

Suppl_Table 1. Source references of the data used in the paleoenvironmental maps in Fig. 3 and 4

- Cao, L., Pliocene palynological flora in Disong of Burang, Xizang(Tibet), *Acta Palaeontologica Sinica*, 21(4), 469-483, (1982).
- China Geological Survey, Chinese 1:500,000 Geological Map Databases 1.0. Beijing, Geological Publishing House, (2001).
- Chinese Stratum Thesaurus Editorial Board. *Tertiary Stratum Thesaurus*, Beijing, Science Press, 1-163 (1999).
- Gan, Z.B., Spore-pollen assemblage from the Early Miocene of Wuluogong, Northern Hebei, In: Palynological Society of China, Gan Zhenbo(Ed.), *Selected Papers from the First Symposium of the Palynological Society of China*, Beijing, Science Press, 59-63 (1982).
- Geng, B.Y., Tao, J.R., Xie, G.P., Early Tertiary fossil plants and paleoclimate of Lanzhou Basin, *Acta Phytotaxonomica Sinica*, 39(2), 105-115 (2001).
- Guo, Z. T., Ruddiman, W. F., Hao, Q. Z., Wu, H. B., Qiao, Y. S., Zhu, R. X., Peng, S. Z., Wei, J. J., Yuan, B. Y., Liu, T. S., Onset of Asian desertification by 22 Myr ago inferred from loess deposits in China, *Nature*, 416, 159-163 (2002).
- Hao, Y.H., Paleocene sequences of pollen assemblages in the Tantou Basin, In: *A Collection of Petroleum Stratigraphy and Paleontology Studies*, 245-251 (1987).
- Hu, C.L., Early Miocene sporo-pollen assemblage in Sihong areas, The Editorial Committee of “Collection of Stratigraphic Paleontology Thesis”, Research Academy of Geological Sciences ed. *Collection of Stratigraphic Paleontology Thesis* (Vol. 16). Beijing, Geological Publishing House, 207-221 (1986).
- Institute of Petroleum Exploration and Development, Qinghai Petroleum Exploration Administration, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, *Tertiary Sporo-pollen in Qaidam Basin*, Beijing, Petroleum Industry Press, 3-41 (1985).
- Institute of Petroleum Exploration, Department of Petroleum and Chemical Industry, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, *Eogene Sporo-pollen in Bohai Coast*, Beijing, Science Press, 1-30 (1978).
- Jin, X.F., Cretaceous-Tertiary micropaleontologic flora and fauna in Turpan-Hami basin, *Petroleum Exploration and Development*, 23(1), 33-38 (1996).
- Lei, Z.Q., Tertiary sporo-pollen assemblage of Zhuijiangkou (Pearl River North) basin and its stratigraphical significance, *Acta Botanica Sinica*, 27(1), 94-105 (1985).
- Lei, Y.Z., Guan, S.Z., Zhang, Q.R., Sun, Q. Y., *Biostratigraphy of the Three-Gorge region in the Yangtze River basin (5): Cretaceous-Tertiary Volume*, Beijing, Geological Publishing House, 110-120 (1987).
- Li Y.T., Sun, M.R., Sun, X.Y., *Chinese Stratigraphy (13) : The Tertiary System of China*. Beijing, Geological Publishing House, 1-362 (1984).
- Li, J.G., Discovery and Preliminary study on Palynofossils from the Cenozoic Qiuwu Formation of Xizang(Tibet), *Acta Micropalaeontologica Sinica*, 21(2), 216-221 (2004).
- Li, J.G., Zhang, Y.Y., Neogene palynofloras from east offshore, Hainan island. *Acta Micropalaeontologica Sinica*, 15(3), 323-330 (1998).
- Li, J.G., Zhou, Y., Pliocene palynoflora from the Zanda basin, West Xizang (Tibet), and the palaeoenvironment, *Acta Micropalaeontologica Sinica*, 18(1), 89-96 (2001).

