Combining oral traditions and Bayesian chronological modelling to understand village development in the Gulf of Papua (Papua New Guinea)

Chris Urwin, Quan Hua, Henry Arifeae

ONLINE SUPPLEMENT

**OxCal code for the Bayesian model**

Plot()

 {

 Sequence(Ancestral Villages)

 {

 Boundary("Start Popo Ancestral Village");

 Phase("Popo Ancestral Village")

 {

 Sequence(Maivipi)

 {

 Boundary("Start MA-1");

 Phase("MA-1")

 {

 R\_Date("OZW434", 555, 25);

 R\_Date("OZW433", 370, 20);

 R\_Date("OZV344", 385, 30);

 R\_Date("OZV346", 495, 25);

 R\_Date("OZV345", 650, 25);

 R\_Date("OZV347", 650, 25);

 R\_Date("OZV348", 505, 25);

 R\_Date("OZV349", 540, 30);

 R\_Date("OZV350", 555, 25);

 Interval("Duration MA-1");

 };

 Boundary("End MA-1");

 };

 Sequence(Miruka)

 {

 Boundary("Start MIR-2");

 Phase("MIR-2")

 {

 R\_Date("OZV356", 570, 25);

 R\_Date("OZV357", 645, 25);

 R\_Date("OZV358", 690, 20);

 R\_Date("OZV359", 650, 25);

 R\_Date("OZV360", 655, 25);

 R\_Date("OZV361", 590, 25);

 Interval("Duration MIR-2");

 };

 Boundary("End MIR-2");

 Interval("MIR-1/2 Hiatus");

 Boundary("Start MIR-1");

 Phase("MIR-1")

 {

 R\_Date("OZV354", 265, 20);

 R\_Date("OZV355", 310, 20);

 Interval("Duration MIR-1");

 };

 Boundary("End MIR-1");

 };

 Sequence(Marea Ita)

 {

 Boundary("Start ITA-2");

 Phase("ITA-2")

 {

 R\_Date("OZV294", 345, 25);

 R\_Date("OZV295", 310, 25);

 Interval("Duration ITA-2");

 };

 Boundary("Transition ITA-1/2");

 Phase("ITA-1")

 {

 R\_Date("OZV292", 260, 30);

 R\_Date("OZV293", 240, 30);

 R\_Date("OZV822", 270, 35);

 Interval("Duration ITA-1");

 };

 Boundary("End ITA-1");

 };

 Sequence(Popo Uku)

 {

 After(Basal Popo Uku)

 {

 R\_Date("OZU285", 415, 20);

 };

 Boundary("Start of PU-3");

 Phase(PU-3)

 {

 R\_Date("OZU284", 330, 20);

 R\_Date("WK41609", 305, 21);

 R\_Date("OZU283", 330, 25);

 Interval("Duration PU-3");

 };

 Boundary("Transition PU-3/2");

 Phase("PU-2")

 {

 R\_Date("OZU282", 205, 20);

 Interval("Duration PU-2");

 };

 Boundary("Transition PU-2/1");

 Phase("PU-1")

 {

 R\_Date("WK41608", 131, 20);

 Interval("Duration PU-1");

 };

 Boundary("End PU-1");

 };

 R\_Date("AHU\_OZV338", 140, 25);

 R\_Date("AHU\_OZV339", 170, 25);

 R\_Date("AHU\_OZV340", 465, 25);

 R\_Date("KOA\_OZV341", 170, 25);

 Interval("Duration\_Popo Ancestral Village");

 };

 Boundary("Transition Popo to Mirimua Mapoe");

 Phase("Mirimua Ancestral Village")

 {

 After(Basal Mirimua Mapoe)

 {

 R\_Date("OZV365", 260, 25);

 };

 R\_Date("OZV364", 110, 25);

 R\_Date("OZV363", 125, 25);

 Interval("Duration\_Mirimua Mapoe Village");

 };

 Boundary("End Mirimua Mapoe Village");

 };

 Order()

 {

 };

 };

**Online Supplement Table 1**. Stratigraphy of Popo Uku 1, Square A (from Urwin et al. 2018).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1 | 1-11 | Very dark brown sand-silt, transitioning from XU 8 onwards to more dark greyish brown sandy sediment as organics decrease below the current cultivation layer. Well consolidated, and poorly compacted with numerous small rootlets. Contains charcoal and horizontally oriented pottery. | 6.98-6.03 | 2.5Y 3/2 (XUs 1-8) 2.5Y 4/2 (XUs 9-11) |
| 2 | 12-17 | Dark greyish brown sand with small yellowish-brown sandy fraction. Well consolidated and loosely compacted. Less cultural material, more fragmented than in SU 1 (pottery and charcoal). SU2 appears lighter than SU3 in section profile due to smaller proportion of charcoal. | 6.58-6.42 | 2.5Y 4/2 |
| 3 | 18-30 | Dark greyish brown sand with significant fraction of coarse yellow-brown sandy sediment. Quite compacted and loosely consolidated. Larger, and more, fragments of pottery found compared to SU 2: not as fragmented. Still charcoal found in situ. | 6.59-6.42 | 2.5Y 4/2 |
| 4 | 31-41 | Greyish brown homogeneous sand, poorly compacted and poorly consolidated with some rotting coconut roots lying horizontal. Sediment becoming more compact, consolidated, and moist towards base of excavation. Few cultural remains: small fragments of charcoal and pottery perhaps as a result of vertical mixing. | 6.45-6.26  | 2.5Y 5/2 |

