**Table S3:** d13C of atmospheric CO2 calculated using d13Cof marine carbonates (Sun et al. 2012; Shen et al. 2013)and low latitude SST (Joachimski et al. 2020; Sun et al. 2012). SST was reconstructed from conodont d18O with conodonts deriving from the carbonates used for carbon isotope analysis. By this we assume that calculated temperatures reflect ambient water temperature during carbonate precipitation. Carbon isotope fractionation between CO2 and HCO3- (eCO2-CaCO3) from (Romanek et al. 1992).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | d13Ccarb | low latitude  | avg. SST | eCO2-CaCO3 | d13Catm |
| (‰ VPDB) | SST (° C) | (° C) | (‰ VPDB) |
|  |  |  |  |  |  |
| **Anisian** | 2.0 |   | 32 | 8.14 | -6.14 |
| **Olenekian (Spathian)** | 1.0 to 3.0 | 34-36 | 35 | 7.78  | -6.78 to -4.78 |
| **Olenekian (early Smithian)** | 3.0 | 34-36 | 35 | 7.78 | -4.78 |
| **Induan (Dienerian)** | 3.0 | 34-36 | 35 | 7.78 | -4.78 |
| **Changhsingian (latest)** | -1.0 to 1.0 | 28-32 | 30 | 8.74 | -9.38 to -7.38 |
| **Changhsingian** | 1.0 to 3.0 | 22-30 | 26 | 8.86 | -7.86 to -5.86 |