Supplementary data for Jenkyns and Macfarlane ‘*The chemostratigraphy and environmental significance of the Marlstone and Junction Bed (Beacon Limestone, Toarcian, Lower Jurassic, Dorset, UK*)’

Bulk and belemnite carbon- and oxygen-isotope data.

(Repeated entries for values of some belemnites are given in some places because the fossil in question is large enough to extend over a stratigraphic distance of several centimetres that has more than one corresponding bulk-carbonate isotopic value.)

Block 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Height (cm) | 13Cbulk | 18Obulk | 13Cbelemnite | 18Obelemnite | 13Csingle belemnite | 18Osingle belemnite |
| -1 |  |  | 1.235 | -0.746 | 1.235 | -0.746 |
| 0 | -0.53 | -1.45 |  |  |  |  |
| 1 | -0.14 | -1.414 |  |  |  |  |
| 2 | -3.58 | -2.998 | 1.048 | -0.364 | 1.048 | -0.364 |
| 3 | -2.64 | -2.785 |  |  |  |  |
| 4 | -3.761 | -3.153 | 1.87 | -0.394 | 1.87 | -0.394 |
| 5 | -3.914 | -2.909 | 2.873 | -0.451 |  |  |
| 6 | -2.867 | -2.856 | 2.873 | -0.451 |  |  |
| 7 | -3.971 | -2.892 | 2.873 | -0.451 | 2.873 | -0.451 |
| 8 | -2.899 | -3.001 |  |  |  |  |
| 9 | -3.712 | -3.171 |  |  |  |  |
| 10 | -1.187 | -1.46 | 2.392 | -0.214 | 2.392 | -0.214 |
| 10 | -5.421 | -4.796 |  |  |  |  |
| 11 | 0.168 | -0.756 | 2.392 | -0.214 |  |  |
| 12 | -1.055 | -2.328 | 2.392 | -0.214 |  | - |
| 13 | 1.949 | -1.783 |  |  |  |  |
| 14 | -0.366 | -2.324 |  |  |  |  |
| 15 | 1.347 | -1.913 | -0.206 | -2.591 |  |  |
| 16 | 1.849 | -1.674 | -0.206 | -2.591 | -0.206 | -2.591 |
| 17 | 1.292 | -1.865 |  |  |  |  |
| 18 | 1.682 | -1.716 |  |  |  |  |
| 19 | 0.466 | -1.873 |  |  |  |  |
| 20 | 1.154 | -1.753 |  |  |  |  |
| 21 | 1.822 | -1.491 |  |  |  |  |
| 22 | 1.549 | -1.62 |  |  |  |  |
| 23 | 1.905 | -1.409 |  |  |  |  |
| 24 | 1.228 | -1.808 | 2.955 | -2.411 |  |  |
| 25 | 0.984 | -1.887 | 2.955 | -2.411 | 2.955 | -2.411 |
| 26 | 0.727 | -1.741 |  |  |  |  |
| 27 | 0.918 | -1.667 |  |  |  |  |
| 28 | 0.245 | -2.15 | 2.345 | -1.081 | 2.345 | -1.081 |
| 29 | -0.997 | -1.972 |  |  |  |  |
| 30 | 2.543 | -0.671 |  |  |  |  |
| 31 | -4.006 | -2.43 |  |  |  |  |
| 32 | 0.022 | -1.639 |  |  |  |  |
| 33 | -6.132 | -4.253 |  |  |  |  |
| 34 | -6.146 | -4.281 |  |  |  |  |
| 35 | -6.829 | -4.152 |  |  |  |  |
| 36 | 0.803 | -1.594 |  |  |  |  |
| 37 | -0.538 | -1.801 |  |  |  |  |
| 38 | 1.314 | -1.164 | 2.739 | -0.605 | 2.739 | -0.605 |
| 39 | 1.717 | -1.272 |  |  |  |  |
| 40 | 1.16 | -1.339 |  |  |  |  |
| 41 | 1.152 | -1.594 |  |  |  |  |
| 42 | 0.969 | -1.492 |  |  |  |  |
| 43 | 1.685 | -1.293 |  |  |  |  |
| 44 | 1.171 | -1.358 |  |  |  |  |
| 45 | 1.574 | -1.261 |  |  |  |  |
| 46 | 2.125 | -1.296 |  |  |  |  |
| 47 | 1.964 | -1.196 |  |  |  |  |
| 48 | 0.853 | -1.197 |  |  |  |  |
| 49 | 1.352 | -1.119 |  |  |  |  |
| 50 | 1.971 | -1.183 |  |  |  |  |
| 51 | 1.554 | -1.348 | 2.483 | -0.016 | 2.483 | -0.016 |
| 52 | 1.863 | -1.298 |  |  |  |  |
| 53 | -1.208 | -2.447 | 1.392 | -1.205 | 1.392 | -1.205 |
| 54 | -0.605 | -2.093 |  |  |  |  |
| 55 | 0.791 | -1.577 |  |  |  |  |
| 56 | 0.135 | -2.176 |  |  |  |  |

