**Supplementary material**

**Archaeological earthen mound complex in Patos Lagoon, Southern Brazil: chronological model and freshwater influence**

Rafael G Milheira1, Kita D Macario2,\*, Ingrid S Chanca2, Eduardo Q Alves2,3

1 Universidade Federal de Pelotas, Instituto de Ciências Humanas. Rua Cel. Alberto Rosa 154, 96010-770 - Pelotas, RS - Brazil

2 Universidade Federal Fluminense, Instituto de Física. Av. Gal. Milton Tavares de Souza s/n, 24210-346 - Niterói, RJ - Brazil

3 Oxford Radiocarbon Accelerator Unit, University of Oxford, Dyson Perrins Building, South Parks Road, Oxford, OX1 3QY, United Kingdom

\* Corresponding author. E-mail: kitamacario@gmail.com

**OxCal model CQL**

Options()

 {

 Outlier\_Model("General",T(5),U(0,4),"t");

 Curve("ShCal13","ShCal13.14c");

 Delta\_R("psg",U(-100,400));

 Plot()

 {

 Phase()

 {

 Span();

 Sequence()

 {

 Boundary("Start 0");

 Phase()

 {

 Sequence()

 {

 Boundary("Start 1");

 Phase("PSG-01")

 {

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13059", 1860, 100)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13057", 1930, 180)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13058", 1697, 32)

 {

 color="blue";

 Outlier(0.05);

 };

 };

 Boundary("End 1");

 };

 Sequence()

 {

 Boundary("Start 2");

 Phase("PSG-02")

 {

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("UGAMS-12062", 1280, 20)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-140391", 1724, 40)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 R\_Date("LACUFF-13051", 1493, 31)

 {

 color="brown";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 R\_Date("LACUFF-13050", 1680, 30)

 {

 color="brown";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 R\_Date("LACUFF-13049", 1604, 32)

 {

 color="brown";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13056", 1859, 29)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("UGAMS-12061", 1590, 20)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 After("", )

 {

 R\_Date("UGAMS-12060-bone", 1390, 20)

 {

 color="brown";

 Outlier(0.05);

 };

 };

 };

 Boundary("End 2");

 };

 Phase("PSG-03")

 {

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("BETA-389011", 1490, 30)

 {

 color="blue";

 Outlier(0.05);

 };

 };

 Sequence()

 {

 Boundary("Start 4");

 Phase("PSG-06")

 {

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13054", 1652, 33)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13055", 1548, 59)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-140392", 1355, 37)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13053", 1480, 130)

 {

 color="blue";

 Outlier(0.05);

 };

 };

 Boundary("End 4");

 };

 Sequence()

 {

 Boundary("Start 5");

 Phase("PSG-07")

 {

 Curve("=ShCal13");

 R\_Date("BETA 389014", 1630, 30)

 {

 color="brown";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("BETA 389013", 1670, 30)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-140395", 1756, 28)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 R\_Date("LACUFF-140394", 1662, 194)

 {

 color="brown";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-140393", 1214, 22)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-13052", 2340, 150)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 Delta\_R("=psg");

 R\_Date("LACUFF-140396", 1696, 28)

 {

 color="blue";

 Outlier(0.05);

 };

 Curve("=ShCal13");

 After("", )

 {

 R\_Date("BETA-415598-bone", 1720, 30)

 {

 color="brown";

 Outlier(0.05);

 };

 };

 };

 Boundary("End 5");

 };

 };

 Boundary("End 0");

 };

 };

 };

 };

**OxCal model output:**

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Modelled (BP) |  |  |
| Amodel 94.6 |  |  |  |  |
| Aoverall 63.5" |  |  |  |  |
|  | from | to | mu | sigma |
| Boundary End 0 | ... | 754 | 1065 | 169 |
| Boundary End 5 | 1546 | 978 | 1376 | 145 |
| R\_Date BETA-415598-bone | 1701 | 1525 | 1597 | 63 |
| R\_Date LACUFF-140396 | 1686 | 1365 | 1492 | 67 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13052 | 2027 | 1283 | 1521 | 146 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-140393 | 1660 | 1016 | 1438 | 140 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-140394 | 1685 | 1315 | 1490 | 87 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-140395 | 1702 | 1407 | 1522 | 73 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date BETA 389013 | 1606 | 1353 | 1478 | 64 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date BETA 389014 | 1556 | 1407 | 1479 | 39 |
| Curve =ShCal13 |  |  |  |  |
| Phase PSG-07 |  |  |  |  |
| Boundary Start 5 | 1960 | 1410 | 1590 | 152 |
| Sequence |  |  |  |  |
| Boundary End 4 | 1376 | 992 | 1194 | 94 |
| R\_Date LACUFF-13053 | 1528 | 1135 | 1320 | 94 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-140392 | 1415 | 1084 | 1250 | 76 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13055 | 1520 | 1190 | 1348 | 68 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13054 | 1575 | 1302 | 1409 | 74 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| Phase PSG-06 |  |  |  |  |
| Boundary Start 4 | 1727 | 1308 | 1485 | 117 |
| Sequence |  |  |  |  |
| R\_Date BETA-389011 | 1403 | 1186 | 1295 | 53 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| Phase PSG-03 |  |  |  |  |
| Boundary End 2 | 1300 | 984 | 1186 | 97 |
| R\_Date UGAMS-12060-bone | 1307 | 1191 | 1280 | 23 |
| After |  |  |  |  |
| Curve =ShCal13 |  |  |  |  |
| R\_Date UGAMS-12061 | 1518 | 1295 | 1369 | 59 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13056 | 1816 | 1303 | 1586 | 121 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13049 | 1531 | 1372 | 1453 | 47 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13050 | 1592 | 1423 | 1521 | 51 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13051 | 1404 | 1298 | 1341 | 31 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-140391 | 1698 | 1368 | 1505 | 81 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date UGAMS-12062 | 1600 | 1013 | 1297 | 155 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| Phase PSG-02 |  |  |  |  |
| Boundary Start 2 | 1866 | 1451 | 1651 | 105 |
| Sequence |  |  |  |  |
| Boundary End 1 | 1677 | 1192 | 1423 | 119 |
| R\_Date LACUFF-13058 | 1700 | 1365 | 1503 | 78 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13057 | 1790 | 1346 | 1546 | 113 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| R\_Date LACUFF-13059 | 1777 | 1367 | 1553 | 105 |
| Delta\_R =psg | -59.5 | 142.5 | 63.1003 | 53.2785 |
| Curve =ShCal13 |  |  |  |  |
| Phase PSG-01 |  |  |  |  |
| Boundary Start 1 | 1906 | 1401 | 1623 | 137 |
| Sequence |  |  |  |  |
| Phase |  |  |  |  |
| Boundary Start 0 | 2177 | ... | 1774 | 207 |
| Sequence |  |  |  |  |
| Span | ... | 1351 | 723 | 321 |
| Phase |  |  |  |  |
| Delta\_R psg | -59.5 | 142.5 | 63.1003 | 53.2785 |

**Outlier model output**

