Kohala: Intensification over time

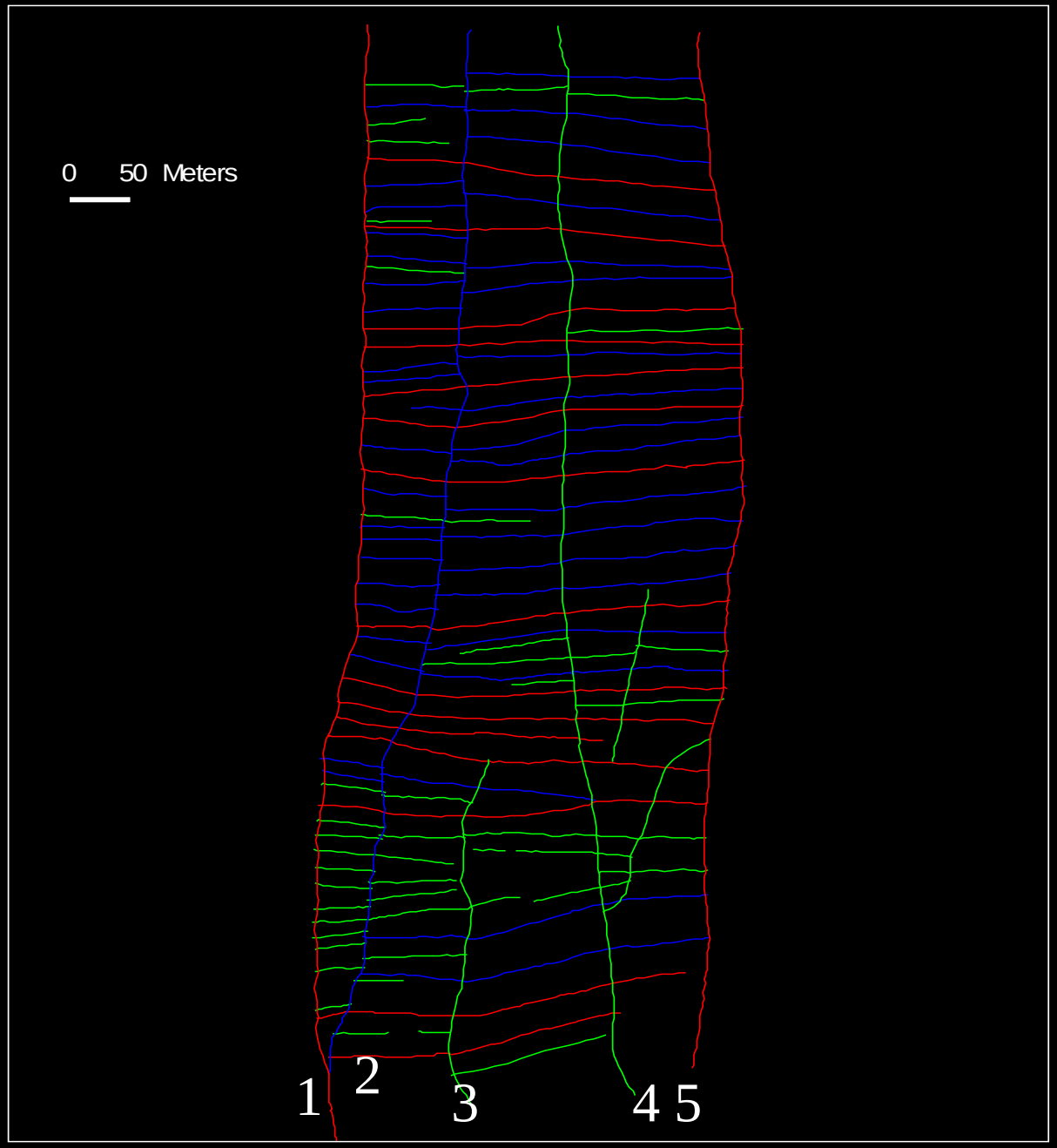
- Temporal trends in agricultural intensification can be tracked through area of land in field system, and wall density

- Trends in Kahua show steady intensification over a period from ca. A.D. 1200-1800




