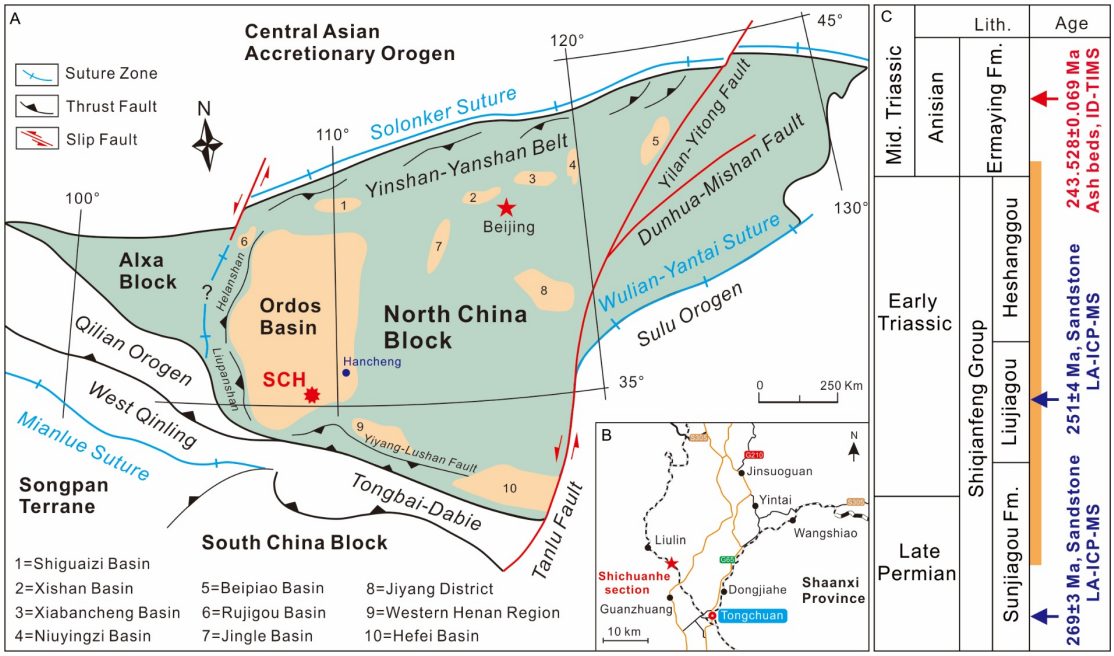

Fig 1. Simplified paleotectonic map of the North China Block and its sedimentary basins (modified from Meng et al., 2019). Red star marks the studied Shichuanhe (SCH) section. Blue point indicates the Hancheng section. Inset B shows a detailed location of the SCH section. C. Brief Permian–Triassic chrono- and lithostratigraphic framework in North China. ID-TIMS age is from Liu et al. (2018), LA-ICP-MS ages are from Zhu et al. (2019). Orange bar represents studied interval.

