**Mid-to-late Holocene lake evolution and its links with westerlies and Asian monsoon in the middle part of the Hexi Corridor, NW China**

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**Figure. S1** Photo for the BHZ lake section and detailed characteristics of lacustrine sediments.

**Table S1. AMS 14C ages for the BHZ section.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Laboratory number** | **Depth (cm)** | **Dating materials** | **14C age (yr BP)** | **Corrected 14C age (yr BP)** | **Calibrated 14C age (2σ) (cal yr BP)** |
| BA200385 | 527 | Organic matter | 5940±30 | 3940±30 | 4381 (4515-4254) |
| BA200386 | 514.5 | Organic matter | 7265±35 | 5265±35 | 6058 (6181-5934) |
| BA200387 | 502 | Organic matter | 5860±35 | 3860±35 | 4285 (4410-4154) |
| BA200388 | 489.5 | Organic matter | 7430±35 | 5430±35 | 6235 (6299-6123) |
| BA200389 | 477 | Organic matter | 6890±35 | 4890±35 | 5628 (5717-5492) |
| BA200390 | 464.5 | Organic matter | 5925±30 | 3925±30 | 4359 (4506-4246) |
| BA200391 | 452 | Organic matter | 6600±35 | 4600±35 | 5324 (5463-5066) |
| BA200392 | 439.5 | Organic matter | 4915±25 | 2915±25 | 3055 (3156-2965) |
| BA200393 | 427 | Organic matter | 5950±30 | 3950±30 | 4411 (4519-4291) |
| BA200394 | 414.5 | Organic matter | 5295±30 | 3295±30 | 3512 (3574-3450) |
| BA200395\* | 402 | Organic matter | 14800±90 | 12800±90 | 15284 (15580-15025) |
| BA200396\* | 389.5 | Organic matter | 12990±70 | 10990±70 | 12914 (13074-12765) |
| BA200397 | 377 | Organic matter | 7435±35 | 5435±35 | 6236 (6300-6125) |
| BA200398 | 364.5 | Organic matter | 7285±35 | 5285±35 | 6078 (6188-5940) |
| BA200399\* | 352 | Organic matter | 8810±45 | 6810±45 | 7643 (7727-7575) |
| BA200400\* | 339.5 | Organic matter | 8625±45 | 6625±45 | 7508 (7573-7430) |
| BA200401\* | 327 | Organic matter | 10020±45 | 8020±45 | 8877 (9019-8651) |
| BA200402\* | 314.5 | Organic matter | 9930±45 | 7930±45 | 8772 (8985-8604) |
| BA200403\* | 302 | Organic matter | 9420±45 | 7420±45 | 8257 (8364-8050) |
| BA200404\* | 289.5 | Organic matter | 9375±45 | 7375±45 | 8187 (8325-8034) |
| BA200405\* | 277 | Organic matter | 12750±70 | 10750±70 | 12727 (12826-12621) |
| BA200406\* | 264.5 | Organic matter | 15430±100 | 13430±100 | 16173 (16492-15855) |
| BA200407\* | 246 | Organic matter | 14210±80 | 12210±80 | 14145 (14806-13813) |
| BA200408\* | 238 | Organic matter | 10890±60 | 8890±60 | 10010 (10198-9757) |
| BA200409\* | 230 | Organic matter | 2160±25 | 160±25 | 173 (286-/) |
| BA200410 | 222 | Organic matter | 6115±40 | 4115±40 | 4646 (4822-4454) |
