**Supplementary materials:**

**1. Fig. S1** Pearson correlation coefficient between stalagmite δ18O records of SZ-1 and SZ-3 during about 33-25 ka.

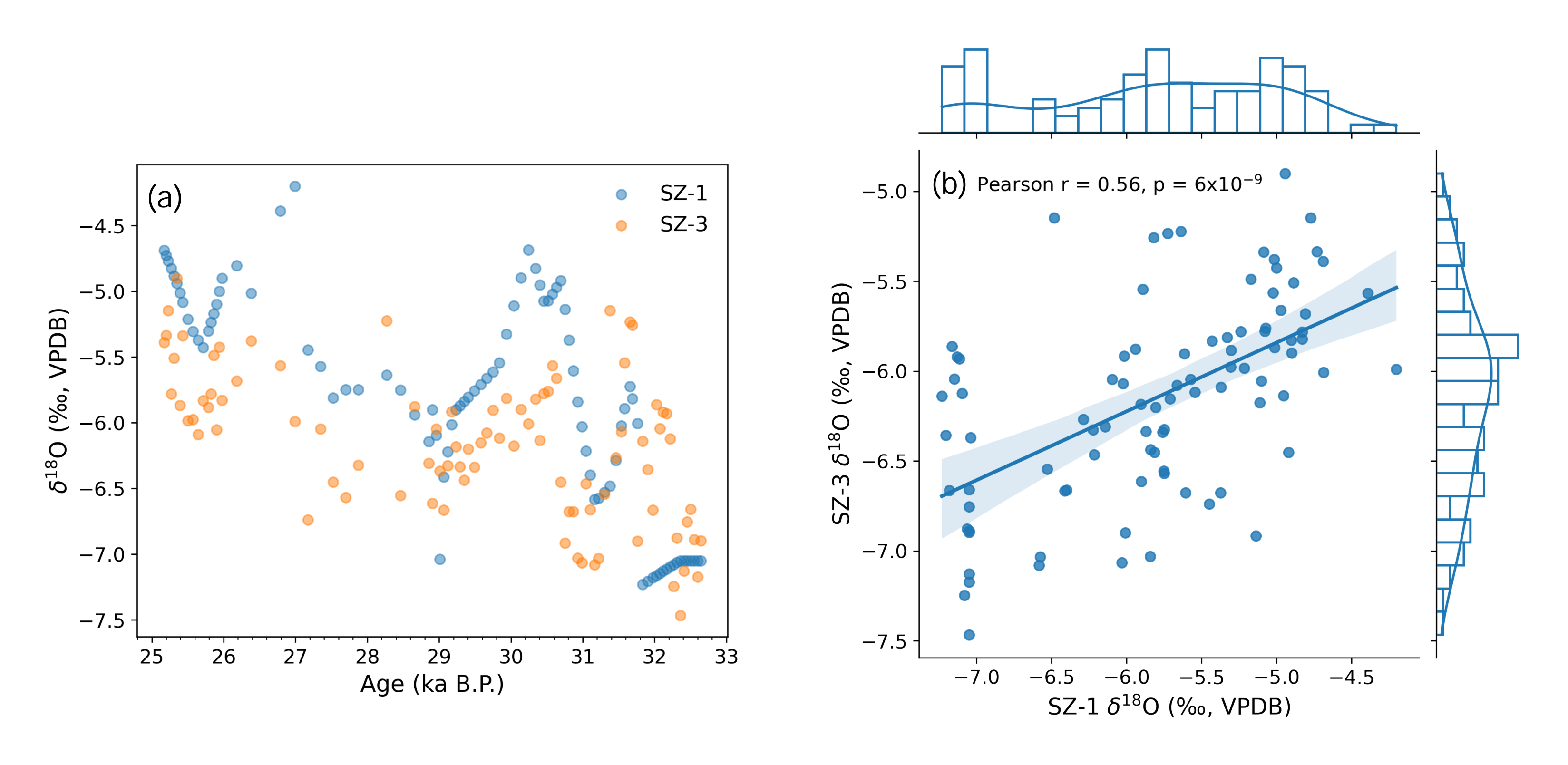
**2. Fig. S2** XRD analyses results for samples at different sections along stalagmites SZ-1 and SZ-3.