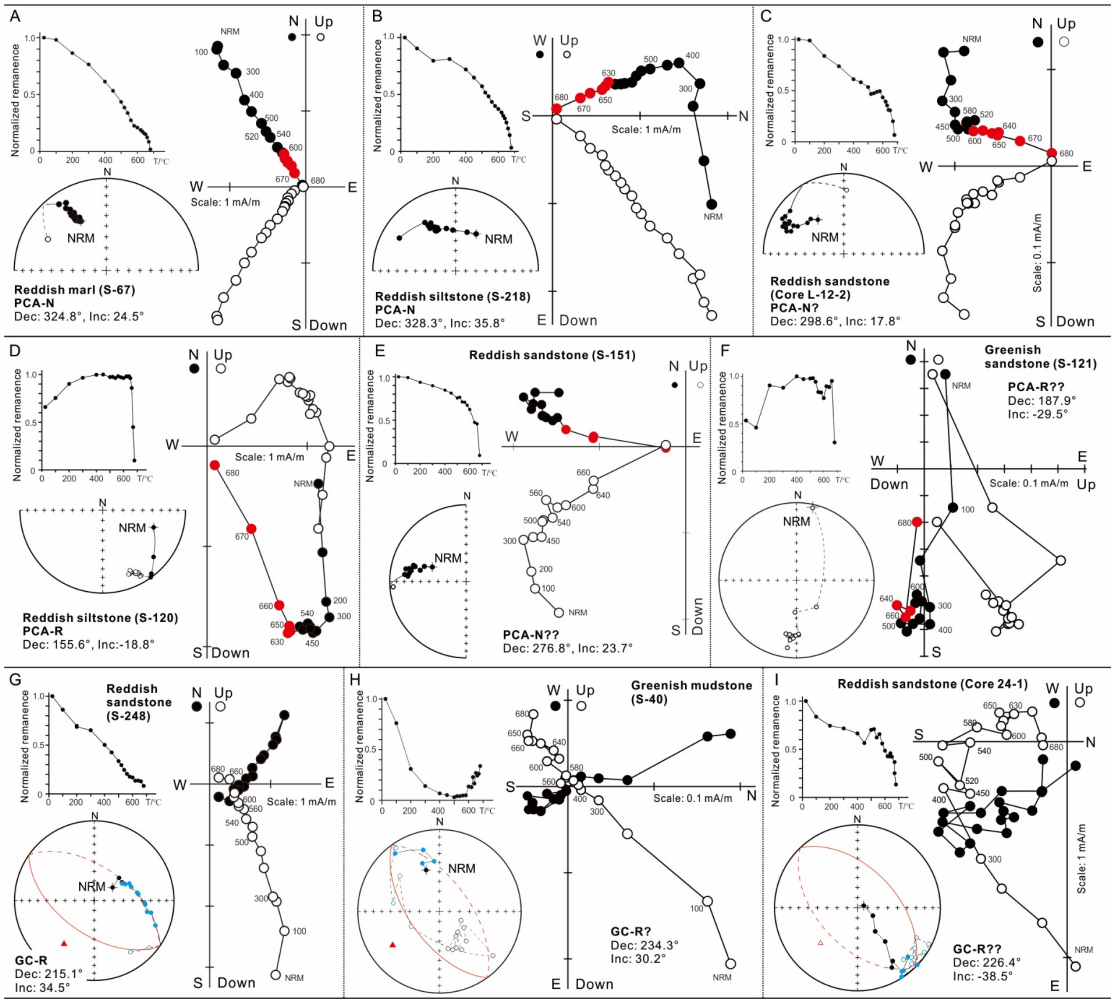

Fig 2. Representative demagnetization behaviors with polarity interpretation of specimens from Shichuanhe section. A–F: Principal Component Analysis (PCA), steps used for ChRM line-fits are highlighted in red. A. A largely single component magnetization shows a stable end-point that is close to expected Early Triassic direction in North China (polarity N; S1 class), Sunjiagou Formation. B. After removal of an eastward LTC below 400°C, specimen shows good linearity to the origin with the ChRM from 630–680°C steps, polarity N (S1), Heshanggou Formation. C. Similar demagnetization behavior to B, but the ChRM direction is a little deviated from expected direction (N?, S2), Liujiagou Formation. D. Two component magnetizations with the ChRM 630°C to the origin (R, S1). Apparent mid-stable component is from blocking temperature overlap between the ChRM and the LTC, Sunjiagou Formation. E. Specimen shows good linearity above 600°C, but isolated ChRM is deviated from expected direction (N??, S3), Liujiagou Formation. F. The last three steps show moderately linear ChRM component and the LTC is a composite LTC and Triassic reverse component (R??, S3), Sunjiagou Formation. Filled (open) symbols are lower (upper) hemisphere. G–I: Great-circle (GC) fits, red arc represents fitted great circle and blue indicates

points used. Lower projection paths dashed and upper projection paths are solid. G. Great circle plane from 200–680℃, specimen shows unscattered great circle trend towards the expected reverse direction (R, T1). LTC (100–500℃) is likely a composite component, Heshanggou Formation. H. Well-defined LTC 100–400 ℃ and a somewhat scattered trend (moderate arc length 100–540℃) towards Triassic reverse, with erratic directions above 600℃, due to thermal alteration (R?, T2), Sunjiagou Formation. I. Well-defined LTC NRM–400℃ and a trend towards expected Triassic reverse direction with the great circle fitted to the higher temperature steps (R??, T3), Liujiagou Formation.

