# Supporting Information

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### SI Text

**Sampling Areas.** We identified two areas for sampling the archaeological landscape for residential features: (*i*) the adjacent *ahupua'a* territories of Kālala, Makiloa, and Pahinahina, situated within the southern margins of the Leeward Kohala Field System (LKFS) and (*ii*) the adjacent territories of Kaiholena and Makeanehu in the central core of the LKFS. The total area of the southern sampling area is ∼19 $km^2$ and that of the central sampling area is ∼13 $km^2$. These five *ahupua'a* units compose 19% of the total area of the 32 territories that make up the LKFS. The Kaiholena–Makeanehu sampling area was chosen to represent the high-productivity core of the LKFS, whereas the southern Kālala–Makiloa–Pahinahina sampling area represents a more marginal zone where rainfall is less predictable and drought more frequent.

**Survey and Excavation of Residential Features.** Both sampling areas were intensively surveyed with the aim of identifying and recording 100% of surface-visible archaeological features. Given low vegetation cover and good visibility, feature coverage is judged to be excellent. Features were spatially located and defined using submeter Trimble GeoXH GPS data recorders, with resulting data incorporated into a Geographic Information System database for the LKFS. All features were recorded using a standardized set of morphological and descriptive variables. In the coastal sections, the survey recorded visible surface architecture between the coast and extending 540 m inland. In the uplands, the survey extended from the lower elevation limits of the LKFS to the system's upper elevation limits, except where these had been obscured by historic bulldozing. The survey identified 748 residential features. We selected 57 residential features (7.6%) for excavation and dating, focusing on the presence of flattened surfaces inside enclosures, alignments of stone facing, and surface midden, all characteristic of permanent rather than temporary habitation. When residential complexes were made up of multiple features, several features were sampled within the complex. A total of 78 units were excavated within the 57 features, with the aggregate excavation area being 73 $m^2$. Thirty-four of the features are located in the coastal zone, and 23 features are located within the upland field system.

**Radiocarbon Dating.** Radiocarbon dates were obtained from subsurface cultural deposits (including hearth and oven features) within the residential enclosures. Wood charcoal and nutshell samples were identified to the lowest taxonomic level possible (identifications were made by M. Jeraj of the University of Wisconsin using a Hawaiian wood reference collection). Samples from short-lived native shrubs and candlenut endocarps (*Aleurites moluccana*, *kukui*) were selected for accelerator mass spectrometry radiocarbon dating (AMS). Forty-one of the 57 excavated residential features were sampled, producing 48 AMS radiocarbon dates on charcoal samples recovered from these features. Measured ages were calibrated using OxCal 4.1 with the IntCal04 calibration curve (1). Calendar ages and 95% confidence intervals for the radiocarbon determinations are indicated in Table S1.

We used Bayesian chronological models to assess the probability of absolute chronologies based upon excavated materials and architectural contexts. Bayesian analysis of radiocarbon dates incorporates previously defined chronological parameters with probability distributions for dates generated by $^{14}C$ calibration (1–3). The resulting probability distributions indicate the likelihood that an event occurred at a particular time and the calendar age range of model parameters. Poor fit between model and measurements can be tested by Bayesian analysis of radiocarbon dates and quantified using an agreement index (1, 4). Bayesian analysis of the radiocarbon dates from the Kaiholena–Makeanehu residential structures used two contrasting models (Table S2). These models used the following parameters: the approximate date by which colonization of Hawai'i is firmly established (1100 ± 50 B.P. y calibrated) (5), a modern end-date of A.D. 1900 ± 50, the hypothesized sequential construction phases for Kaiholena and Makeanehu, and nine radiocarbon determinations from the six excavated residential enclosures (excluding KHL-10 and KHL-12, which lacked clear abutment relationships). The first model is based on the construction sequence and the radiocarbon dates of associated residential features, whereas the second model is based on a randomly ordered sequence of the radiocarbon dates assigned to the construction phases. The parameters of the two models were implemented using the multiphase model functions available in OxCal version 4.1, described in Bronk Ramsey (1). Both models are sequential and assume that all of the events (calibrated radiocarbon dates) in each group are in a predefined order. We designated the boundaries between the groups as sequential, thus allowing for a gap of unknown temporal duration between groups. This scenario best fits our understanding of the construction sequences of the LKFS, which occurred in a relative order, but at an unknown tempo. The individual agreement indices (A index) measure the degree of overlap between the standard calibrated radiocarbon date and the new calibration that takes into account the permutations of the model. Indices less than 60% indicate instances in which the new calibration diverges significantly from the original; values higher than 100% identify strong agreement. OxCal calculates an index of statistical agreement for the model itself, designated as the $A_{model}$ percentage. Like the A index, $A_{model}$ values greater than 60% indicate that the samples in the model are in acceptable internal agreement.

