**Table S1. Database of radiocarbon reservoir age of 81 inflow/outflow lakes in China based on published research in the past 20 years**

Method indicates how reservoir ages were obtained: (0) Terrestrial Plant Residues, reservoir age is zero; (1) Ignore the lake radiocarbon reservoir effect or considered as negligible; (2) Modern lake water/shell/plant/animal; (3) Surface sediments TOC; (4) Surface sediments 137Cs/210Pb; (5) Linear regression/piecewise linear regression; (6) Stratigraphic alignment; (7) Reliable dating materials defined by the author; (8) Independent age determination(OSL, U/Th, and varve counting); (9) Geochemical model.

TOC denote total organic carbon. PR denote plant residue. DOC denote dissolved organic carbon. DIC denote dissolved inorganic carbon.

# Inflow lake

## Northeast and North-central China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock  | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 1 | Lake Ningjin  | 37.39 | 114.87 | 28 | Quaternary sediment | 0-1 |  | TOC:4 | 1 | (Guo et al., 2005) |
| 2 | Lake Gonghai | 38.9 | 112.23 | 1860 | Sandstone;Shale;Quaternary sediment | 5-30 |  | PR:25 | 0 | (Chen et al., 2015a) |
| 3 | Lake Qigai Nuur | 39.4 | 109.4 | 1308 | Quaternary sediment | <4 | 1950 | TOC:17 | 3 | (Sun and Feng, 2013) |
| 4 | Lake Yanhaizi | 40.1 | 108.4 | 1180 | Quaternary sediment | 0.09-1.08 | 879 | TOC:2;humin:7;pollen:1 | 5 | (Chen et al., 2003) |
| 5 | Lake Daihai | 40.6 | 112.7 | 1221 | Quaternary sediment | 1-6 | 360 | TOC:8 | 5 | (Xiao et al., 2004)(Xiao et al., 2006) |
| 6 | Lake Anguli Nuur  | 41.3 | 114.3 | 1315 | Quaternary sediment;Basalt | 0-5 | 0 | Charcoal:6;PR:2;TOC:5 | 1 | (Li and Liu, 2018) |
| 7 | Lake Bayanchagan | 41.7 | 115.2 | 1335 | Quaternary sedimentBasalt |  | 570 | TOC:7;Seed:2 | 3 | (Jiang et al., 2006) |
| 8 | Sihailongwan Maar lake | 42.28 | 126.6 | 797 | Pumic tuff;Siliciclastic particles; pyroclastics | 4.4-17.3 |  | PR:36 | 0 | (Schettler et al., 2006)(Stebich et al., 2015) |
| 9 | Lake Xiari Nuur | 42.6 | 115.5 | 1230 | Quaternary sediment;magmatic and metamorphic rocks |  | 0 | PR:4;Stem:3;TOC:10 | 4 | (Tang et al., 2015)(Sun et al., 2018) |
| 10 | Lake Bayan Nuur | 43.12 | 113.5 | 1070 | Quaternary sediment | 0.1-4 | 360 | TOC:41 | 5,6 | (Ming et al., 2020b) |
| 11 | Lake Dali | 43.3 | 116.6 | 1220 | Quaternary sediment;basalt | 0-6 | 472 | TOC:21 | 3 | (Fan et al., 2017)  |
| 12 | Lake Chagan Nuur | 43.44 | 115.03 | 1010 | Quaternary sediment | 4-14 | 152 | TOC:27 | 3 | (Li et al., 2020) |
| 13 | Moon lake | 47.51 | 120.86 | 1190 | Basalt | 1-23.6 |  | PR:15;TOC:6 | 1 | (Qiang et al., 2010) |
| 14 | Lake Tianchi(Wudalianchi volcano group) | 48.74 | 126 | 596.9 | Basalt | 5-50 | 0 | TOC:7;Seed:4;Leaf:3 | 8 | (Zhou et al., 2016) |
| 15 | Lake Hulun | 49 | 117.5 | 545.3 | Quaternary sediment;volcanic rocks |  | 685 | TOC:13 | 3 | (Xiao et al., 2009)(Wen et al., 2010) |