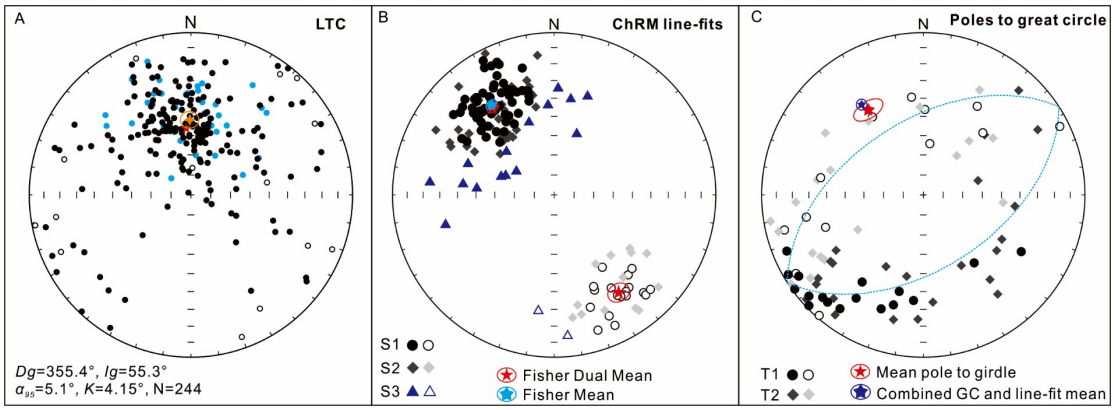

Fig 3. Equal-area stereographic projection of the low-temperature components (LTC) and characteristic (ChRM) components of the Shichuanhe section. A. LTC in geographic coordinates, with the Fisher means (red star) close to the recent geomagnetic dipole field direction (orange star) at the SCH site (IGRF, computed from https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#igrfwmm). B. Dual polarity ChRM line fits (in stratigraphic coordinates), with calculated Fisher (dual) mean (only S1 and S2 data used) and Fisher means of all converted to normal (Blue star with 95% confidence ellipse). C. Poles to the great circle planes of T1 and T2 class data, along with the mean of the combined great circle and line-fits (McFadden and McElhinny, 1988). The single girdle plane (dotted) is the plane normal to the mean direction calculated using both the great circle poles and ChRM fits. Red star indicates the mean pole to the great circle girdle of points and its elliptical 95% confidence cone. The filled (open) circles refer to the lower (upper) hemisphere, respectively.