| BA200411 | 214 | Organic matter | 6230±40 | 4230±40 | 4748 (4863-4621) |
| BA200412 | 206 | Organic matter | 7570±40 | 5570±40 | 6353 (6440-6291) |
| BA200413 | 198 | Organic matter | 7120±35 | 5120±35 | 5831 (5982-5748) |
| BA200414 | 190 | Organic matter | 7420±40 | 5420±40 | 6231 (6301-6019) |
| BA200415\* | 182 | Organic matter | 13160±80 | 11160±80 | 13075 (13234-12845) |
| BA200416\* | 174 | Organic matter | 12820±70 | 10820±70 | 12769 (12895-12698) |
| BA200417\* | 166 | Organic matter | 13040±70 | 11040±70 | 12964 (13098-12775) |
| BA200418\* | 158 | Organic matter | 10180±60 | 8180±60 | 9134 (9399-8999) |
| BA200419\* | 150 | Organic matter | 11250±60 | 9250±60 | 10417 (10569-10253) |
| BA200420 | 142 | Organic matter | 2610±25 | 610±25 | 603 (650-548) |
| BA200421 | 134 | Organic matter | 4845±30 | 2845±30 | 2952 (3060-2870) |
| BA200422 | 126 | Organic matter | 5575±30 | 3575±30 | 3875 (3975-3728) |
| BA200423 | 118 | Organic matter | 2610±20 | / | 2745 (2758-2728) |
| BA200424 | 110 | Organic matter | 2390±20 | / | 2399 (2487-2348) |
| BA200425 | 102 | Organic matter | 2555±25 | / | 2717 (2750-2516) |
| BA200426 | 94 | Organic matter | 2735±25 | / | 2817 (2875-2765) |
| BA200427 | 86 | Organic matter | 2940±25 | / | 3100 (3204-2997) |
| BA200428 | 78 | Organic matter | 3505±30 | / | 3771 (3870-3692) |
| BA200429 | 70 | Organic matter | 4290±30 | / | 4852 (4960-4825) |
| BA200430 | 62 | Organic matter | 3195±25 | / | 3415 (3454-3371) |
| BA200431 | 54 | Organic matter | 2930±25 | / | 3083 (3167-2969) |
| BA200432 | 46 | Organic matter | 2175±25 | / | 2228 (2309-2070) |
| BA200433 | 38 | Organic matter | 1925±25 | / | 1845 (1924-1745) |
| BA200434 | 30 | Organic matter | 755±20 | / | 680 (723-666) |

\*: The anomalous ages discarded in the establishment of the age-depth model.

**Table S2. The median grain-size, MS, δ13Corg and δ18O, TOC, and TN of the BHZ section in the Heihe River basin.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample number** | **Depth (cm)** | **Clay (μm)** | **MS (Xfd, %)** | **δ13Corg (‰)** | **δ18O (‰)** | **TOC (%)** | **TN (%)** |
| BHZ-001 | 527 | 52.764 | 0.249501 | -25.29 | -8.85  | 1.07  | 0.04  |
| BHZ-002 | 514.5 | 55.512 | -0.499 | -24.76 | -8.97  | 1.02  | 0.04  |
| BHZ-003 | 502 | 61.197 | -0.2495 | -23.57 | -8.77  | 1.23  | 0.05  |
| BHZ-004 | 489.5 | 56.771 | 0.591716 | -23.84 | -9.44  | 1.21  | 0.04  |
| BHZ-005 | 477 | 56.566 | -0.34861 | -23.72 | -9.01  | 1.22  | 0.04  |
| BHZ-006 | 464.5 | 56.775 | -0.499 | -23.76 | -8.55  | 1.48  | 0.05  |
| BHZ-007 | 452 | 56.056 | 0.948104 | -23.72 | -8.89  | 1.43  | 0.04  |
