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| **Supplementary Table 1** | | | | | | |
| Sample No. | Bed No. | Distance (m) | Unit | Lithology | δ13C(‰) | δ18O(‰) |
| 1 | 12 | 40 | Upper member of Bashisuogong Formation | calcarenite | -2.2 | -2.3 |
| 2 | 22 | 52 | calcarenite | -2.2 | -2.8 |
| 3 | 24 | 62 | calcarenite | -2.7 | -2.1 |
| 4 | 26 | 72 | calcarenite | -2.8 | -2.7 |
| 5 | 28 | 76 | calcarenite | -1.6 | -1.3 |
| 6 | 31 | 90 | bioclastic limestone | 2.9 | -7.2 |
| 7 | 33 | 98 | bioclastic limestone | 2.4 | -6.7 |
| 8 | 34 | 108 | bioclastic limestone | 2.7 | -7.0 |
| 9 | 35 | 116 | bioclastic limestone | 2.7 | -6.8 |
| 10 | 36 | 126 | bioclastic limestone | 2.7 | -6.0 |
| 11 | 37 | 132 | bioclast bearing limestone | 1.9 | -5.9 |
| 12 | 38 | 144 | bioclast bearing limestone | 1.6 | -5.8 |
| 13 | 39 | 154 | bioclast bearing limestone | 1.9 | -4.8 |
| 14 | 40 | 162 | bioclast bearing limestone | 1.1 | -4.9 |
| 15 | 41 | 172 | bioclast bearing limestone | 1.9 | -5.7 |
| 16 | 42 | 182 | bioclast bearing limestone | 1.5 | -4.0 |
| 17 | 43 | 192 | bioclast bearing limestone | 1.9 | -5.2 |
| 18 | 44 | 200 | bioclast bearing limestone | 4.1 | -7.0 |
| 19 | 45 | 210 | bioclast bearing limestone | 3.4 | -6.9 |
| 20 | 46 | 220 | bioclast bearing limestone | 3.5 | -6.7 |
| 21 | 47 | 230 | bioclastic limestone | 4.4 | -5.4 |
| 22 | 48 | 240 | Lower member of Biegentaw Formation | carbonaceous mudstone | -0.7 | -6.0 |
| 23 | 49 | 250 | carbonaceous mudstone | -0.3 | -8.1 |
| 24 | 51 | 256 | carbonaceous mudstone | 0.5 | -6.8 |
| 25 | 53 | 260 | carbonaceous mudstone | -0.9 | -5.4 |
| 26 | 58 | 360 | bioclast bearing limestone | -0.9 | -5.7 |
| 27 | 61 | 414 | bioclast bearing limestone | -1.5 | -4.4 |
| 28 | 64 | 448 | bioclast bearing limestone | -0.8 | -5.4 |
| 29 | 66 | 480 | Middle member of Biegentaw Formation | bioclastic limestone | 2.0 | -5.0 |
| 30 | 67 | 490 | bioclastic limestone | 2.2 | -4.3 |
| 31 | 68 | 508 | bioclast bearing limestone | 1.9 | -3.2 |
| 32 | 69 | 514 | bioclastic limestone | 1.7 | -4.8 |
| 33 | 72 | 552 | bioclastic limestone | 1.8 | -5.7 |
| 34 | 73 | 584 | bioclastic limestone | 1.9 | -3.7 |
| 35 | 80 | 634 | bioclast bearing limestone | 2.0 | -6.8 |
| 36 | 82 | 650 | bioclast bearing limestone | 1.8 | -6.6 |
| 37 | 83 | 660 | bioclast bearing limestone | 1.1 | -6.5 |
| 38 | 84 | 674 | bioclast bearing limestone | 2.5 | -5.1 |
| 39 | 85 | 690 | bioclast bearing limestone | 2.5 | -6.1 |
| 40 | 86 | 700 | bioclast bearing limestone | 1.6 | -5.9 |
| 41 | 88 | 714 | bioclast bearing limestone | 0.3 | -5.2 |
| 42 | 89 | 730 | bioclast bearing limestone | 1.6 | -2.8 |
| 43 | 90 | 744 | bioclast bearing limestone | 0.8 | -3.8 |
| 44 | 91 | 758 | bioclast bearing limestone | 2.9 | -4.2 |
| 45 | 92 | 776 | bioclast bearing limestone | 2.8 | -5.3 |
| 46 | 93 | 790 | bioclast bearing limestone | 2.4 | -4.7 |
