Earth Surface Dynamics

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Title: Palaeo-landslide dams controlled the formation of Late Quaternary terraces in Diexi, the upper Minjiang River, eastern Tibetan Plateau

Dear Dr Schwanghart,

We extend our deepest gratitude for your invaluable feedback and suggestions on our manuscript. We truly appreciate the time and effort you dedicated to reviewing the manuscript and providing insightful comments. Your suggestions have significantly enhanced the quality of the manuscript. We have carefully implemented your suggestions, and as a result, the manuscript is now more robust and scientifically rigorous.

We have included six new radiocarbon dates in the manuscript. These new dates not only reinforce the reliability of the original conclusions but also provide a valuable resource for future researchers. The relevant texts, figures and table have been revised based on these new radiocarbon dates.

Thank you once again for your invaluable support and guidance.

Please find the detailed response in the attached document.

Best regards,
Xuanmei Fan on behalf of all co-authors

The Response to Comments from Editor

Specific Comments
Comment 1 A minor, yet still unclear issue, is the role of wave erosion on the formation of the extraordinary wide terrace Tunajie T1. Do you have any additional evidence, possibly from other studies, that supports your interpretation? Are lakes of similar size actually able to create waves that are capable of performing as much erosion? If not, I suggest to formulate this explanation more carefully. Also, the schematic model of Malatesta et al. 2021 assumes fluctuating sea levels. In case of a landslide dam, this would mean that the lake either changes the height of the outlet (e.g. by additional landsliding at the lake sill), or that the lake switches from open to closed conditions. Is any of these processes actually possible?
Response 1 Thanks for your valuable comments. As you pointed out, the schematic model assumes a fluctuating sea level. We reconsidered our position on this issue of beveling and backwearing of terrace, T1. In the absence of actual observations to draw upon, we provide three possible explanations. Consequently, we removed Fig. 9 and we reworked this section (*L382-388*), as follows: *Regarding Tuanjie T1, we note the extraordinary terrace width. There are three possible factors that created the very wide T1 terrace: (i) During this period, strong monsoon activity resulted in high discharges and low sediment input, leading to river incision (Malatesta and Avouac, 2018; Tian et al., 2021; Yu et al., 2021). (ii) We note some additional erosion may have occurred owing to the positioning of the Tuanjie terraces on the concave margin of the valley (Fig. 1b) where lateral fluvial erosion tends to be accentuated. (iii) As the lowest terrace, Tuanjie T1 was subjected to frequent erosion during the progressive outburst of the palaeo-dam (Phase IV to Phase VII, Fig. 9).*
Response 2 – For the six new radiocarbon dates Recently, we received six new radiocarbon dates, including three samples taken from the bottom lacustrine deposits of Tuanjie T2, and three collected from the bottom lacustrine deposits of Taiping T1, T2, and T3, respectively. These data not only strengthen the reliability of the original conclusions, also provide valuable resources for future research. Therefore, we have added these new data to this

manuscript.

Note that since we only have one date of 39 ka, and there is no further evidence to support the Minjiang River blockage before 39 ka, the blockage time is still 'before 35 ka'.

Based on these new data, the manuscript has been revised as follows:

1. Texts:

(1) In Section 3.2.2, we added a description of the test purposes of these six samples on *L175-176*, as follows:

Six samples taken from the bottom lacustrine deposits were used to determine the depositional ages of the terraces.

(2) In Section 4.4, we added the results of these six samples on *L286-188*, as follows:

The bottom lacustrine deposits of T2 yielded ages of ~ 34, ~ 39, and ~ 37 cal. ka BP. The depositional ages of all three bottom lacustrine samples of Taiping T1, T2, T3 are ~ 30, ~34, and ~ 30 cal. ka BP, respectively.

(3) In Section 5.1, we rewrote the sentence of ‘older age’ on *L297-298*, as follows:

We note that the older ages of the Tuanjie and Taiping lacustrine deposits (Fig. 5a) are ~35 ka and ~30 ka, respectively; …

(4) In Section 5.4.2, we rewrote the sentence on Line 377, as follows:

… however, we cannot see any clear relationship between the age of the terraces and the climatic variations over the past *39,000* yrs (Fig. 7).

(5) In Section 5.5, two more pieces of evidence have been added to support the Minjiang River blocked before 35 ka, on *Line 420-421*, as follows:

(1) the bottom lacustrine deposits of Tuanjie T2 dated to ~ 35 ka; (2) the deposition age of Taiping T2 was ~ 34 ka.