## Southeast and Southwest China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 16 | Jiulongchi Wetland | 27.89 | 108.69 | 2212 | metasandstone; volcanic rock | 2-8 |  | TOC:9 | 1 | (Quan et al., 2019) |
| 17 | Lugu lake | 27.68 | 100.8 | 2690 | Quaternary sediment;Limestone; Mudstone; Sandstone | 3.78-13.8 |  | PR:9 | 0 | (Ouyang et al., 2019) |
|  | 173 | PR:5 | 4 | (Sheng et al., 2015) |
| 1-6 | 1662 | PR:7;TOC:15 | 2 | (Wang et al., 2014b) |
| 3-12 |  | PR:6 | 0 | (Wang et al., 2020) |
| 18 | Lake Haligu | 27 | 100.18 | 3277 | Basalt;Limestone |  |  | Humic acid:4 | 1 | (Song et al., 2012) |
| 19 | Lake Chenghai | 26.53 | 100.66 | 1503 | Basalt;Quaternary sediment |  |  | Charcoal:4 | 0 | (Hillman et al., 2016) |
|  |  | PR:8 | 0 | (Sun et al., 2019) |
| 0.8-2.9 | 350-1210 | PR:11;TOC:5 | 7 | (Xiao et al., 2017) |
| 20 | Lake Tengchongqinghai  | 25.13 | 98.57 | 1885 | Andesite;Basalt;Tuffaceous breccia |  |  | PR:2;Wood:2;Leaf:2;Twig:3;TOC:4 | 1 | (Peng et al., 2019) |
| 0-60 |  | PR:16 | 0 | (Yang et al., 2016) |
|  | 180 | PR:10TOC:7 | 7 | (Zhang et al., 2015) |
| 21 | Dahu lake | 24.75 | 115.03 | 246 | Granite | 0-40 |  | PR:17 | 0 | (Zhou et al., 2004) |
|  |  | TOC:12 | 1 | (Wei et al., 2018) |
| 0-35 |  | PR:4Charcoal:1TOC:15 | 1 | (Zhong et al., 2010) |
| 22 | Qilu Lake | 24.01 | 102.75 | 1797 | Quaternary alluvium;Dolomite;limestone  |  |  | Charcoal:6leaf:1 | 0 | (Hillman et al., 2020) |
| 0-25 |  | TOC:7;Carbonate:2;Mollusk shell:3;Wood:2 | 1 | (Hodell et al., 1999) |
| 23 | Huguang maar lake | 21.15 | 110.28 | 23 | Volcanic | 0-18 |  | PR:5;TOC:4 | 1 | (Yancheva et al., 2007) |
| 0-12 |  | PR:9;TOC:5 | 1 | (Jia et al., 2015) |
|  |  | leaf:15;Seed:1;TOC:6 | 0 | (Zhang et al., 2020) |
| 0-18 |  | PR:10;Charcoal:2 | 0 | (Wang et al., 2016) |
| 24 | Lake Tianyang | 20.51 | 110.31 | 90 | Basalt | 1.7-22.8 |  | PR:5TOC:2 | 1 | (Wang et al., 2014a) |
| 25 | Lake Shuangchi Maar | 19.94 | 110.18 | 40 | Pyroclast | 0-20 | 0 | TOC:11Pollen:5 | 3 | (Dodson et al., 2019) |
|  |  | PR:10TOC:1 | 1 | (Yang et al., 2009) |
| 0-60 |  | PR:11 | 0 | (Ling et al., 2020) |
|  |  | TOC:6 | 1 | (Zhang et al., 2018) |

## Northwest China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 26 | Qingtu lake | 39.05 | 103.67 | 1291 | Basalt;Limestone;Slate;Quaternary sediment | 1-2.5 | 0 | TOC:8Shell:6 | 8 | (Long et al., 2011) |
| 27 | Lake Balikun | 43.65 | 92.8 | 1575 | Quaternary sediment |  | 790 | PR:1Pollen:1TOC:11 | 7 | (Tao et al., 2010)(An et al., 2012) |
| 0-5 | 750 | TOC:7 | 5 | (Xue and Zhong, 2011) |
| 28 | Lake Wulungu | 46.46 | 87.5 | 478.6 | Sandstone;Quaternary sediment | 0.5-3 | 760 | TOC:7 | 4 | (Liu et al., 2008b) |
| 2-8 | 760 | TOC:4Charcoal:1 | 4 | (Duan et al., 2018)(Zhang et al., 2016c) |
| 29 | Lake Aibi | 44.9 | 82.5 | 200 | Quaternary sediment | 0.5-1.3 | 1800 | TOC:8 | 5 | (Wang et al., 2013) |
| 30 | Lake Sayram | 44.5 | 81.16 | 2071.9m | Sandstone;Volcanic rock | <1 | 778 | TOC:14 | 5 | (Jiang et al., 2019) |
| 31 | Lop Nuur | 40 | 90 | 780-795 | Quaternary sediment |  | 180 | PR:1Charcoal:1TOC:19 | 7 | (Liu et al., 2019) |
| 0-2 | 3229 | TOC:22OSL:10 | 3 | (Zhang et al., 2012) |