0 50 Meters
1
5

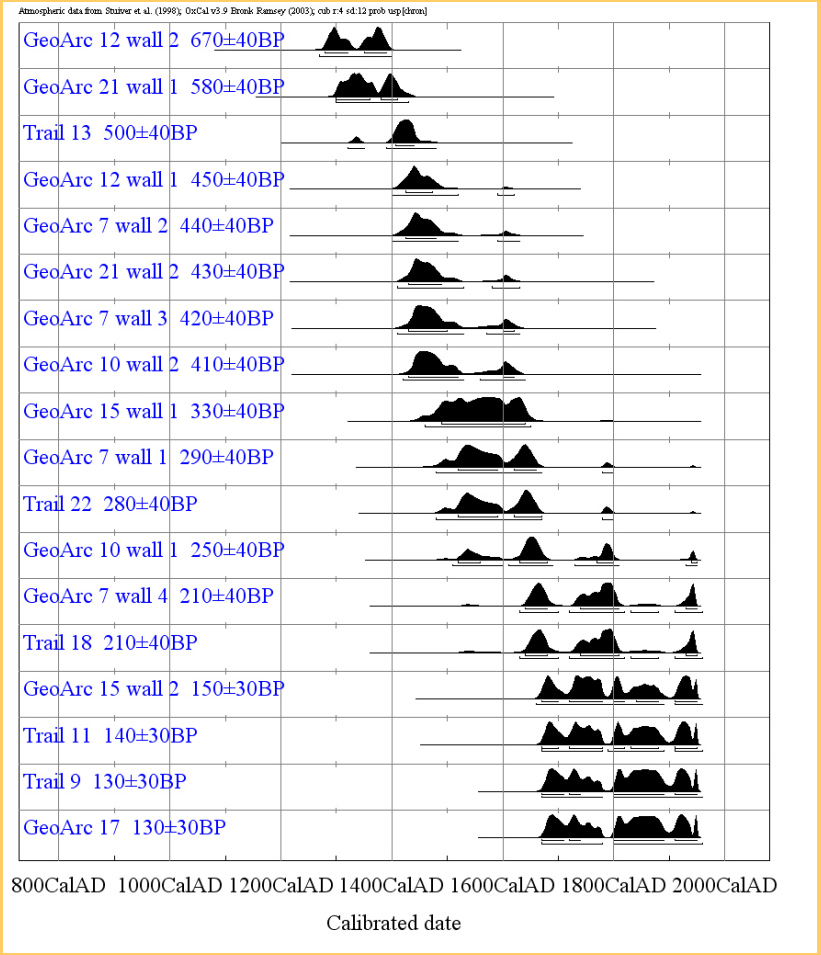

0 50 Meters
1
2
5


0 50 Meters
1
2
3
4
5

Charcoal samples under field walls provide ^{14}C chronology for the field system