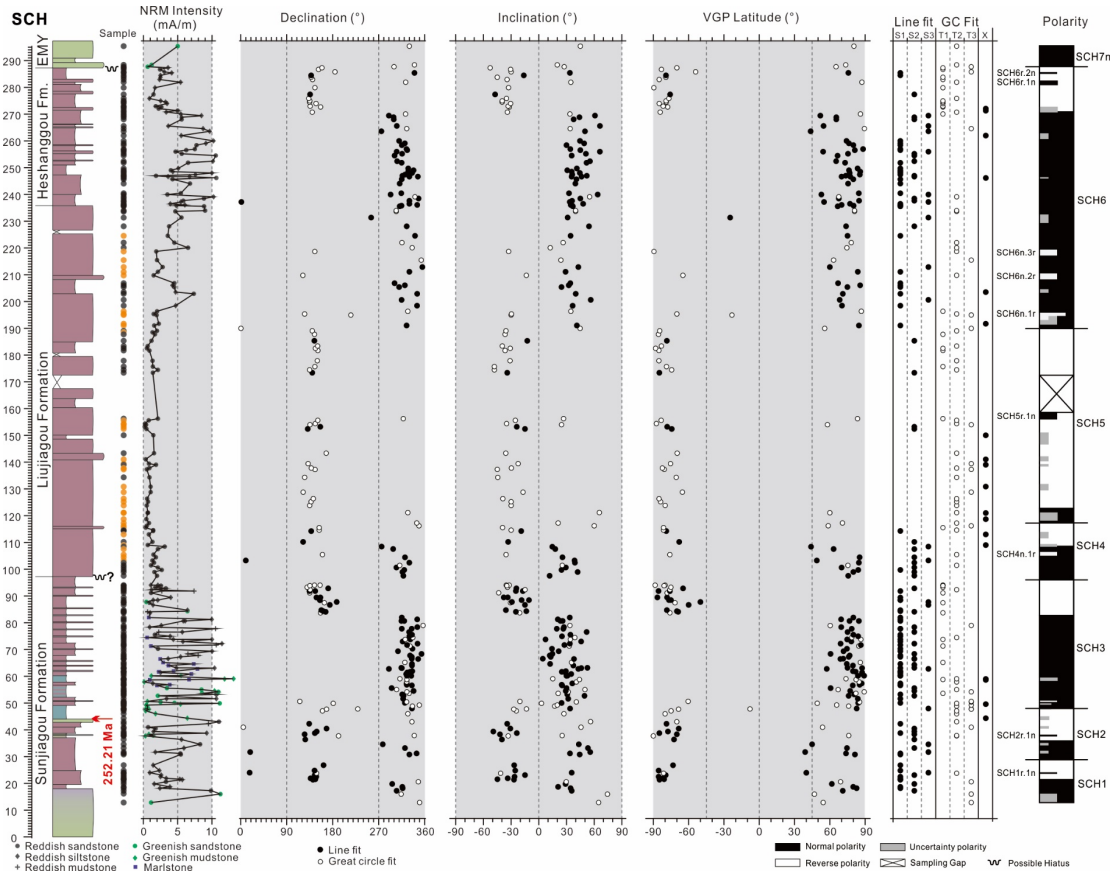

Fig 4. Magnetostratigraphy of the Shichuanhe (SCH) section with polarity quality ratings. Demagnetization behavior of S and T refer to ChRM line-fits (filled circles) and great circle fits (open circles), respectively, which are subdivided into S1, S2, S3 and T1, T2, T3 class (see text for details). Specimens with no Triassic magnetization are marked X. Half-width bars indicate a single sample with high quality (S1, S2 or T1, T2), showing opposite polarity interpretation with respect to adjacent samples. For the gray bar, one-quarter-width means single poorest quality or undetermined polarity (S3, T3 and X), whereas half-width indicates successive poorest or undetermined polarities.