**Construction Sequence for Kaiholena–Makeanehu.** Using instances of abutment for trails and residential features, the following construction sequence was determined for the study area of Kaiholena–Makeanehu. This sequence is codified in color in Fig. 6 and is also summarized graphically in Fig. S3.

***Phase 1.*** Boundary Trail 1 (trail BT1) marks the Kaiholena–Makeanehu *ahupua'a* boundary. No agricultural alignments cross or intersect this trail, and agricultural developments on either side of the trail were therefore spatially independent. In Kaiholena, six long alignments (shown in red in Fig. 6) abut this trail and extend to the north. In Makeanehu, two long alignments (in red) abut the trail and extend beyond trail M1, which defines the southern boundary of the study area.

***Phase 2.*** In Kaiholena, a set of alignments (shown in blue in Fig. 6) extend north from the *ahupua'a* boundary trail (trail BT1). A section of one of the alignments appears to have been disturbed by the construction of residential complex KHL-50, although the precise relationship between the agricultural alignments and the residential enclosure is ambiguous. Two additional alignments were constructed in the center of the Kaiholena study area during this time, perhaps indicating their construction after the other phase 2 Kaiholena alignments. Phase 2 development in Makeanehu is marked by the construction of Makeanehu trail 1 (trail M1), with five agricultural alignments (in blue) abutting this trail extending to the north.

***Phase 3.*** Trail K1 was constructed during this in Kaiholena, along with a series of abutting agricultural alignments (shown in purple in Fig. 6). Trail K1 divides this portion of the Kaiholena study area in two, and a concentration of alignments were constructed to the north of the trail in the western portion of the study area. In Makeanehu, trail M2 was constructed during phase 3, and to the north of this trail a number of alignments (in purple) were built between it and the *ahupua'a* boundary trail (trail BT1), with several additional alignments extending south to abut trail M1.

***Phase 4.*** Two trails (trails K2 and K3) were constructed in Kaiholena during this phase, dividing the two main areas of the Kaiholena study area into four zones. Agricultural alignments were constructed during this phase, particularly in the southern half of the Kaiholena study area. In Makeanehu, the area bounded by trails M1 and M2 was bisected by the construction of trail M3. Notably, no comparable trail in the area bounded by trails BT1 and M2 was constructed. During this phase several alignments were constructed between trails M3 and M1, suggesting intensification in that area. Several additional alignments were constructed extending north from trail M3 to both trails M2 and BT1. The alignments from trails M3 to M2 conform to the expectations of the building group associations, but the alignments extending from trail M3 to trail BT1 do not. It is possible that the abutments and offsets of these alignments at trail M3 were misidentified during the field survey and actually represent intersections of alignments that originally extended from trail BT1 to trail M1. It is also possible that the intersections of these alignments at trail M2 are in fact abutments.

***Phase 5.*** The final phase of development in both *ahupua'a* includes the addition of several smaller alignments infilling previously established plots. Although both *ahupua'a* have five developmental phases, the distribution of architectural features by itself cannot establish whether the two phase sequences are temporally synchronous (i.e., that phase 3 in Kaiholena corresponds to phase 3 in Makeanehu). This is because the boundary trail separating the two *ahupua'a* (trail BT1) spatially isolates agricultural development within each *ahupua'a*. For the residential enclosures, we determined an independent sequence of construction phases on the basis of the abutment or incorporation of agricultural alignments with residential features, in particular enclosing walls.

KHL-10 and KHL-12 are the only radiocarbon-dated residential features in the sample that are not surrounded by enclosing walls and therefore have no clear association with abutting agricultural alignments. A single alignment abuts the natural outcrop that shelters the deposits of KHL-12, but it cannot be determined if the construction or occupation of the terrace below the outcrop occurred before or after the construction of the alignment. For this reason, KHL-10 and KHL-12 are excluded from our hypothesized sequence for residential construction, which is as follows:

*i*) The enclosing wall of KHL-1 is abutted by one of the phase 1 alignments. Thus, KHL-1 was constructed at the same time, or before, phase 1.

*ii*) The enclosing wall of KHL-48 is abutted by alignments from phase 2, and possibly from phase 1. Thus, KHL-48 was constructed either at the same time, or before, the phase 2 alignments.

*iii*) The residential enclosure associated with KHL-50 incorporates and is abutted by phase 2 agricultural alignments. Therefore, this residential feature was constructed at the same time, or before, phase 2.

*iv*) The enclosing wall of MKE-1 is abutted by alignments from phase 2 and is also built over by alignments from phase 3 on its western side. This configuration indicates that MKE-1 was constructed before, or at the same time, as phase 2, and before phase 3.

*v*) The enclosing wall that surrounds the residential features of KHL-2 was built on top of and incorporates some of the phase 2 agricultural alignments. This indicates that the enclosing wall of KHL-2 either dates to the same period or postdates phase 2.