2. Figures:

The six new dates have been added to figures. 2, 3, 5, 7e, 9a, as follows:

Figure 2. OSL and calibrated radiocarbon (denoted as cal. ka BP) dating results from Tuanjie. (a) The highest lacustrine deposits. (b) Lacustrine deposits and palaeosol at T7. (c) Gravel unit at T5. (d) Lacustrine deposits and palaeosol at T5. (e) Loess at T4. (f) Lacustrine deposits and palaeosol at T4. (g) Palaeosol at T3. (h) Lacustrine deposits at T3. (i) Gravel unit and palaeosol at T2. (j) Lacustrine deposits at T2. *(k) Lacustrine deposits at T2.* (l) Palaeosol at T1. (m) Lacustrine deposits at T1. White dashed lines mark unit boundaries.

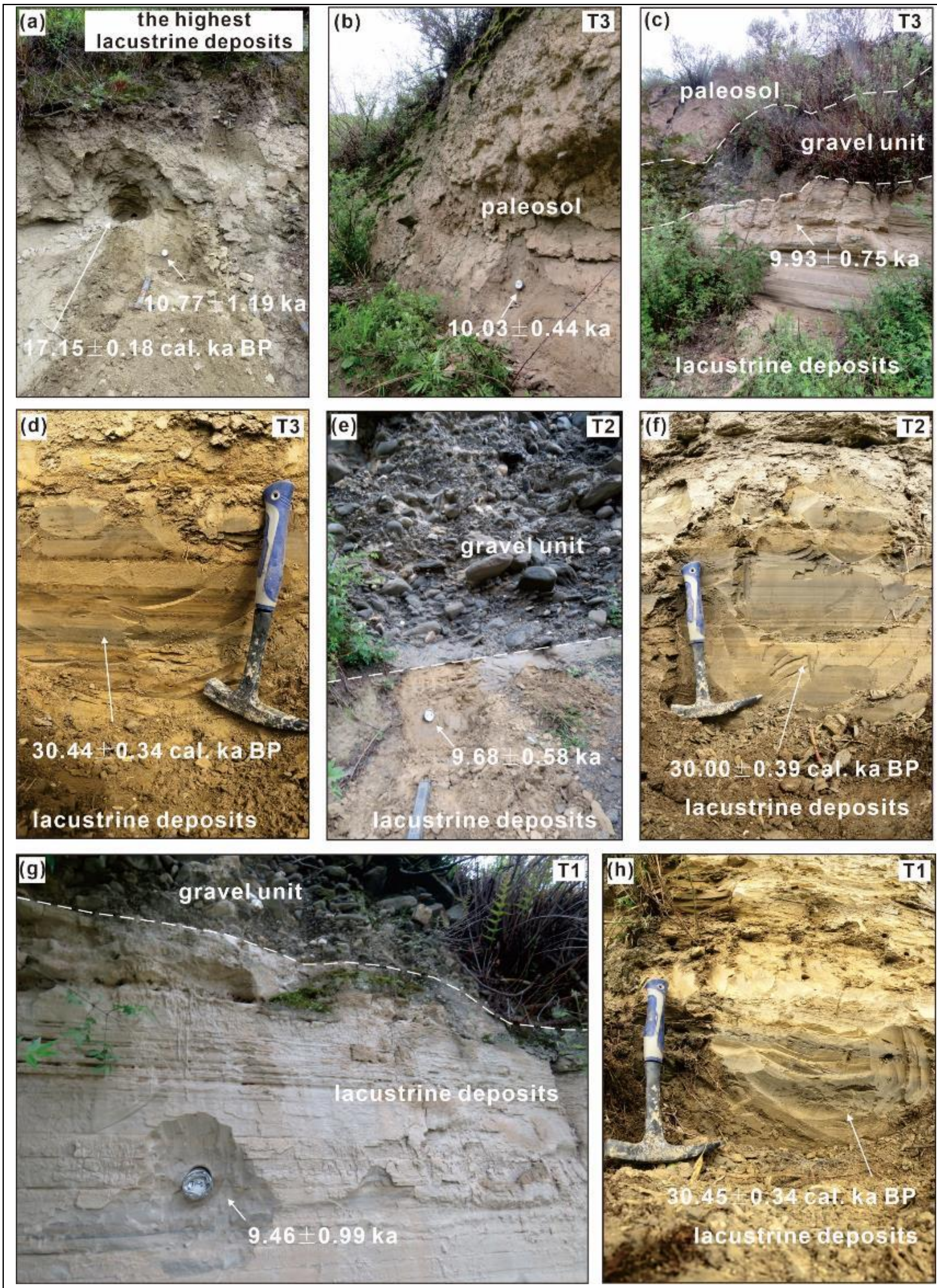

Figure 3. OSL and calibrated radiocarbon (denoted as cal. ka BP) dating results from Taiping. (a) Paired OSL and radiocarbon samples collected from the highest lacustrine deposits. (b) Palaeosol at T3. (c) Lacustrine deposits in T3. *(d) Lacustrine deposits in T3.* (e) Lacustrine deposits at T2. *(f) Lacustrine deposits at T2.* (g) Lacustrine deposits at T1. *(h) Lacustrine deposits at T1*. White dashed lines mark unit boundaries.