**Online Supplement Table 2**. Stratigraphy of Marea Ita 1, Square A (from Urwin 2019a: Table 29).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1a | 1-5 | Very dark grayish brown poorly consolidated and compacted silt sand. Held together by matted grass roots. These levels contain pottery sherds, charcoal, animal bone and shell.  | 6.28-6.71 | 2.5Y 3/2 |
| 1b | 6-12 | Very dark grayish brown poorly consolidated and poorly compacted sand silt. Contains large quantities of pottery sherds, charcoal, animal bone and shell. | 6.22-6.83 | 2.5Y 3/2 |
| 1b-2 | 13-15 | Sedimentary transition from SU1b to SU2 (mostly composed of SU1b). Colour change observed during excavation, but not in lab conditions. | 6.85-7.03 | 2.5Y 3/2 |
| 2 | 16-29 and Sub XUs (33-39)  | Very dark grayish brown sand, moderately compacted and moderately consolidated. Contains large quantities of pottery sherds, charcoal, animal bone and shell. | 6.81-7.50 | 2.5Y 3/2  |
| 2-3 | 30-32 | Dark greyish brown sand composed of SU2 and SU3 sediments mixed during excavation.  | 6.45-6.26  | 2.5Y 5/2 |

**Online Supplement Table 3**. Stratigraphy of Maivipi 1, Square A (from Urwin 2019a: Table 43).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1 | 1-4 | Very dark brown sandy loam containing many roots. Very well consolidated and moderately compacted. Contains large quantities of pottery sherds.  | Not recorded | 10YR 2/2 |
| 2a | 5-12 | Very dark grey well compacted and well consolidated sand with a clay fraction giving the sediment a moist ‘sticky’ texture. Contains very large amounts of pottery.  | 6.04-6.36 | 2.5Y 3/1 |
| 2b | 13-19 and sub-XUs(19b-23b) | Very dark greyish brown sand with some pottery sherds and charcoal. Moderately compacted and moderately consolidated. Slightly ‘sticky’ texture. | 6.19-6.50 | 2.5Y 3/2 |
| 3a | 20-28 | Dark greyish brown coarse-grained sand. Moderately compacted and poorly consolidated. Contains fully eroded red-orange haematite nodules. | 6.11-6.21 | 2.5Y 4/2 |
| 3a-3b | 29-33 | Interface of SU3a and SU3b. XU29-XU30 are primarily composed of SU3a sediments and contain water rounded pebbles. XU31-XU33 mostly comprise SU3b.  | 6.18-6.32 | 2.5Y 4/2 (XU29-XU30)2.5Y 5/3(XU31-XU33) |
| 3b | 34-36 | Culturally depauperate light olive brown coarse-grained sand. Sediment becoming very damp close to the water table.  | 6.15-6.27 | 2.5Y 5/3 |

**Online Supplement Table 4**. Stratigraphy of Miruka 1, Square A (from Urwin 2019a: Table 58).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1 | 1-11 | Poorly compacted and unconsolidated dark brown sandy loam, with dense fern and kunai grass roots throughout. Root material drops off significantly after XU5, coinciding with a colour change to very dark greyish brown. Large pottery sherds found horizontally oriented. | 5.60-5.91 | 2.5Y 3/1 (XU1-XU5)2.5Y 3/2 (XU6-XU11) |
| 1-2a interface | 12-15 | Primarily composed of SU2a sediments. Dark greyish brown sand, quite well compacted. Large horizontally oriented pottery sherds still present. | 5.80-5.88 | 2.5Y 4/2 |
| 2a | 16-24 | Very dark grey sand. Sediment is quite well compacted and contains a fraction of black iron-rich sand.  | 5.69-6.06 | 2.5Y 3/1 |
| 2b | 25-30 | Black iron-rich sand, well consolidated and moderately compacted. Few cultural materials, and charcoal seldom visible in situ.  | 6.06-6.14 | GLEY1 2.5/N |
| 2b-3a interface | 31-34 | Transition from SU2b to SU3a begins as small flecks of SU3a deposit in SU2b (XU31-XU32). From XU33 to XU34 the deposit is primarily composed of SU3a. | 6.03-6.16 | GLEY1 2.5/N (XU31-XU32)2.5Y 3/1 (XU33-XU34) |
| 3a | 35-39 | Coarse-grained greyish brown sand with some large water-rounded pebbles and small pieces of charcoal and pottery.  | 6.26-6.35 | 2.5Y 5/2 |
| 3b | 40-43 | Light olive brown, coarse-grained sand, culturally depauperate. Sand is quite damp towards the base of SU3b. Poorly compacted and somewhat consolidated. | 6.32-6.37 | 2.5Y 5/3 |