*vi*) The enclosing wall of MKE-2 is abutted by phase 4 alignments and is built over the agricultural alignments of phase 2. This indicates that MKE-2 was constructed after phase 2 and either before or at the same time as phase 4.


1. Bronk Ramsey C (2009) Bayesian analysis of radiocarbon dates. *Radiocarbon* 51: 337–360.
2. Bayliss A (2009) Rolling out revolution: Using radiocarbon dating in archaeology. *Radiocarbon* 51:123–147.
3. Bronk Ramsey C, et al. (2010) Radiocarbon-based chronology for dynastic Egypt. *Science* 328:1554–1557.
4. Bronk Ramsey C (1995) Radiocarbon calibration and analysis of stratigraphy: The OxCal program. *Radiocarbon* 37:425–430.
5. Tuggle HD, Spriggs M (2000) The age of the Bellows Dune Site O18, O'ahu, Hawai'i, and the antiquity of Hawaiian colonization. *Asian Perspect* 39:165–188.

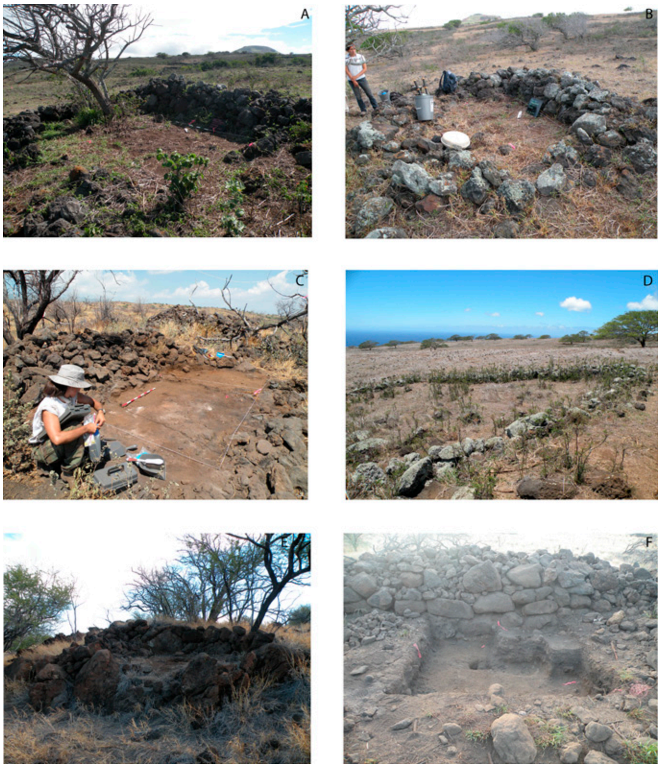

**Fig. S1.** Examples of residential features from the excavation sample. (*A*) MKI-199, enclosure. (*B*) MKI-303, small enclosure. (*C*) KAL-30A, terrace with windbreak. (*D*) KHL-50, large enclosure with inner terrace. (*E*) MKE-104, terrace atop boulder outcrop, with attached enclosure. (*F*) MKI-56, large monumental enclosure.