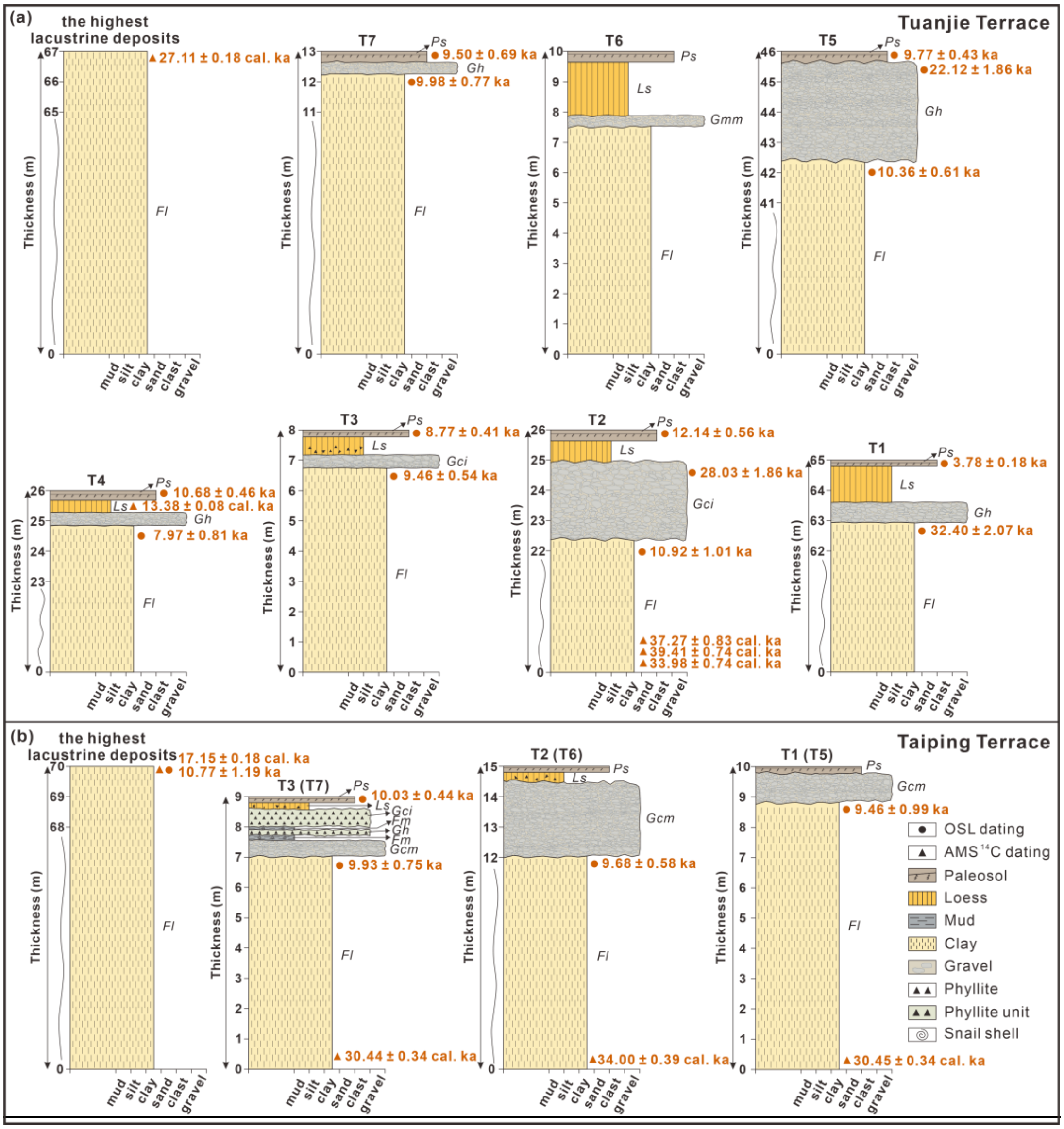

Figure 5. Terrace sedimentary sequences, lithofacies, and dating results (radiocarbon dates are denoted cal. ka): (a) Tuanjie T1, T2, T3, T4, T5, T6, T7, and the highest lacustrine deposits, respectively. (b) Taiping T1, T2, T3, and the highest lacustrine deposits. All lithofacies labels are linked to Table 1; see Table 2 and Fig. 4 for terrace correlations.