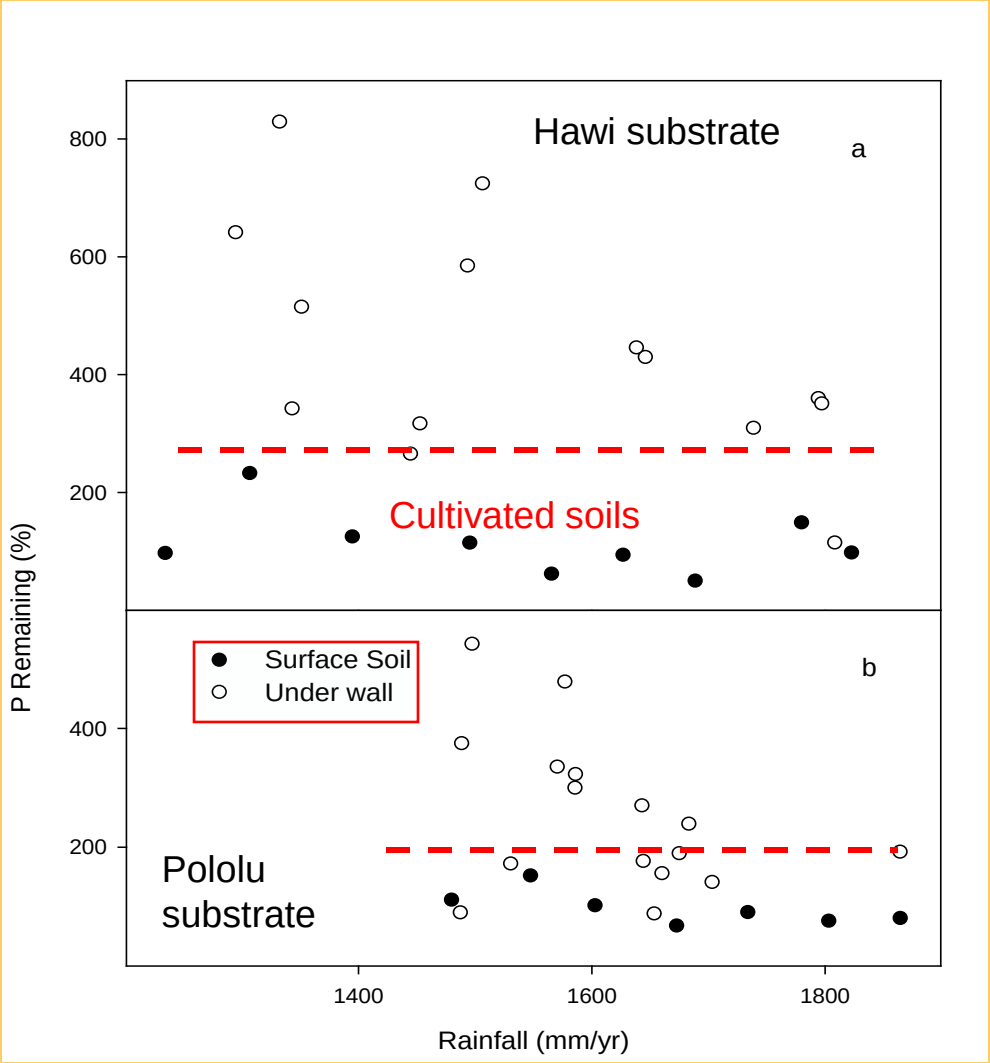
The relative wall sequence chronology for the field system can now be calibrated to an “absolute” chronology

The field system was developed from ca. cal A.D. 1400 until the early post-contact period