Block 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Height (cm) | 13Cbulk | 18Obulk | 13Cbelemnite | 18Obelemnite | 13Csingle belemnite | 18Osingle belemnite |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |
| 10.5 |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |
| 11.5 |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |
| 12.5 |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |
| 13.5 |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |
| 14.5 |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |
| 15.5 |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |
| 16.5 |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |
| 17.5 |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |
| 18.5 |  |  |  |  |  |  |
| 19 |  |  |  |  |  |  |
| 19.5 |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |
| 23 |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |
| 27 |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |
| 29 |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |
| 31 |  |  |  |  |  |  |
| 32 |  |  |  |  |  |  |
| 33 |  |  |  |  |  |  |
| 34 |  |  |  |  |  |  |
| 35 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Elemental and Sr-isotope data from belemnites (Sr-isotope ratios normalized to an NIST SRM 987 standard value of 0.710250)

Block 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Height (cm)  |  Mg (ppm) |  Ca (g) |  Mn (ppm) |  Fe (ppm) | 87Sr/86Sr | 2- error |
| -1 | 1315.2 | 0.28550 | 28.88 | 6.1 | 0.707097 | 2.10E-05 |
| 2 | 1908.4 | 0.33624 | 19.72 | 0.35 | 0.707075 | 1.70E-05 |
| 4 | 1162.2 | 0.22139 | 12.56 | 2.4 | 0.707108 | 2.10E-05 |
| 5 | 1420.5 | 0.27018 | 13.41 | 0 |  |  |
| 6 | 1420.5 | 0.27018 | 13.41 | 0 | 0.707040 | 8.60E-05 |
| 7 | 1420.5 | 0.27018 | 13.41 | 0 |  |  |
| 10 | 1770.2 | 0.32246 | 100.16 | 2.3 |  |  |
| 11 | 1770.2 | 0.32246 | 100.16 | 2.3 | 0.707003 | 1.70E-05 |
| 12 | 1770.2 | 0.32246 | 100.16 | 2.3 |  |  |
| 15 | 2062.6 | 0.18056 | 28.81 | 8.5 |  |  |
| 15.5 |  |  |  |  | 0.707198 | 2.00E-05 |
| 16 | 2062.6 | 0.18056 | 28.81 | 8.5 |  |  |
| 24 | 3789 | 0.32038 | 62.06 | 10.99 |  |  |
| 24.5 |  |  |  |  | 0.707170 | 1.60E-05 |
| 25 | 3789 | 0.32038 | 62.06 | 10.99 |  |  |
| 28 | 1936.1 | 0.19824 | 9.511 | 2.75 | 0.707161 | 2.10E-05 |
| 28 | 3058.6 | 0.26212 | 696.5 | 35.9 | 0.707189 | 9.20E-06 |
| 38 | 3881.7 | 0.32154 | 66.6 | 16.8 | 0.707199 | 1.20E-05 |
| 51 | 3191.7 | 0.27842 | 23.48 | 5.3 | 0.707237 | 2.00E-05 |
| 53 | 4498.6 | 0.30987 | 19.5 | 3.69 | 0.707200 | 2.00E-05 |