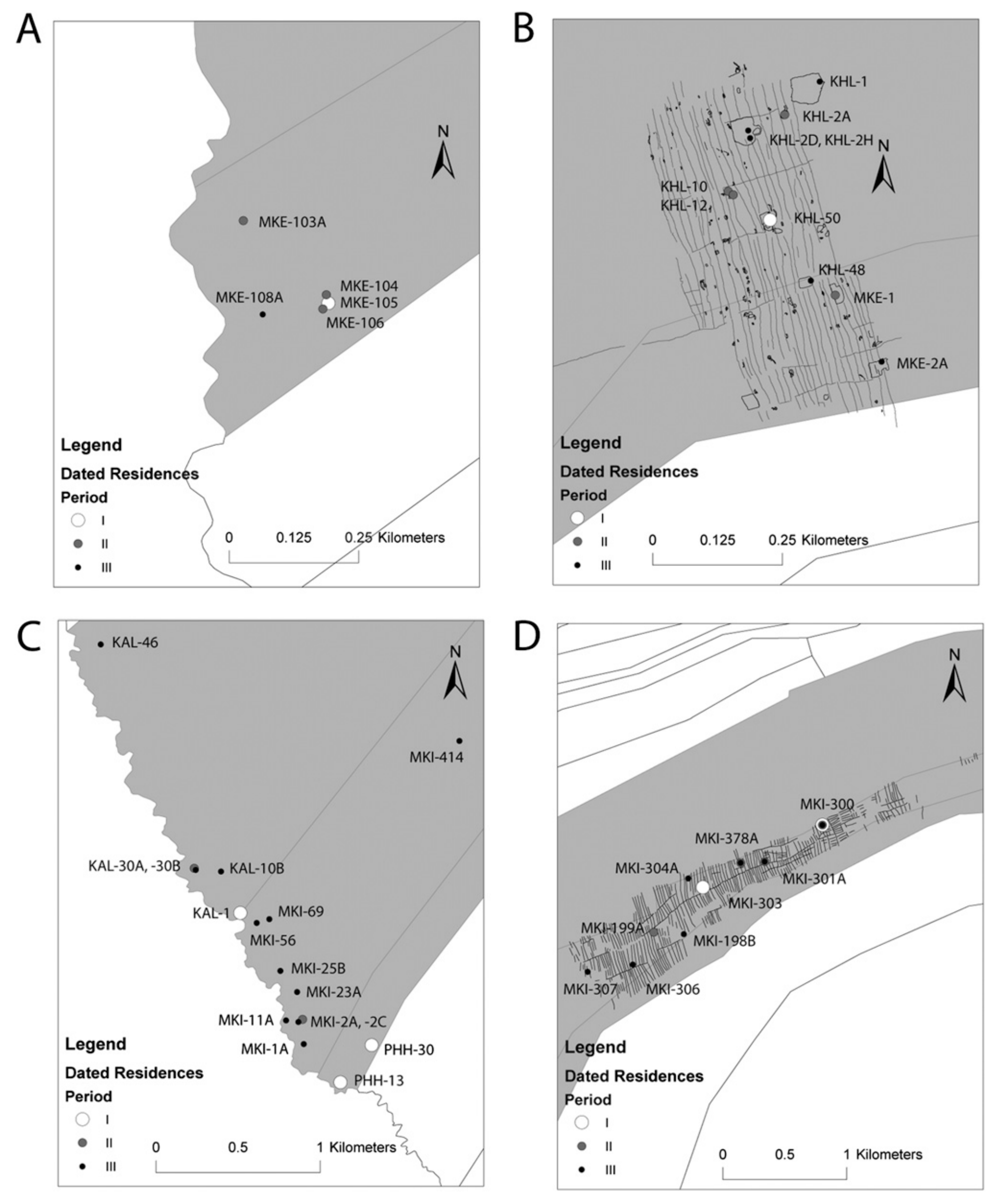


**Fig. S2.** Details of residential feature distribution in (*A*) coastal Makeaneahu; (*B*) upland Kaiholena and Makeanehu (central study area); (*C*) coastal Kālala, Makiloa, and Pahinahina; and (*D*) upland Makiloa (southern study area). Symbols indicate the chronological period of residential features determined by AMS dating.

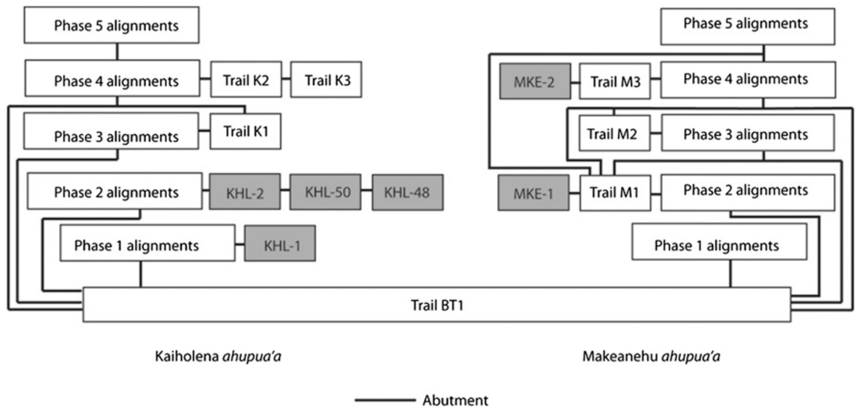


**Fig. S3.** Sequence of trail, alignment, and residential feature construction for Kaiholena and Makeanhu *ahupua'a*. Boxes indicate relative order of feature construction over time. Thick connecting lines indicate an abutting relationship between the features.