| 47 | 94 | 812 | bioclastic limestone | 4.0 | -5.7 |
| 48 | 95 | 832 | bioclastic limestone | 4.4 | -6.6 |
| 49 | 96 | 854 | bioclastic limestone | 4.8 | -2.9 |
| 50 | 98 | 940 | bioclastic limestone | 4.6 | -3.6 |
| 51 | 99 | 946 | bioclastic limestone | 4.3 | -4.2 |
| 52 | 100 | 956 | bioclastic limestone | 2.4 | -3.6 |
| 53 | 101 | 976 | bioclastic limestone | 3.8 | -3.8 |
| 54 | 102 | 986 | bioclastic limestone | 4.4 | -3.3 |
| 55 | 103 | 996 | bioclastic limestone | 4.8 | -3.5 |
| 56 | 104 | 1004 | bioclastic limestone | 5.7 | -3.7 |
| 57 | 105 | 1014 | bioclastic limestone | 6.4 | -3.7 |
| 58 | 106 | 1032 | Upper member of Biegentaw Formation | micrite | 7.2 | -3.3 |
| 59 | 107 | 1054 | bioclastic limestone | 4.3 | -4.6 |
| 60 | 108 | 1062 | bioclastic limestone | 5.9 | -5.1 |
| 61 | 109 | 1072 | bioclastic limestone | 5.7 | -6.7 |
| 62 | 110 | 1088 | bioclastic limestone | 5.7 | -3.8 |
| 63 | 111 | 1106 | micrite | 5.6 | -5.4 |
| 64 | 112 | 1124 | micrite | 3.9 | -5.6 |
| 65 | 112 | 1150 | micrite | 5.6 | -1.7 |
| 66 | 113 | 1180 | bioclastic limestone | 5.1 | -5.1 |
| 67 | 114 | 1208 | bioclastic limestone | 5.0 | -4.7 |
| 68 | 115 | 1240 | bioclastic limestone | 5.2 | -4.5 |
| 69 | 116 | 1270 | bioclastic limestone | 5.7 | -4.2 |
| 70 | 117 | 1292 | bioclastic limestone | 5.3 | -4.9 |
| 71 | 118 | 1330 | bioclastic limestone | 5.1 | -5.0 |
| 72 | 119 | 1352 | bioclastic limestone | 4.2 | -4.8 |
| 73 | 120 | 1370 | bioclastic limestone | 5.3 | -4.5 |
| 74 | 121 | 1402 | bioclastic limestone | 5.3 | -4.8 |
| 75 | 122 | 1422 | bioclastic limestone | 4.6 | -5.8 |
| 76 | 123 | 1456 | bioclastic limestone | 4.8 | -5.5 |
| 77 | 124 | 1480 | bioclastic limestone | 4.8 | -6.3 |
| 78 | 125 | 1526 | bioclastic limestone | 4.9 | -5.1 |
| 79 | 126 | 1558 | bioclastic limestone | 5.1 | -5.6 |
| 80 | 127 | 1594 | bioclastic limestone | 4.3 | -4.1 |
| 81 | 128 | 1628 | bioclastic limestone | 4.7 | -3.7 |
| 82 | 131 | 1664 | Lower member of Kangkelin Formation | reef limestone | -3.9 | -6.8 |
| 83 | 131 | 1682 | reef limestone | -4.9 | -6.4 |
| 84 | 132 | 1698 | reef limestone | -3.9 | -6.5 |
| 85 | 132 | 1716 | reef limestone | -3.4 | -6.8 |
| 86 | 133 | 1732 | reef limestone | -6.1 | -6.6 |
| 87 | 134 | 1750 | reef limestone | -2.7 | -6.4 |
| 88 | 135 | 1766 | reef limestone | 0.9 | -6.6 |
| 89 | 136 | 1784 | reef limestone | 3.8 | -7.0 |
| 90 | 137 | 1800 | reef limestone | 0.0 | -6.7 |
| 91 | 138 | 1816 | reef limestone | 5.2 | -5.1 |
| 92 | 139 | 1832 | bioclastic limestone | 2.9 | -6.7 |
| 93 | 139 | 1844 | bioclastic limestone | 4.9 | -4.1 |
| 94 | 140 | 1868 | reef limestone | 0.6 | -6.6 |
| 95 | 141 | 1900 | bioclastic limestone | 5.3 | -5.6 |
| 96 | 142 | 1926 | bioclastic limestone | 5.5 | -5.5 |
| 97 | 143 | 1950 | bioclastic limestone | 5.1 | -4.9 |
| 98 | 144 | 1980 | bioclastic limestone | 3.7 | -5.1 |
| 99 | 145 | 1998 | bioclastic limestone | 5.4 | -3.3 |