## Tibetain Plateau

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 32 | Lake Qinghai | 37 | 100 | 3194 | Limestone;Sandstone;Shale | 0-4 | 135,1143,2523 | TOC:52Seed:6PR:7 | 5 | (Zhou et al., 2014) |
|  | 1500 | Geochemical model | 9 | (Yu et al., 2007) |
| 33 | Chaka Salt Lake | 36.7 | 99.1 | 3200 | Quaternary sediment;Carbonate; Calcareous mudstone; Sandstone | 0-1.6 | 1700 | Bulk:10 | 6（YD） | (Liu et al., 2008a) |
| 34 | Lake Dalianhai | 36.24 | 100.4 | 2850 | Quaternary sediment;Limestone;Sandstone;Marble | 0-3 | 675 (Surface);385 (Bottom) | PR:23 | 7 | (Chen et al., 2012) |
| 35 | Lake Gahai | 37.13 | 97.56 | 3480 | Quaternary sediment | 0-3 | 4522;5128 | Carbonate:28;Mollusk shell:4 | 5 | (Zhang et al., 2016b) |
| 36 | Lake Hala | 38.33 | 97.5 | 4078 | Siltstone;Sandstone;Slate; quartz-schist;Conglomerates;Breccia; Limestone;Marlstone;Dolostone;Quaternary sediment | 4-16 | 1000 | Bulk:19PR:3 | 3 | (Wuennemann et al., 2012) |
| 37 | Lake Sugan | 38.85 | 93.9 | 2795 | Sandstone;Conglomerate;Quaternary sediment |  | 2200 |  PR:5(Ruppia seed:4) | 4,5 | (Qiang et al., 2005) |
|  | 2592-4340 | PR:1;Seed:4 | 8 | (Zhou et al., 2009) |
| 38 | Hurleg lake | 37.28 | 96.90 | 2817 | Sandstone;Quaternary sediment | 2-16 |  | Plant Macrofossils:7 | 0 | (Zhao et al., 2007) |
|  | 3640 | Macrophytes:2;TOC: 3 | 5 | (Song et al., 2020) |
| 39 | Kusai Lake | 35.62 | 93.63 | 4475 | Sandy slate;Quaternary alluvium | 0-2 | 3400 | TOC:7 | 4 | (Liu et al., 2009) |
|  | 2980-33104010 | TOC:27 | 8  | (Zhang et al., 2021) |
| 40 | Lake Donggi Cona | 35.30 | 98.44 | 4090 | Limestone;Clastic rocks;Quaternary sediment |  | 1655 | TOC:13Humic:4Humin:3 | 3 | (Mischke et al., 2010) |
| 0.4-2.2 | 2090 | Bulk:29 | 3 | (Opitz et al., 2012) |
| 41 | Buruo Co | 34.33 | 85.70 | 5170 | Carbonate;Granite | 0.2-1.4 | 3856 | Bulk:15 | 4 | (Xu et al., 2019) |
| 42 | Linggo CO | 33.80 | 88.51 | 5059 | Clastic carbonates;Limestone |  | 600 | Algae:1Shrimp:1;Plant remains:2;TOC:21 | 7 | (Hu et al., 2018) |
| 5-19 | 1611 | TOC:27;PR:2 | 7 | (Hou et al., 2017a) |
| 43 | Chibuzhang Co | 33.31 | 90.01 | 4941 | Sandstone; siltite; Carbonates; volcanic rock | 0.2-1.8 | 3488(below 510cm)2380(0-510cm) | TOC:20Plant remains:3 | 4,5 | (Mischke et al., 2019) |
| 44 | Zigetang Co | 32.10 | 90.80 | 4561 | Slate; Quaternary alluvial sediment; Limestone |  | 2060 | Bulk:13 | 3 | (Jin et al., 2016) |
| 45 | Dagze Co | 31.81 | 87.41 | 4450 | Granite; limestone |  | 1693 | Bulk:9 | 5 | (Hou et al., 2017b) |
| 46 | Selin Co | 31.75 | 89.31 | 4542 | Limestone;Sandstone;Siliceous;Lyddite;Quartzite;Volcanic;Basaltic | 0.52-1.56 | 2635 | Bulk:15 | 5 | (Gyawali et al., 2019) |
| 47 | Jiang Co | 31.55 | 90.81 | 4603 | Sandstone; Quaternary sediment; granite |  | 2290 | Bulk:7 | 5 | (Hou et al., 2017b) |
|  | 3473 | TOC:3 | 5 | (Ji et al., 2021)  |
| 48 | Lake Cuoe  | 31.40 | 91.50 | 4532 | Sandstone;Granite;Imestones；Dolerite;Quaternary alluvium | 0-6 | 3470 | Bulk:10;Plant remains:3 | 3 | (Wu et al., 2006) |
|  | 3260 | TOC:10PR:3 | 3 | (Wu et al., 2010)  |
| 49 | Tangra Yumco | 31.03 | 86.50 | 4545 | Quaternary sediment;Magmatic rocks | 0.1-1.2 | 2070 | Bulk:22Wood:1PR:1 | 2 | (Henkel et al., 2016) |
|  | 2255 | TOC:8Plant residue:6 | 3 | (Wang et al., 2017) |
| 50 | Num Co | 30.70 | 90.70 | 4718 | Granitoids;Orthogneisses;Limestones;Sandstones;Conglomerates | 0.3-2.2 | 949-2476 (Variable with location) | Bulk:11 | 4 | (Kasper et al., 2012) |
| 51 | Mapam Yumco | 30.56 | 81.44 | 4572 | Siliceous;Limestone;Volcanic | 1.2-2.1 | 638 | TOC:15 | 4 | (Zhu et al., 2019) |
| 52 | Lake Pumoyum | 28.55 | 90.43 | 5030 | Metamorphic rock; Quaternary sediment | 0-6 | 1152 | PR:18;Aquatic plant residues:12 | 4 | (Lu et al., 2011) |
| 53 | Aweng Co | 32.7 | 81.63 | 4427 | Granite; Quaternary sediment |  | 4066(0 cm-309 cm);3227(below 309 cm) | Bulk:7 | 5 | (Li et al., 2017) |