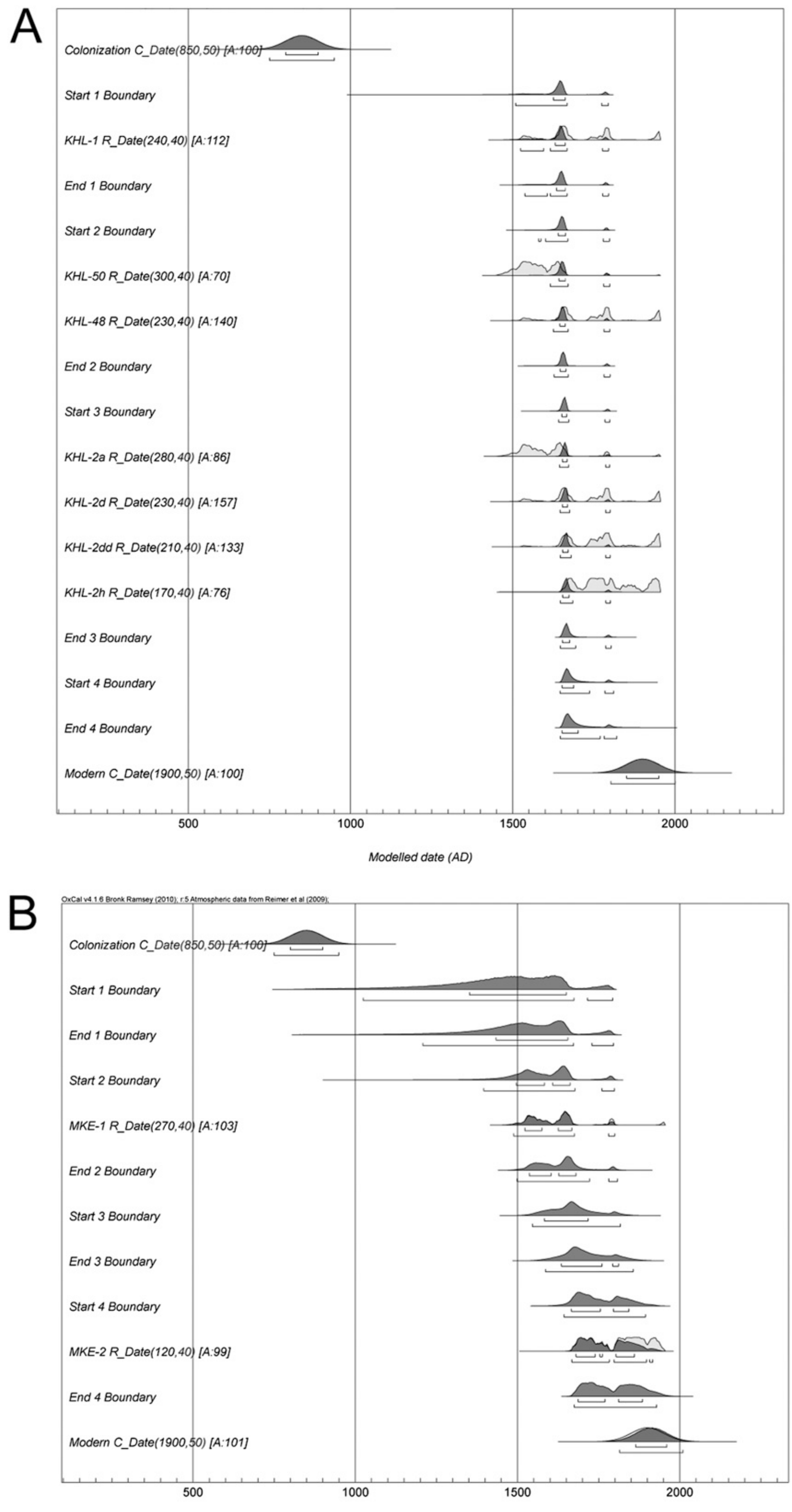


**Fig. S4.** (*A*) Kaiholena model ($A_{model}$ = 100.4%). (*B*) Makeanehu model ($A_{model}$ = 101.11). Calibrations calculated with OxCal 4.1 using atmospheric data from the IntCal09 curve.