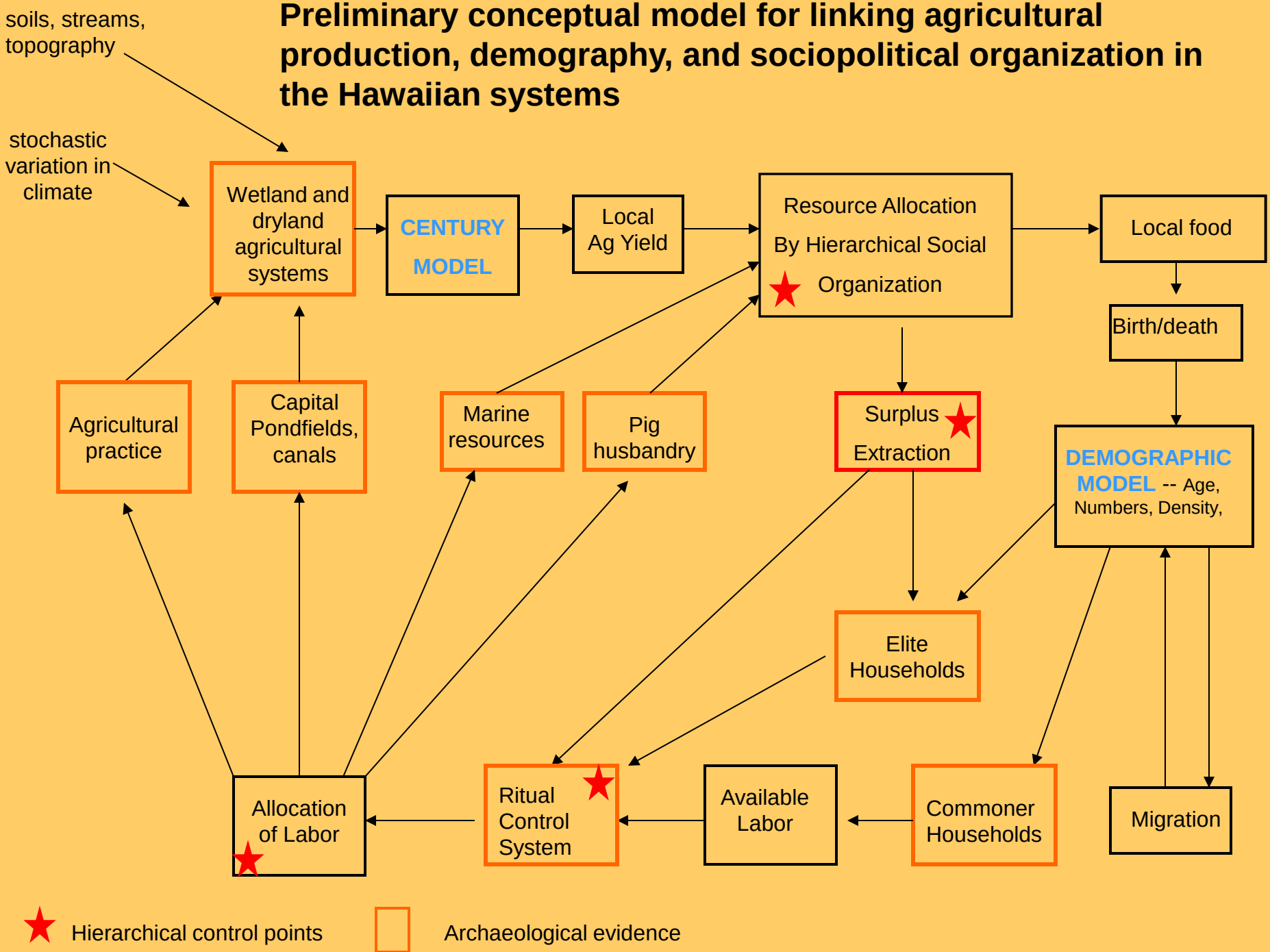
Oxcal plot of probability distributions for series of ^{14}C dates from the Kahua region of the Kohala field system

Nutrient status in relation to intensification in the Kohala field system



- Soil samples from under field walls (i.e., non-cultivated) were contrasted with samples from the middle of field plots
- Results show significant declines in nutrient status (remaining P shown in this graph)
- Intensification therefore had a cumulative negative effect on soil fertility and agricultural production

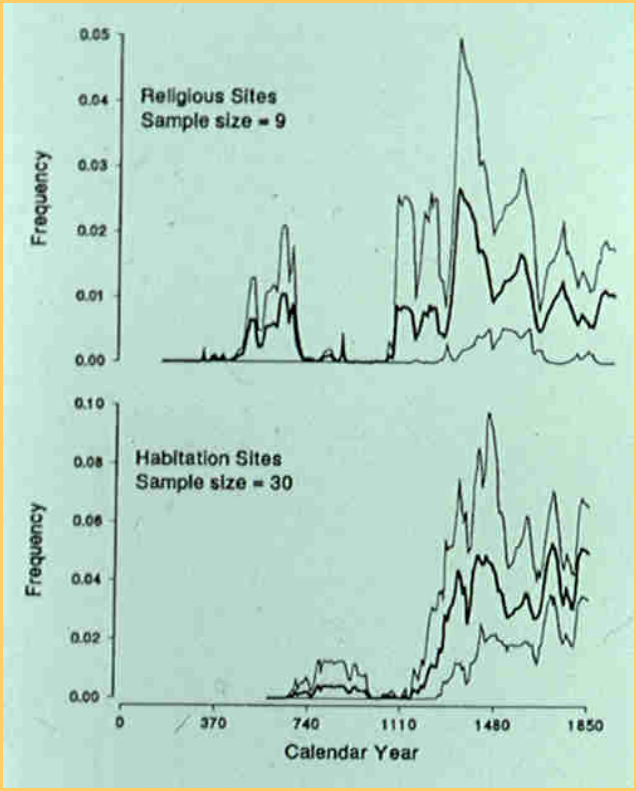
Preliminary conceptual model for linking agricultural production, demography, and sociopolitical organization in the Hawaiian systems