Block 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Height (cm) | Mg (ppm) | Ca (g) | Mn (ppm) | Fe (ppm) | 87Sr/86Sr | 2- errors |
| 1 | 1487.5 | 0.299 | 11.77 | 3.32 |  |  |
| 1.5 |  |  |  |  | 0.707072 | 2.00E-05 |
| 2 | 1487.5 | 0.299 | 11.77 | 3.32 |  |  |
| 6 | 1359.3 | 0.258 | 40.42 | 4.76 |  |  |
| 6.5 |  |  |  |  | 0.707121 | 2.00E-05 |
| 7 | 1359.3 | 0.258 | 40.42 | 4.76 |  |  |
| 9 | 2273.8 | 0.299 | 10.15 | 3.19 | 0.70711 | 2.00E-05 |
| 9 | 1337.4 | 0.253 | 14.52 | 6.23 | 0.707061 | 2.10E-05 |
| 13 | 3780.1 | 0.34 | 77.64 | 14.46 | 0.707156 | 2.10E-05 |
| 13 | 3104.9 | 0.275 | 20.48 | 5.14 |  |  |
| 14 | 3104.9 | 0.275 | 20.48 | 5.14 | 0.707122 | 2.00E-05 |
| 15 | 3104.9 | 0.275 | 20.48 | 5.14 |  |  |
| 20 | 4851.3 | 0.371 | 965.34 | 105.6 | 0.707218 | 2.00E-05 |
| 29 | 1604.4 | 0.189 | 8.79 | 2.56 | 0.707188 | 2.10E-05 |
| 32 | 2711.6 | 0.289 | 43.84 | 7.1 | 0.707158 | 2.10E-05 |

Palaeotemperature reconstructions

Belemnite oxygen-isotope data have been converted to palaeotemperatures using the equation of Anderson and Arthur (1983):

*T°C* = 16.0 − 4.14 (c − w) + 0.13 (c − w)2

where c is the 18O value of carbonate relative to V-PDB and w is the 18O value of seawater relative to V-SMOW, taken as -1‰ for an ice-free Mesozoic ocean (Shackleton and Kennett, 1974).

Belemnite Mg:Ca ratios have been determined and converted to palaeotemperatures using the bivalve-based equation of Klein et al, (1996):

*T°C* = 2.5\* [ (Mg/Ca) × 1000] – 2.07

Relevant results are displayed in Figures 9 and 10 of the paper.

Anderson TF and Arthur MA (1983) Stable isotopes of oxygen and carbon and their application to sedimentologic and paleoenvironmental problems. In *Short Course, Society of Economic Paleontologists and Mineralogists* (contributors MA Arthur, TF Anderson, IR Kaplan, J Veizer and LS. Land), Chapter 1, 1–151.

Shackleton, NJ and Kennett JP (1975) Paleotemperature history of the Cenozoic and the initiation of Antarctic glaciation: oxygen and carbon isotope analyses in DSDP Sites 277,279, and 281. In *Initial Reports of the Deep Sea Drilling Project* (JP Kennett, JP, RE Houtz *et a*l.), Washington, U.S. Government Printing Office, **29**, 743–755.

Klein RT, Lohmann KC and Thayer CW (1996) Bivalve skeletons record sea-surface temperature and δ18O via Mg/Ca and 18O/16O ratios. *Geology* **24**, 415–418.

Diagenetic cement from fissure-fills in the Junction Bed/ Marlstone complex adjacent to the Eype’s Mouth Fault

|  |  |
| --- | --- |
| 13C | 18O |
| -8.577 | -5.971 |
| -10.225 | -6.318 |
| -6.095 | -5.239 |
| -4.998 | -5.773 |
| -4.089 | -5.804 |
| -4.536 | -5.431 |
| -2.705 | -3.502 |