# Outflow lake

## Northeast and North central China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 54 | Lake Jingbo  | 43.59 | 129.03 | 350 | Basalt;Quaternary sediment;Granite  |  | 225 | TOC:7 | 4 | (Hou et al., 2006)(Li et al., 2011) |
| 0-8 | 740-1380 | PR:9;TOC:4 | 7 | (Chen et al., 2015b) |
| 55 | Baiyangdian | 38.87 | 115.89 | 29 | Quaternary sediment |  | 35 | PR:4;mollusk shell:3;mussel:1 | 5 | (Shen et al., 2018) |
| 56 | Lake Dongping | 35.98 | 116.19 | 40 | Quaternary sediment |  | 980-1900 | TOC:7 | 3 | (Yang et al., 2014) |
| Gneiss |  | 2345 | DIC:1 | 2 |  |
| Limestone |  | 484 | PR:1 |  |  |

## Southeat and Southwest China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 57 | Lake Nanyi | 31.15 | 119.05 | 2.2 | Sandstone;Shale;Limestone |  | 40 | PR:4;TOC:3 | 7 | (Liu et al., 2018) |
| 58 | Lake Longgan | 29.91 | 116.02 | 12 | Quaternary sediment | 0-4 |  | TOC:5 | 1 | (Xue et al., 2017) |
| 59 | Lake Poyang | 29.15 | 116.41 | 21 | Sandstone;Quaternary sediment | 0.2-1.6 | 560 | Wood:2;TOC:5 | 7 | (Li et al., 2016b) |
| 60 | Lake Shudu | 27.91 | 99.95 | 3630 | Quartzite;Schist;Limestone;Sandstone;Quaternary sediment | 4-10 |  | TOC:17;Pollen:4 | 1 | (Cook et al., 2013) |
| 64 | Tiancai Lake | 26.63 | 99.72 | 3898 | Magmatite;Sandstone | 4.7-41.9 |  | PR:15;TOC:3 | 1 | (Xiao et al., 2014) |
| 62 | Erhai Lake | 25.8 | 100.18 | 1937.7 | Carbonate;Gneisses;Silicite | 1.13-4.20 |  | PR:7Cellulose:14  | 0 | (Tareq et al., 2011) |
|  | 523-610 | TOC:2;Snail shell:2;Pondweed:1;Snail(modern):1DOC:1 | 2 | (Xu et al., 2015) |
| 63 | Dianchi lake | 25.06 | 102.68 | 1886 | Sandstone;Limestone | 10-20 |  | Charcoal:5;Wood:4;Seed:1 | 0 | (Xiao et al., 2020) |
| 64 | Fuxian lake | 24.42 | 102.86 | 1721 | Sandstone;Limestone;Basalt  | 0-7 | 160 | TOC:6;Aquatic :1 | 4 | (Liu et al., 2017) |
| 65 | Xingyun lake | 24.34 | 102.78 | 1723 | Sandstone;shaleslate;Limestone;Dolomite;Phyllite  |  | 1100 | Wood:3;Charcoal:6;Leaf:3;Gastropod Shell:3 | 7 | (Hillman et al., 2017) |
| 0-14 | 1200 | TOC:8 | 5 | (Zhang et al., 2014) |
| 5-25 | 960-2200 | Twigs:8;TOC:8;Gastropod:1 | 7 | (Zhou et al., 2015) |