**Table S1. Calibrated radiocarbon dates from residential features in Leeward Kohala *ahupua'a***

| *Ahupua'a* | Lab no. | Location | Material | Measured radiocarbon age | $^{13}C/^{12}C$ Ratio | Conventional radiocarbon age | Calibrated age range B.P ($2\sigma$) |
|---|---|---|---|---|---|---|---|
| *Pahinahina* | β-256583 | PHH-13 TU1 level 5 | *Aleurites moluccana* nutshell | 470 ± 40 | −27.1 | 440 ± 40 | 1409–1520 (88.7%)<br>1592–1620 (6.7%) |
| | β-256575 | PHH-30 TU1 level 3 | *Pleomele hawaiiensis* | 330 ± 40 | −20.6 | 400 ± 40 | 1432–1526 (66.6%)<br>1556–1633 (28.8%) |
| *Makiloa* | β-243703 | MKI-2A TU1 FE 1 | *Sophora chrysophylla* | 360 ± 40 | −26.4 | 340 ± 40 | 1462–1642 (95.4%) |
| | β-243704 | MKI-25 TU 3 | *Osteomeles anthyllidifolia* | 230 ± 40 | −24.1 | 240 ± 40 | 1520–1592 (14.5%)<br>1619–1684 (40.1%)<br>1732–1808 (31.3%)<br>1928–1954 (9.5%) |
| | β-240446 | MKI-1A TU1 Ext 7 | *Aleurites moluccana* nutshell | 180 ± 40 | −21.9 | 230 ± 40 | 1521–1574 (7.4%)<br>1584–1590 (0.4%)<br>1626–1692 (36.9%)<br>1728–1811 (38.3%)<br>1921–1954 (12.4%) |
| | β-240674 | MKI-2C TU 3 Level 2 | *Aleurites moluccana* nutshell | 190 ± 40 | −23.1 | 220 ± 40 | 1525–1558 (3.1%)<br>1631–1694 (33.1%)<br>1726–1814 (43.6%)<br>1838–1842 (0.2%)<br>1853–1867 (0.6%)<br>1918–1954 (14.9%) |
| | β-240448 | MKI-56-TU1 Level 6 | *Aleurites moluccana* nutshell | 180 ± 40 | −24.3 | 190 ± 40 | 1644–1706 (22.4%)<br>1720–1818 (48.3%)<br>1832–1880 (6.9%)<br>1915–1954 (17.8%) |
| | β-240447 | MKI-23A TU1 Level 7 | *Aleurites moluccana* nutshell | 160 ± 40 | −23.7 | 180 ± 40 | 1648–1706 (20.4%)<br>1720–1820 (47.6%)<br>1832–1882 (9.6%)<br>1914–1954 (17.8%) |
| | β-276165 | MKI-414 TU 1 Level 1 | *Cordia subcordata* | 150 ± 40 | −24.5 | 160 ± 40 | 1662–1710 (17.0%)<br>1717–1890 (61.3%)<br>1910–1952 (17.1%) |
| | β-240675 | MKI-11A TU1 FE 13 | *Aleurites moluccana* nutshell | 150 ± 40 | −24.9 | 150 ± 40 | 1665–1784 (46.0%)<br>1795–1893 (32.6%)<br>1906–1952 (16.9%) |
| | β-276160 | MKI-69 TU1 Level 5 | *Caesalpinia cf bondus* | 70 ± 40 | −23.7 | 90 ± 40 | 1680–1764 (29.3%)<br>1801–1938 (66.1%) |
| | β-240449 | MKI-56 TU1 Level 2 | *Aleurites moluccana* nutshell | 100.2 ± 0.5 pMC | −21.2 | 40 ± 40 | 1690–1730 (23.5%)<br>1810–1925 (71.9%) |
| | β-278189 | MKI-300 TU1 Level 4 | *Dubautia cf arborea* | 480 ± 40 | −24.9 | 480 ± 40 | 1326–1344 (2.8%)<br>1394–1476 (92.6%) |
| | β-278191 | MKI-303 TU1 FE 1W | *Acacia koa* | 420 ± 40 | −25.6 | 410 ± 40 | 1426–1524 (72.0%)<br>1558–1632 (23.4%) |
| | β-269616 | MKI-300 TU1 Level 3 | *Aleurites moluccana* nutshell | 210 ± 40 | −19.3 | 300 ± 40 | 1474–1662 (95.4%) |
| | β-278193 | MKI-378A TU1 Level 5 | *Psychotria* sp. | 310 ± 40 | −26.5 | 290 ± 40 | 1482–1666 (93.5%)<br>1784–1795 (1.9%) |
| | β-276161 | MKI-199A TU1 Level 4 | *Chamaesyce cf multiformis* | 280 ± 40 | −24.9 | 280 ± 40 | 1482–1669 (90.3%)<br>1780–1798 (4.5%)<br>1946–1952 (0.6%) |
| | β-278190 | MKI-301A TU2 Level 3 | *cf Scaevola* sp. | 300 ± 40 | −27.2 | 260 ± 40 | 1492–1602 (37.0%)<br>1615–1680 (40.6%)<br>1763–1801 (14.0%)<br>1938–1954 (3.9%) |
| | β-269615 | MKI-300 TU1 Level 2 | *Aleurites moluccana* nutshell | 230 ± 40 | −24.5 | 240 ± 40 | 1520–1592 (14.5%)<br>1619–1684 (40.1%)<br>1732–1808 (31.3%)<br>1928–1954 (9.5%) |
| | β-278192 | MKI-306 TU 1 FE 2 | *Psychotria* sp. | 240 ± 40 | −25.7 | 230 ± 40 | 1521–1574 (7.4%)<br>1584–1590 (0.4%)<br>1626–1692 (36.9%)<br>1728–1811 (38.3%)<br>1921–1954 (12.4%) |