**3. Fig. S3** Collected stalagmite δ18O records in the Asian region for amplitudes comparison.

**4. Fig. S4** Simplified graphical sketch explaining the absolute amplitude during the Heinrich stadials.

**5. Tab. S1** Amplitudes of δ18O for collected stalagmite records during the HS 1 to HS 4.

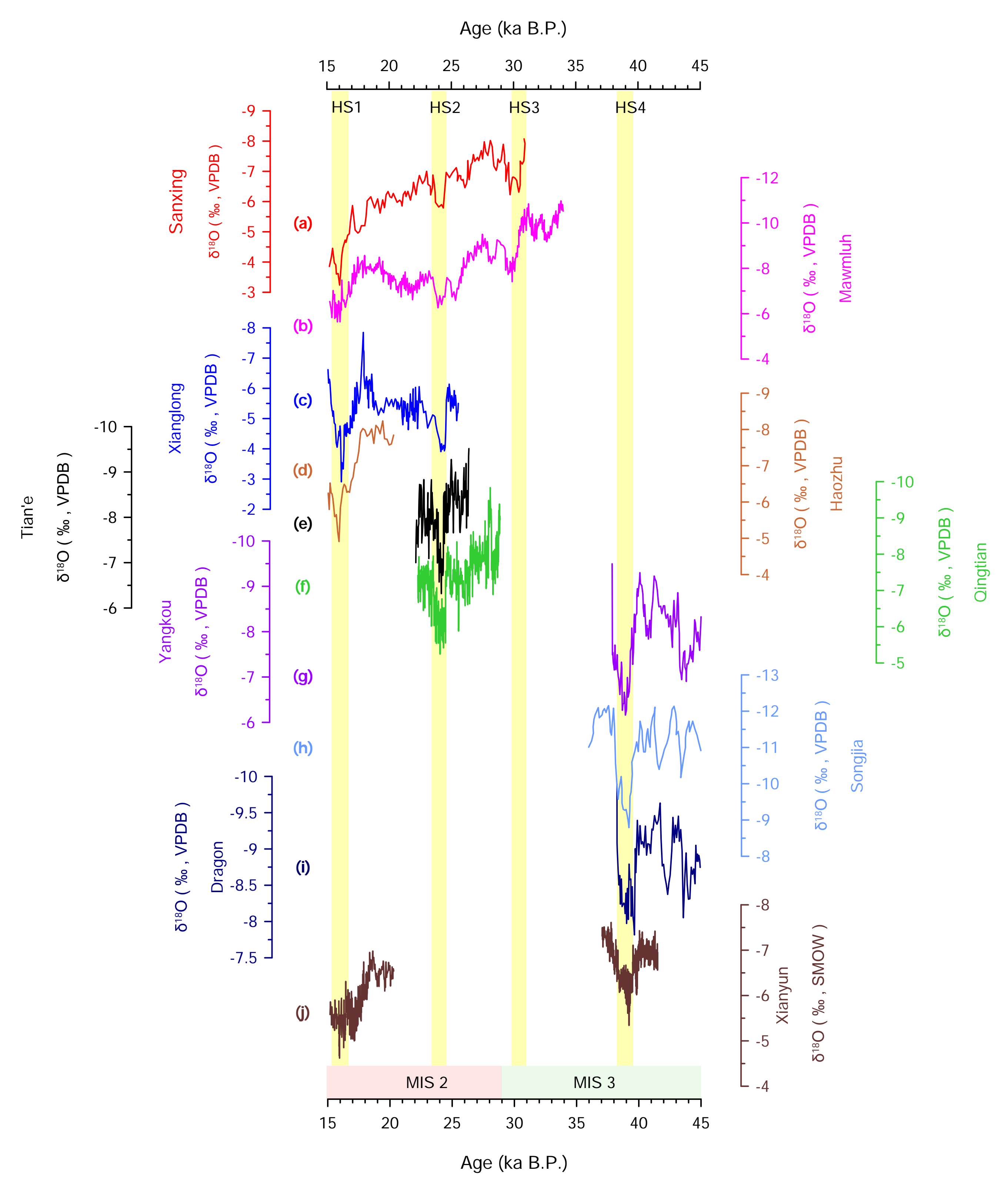
**6. References**



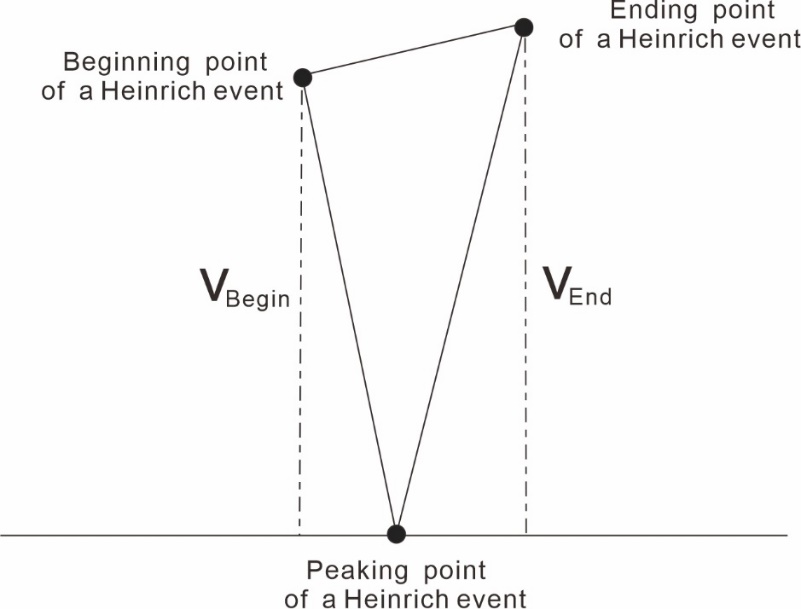
**Figure S1.** Pearson correlation coefficient between stalagmite δ18O records of SZ-1 and SZ-3 during their about 33-25 ka. The SZ-1 record is recalculated based on liner interpolation to compare with SZ-3 on a common timescale.



**Figure S2.** XRD analyses results for samples at different sections along stalagmites SZ-1 and SZ-3. All samples are dominantly composed of calcite.



**Figure S3.** Collected stalagmite δ18O records in the Asian region for amplitude comparison. (a) Sanxing Cave (Jiang et al., 2014); (b) Didonghe Cave (Chen et al., 2022); (c) Xianglong Cave (Li et al., 2019); (d) Haozhu Cave (Zhang et al., 2016); (e) Tian’e Cave (Chen et al., 2006); (f) Qingtian Cave (Liu et al., 2018); (g) Yangkou Cave (Han et al., 2016; Li et al., 2017); (h) Xiaobailong (Cai et al., 2006); (i) Dragon Cave (Dong et al., 2018); (j) Xianyun Cave (Zhang et al., 2021; Qiu et al., 2022).



**Figure S4.