- Li, L.Y., Li, S.Q., Li, F.L., Geng, M.S., New research advance on Tertiary strata in Sonid Zuoqi, Inner Mongolia, *Geoscience*, 9 (2), 179-183 (1995).
- Li, M.Y., Sporo-pollen from Shanghu Formation of early Paleocene in Nanxiong Basin, Guangdong, *Acta Palaeontologica Sinica*, 28(6), 741-750 (1989).
- Li, M.Y., Eocene pollen and spore assemblage from Wuhu, Anhui Province, *Acta Palaeobot. Palynol. Sin.*, 1,141-156 (1986).
- Li, M.Y., Qin, G.R., Paleocene sporopollen from the Buxin group of the Longgui basin, Guangdong, *Acta Micropalaeontologica Sinica*, 11(1), 55-69 (1994).
- Li, W., Liang, Y., Sporo-pollen analysis on the lacustrine deposits in Zanda Basin during the Pliocene, In: Team of Comprehensive Scientific Expedition to the Qinghai-Xizang Plateau, Academia Sinica (Eds.), *Quaternary Geology in Xizang*, Beijing, Science Press, 132-144 (1983).
- Liang, Q.Z., Yin, J.Y., Jiang, N.R., A study on the living age of palaeoape in Yunnan with palaeomagnetism method, *Yunnan Geology*, 13(3), 291-305 (1994).
- Liu, F.Y., Yu, J.X., Wang, Y.B., Spore-pollen assemblage characters from Tertiary Guide group in source of the Yellow River, *Earth Science—Journal of China University of Geosciences*, 27(4), 373-377 (2002).
- Liu, G.W., A Miocene palynoflora from Huanan county of Heilongjiang Province, NE China, *Acta Micropalaeontologica Sinica*, 15 (1), 48-54 (1998).
- Liu, J.R., Yang, R.Y., Discovery of tertiary strata in a clay-gravel layer of Guilin Karst area and its implications, *Carsologica Sinica*, 16(4), 370-385 (1997).
- Liu, M.L., Upper Cretaceous and Tertiary palyno-assemblage sequences in Northeast China, *Journal of Stratigraphy*, 14(4), 277-285 (1990).
- Liu, Z.F., Wang, C.S., Depositional environment and paleoclimatic significance of the Early Oligocene Yaxicuo Group in the Hoh Xil Basin *Acta Sedimentologica Sinica*, 18(3), 355-361 (2000).
- Liu, Z.F., Wang, C.S., Depositional environment of the Tertiary Fenghuoshan group in the Hoh Xil Basin, Northern Tibetan Plateau, *Acta Sedimentologica Sinica*, 19(1), 28-36 (2001).
- Ma, Y.Z., Tertiary sporo-pollen assemblages from Southern Dunhuang basin, Gansu Province, *Acta Micropalaeontologica Sinica*, 8(2), 207-226 (1991).
- Ma, Y.Z., Li, J.J., Fan, X.M., The pollen and climate record of red bed between 30.6 and 5.0Ma in the Linxia Basin, *Chinese Science Bulletin*, 43(3), 301-304 (1998).
- Ma, Y.Z., Tao, M.X., Chen, F.Y., The Red Bed sporo-pollen assemblages and geological age from Zhuerzhang of Yaojie, Gansu, *Acta Sedimentologica Sinica*, 12(4), 64-72 (1995).
- Qiu, Z.D., Miocene Small Mammal Faunas of Tung Gur, Inner Mongolia, Beijing, Science Press, 1-216 (1996).
- Qiu, Z.D., Huang, W.L., Guo, Z.H., Hipparians fossils in China. China paleontology Monograph, New-C 25, Beijing, Science Press, 135-185 (1987).
- Song, C.H., Fang, X.M., Li, J.J., Gao, J.P., Sun, D., Nie, J.S., Yan, M.D., Sedimentary evolution of the Guide basin in the Late Cenozoic and the uplift of the Qinghai-Tibet Plateau, *Geological Review*, 40(4), 337-346 (2003).
- Song, Z.C., Late Cenozoic Palyno-flora from Zhaotong, Yunnan, *Mem. Nanjing Inst. Geol. Palaeontol., Acad. Sin.*, 24, 1-52 (1988).
- Song, Z.C., Cao, L., The Paleocene spores and pollen grains from the Fushun coalfield, Northeast China, *Acta Palaeontologica Sinica*, 15(2), 147-164 (1976).
- Song, Z.C., Liu, G.W., Early Tertiary palynoflora and its significance of palaeogeography from