**Table S1. Cont.**

| *Ahupua'a* | Lab no. | Location | Material | Measured radiocarbon age | $^{13}C/^{12}C$ Ratio | Conventional radiocarbon age | Calibrated age range B.P (2σ) |
|---|---|---|---|---|---|---|---|
| | β-269617 | MKI-301A TU1 FE 1 | *Aleurites moluccana* nutshell | 210 ± 40 | −24.3 | 220 ± 40 | 1525–1558 (3.1%) |
| | | | | | | | 1631–1694 (33.1%) |
| | | | | | | | 1726–1814 (43.6%) |
| | | | | | | | 1838–1842 (0.2%) |
| | | | | | | | 1853–1867 (0.6%) |
| | | | | | | | 1918–1954 (14.9%) |
| | β-276162 | MKI-304A TU1 Level 5 | *cf Psychotria* sp. | 170 ± 40 | −25 | 170 ± 40 | 1655–1707 (18.4%) |
| | | | | | | | 1719–1826 (46.5%) |
| | | | | | | | 1832–1886 (12.9%) |
| | | | | | | | 1912–1954 (17.5%) |
| | β-269614 | MKI-198B TU1 Level 2 | *Aleurites moluccana* nutshell | 190 ± 40 | −20.7 | 160 ± 40 | 1662–1710 (17.0%) |
| | | | | | | | 1717–1890 (61.3%) |
| | | | | | | | 1910–1952 (17.1%) |
| | β-276164 | MKI-378A TU1 Level 5 | *cf Scaevola* sp. | 150 ± 40 | −24.8 | 150 ± 40 | 1665–1784 (46%) |
| | | | | | | | 1795–1893 (32.6%) |
| | | | | | | | 1906–1952 (16.9%) |
| | β-276163 | MKI-307 TU1 Level 3 | *Chamaesyce cf multiformis* | 101.3 ± 0.5 pmc | −9.8 | 150 ± 40 | 1665–1784 (46%) |
| | | | | | | | 1795–1893 (32.6%) |
| | | | | | | | 1906–1952 (16.9%) |
| | β-269618 | MKI-301A TU1 Level 3 | *Aleurites moluccana* nutshell | 130 ± 40 | −23.6 | 150 ± 40 | 1665–1784 (46%) |
| | | | | | | | 1795–1893 (32.6%) |
| | | | | | | | 1906–1952 (16.9%) |
| | β-269620 | MKI-304A TU1 Level 3 | *Aleurites moluccana* nutshell | 130 ± 40 | −26.2 | 110 ± 40 | 1678–1765 (32.1%) |
| | | | | | | | 1772–1776 (0.8%) |
| | | | | | | | 1800–1940 (62.5%) |
| *Kālala* | β-256577 | KAL-1 TU 1 Ext 15 cmbs | *Chamaesyce cf multiformis* | 420 ± 40 | −26.5 | 400 ± 40 | 1432–1526 (66.6%) |
| | | | | | | | 1556–1633 (28.8%) |
| | β-256572 | KAL-30A TU1B FE 1 | *Acacia koa* | 190 ± 40 | −21.8 | 240 ± 40 | 1520–1592 (14.5%) |
| | | | | | | | 1619–1684 (40.1%) |
| | | | | | | | 1732–1808 (31.3%) |
| | | | | | | | 1928–1954 (9.5%) |
| | β-256595 | KAL-30B TU2 FE 1 | *Aleurites moluccana* wood | 200 ± 40 | −12.6 | 220 ± 40 | 1525–1558 (3.1%) |
| | | | | | | | 1631–1694 (33.1%) |
| | | | | | | | 1726–1814 (43.6%) |
| | | | | | | | 1838–1842 (0.2%) |
| | | | | | | | 1853–1867 (0.6%) |
| | | | | | | | 1918–1954 (14.9%) |
| | β-276158 | KAL-46 N107 E 101 | *Caesalpinia cf bondus* | 130 ± 40 | −23.3 | 160 ± 40 | 1662–1710 (17.0%) |
| | | | | | | | 1717–1890 (61.3%) |
| | | | | | | | 1910–1952 (17.1%) |
| | β-276159 | KAL-46 N101 E100 | *Aleurites moluccana* nutshell | 140 ± 40 | −24.4 | 150 ± 40 | 1665–1784 (46.0%) |
| | | | | | | | 1795–1893 (32.6%) |
| | | | | | | | 1906–1952 (16.9%) |
| | β-243702 | KAL-10B TU3 Level 3 | *Styphelia tameaeiae* | 141.4 ± 0.5 pMC | −21.2 | 140.3 ± 0.5 pMC | Postbomb |
| *Makeanehu* | β-256590 | MKE-106 TU1 Level 3 | *Leptocophylla tameiameiae* | 390 ± 40 | −23 | 420 ± 40 | 1420–1523 (78.7%) |
| | | | | | | | 1572–1628 (16.7%) |
| | β-256576 | MKE-105 TU1 Level 4 | *Chamaesyce cf multiformis* | 290 ± 40 | −20.8 | 360 ± 40 | 1450–1635 (95.4%) |
| | β-256589 | MKE-103A TU1 Ext | *Daubatia* sp. | 300 ± 40 | −25.4 | 290 ± 40 | 1482–1666 (93.5%) |
| | | | | | | | 1784–1795 (1.9%) |
| | β-256573 | MKE-104 TU1 FE 3 | *Chamaesyce cf multiformis* | 220 ± 40 | −11.2 | 250 ± 40 | 1512–1600 (24.2%) |
| | | | | | | | 1616–1684 (41.5%) |
| | | | | | | | 1735–1805 (23.3%) |
| | | | | | | | 1933–1954 (6.4%) |
| | β-256582 | MKE-108A TU 1 Level 5 | *Aleurites moluccana* nutshell | 160 ± 40 | −23.8 | 180 ± 40 | 1648–1706 (20.4%) |
| | | | | | | | 1720–1820 (47.6%) |
| | | | | | | | 1832–1882 (9.6%) |
| | | | | | | | 1914–1954 (17.8%) |
| | β-256574 | MKE-1 TU1 Level 2 | *Chamaesyce cf multiformis* | 270 ± 40 | −25.3 | 270 ± 40 | 1486–1676 (85.4%) |
| | | | | | | | 1777–1800 (7.9%) |
| | | | | | | | 1941–1954 (2.1%) |