**Online Supplement Table 5**. Stratigraphy of Aitae Hiru 1, Square A (from Urwin 2019a: Table 69).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1a | 1-4 | Dark greyish brown sand-silt matted together by betel nut and fern roots. Poorly compacted and loosely consolidated due to very dry weather in September and early October 2015.  | 5.72-5.99 | 10YR 4/2 |
| 1b | 5-8 | Sediment is akin to SU1a but is slightly more compacted. SU1b appeared darker brown in colour during excavation, as these deeper levels had been less affected by dry weather. SU1b has fewer roots.  | 6.00-6.07 | 10YR 4/2 |
| 1b-2 interface | 9-10 | Mixed sediment, transitioning between SU1b and SU2. Sediment became noticeably more compact midway through the excavation of XU9. | 6.08-6.09 | 10YR 4/2 (XU9)10YR 4/3 (XU10) |
| 2 | 11-18 | Brown, moderately well compacted sand-silt. Poorly consolidated and fairly dry. Large coconut roots running horizontally across excavation square in this SU.  | 6.02-6.22 | 10YR 4/3 |
| 3 | 19-24 | Brown sand, moderately well compacted and slightly consolidated. | 6.18-6.38 | 10YR 5/3 |
| 4 | 25-26 | Yellowish brown coarse-grained beach sand. Some dark grey mottling and water staining evident during excavation.  | 6.41-6.42 | 10YR 5/4 |

**Online Supplement Table 6**. Stratigraphy of Koavaipi 1, Square A (from Urwin 2019a: Table 72).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1a | 1-7 | Very dark grey sandy loam held together by betel nut, fern, and grass rootlets. Very poorly compacted and consolidated. Some small pottery sherds seen during excavation. | 5.91-6.15 | 10YR 3/1 |
| 1b | 8-12 | Moderately compacted and poorly consolidated very dark greyish brown sand with charcoal deposits. Betel palm roots still observed. | 5.97-6.16 | 10YR 3/2 |
| 1b-2 interface | 13 | Akin to SU1b sediment, but with a very slight (darker) colour change noticed during excavation. Culturally depauperate. | 5.94 | 10YR 3/2 |
| 2 | 14-16 | Culturally depauperate black iron-rich sands. Moderately consolidated and compacted.  | 5.92-5.99 | GLEY1 2.5N |
| 2-3 interface | 17-18 | Dark greyish brown sand at the interface of SU2 and SU3. XU17 appears to be mostly composed of SU2 sediments, and XU18 has a slightly greater proportion of coarse-grained beach sand (SU3).  | 6.00-6.11 | 2.5Y 4/2  |
| 3 | 19-21 | Coarse-grained olive brown beach sand with grey and orange mottling and water rolled pebbles. Uncompacted but slightly consolidated by moisture. | 6.06-6.12 | 2.5Y 4/3  |

**Online Supplement Table 7**. Stratigraphy of Mirimua Mapoe 1, Square A (from Urwin 2019a: Table 77).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SU | XUs | Sediment Description | pH Range | Dry Munsell |
| 1 | 1-5 | Dark olive grey humic sand. Well compacted and moderately consolidated. Pottery sherds and charcoal visible in situ. Coconut, betel palm, and fern roots are found throughout.  | 5.59-5.73 | 5Y 3/2 |
| 1-2a interface | 6 | Stratigraphic transition from SU1 to SU2. Slightly lighter in colour and less compacted than SU1 deposits. | 5.92 | 5Y 3/2 |
| 2a | 7-13 | Moderately compacted olive grey sand. Cultural materials still seen in situ in XU6-XU7. Coconut roots still present.  | 5.86-5.95 | 5Y 4/2 |
| 2a-2binterface | 14-17 | Gradual stratigraphic transition from SU2 to SU3. XU14-15 are primarily composed of SU2a and XU16-XU17 are mostly SU2b. | 5.80-5.91 | 5Y 4/2 (XU14-XU15)2.5Y 5/3(XU16-XU17) |
| 2b | 18-19 | Light olive brown uncompacted and moderately consolidated coarse-grained sand with some grey and orange staining.  | 5.80-5.91 | 2.5Y 5/3 |