- Northern and Eastern Xizang, Palaeontology of Xizang(Book 5), Beijing, Science Press, 165-190 (1982).
- Sun, M., Sun, S., Paleocene spore and pollen assemblages from the Nanxiong basin, Guangdong Province, Bulletin of the Institute of Geology, Chinese Academy of Geological Science, (5), 127-143 (1982).
- Sun, S.Y., Oligocene spore and pollen assemblages from the Tongxin district of Ningxia, Bulletin of the Institute of Geology, Chinese Academy of Geological Science, 4, 127-134 (1982).
- Sun, X.J., He, Y.M., Study on Paleocene Palynology of Jiangxi Province, Beijing, Science Press, 1-143 (1980).
- Sun, X.J., Kong, Z.C., Li, M.X., Li, P., Early Tertiary palynological assemblages from Liushagang formation in the north of South China Sea Acta Phytotaxonomica Sinica, 20 (1), 63-71 (1982).
- Sun, X.Y., Wang, D.N., Zhao, Y.L., Paleocene-Early Eocene palynological assemblages from the Xiangcheng Group in the Lingbao Basin of Henan, Bulletin of the Institute of Geology, Chinese Academy of Geological Science, (11), 127-135 (1985).
- Sun, X.Y., Zhao, Y.L., He, Z.S., The Oligocene-Miocene palynological assemblages from the Xining-Minghe basin, Qinghai Province, Geological Review, 30(3), 207-216 (1984).
- Teng, Z.H., Yue, L.P., He, D.F., Deng, X.Q., Bian, X.W., Magnetostratigraphic research of Cenozoic section of Kuche River area, South Xinjiang, Journal of Stratigraphy, 21(1), 55-62 (1997).
- Tong, G.B., Zhang, J.P., Yang, X.D., Luo, B.X., Wang, Y.Z., Chen, P.Y., Late Cenozoic palynoflora and environment changes in Yunnan-Guizhou Plateau, Marine Geology & Quaternary Geology, 14(3), 91-103 (1994).
- Wang, B.Y., Problems and recent advances in the division of the continental Oligocene, Journal of Stratigraphy, 21(2), 81-90 (1997).
- Wang, C.F., Qian, S.H., Division and correlation of the lower Tertiary in Jining, Shandong Province, Journal of Stratigraphy, 5(3), 208-215 (1981).
- Wang, D.N., Sun, X.Y., Zhao, Y.L., The Paleocene-Eocene palynoflora from the Tantou Basin in west Henan, Acta Botanica Sinica, 26 (4), 448-455 (1984).
- Wang, K.F., Jiang, H., Zheng, Z., Zhang, Y.C., Wang, W.M., Sporo-pollen assemblages in intermediate layer of basalt deposits in Tiantai, Xinchang and Shengxian, Zhejiang Province, Journal of Stratigraphy, 9(1), 28-34 (1985).
- Wang, K.F., Yang, J.W., Li, Z., Li, Z.R., On the Tertiary sporo-pollen assemblages from Lunpola basin of Xizang, China and their palaeogeographic significance, Scientia Geological Sinica, (4), 366-374 (1975).
- Wang, K.F., Zhang, Y.L., Jiang, H., Zhang, Y.C., Wan, Z.J., Li, Z.R., Cretaceous-Tertiary sporo-pollen assemblages of Zhejiang with their palaeovegetation and palaeoclimate, Acta Palaeontologica Sinica, 28(5), 653-662 (1989).
- Wang, K.F., Zhang, Y.L., Wang, R., Cretaceous-Tertiary Sporo-pollen assemblage in Anhui, China, Beijing, Petroleum Industry Press, 1-129 (1987).
- Wang, B.Y., Qiu, Z.X., Wang, X.M., Jie, G.P., Xie, J.Y., Downs, W., Qiu, Z.D., Deng, T., Cenozoic stratigraphy in Danghe area, Gansu Province, and uplift of Tibetan Plateau, Vertebrata Palasiatica, 41(1), 66-75 (2003).
- Wang, W.M., Sporo-pollen assemblage from the Miocene Tonguer formation of Inner Mongolia and its climate, Acta Botanica Sinica, 32(11), 901-904 (1990).