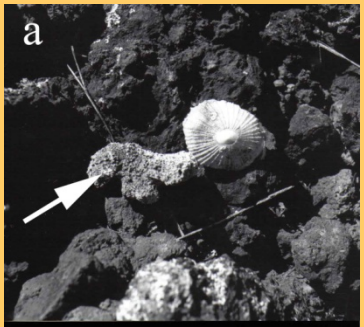
Rise of expansive polities in late prehistory was accompanied by major investments in monumental architecture, correlated with the development of specialized religious cults.

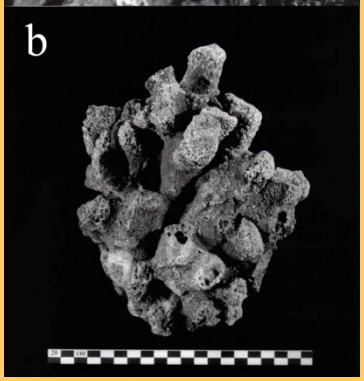
Artist's reconstruction of the *luakini* war temple of Pu'u Kohola, Hawai'i Island. (Painting by H. K. Kane)

Radiocarbon dates associated with religious and habitation sites.



^{230}Th High-Precision Dating of Branch Coral Offerings on Temple Sites





Branch coral on temple altar, and coral head from household shrine.

Application of ^{230}Th method allows us to date dedicatory offerings on temple sites to a high degree of precision: +/- 10 years at 2 standard deviations.

Table 2. ^{230}Th/U dates for archaeological and modern corals

Sample[a]	coral habit	Sample wt (mg)	U ppm	^{232}Th pg/g	(^{230}Th/^{232}Th)[b]	(^{232}Th/^{238}U)x 10^5	±%[c]	(^{230}Th/^{238}U) x10^3	±%	(^{234}U/^{238}U)	±%	Uncorrected Date[d]	±(yr)	Corrected Date[e]	±(yr)
Kawela 1-A	branch fragment	1050.1	2.86	600	67.6	6.911	1.18	4.669	1.55	1.1453	0.44	1562	±7	1578	±12
Kawela 1-B	branch fragment	928.4	2.84	573	71.2	6.657	0.68	4.741	0.78	1.1493	0.35	1560	±5	1575	±10
Kawela 2	branch tip	1077.4	2.43	327	106.4	4.431	0.91	4.713	1.19	1.1459	0.31	1558	±6	1568	±8
Auwahi	branch fragment	1036.1	3.17	314	119.9	3.262	0.73	3.911	1.02	1.1443	0.18	1627	±4	1635	±6
Kipapa	branch tip	1028.3	2.90	261	139.2	2.964	0.83	4.126	1.30	1.1475	0.31	1612	±6	1619	±7
MA 275	branch fragment	1074.6	2.43	224	133.5	3.031	3.90	4.048	1.23	1.1463	0.17	1621	±5	1628	±6
MAW 255	branch tip	920.5	3.35	380	108.1	3.736	0.42	4.038	1.35	1.1504	0.17	1623	±5	1632	±7
Naka 405	branch tip	935.8	2.77	390	91.7	4.640	0.57	4.254	0.90	1.1444	0.31	1601	±4	1612	±7
Naka 405	8 cm from branch tip	1024.8	3.14	279	147.2	2.922	0.35	4.300	1.49	1.1488	0.23	1598	±6	1605	±7
Naka 414	colony-base fragment	1006.9	2.36	106	306.7	1.487	0.34	4.559	1.20	1.1505	0.26	1574	±5	1578	±6
Naka 1010	colony-base fragment	1044.6	2.57	145	241.6	1.860	0.66	4.492	2.29	1.1469	0.19	1579	±10	1583	±10
Modern[f]	branch tip	1002.5	3.21	366	3.1	3.752	0.56	0.116	12.00	1.1457	0.17	1993	±1	2002	±5

[a] A and B are replicate samples obtained by splitting 2 g of coral.