| BHZ-008 | 439.5 | 49.496 | 0.04562 | -25.05 | -8.74  | 0.75  | 0.04  |
| BHZ-009 | 427 | 56.525 | -0.0499 | -23.79 | -8.53  | 1.57  | 0.03  |
| BHZ-010 | 414.5 | 60.903 | 0.15 | -23.82 | -8.73  | 1.46  | 0.04  |
| BHZ-011 | 402 | 67.064 | -0.1 | -24.04 | -9.20  | 1.59  | 0.03  |
| BHZ-012 | 389.5 | 68.51 | 0 | -23.71 | -8.90  | 1.56  | 0.05  |
| BHZ-013 | 377 | 81.16 | 0.05 | -23.69 | -8.64  | 1.65  | 0.04  |
| BHZ-014 | 364.5 | 81.809 | 0.698603 | -23.65 | -9.51  | 1.60  | 0.03  |
| BHZ-015 | 352 | 79.069 | -0.05 | -23.68 | -9.71  | 1.44  | 0.02  |
| BHZ-016 | 339.5 | 75.618 | 0.4 | -23.14 | -9.88  | 1.40  | 0.02  |
| BHZ-017 | 327 | 74.311 | 0 | -23.20 | -10.15  | 1.34  | 0.04  |
| BHZ-018 | 314.5 | 64.967 | 0 | -22.87 | -9.43  | 1.28  | 0.03  |
| BHZ-019 | 302 | 67.719 | 0.6 | -22.51 | -9.92  | 1.29  | 0.03  |
| BHZ-020 | 289.5 | 64.874 | 0.1 | -22.71 | -9.62  | 1.30  | 0.02  |
| BHZ-021 | 277 | 57.387 | 0.45 | -22.68 | -9.56  | 1.27  | 0.03  |
| BHZ-022 | 264.5 | 41.745 | 0.05 | -21.76 | -10.43  | 1.15  | 0.03  |
| BHZ-023 | 252 | 26.762 | -0.4 |  |  |  |  |
| BHZ-024 | 250 | 32.841 | -0.35 | -22.46 | -10.13  | 1.22  | 0.02  |
| BHZ-025 | 248 | 49.035 | -0.7 |  |  |  |  |
| BHZ-026 | 246 | 51.144 | 0.1 | -21.56 | -10.06  | 1.29  | 0.02  |
| BHZ-027 | 244 | 44.594 | 0.198807 |  |  |  |  |
| BHZ-028 | 242 | 34.234 | -0.45 | -21.21 | -9.96  | 1.18  | 0.03  |
| BHZ-029 | 240 | 29.483 | -0.25 |  |  |  |  |
| BHZ-030 | 238 | 28.76 | -0.2 | -22.26 | -10.20  | 1.09  | 0.03  |
| BHZ-031 | 236 | 25.823 | -0.35 |  |  |  |  |
| BHZ-032 | 234 | 15.157 | 0.199601 | -21.67 | -11.09  | 1.01  | 0.04  |
| BHZ-033 | 232 | 14.681 | -0.1497 |  |  |  |  |
| BHZ-034 | 230 | 25.11 | 0.25 | -25.16 | -10.30  | 1.24  | 0.04  |
| BHZ-035 | 228 | 23.21 | 0.451807 |  |  |  |  |
| BHZ-036 | 226 | 28.658 | -0.4 | -23.76 | -9.98  | 1.32  | 0.04  |
| BHZ-037 | 224 | 43.591 | 0.1 |  |  |  |  |
| BHZ-038 | 222 | 63.837 | 0.136364 | -24.30 | -9.06  | 1.57  | 0.04  |
| BHZ-039 | 220 | 62.236 | 0.05 |  |  |  |  |
| BHZ-040 | 218 | 65.421 | 0 | -24.76 | -8.74  | 1.63  | 0.06  |
| BHZ-041 | 216 | 67.09 | 0.1 |  |  |  |  |
| BHZ-042 | 214 | 54.693 | -0.4491 | -25.16 | -8.97  | 1.68  | 0.04  |
| BHZ-043 | 212 | 68.218 | 0 |  |  |  |  |
| BHZ-044 | 210 | 73.209 | 0.2 | -24.16 | -9.34  | 1.43  | 0.03  |
| BHZ-045 | 208 | 69.821 | 0.1 |  |  |  |  |
| BHZ-046 | 206 | 67.465 | 0.299401 | -24.67 | -9.05  | 1.56  | 0.04  |
| BHZ-047 | 204 | 72.883 | 0.0499 |  |  |  |  |
| BHZ-048 | 202 | 69.892 | 0.1 | -25.22 | -8.77  | 1.70  | 0.05  |
| BHZ-049 | 200 | 73.782 | -0.1 |  |  |  |  |
| BHZ-050 | 198 | 64.593 | 0.199601 | -24.18 | -8.88  | 1.63  | 0.03  |