- Wang, W.M., Zhang, D.H., Tertiary sporo-pollen assemblages from the Shangdu-Huade basin, Inner Mongolia: With discussion on the formation of steppe vegetation in China. *Acta Micropalaeontologica Sinica*, 7(3), 239-252 (1990).
- Wang, X.Z., Tertiary sporo-pollen assemblages in lignite from Liujiagou, Shanxi Province. *Acta Scientiarum Naturalium Universitatis Pekinensis*, (4), 89-110 (1978).
- Wu, J.Z., Yuan, S., Miocene sporo-pollen assemblages from Eastern Zhoukou depression, *Experimental Petroleum Geology*, 15(1), 108-113 (1993).
- Wu, Y.S., Spore and pollen assemblage of Nadu Formation of Baise basin, Guangxi, *Acta Palaeontologica Sinica*, 20(1), 93-94 (1981).
- Wu, Z.H., Jiang, W., Doug, N., Bill, K., Strata and spores association of Dogai Coring Redbeds of North Tibetan Plateau, *Geoscience*, 16(3), 225-232 (2002).
- Wu, Z.J., Yu, J.F., Late Paleocene spores and pollen grains from the uppermost part of Nongshan group in Nanxiong basin, Guangdong, *Acta Palaeontologica Sinica* 20 (5), 441-448 (1981).
- Xia, Y.M., Wang, P.F., The paleobotany and paleoclimate in the Songnen Plain: a study on the late Tertiary-Pleistocene spore pollen assemblages, *Acta Geographica Sinica*, 42 (2), 165-178 (1987).
- Xu, K., Shi, D.J., Qiu, K.M., Late Cenozoic paleovegetation and paleoclimate in the north of the Liaodong Bay, *Marine Geology & Quaternary Geology*, 17(1), 25-32 (1997).
- Yang, S.R., Paleocene Palynology of the Shangyang Formation, Hepu Basin, Guangxi, China, *Acta Micropalaeontologica Sinica*, 10 (2), 213-222 (1993).
- Yao, Y.M., Xiu, S.C., Wei, X.L., Meng, S.M., Ye, Y.G., Diao, S.B., Researches on the ESR geochronometry in Palaeogene of Dongying depression, *Petroleum Geology and Recovery Efficiency*, 9(2), 31-34 (2002).
- Yuan, F.L., Du, H.J., Chinese Cenozoic Biostratigraphy, Beijing, Geological Publishing House, 1-376 (1984).
- Yue, L.P., Heller, F., Qiu, Z.X., Zhang, L., Jie, G.P., Qiu, Z.D., Zhang, Y.X., Magnetostratigraphy and palaeoenvironmental record of Tertiary deposits of Lanzhou Basin, *Chinese Science Bulletin*, 46(9), 770-774 (2001).
- Zhang, Y.Y., Qian, Z.S., Eocene palynofloras from the Dainan and Sanduo formations in north Jiangsu—with special reference to Eocene climatic changes in Southeast China, *Acta Micropalaeontologica Sinica*, 9 (1), 1-24 (1992).
- Zhang, Y.Y., Wang, K.D., Liu, J.L., Zheng, Y.H., Eocene palynoflora from the southwestern continental shelf basin of the East China Sea, *Acta Micropalaeontologica Sinica*, 7(4), 389-402 (1990).
- Zhang, Y.Y., Zhan, J.Z., Late Cretaceous and Early Tertiary Spores and Pollen from the Western Tarim Basin, S. Xinjiang China, Beijing, Science Press, 1-319 (1991).
- Zhang, Z.L., Wang, X.F., Ding, L., The time ownership of Kuche member in Tarim basin and its ecologic characteristic, *Petroleum Geology & Oilfield Development in Daqing*, 19(6), 15-17 (2000).
- Zhao, Y.N., Sun, X.Y., Wang, D.N., Tertiary sporopollen assemblages from Shache and Kuche basin, Xinjiang, *Bulletin of the Institute of Geology, Chinese Academy of Geological Science*, 4, 95-113 (1982).
- Zhao, Y.N., Wang, D.N., Sun, X.Y., The age of Lushidayu basin-Constrained on the sporo-pollen assemblages, *Collection of Stratigraphic Paleontology Thesis*, 14, 219-226 (1986).
- Zheng, H.B., Butcher, K., Powell, C., Evolution of Neogene Foreland Basin in Yecheng ,

- Xinjiang ,and Uplift of Northern Tibetan Plateau—I Stratigraphy and Petrology, *Acta Sedimentologica Sinica*, 20(2), 274-281 (2002).
- Zheng, Y.H., Miocene pollen and spores from Xianju-Ninghai, Zhejiang, In: Selected Papers of the 1st Scientific Conference of the Palynological Society of China, Beijing, Science Press, 71-74 (1982).
- Zheng, Y.H., Sporo-pollen assemblages of the Wuoma Formation of the Gyrong Basin. In: Team of Comprehensive Scientific Expedition to the Qinghai-Xizang Plateau, Academia Sinica (Eds.), Quaternary Geology in Xizang, Beijing, Science Press, 145-152 (1983).
- Zheng, Y.H., Wang, W.X., Sequence of Miocene Fotan Group in SE Fujian and its palyno-assemblages, *Acta Palaeontologica Sinica*, 33 (2), 200-218 (1994).
- Zheng, Y.H., Yuan, P.X., Sporo-polens assemblages from Yuhuatai Formation of Nanjing and its geological age, *Journal of Stratigraphy*, 9(3), 161-169 (1985).
- Zheng, Y.H., Zhang, S.W., Early Miocene sporo-pollen assemblages in Tianshang T103 bore, Anhui Province, *Acta Micropalaeontologica Sinica*, 3(2), 151-160 (1986).
- Zong, G.F., Chen, W.Y., Huang, X.S., Cenozoic Mammals in Hengduanshan region and their Living Environments, Beijing, Ocean Press, 1-226 (1996).

Suppl_Table 2. Numbers and types of records used in the paleoenvironmental maps

Times	Lithology	Pollen	Mammals
Paleocene	16	32	13
Eocene	33	47	16
Oligocene	21	29	14
Early and Middle Oligocene	16	16	11
Late Oligocene	10	13	3
Miocene	33	50	44
Early Miocene	17	19	3
Middle Miocene	13	19	17
Late Miocene	17	14	24
Pliocene	9	18	10