[b] All isotopic ratios are activity ratios, unless otherwise specified.

[c] All errors are given as 95% confidence intervals.

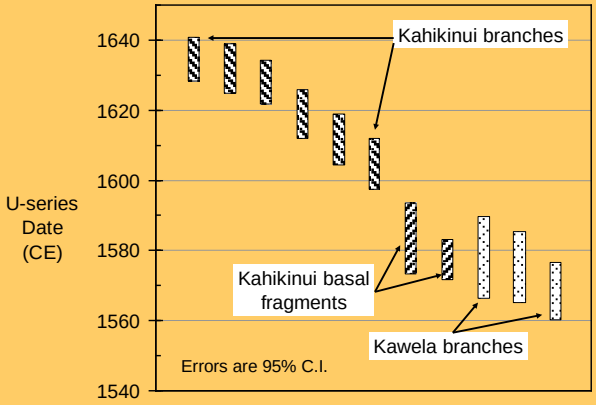
[d] Date not corrected for $^{230}Th_{non\text{-}radiogenic}$ ($^{230}Th_{nr}$). Errors are analytical errors only.

[e] Date corrected for initial Th using a ratio of $(^{230}Th_{nr}/^{232}Th)_{atomic} = 1.2 \times 10^{-5}$, as determined from analysis of living coral; initial Th ratio is assigned an error of ± 50%, which is propagated into final date-errors.

[f] Modern coral was collected in July 2002 and analyzed in December 2003.

Decay constants used are those of Cheng et al. (2000).

Imposition of ritual control hierarchy in Kahikinui indicated by rapid development of temple system



U/Th dates for coral offerings

- A system of temples was emplaced over the Kahikinui landscape between A.D. 1580-1640, as determined by high precision ^{230}Th dating of branch coral offerings
- This temple system is the material manifestation of an elite control hierarchy
- System was imposed ca. 200 years after initial settlement of the landscape, but prior to maximum population peak

Painting by Herb K. Kane

Artist's reconstruction of a stone temple platform under construction

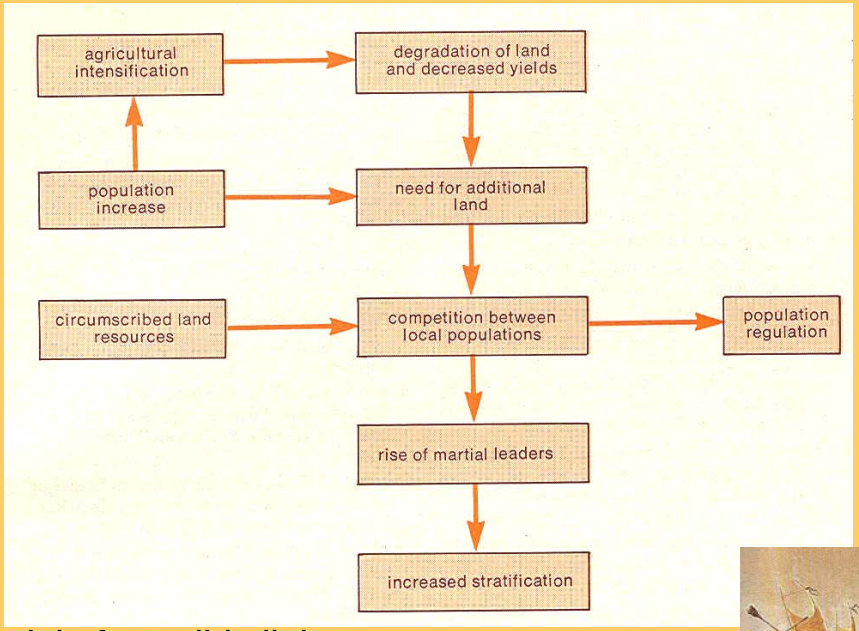
Imposition of Kahikinui temple system may correspond with establishment of ‘archaic state’ ca. A.D. 1570-1630

According to Hawaiian traditions, Pi’ilani, followed by his grandson Kamalalawalu, expanded the West Maui chiefdom to form a new polity encompassing 2,360 square kilometers.