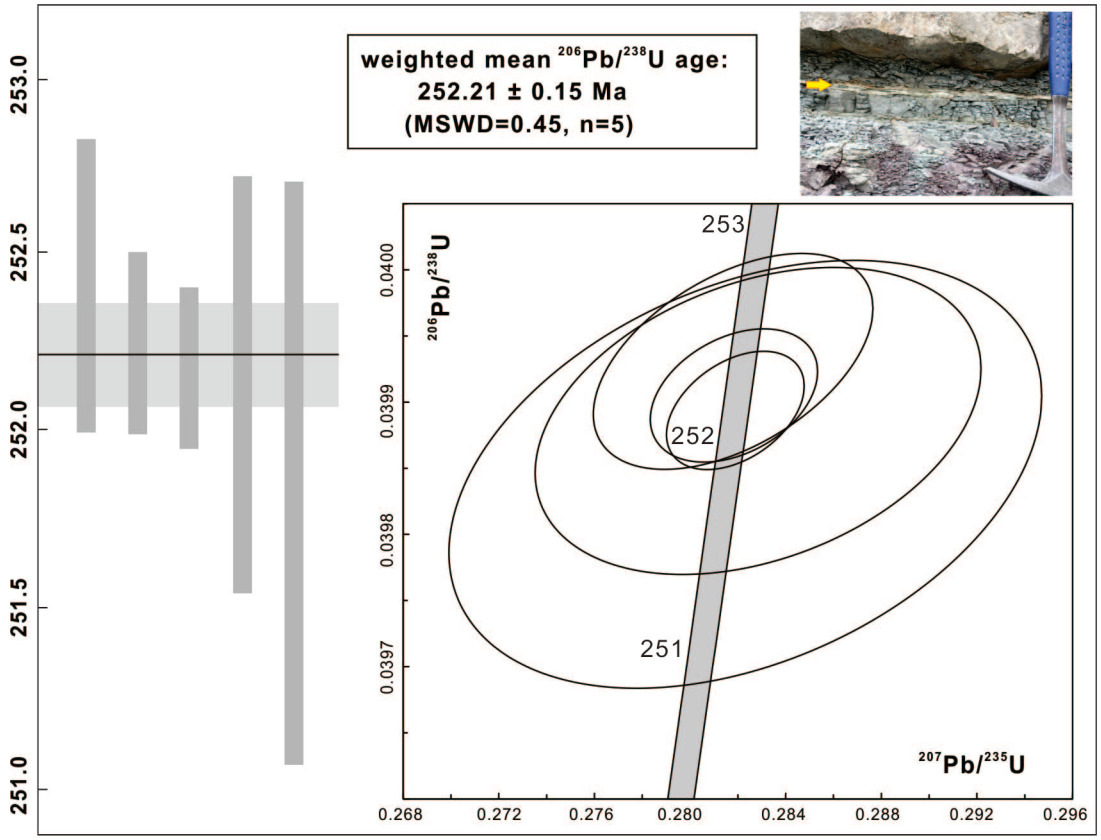

Fig 5. Concordia diagram and ranked $^{206}Pb/^{238}U$ plot of the analyzed zircon grains by the CA-ID-TIMS method from the Shichuanhe ash bed (upper right inset marked by yellow arrow). Each vertical bar represents a single zircon analysis included in the weighted mean age and the bar height is proportional to the 2σ analytical uncertainty. The horizontal black line and gray band represent the calculated weighted mean age and its 2σ analytical uncertainty envelope, respectively. Two outlier analyses excluded from age calculation plot outside the diagram area and are not shown here. See Supplementary data C for complete U-Pb data.

Table 1. Permian–Triassic mean directions and virtual geomagnetic poles for the Shichuanhe section and other sections in North China. Paleolatitude and reversal test of Yang et al. (1991) were not provided in the original study.

