**Supplementary Figure 1.** Photographs of the Shaozhai section depict the interbedded loess-paleosol sequence and pedogenic carbonates. (A, B) the late Pleistocene sequences, with scattered individual nodules spotted by red circles and calcareous spots indicated by red arrows; (C, D) the early Pleistocene sequences, carbonate nodules are spotted by red circles and have an increased diameter; (E, F) the late Pliocene sequences, pedogenic carbonates aggregate in horizons and contain micritic carbonate crystals.



**Supplementary Figure 2.** The published magnetostratigraphic results of the Shaozhai section by Qi et al. (2021) and the comparison of magnetic susceptibility records between multiple sections. (A) Magnetic susceptibility of Shaozhai (Qi et al., 2021); (B) Virtual geomagnetic pole (VGP) latitude and paleomagnetic polarity of Shaozhai (Qi et al., 2021); (C) Geomagnetic polarity timescale (GPTS2012); (D) Magnetic susceptibility of this study; (E) Magnetic susceptibility of Lingtai (Sun et al., 1998).



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