Painting by H. Kawainui Kane

Location of Pi’ilani’s major war temple at Hana.

Implication for Hawaiian cultural evolution: Did limits to agricultural expansion and intensification lead to aggressive territorial expansion ?



Model of possible links between population, intensification, and territorial expansion. (from Kirch 1984)

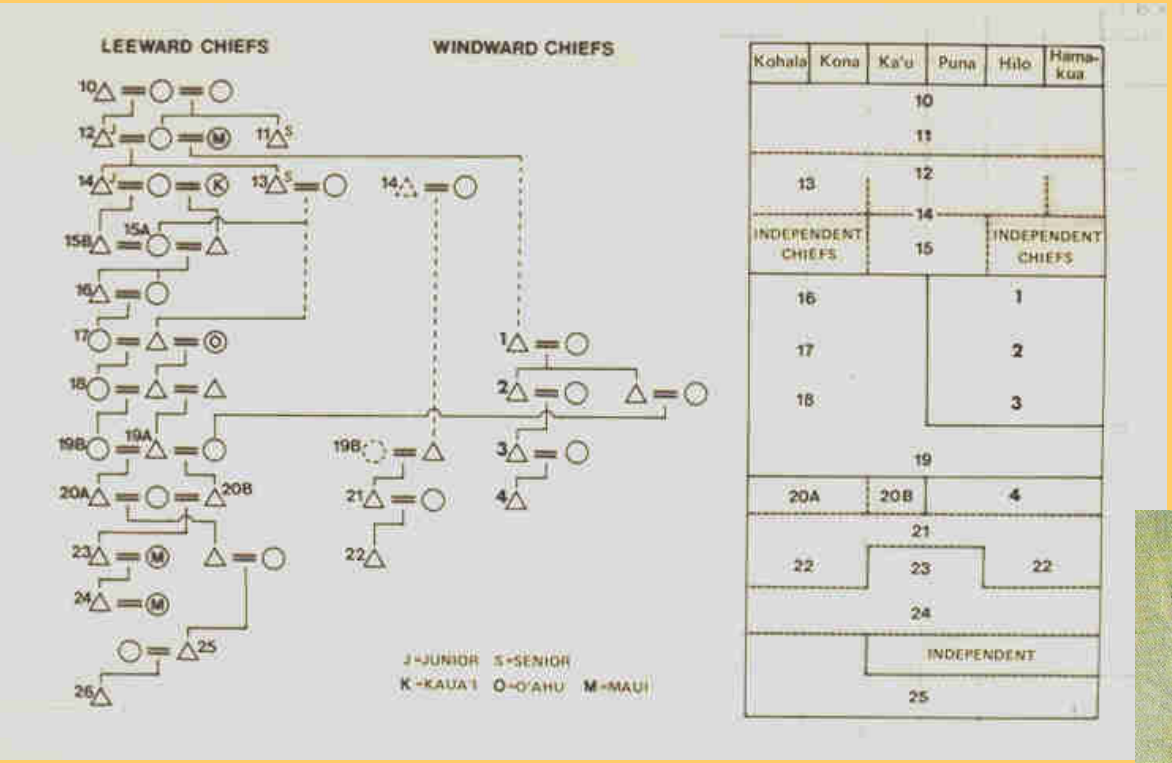
Limits to intensification, coupled with decreasing yields and ability of elites to extract surpluses, may have fueled the aggressive territorial expansion noted for contact-period Hawai'i by ethnohistorians.

Artist's reconstruction of Hawaiian naval warfare

H. K. Kane

Proximate causation: chiefly agency

Population growth, agricultural intensification across nutrient limited landscapes, and stochastic variation in rainfall are all likely to be important ultimate causes, but the role of individual agency as proximate cause is equally important



Genealogy of the chiefly lines of Hawai'i Island showing marriage alliances, and consolidation of smaller polities into emerging archaic state in late prehistory