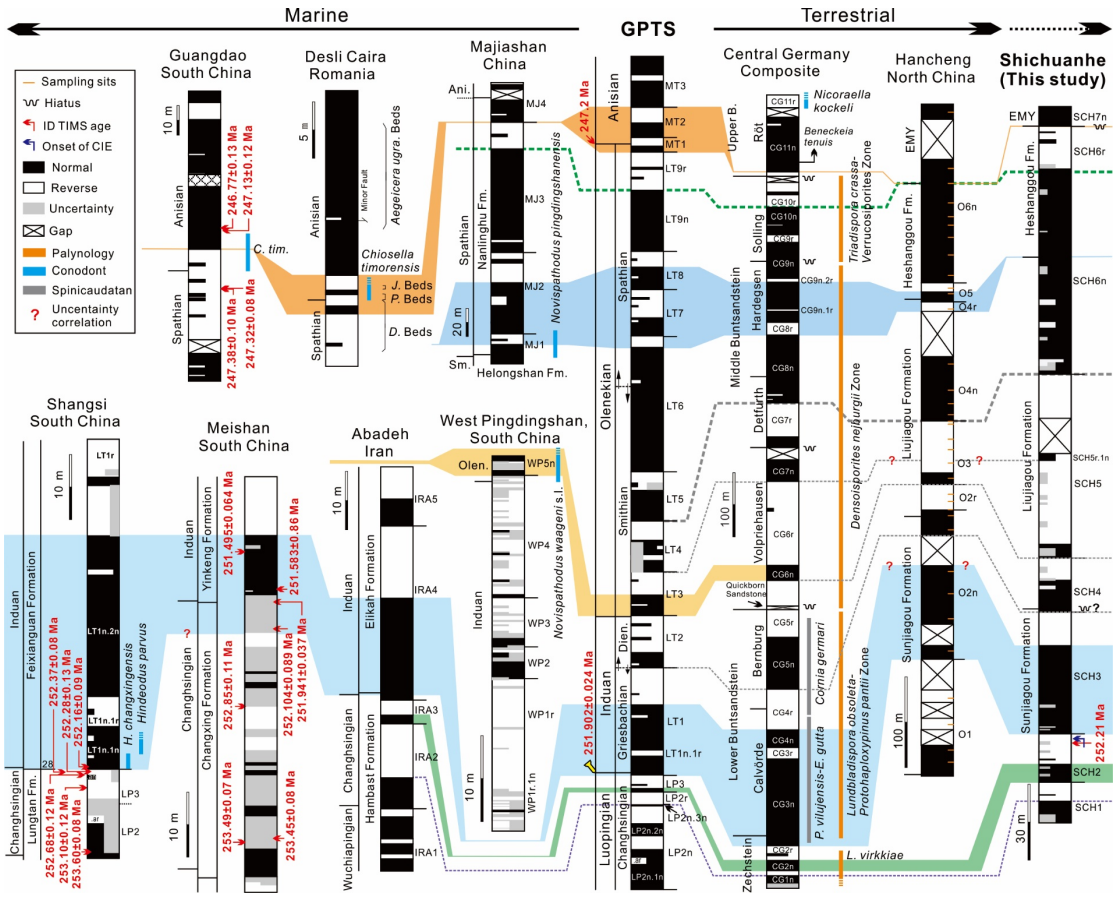

Fig 6. Changhsingian–Anisian magnetic polarity stratigraphy of North China and comparison with other non-marine and marine successions. Geomagnetic polarity timescale (GPTS) is based on Hounslow and Muttoni (2010) and Hounslow and Balabanov (2018). Compiled Central German Composite and biostratigraphy (Szurlies, 2007, 2013; Kürschner and Herngreen, 2010; Scholze et al., 2017). Hancheng section (Ma et al., 1992). Distance between sampling sites >30 m is marked by a sampling gap. West Pingdingshan (Sun et al., 2009), Majiangshan (Li et al., 2016), Meishan (Modified from Hounslow and Balabanov, 2018), Abadeh (Gallet et al., 2000; Szurlies, 2013), Guangdao (Lehrmann et al., 2006), Shangsi (Hounslow and Balabanov, 2018; Yuan et al., 2019). Desli Caira (Grădinaru et al., 2007). Question marks indicate uncertain correlations. *D.* Beds=*Deslicairites* Beds; *P.* Beds=*Paracrocordicera* Beds; *J.* Beds=*Japonites* Beds; *P. vilujensis–E. gutta*=*Palaeolimnadiopsis vilujensis–Euetheria gutta*; *L. virkkiae*=*Lueckisporites virkkiae* Zone.

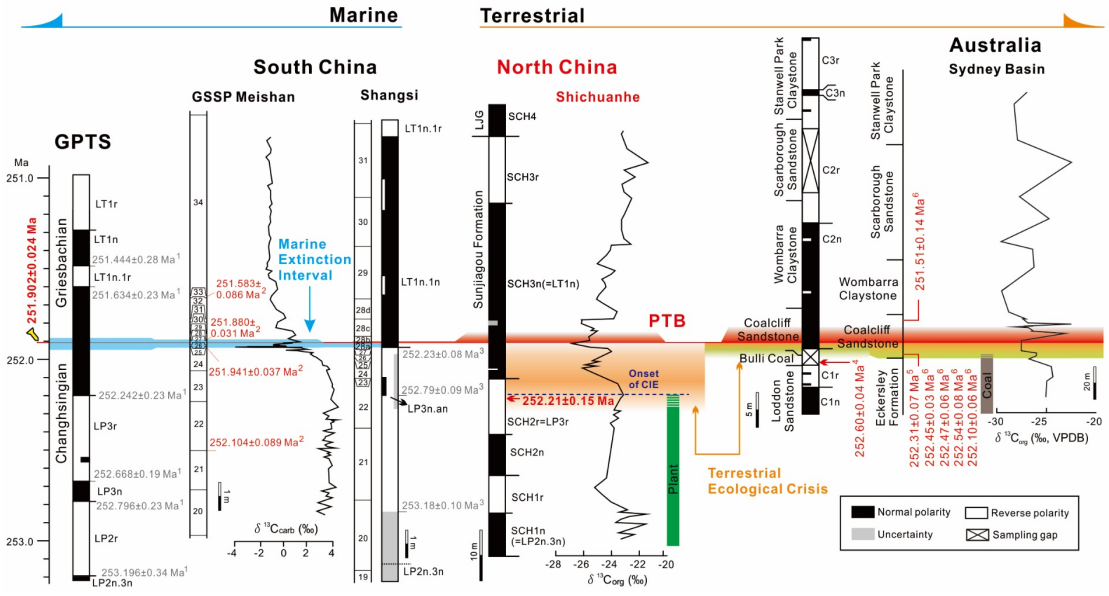

Fig 7. Correlation of the Permian–Triassic interval sequence at Shichuanhe with the GSSP at Meishan (Burgess et al., 2014), Shangsi (Yuan et al., 2019) and Australian sections (Belica, 2017; Fielding et al., 2019, 2021). Ages of [1]=calculated by Hounslow and Balabanov, 2018, [2]=Burgess et al., 2014, [3]=calculated magnetozone boundary ages by Yuan et al., 2019, [4]=Metcalfe et al., 2015, [5]=Fielding et al., 2019, [6]=Fielding et al., 2021. GPTS is from (Hounslow and Balabanov, 2018). Carbon isotope curve of Shichuanhe (Wu et al., 2020).