** Simplified graphical sketch explaining the absolute amplitude during the Heinrich stadials. The related calculation formula is V absolute = (V begin + V end) / 2; with V absolute, the absolute amplitude of those stadials; V begin, the absolute values between beginning points and peaking points of those stadials; Vend, the absolute values between ending points and peaking points of those stadials.

**Table S1**. Amplitudes of δ18O for the collected stalagmite records during the HS 1 to HS 4. Dot lines were used to mark the lack of data.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number | Cave | HS 1 (‰) | HS 2 (‰) | HS 3 (‰) | HS 4 (‰) | Reference |
| 1 | Shizhu | 2.53 | 1.05 | 0.96 | 2.86 | This study |
| 2 | Hulu | 1.21 | 1.50 | 1.76 | 1.47 | Cheng et al., 2016 |
| 3 | Xianyun | 1.3 | -- | -- | 1.08 | Zhang et al., 2021;  Qiu et al., 2022 |
| 4 | Yongxing | -- | 1.92 | 1.17 | 2.65 | Chen et al., 2016 |
| 5 | Songjia | 2.66 | 1.47 | -- | 3.49 | Zhou et al., 2008 |
| 6 | Dragon | -- | -- | -- | 1.67 | Dong et al., 2018 |
| 7 | Sanxing | 2.19 | 1.27 | 1.13 | -- | Jiang et al., 2014 |
| 8 | Didonghe | 1.55 | 1.48 | 2.21 | -- | Chen et al., 2022 |
| 9 | Haozhu | 1.29 | -- | -- | -- | Zhang et al., 2016 |
| 10 | Xianglong | 3.04 | 1.70 | -- | -- | Li et al., 2019 |
| 11 | Tian’e | -- | 1.55 | -- | -- | Chen et al., 2006 |
| 12 | Qingtian | -- | 1.97 | -- | -- | Liu et al., 2018 |
| 13 | Yangkou | -- | -- | -- | 3.06 | Han et al., 2016;  Li et al., 2017 |
| 14 | Xiaobailong | -- | -- | -- | 2.35 | Cai et al., 2006 |

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