| BHZ-051 | 196 | 65.648 | 0.45 |  |  |  |  |
| BHZ-052 | 194 | 68.115 | -0.0998 | -23.99 | -9.11  | 1.47  | 0.03  |
| BHZ-053 | 192 | 69.087 | 0 |  |  |  |  |
| BHZ-054 | 190 | 70.201 | -0.8483 | -24.96 | -9.34  | 1.56  | 0.04  |
| BHZ-055 | 188 | 72.98 | 0.099602 |  |  |  |  |
| BHZ-056 | 186 | 70.2 | 0.348606 | -24.03 | -10.09  | 1.31  | 0.03  |
| BHZ-057 | 184 | 67.643 | 0.15 |  |  |  |  |
| BHZ-058 | 182 | 71.069 | -0.75 | -23.66 | -9.44  | 1.16  | 0.04  |
| BHZ-059 | 180 | 69.647 | 0.25 |  |  |  |  |
| BHZ-060 | 178 | 68.683 | -0.1 | -24.17 | -9.07  | 1.46  | 0.08  |
| BHZ-061 | 176 | 65.336 | -0.2 |  |  |  |  |
| BHZ-062 | 174 | 66.806 | 0.653924 | -23.47 | -9.27  | 1.46  | 0.05  |
| BHZ-063 | 172 | 66.887 | -0.05 |  |  |  |  |
| BHZ-064 | 170 | 61.398 | 0.25 | -24.32 | -8.87  | 1.11  | 0.04  |
| BHZ-065 | 168 | 62.143 | 2.4 |  |  |  |  |
| BHZ-066 | 166 | 64.523 | 0.8 | -23.99 | -9.38  | 1.19  | 0.05  |
| BHZ-067 | 164 | 65.871 | 0.948104 |  |  |  |  |
| BHZ-068 | 162 | 70.452 | -0.7 | -24.18 | -8.94  | 1.27  | 0.04  |
| BHZ-069 | 160 | 70.25 | 0.55 |  |  |  |  |
| BHZ-070 | 158 | 62.152 | 0.795229 | -24.23 | -8.85  | 1.09  | 0.04  |
| BHZ-071 | 156 | 56.2 | 0.25 |  |  |  |  |
| BHZ-072 | 154 | 64.187 | 0.249501 | -24.15 | -9.14  | 1.22  | 0.05  |
| BHZ-073 | 152 | 60.135 | 0.3 |  |  |  |  |
| BHZ-074 | 150 | 59.479 | 0.347913 | -23.85 | -8.89  | 1.22  | 0.06  |
| BHZ-075 | 148 | 55.31 | 1.996008 |  |  |  |  |
| BHZ-076 | 146 | 53.221 | 0.848303 | -22.65 | -8.76  | 1.20  | 0.07  |
| BHZ-077 | 144 | 53.735 | 1.5 |  |  |  |  |
| BHZ-078 | 142 | 56.28 | 0.65 | -23.07 | -8.87  | 1.17  | 0.06  |
| BHZ-079 | 140 | 63.602 | 0.6 |  |  |  |  |
| BHZ-080 | 138 | 60.398 | 0.695825 | -23.93 | -9.53  | 1.61  | 0.05  |
| BHZ-081 | 136 | 60.207 | -0.15 |  |  |  |  |
| BHZ-082 | 134 | 61.138 | 0.149701 | -23.87 | -8.96  | 1.69  | 0.04  |
| BHZ-083 | 132 | 62.91 | 0.05 |  |  |  |  |
| BHZ-084 | 130 | 61.12 | 0.795229 | -23.57 | -8.87  | 1.47  | 0.05  |
| BHZ-085 | 128 | 63.964 | 0.349301 |  |  |  |  |
| BHZ-086 | 126 | 66.293 | 0.399202 | -23.51 | -9.67  | 1.44  | 0.05  |
| BHZ-087 | 124 | 68.123 | -0.0499 |  |  |  |  |
| BHZ-088 | 122 | 59.884 | -0.2 | -22.86 | -9.39  | 1.47  | 0.06  |
| BHZ-089 | 120 | 53.875 | 0.6 |  |  |  |  |
| BHZ-090 | 118 | 54.502 | 0.848303 | -22.22 | -8.62  | 1.39  | 0.05  |
| BHZ-091 | 116 | 52.275 | 0.4 |  |  |  |  |
| BHZ-092 | 114 | 53.599 | 0.2 | -23.47 | -8.81  | 1.45  | 0.05  |
| BHZ-093 | 112 | 58.107 | 0.798403 |  |  |  |  |
| BHZ-094 | 110 | 55.479 | 0.9 | -22.90 | -8.75  | 1.39  | 0.05  |