**Table S1. Cont.**

| *Ahupua'a* | Lab no. | Location | Material | Measured radiocarbon age | $^{13}C/^{12}C$ Ratio | Conventional radiocarbon age | Calibrated age range B.P (2σ) |
|---|---|---|---|---|---|---|---|
| | β-256581 | MKE-2A TU1 Level 2 | *Aleurites moluccana* nutshell | 110 ± 40 | −24.6 | 120 ± 40 | 1675–1778 (36.0%)<br>1799–1942 (59.4%) |
| *Kaiholena* | β-256594 | KHL-10 TU1 FE 2 | *Chamaesyce cf oahuense* | 350 ± 40 | −26.4 | 330 ± 40 | 1465–1645 (95.4%) |
| | β-256593 | KHL-12 TU1 Level 3 | *Psychotria* sp. | 280 ± 40 | −24.7 | 280 ± 40 | 1482–1669 (90.3%)<br>1780–1798 (4.5%)<br>1946–1952 (0.6%) |
| | β-256584 | KHL-2A TU1 Level 8 | *Aleurites moluccana* nutshell | 280 ± 40 | −25 | 280 ± 40 | 1482–1669 (90.3%)<br>1780–1798 (4.5%)<br>1946–1952 (0.6%) |
| | β-256592 | KHL-1 TU1 FE 1 | *Chamaesyce cf multiformis* | 210 ± 40 | −20.9 | 240 ± 40 | 1520–1592 (14.5%)<br>1619–1684 (40.1%)<br>1732–1808 (31.3%)<br>1928–1954 (9.5%) |
| | β-256587 | KHL-2D TU2 FE 1 | *Chamaesyce cf oahuense* | 240 ± 40 | −25.6 | 230 ± 40 | 1521–1574 (7.4%)<br>1584–1590 (0.4%)<br>1626–1692 (36.9%)<br>1728–1811 (38.3%)<br>1921–1954 (12.4%) |
| | β-256586 | KHL-48 TU1 Level 2 | *Aleurites moluccana* nutshell | 200 ± 40 | −22.9 | 230 ± 40 | 1521–1574 (7.4%)<br>1584–1590 (0.4%)<br>1626–1692 (36.9%)<br>1728–1811 (38.3%)<br>1921–1954 (12.4%) |
| | β-271319 | KHL-2D TU2 Level 4 | *Aleurites moluccana* nutshell | 220 ± 40 | −25.5 | 210 ± 40 | 1529–1540 (0.6%)<br>1634–1696 (28.9%)<br>1725–1814 (46.4%)<br>1835–1878 (3.1%)<br>1916–1954 (16.4%) |
| | β-256591 | KHL-2H TU3 FE 1 | *Chamaesyce cf oahuense* | 160 ± 40 | −24.1 | 170 ± 40 | 1655–1707 (18.4%)<br>1719–1826 (46.5%)<br>1832–1886 (12.9%)<br>1912–1954 (17.5%) |

**Table S2. Kaiholena and Makeanehu Bayesian models (based upon construction sequences) and random models**

| Model A Kaiholena | | | Model A Makeanehu | | |
|---|---|---|---|---|---|
| Sequence | Group | Samples | Sequence | Group | Samples |
| During phase 1 | 1 | KHL-1 | During phase 1 | 1 | |
| During phase 2 | 2 | KHL-50, KHL-48 | During phase 2 | 2 | MKE-1 |
| After phase 2 | 3 | KHL-2a, KHL-2d, KHL-2dd, KHL-2h | After phase 2 | 3 | |
| During phase 3 or 4 | 4 | | During phase 3 or 4 | 4 | MKE-2 |

| Random Kaiholena | | | Random Makeanehu | | |
|---|---|---|---|---|---|
| Sequence | Group | Samples | Sequence | Group | Samples |
| Random | 1 | KHL-1, KHL-2h | random | 1 | MKE-2 |
| Random | 2 | KHL-50, KHL-2a, KHL-2d, | random | 2 | MKE-1 |
| Random | 3 | KHL-48, KHL-2dd | | | |

$A_{model}$ indices for Kaiholena model A = 100.4%, for Makeanehu model A = 101.11%, for Kaiholena random model = 75.07%, and for Makeanehu random model = 70.33%.