| 100 | 146 | 2046 | bioclast bearing limestone | 2.9 | -5.8 |
| 101 | 147 | 2088 | bioclastic limestone | 4.5 | -3.7 |
| 102 | 148 | 2110 | bioclastic limestone | 4.1 | -3.7 |
| 103 | 149 | 2146 | bioclastic limestone | 3.6 | -4.3 |
| 104 | 150 | 2170 | bioclastic limestone | 5.1 | -3.7 |
| 105 | 151 | 2196 | bioclastic limestone | 4.3 | -3.5 |
| 106 | 152 | 2226 | Upper member of Kangkelin Formation | calcarenite | 4.8 | -3.4 |
| 107 | 153 | 2246 | calcarenite | 5.7 | -4.4 |
| 108 | 154 | 2258 | bioclastic limestone | 6.2 | -2.4 |
| 109 | 155 | 2274 | bioclastic limestone | 5.0 | -5.7 |
| 110 | 156 | 2290 | bioclastic limestone | 4.8 | -3.5 |
| 111 | 157 | 2300 | bioclastic limestone | 5.9 | -3.0 |
| 112 | 158 | 2306 | bioclastic limestone | 4.9 | -3.9 |
| 113 | 159 | 2328 | bioclastic limestone | 5.0 | -3.1 |
| 114 | 159 | 2350 | bioclastic limestone | 5.1 | -2.9 |
| 115 | 160 | 2384 | bioclastic limestone | 5.7 | -2.8 |
| 116 | 161 | 2428 | bioclastic limestone | 6 | -2.5 |
| 117 | 162 | 2468 | bioclastic limestone | 5.3 | -2.2 |
| 118 | 163 | 2492 | bioclastic limestone | 4.5 | -2.4 |
| 119 | 164 | 2518 | bioclastic limestone | 5 | -2.6 |
| 120 | 165 | 2552 | bioclastic limestone | 4.5 | -2.7 |
| 121 | 166 | 2568 | bioclastic limestone | 4.7 | -3 |
| 122 | 167 | 2580 | bioclastic limestone | 4.7 | -2.9 |
| 123 | 168 | 2606 | bioclastic limestone | 4.7 | -3 |
| 124 | 169 | 2662 | bioclastic limestone | 4.3 | -2.9 |
| 125 | 170 | 2696 | bioclastic limestone | 4.5 | -2.7 |
| 126 | 170 | 2738 | bioclastic limestone | 2.9 | -4.2 |
| 127 | 172 | 2848 | Lower member of Kunkelaqi Formation | bioclastic limestone | 3.6 | -3.7 |
| 128 | 173 | 2858 | bioclastic limestone | 3.5 | -3.4 |
| 129 | 173 | 2908 | bioclastic limestone | 3.5 | -3.6 |
| 130 | 175 | 2976 | micrite | 3 | -4 |
| 131 | 176 | 2998 | micrite | 2.5 | -4.3 |
| 132 | 177 | 3012 | micrite | 2.8 | -3.2 |
| 133 | 178 | 3046 | bioclastic limestone | 3.1 | -5.1 |
| 134 | 179 | 3074 | bioclastic limestone | 3.9 | -2.7 |
| 135 | 180 | 3108 | bioclastic limestone | 3.8 | -3 |
| 136 | 181 | 3140 | bioclastic limestone | 3.4 | -2.7 |
| 137 | 183 | 3154 | bioclastic limestone | 4.7 | -3.5 |
| 138 | 184 | 3208 | bioclastic limestone | 4.5 | -3.6 |
| 139 | 186 | 3218 | micrite | 5.5 | -2.7 |
| 140 | 187 | 3254 | micrite | 5.6 | -1.8 |
| 141 | 188 | 3302 | micrite | 5.1 | -2.5 |
| 142 | 188 | 3350 | micrite | 5.1 | -2.2 |
| 143 | 189 | 3384 | micrite | 0.1 | -4.1 |
| 144 | 189 | 3442 | micrite | 1 | -3.1 |
| 145 | 189 | 3496 | micrite | 3.5 | -5.3 |
| 146 | 190 | 3522 | Upper member of Kunkelaqi Formation | reef limestone | 5 | -2.4 |
| 147 | 190 | 3730 | reef limestone | 4.4 | -2.8 |
| 148 | 190 | 3574 | reef limestone | 4.4 | -5.3 |
| 149 | 190 | 3624 | reef limestone | 5.2 | -2.5 |
| 150 | 190 | 3702 | reef limestone | 4.7 | -3.9 |
| 151 | 190 | 3762 | reef limestone | 4.4 | -6.3 |
| 152 | 190 | 3868 | reef limestone | 4.7 | -4.4 |