| BHZ-095 | 108 | 55.714 | 1 |  |  |  |  |
| BHZ-096 | 106 | 54.37 | 1.45 | -22.92 | -9.34  | 1.41  | 0.05  |
| BHZ-097 | 104 | 48.075 | 1.55 |  |  |  |  |
| BHZ-098 | 102 | 50.496 | 1 | -23.08 | -8.95  | 1.37  | 0.04  |
| BHZ-099 | 100 | 49.941 | 0.149701 |  |  |  |  |
| BHZ-100 | 98 | 53.423 | 0.8 | -23.49 | -9.43  | 1.40  | 0.05  |
| BHZ-101 | 96 | 47.998 | 0.9 |  |  |  |  |
| BHZ-102 | 94 | 48.737 | 1.6 | -22.91 | -9.37  | 1.39  | 0.04  |
| BHZ-103 | 92 | 44.434 | 0.25 |  |  |  |  |
| BHZ-104 | 90 | 46.389 | 0.6 | -23.23 | -9.73  | 1.40  | 0.04  |
| BHZ-105 | 88 | 44.779 | 0.545635 |  |  |  |  |
| BHZ-106 | 86 | 42.355 | 0.898204 | -23.79 | -9.10  | 1.32  | 0.04  |
| BHZ-107 | 84 | 37.737 | 0.848303 |  |  |  |  |
| BHZ-108 | 82 | 41.426 | 0.548902 | -22.94 | -9.61  | 1.27  | 0.03  |
| BHZ-109 | 80 | 36.23 | 0.249501 |  |  |  |  |
| BHZ-110 | 78 | 33.964 | 0.349301 | -23.29 | -10.09  | 1.28  | 0.03  |
| BHZ-111 | 76 | 34.487 | 0.64741 |  |  |  |  |
| BHZ-112 | 74 | 31.761 | 0.1 | -23.17 | -8.87  | 1.28  | 0.03  |
| BHZ-113 | 72 | 33.093 | 0.348606 |  |  |  |  |
| BHZ-114 | 70 | 34.977 | 0.199601 | -23.12 | -10.90  | 1.32  | 0.03  |
| BHZ-115 | 68 | 35.915 | 0.5 |  |  |  |  |
| BHZ-116 | 66 | 36.076 | 0.898204 | -23.19 | -9.51  | 1.31  | 0.06  |
| BHZ-117 | 64 | 35.385 | 0.7 |  |  |  |  |
| BHZ-118 | 62 | 35.478 | 0.3 | -23.05 | -9.64  | 1.28  | 0.04  |
| BHZ-119 | 60 | 38.695 | 0.5 |  |  |  |  |
| BHZ-120 | 58 | 36.888 | 0.65 | -23.70 | -9.64  | 1.36  | 0.03  |
| BHZ-121 | 56 | 37.791 | -0.0498 |  |  |  |  |
| BHZ-122 | 54 | 38.644 | 0.95 | -23.38 | -9.66  | 1.31  | 0.04  |
| BHZ-123 | 52 | 42.01 | 0.5 |  |  |  |  |
| BHZ-124 | 50 | 39.401 | 0.499002 | -23.40 | -8.77  | 1.34  | 0.03  |
| BHZ-125 | 48 | 38.219 | 1.5 |  |  |  |  |
| BHZ-126 | 46 | 32.554 | 0.1 | -23.28 | -9.28  | 1.24  | 0.03  |
| BHZ-127 | 44 | 29.828 | 0.199601 |  |  |  |  |
| BHZ-128 | 42 | 32.435 | 0.348606 | -23.80 | -9.09  | 1.24  | 0.03  |
| BHZ-129 | 40 | 31.845 | 0.55 |  |  |  |  |
| BHZ-130 | 38 | 33.831 | -0.05 | -23.62 | -9.50  | 1.37  | 0.04  |
| BHZ-131 | 36 | 33.832 | -0.3 |  |  |  |  |
| BHZ-132 | 34 | 34.232 | -0.15 | -23.97 | -9.21  | 1.36  | 0.04  |
| BHZ-133 | 32 | 33.663 | 0.2 |  |  |  |  |
| BHZ-134 | 30 | 36.649 | 1.5 | -24.67 | -9.47  | 1.32  | 0.05  |
| BHZ-135 | 28 | 34.419 | 0.9 |  |  |  |  |
| BHZ-136 | 26 | 32.977 | 0.65 | -24.37 | -9.00  | 1.32  | 0.06  |
| BHZ-137 | 24 | 35.853 | 0.64741 |  |  |  |  |
| BHZ-138 | 22 | 34.226 | 0.45 | -24.16 | -8.93  | 1.52  | 0.09  |
| BHZ-139 | 20 | 37.817 | 1.2 |  |  |  |  |
| BHZ-140 | 18 | 37.146 | 1.693227 | -24.18 | -9.67  | 1.51  | 0.07  |