## Northwest China

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 66 | Lake Bosten | 42 | 87 | 1048 | Quaternary sediment |  | 1140 | PR:3TOC:5 | 7 | (Huang et al., 2007) |
| 1-4 | 3464 | Carbonate :18PR:3 | 5 | (Zhang et al., 2016b) |

## Tibetain Plateau

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Lake name | Latitude(°N) | Longitude(°E) | Altitude（m） | Bedrock | TOC(%) | Reservoir Age (14C years BP) | Dating materials: amount | Method | References |
| 67 | Luanhaizi Lake | 37.59 | 101.2 | 3200 | Quaternary sediment | <17 | 800 | aquatic macrophytes: 4;mollusc shells: 4 | 2 | (Mischke et al., 2005)(Herzschuh et al., 2005) |
| 68 | Kalakuli Lake | 38.43 | 75.03 | 3645 | Granite;Schist;Quaternary sediment  |  | 1880 | TOC:17 | 4 | (Liu et al., 2014) |
| 69 | Lake Heihai | 36.00 | 93.15 | 4420 | Slates;Sandstones;Conglomerates;Limestone;Dolomite |  | 6465 | Plant remains:19;Profile samples:12;Living plants:4 | 2 | (Lockot et al., 2015) |
| 70 | Bangong Co | 33.70 | 79.20 | 4217 | Limestone;Quaternary sediment;Dolomite;Sandstone  |  | 6670 | Carbonate :15;TOC: 3;Aquatic plants: 2;Shell: 3;Ostracods: 2 | 5 | (Fontes et al., 1996) |
|  | 4877 | PR:4;TOC:15 | 5 | (Hou et al., 2017a) |
| 71 | Lake Koucha | 34.01 | 97.24 | 4530 | Granite; Sandstone | 0-24 |  | Pollen:4;Alkali soluble fraction: 1;Alkali insoluble fraction: 1 | 0 | (Mischke et al., 2008) |
| 72 | Ahung Co | 31.62 | 92.06 | 4575 | Quartzite,;Shale;Dolomite |  | 680 | Aquatic plant:3;TOC: 3;charcoal:6;PR:50 | 2 | (Morrill et al., 2006) |
| 73 | Basomtso Lake | 30.00 | 93.89 | 3476 | Granite;Amphibolite | 0.2-1.8 |  | Leaves:6 | 0 | (Li et al., 2016a) |
| 74 | Paru Co | 29.77 | 92.35 | 4845 | Andesite | 10-55 |  | charcoal:7oogonia:1 | 0 | (Bird et al., 2014) |
| 75 | Laigu lake | 29.30 | 96.83 | 3978 | Calcareous slate;Granite;Quaternary sediment |  | 2852 | TOC:11 | 5 | (Huang et al., 2016) |
| 76 | Lake Ximencuo | 33.38 | 101.1 | 4000 | Granite | 0-12.5 | 781 | TOC:15Humic:10 | 3 | (Zhang and Mischke, 2009) |
| 77 | Lake Naleng | 31.1 | 99.75 | 4200 | Limestone;Sandstone | 0-7.5 | 1560 | Humic: 9Humin: 9 | 5 | (Kramer et al., 2010) |
| 78 | Wuxu lake | 29.15 | 101.41 | 3715 | Slate;Schist;granite |  |  | Plant macrofossils:18 | 0 | (Zhang et al., 2016a) |
| 79 | Qiangyong Co | 28.88 | 90.22 | 4875 | Limestone;Carbonaceous slate; Granite;Moraines |  | 23585-26490 | Bulk:6;Pollen:17;PR:14 | 5 | (Zhang et al., 2017) |
| 80 | Muge Co | 30.13 | 101.83 | 3780 | Granite;Quaternary sediment |  |  | Bulk:7;pollen:1 | 0 | (Ni et al., 2019) |
| 81 | Lake Ruogen Co | 30.15 | 99.73 | 4315 | Granite; Limestone;Quaternary sediment |  | 2137 | Bulk:11;Surface water DIC:1 |  | (Ming et al., 2020a) |

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