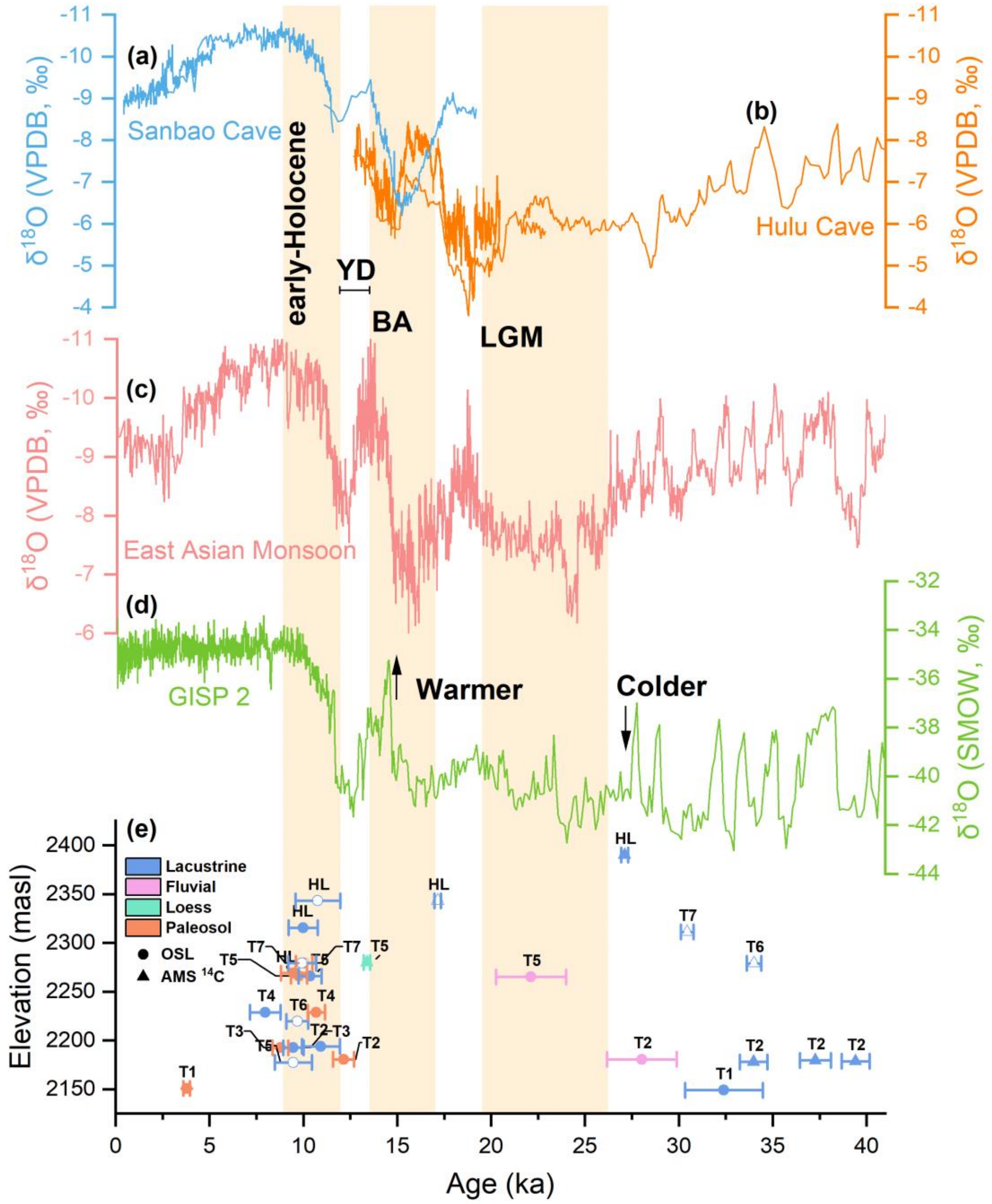

Figure 7. Palaeoclimate ($\delta^{18}O$) proxies compared with the OSL and radiocarbon chronologies obtained from the Diexi terraces. (a) Sanbao Cave (Wang et al., 2008); (b) Hulu Cave (Wang et al., 2001); (c) East Asian Monsoon (Cheng et al., 2016); (d) GISP-2 (Grootes et al., 1993); and (e) the Diexi terraces at Tuanjie (solid symbol) and Taiping (hollow symbol). The early Holocene, Younger Dryas (YD), Bølling-Allerød interstadial (BA), and the Last Glacial Maximum (LGM) are labelled.

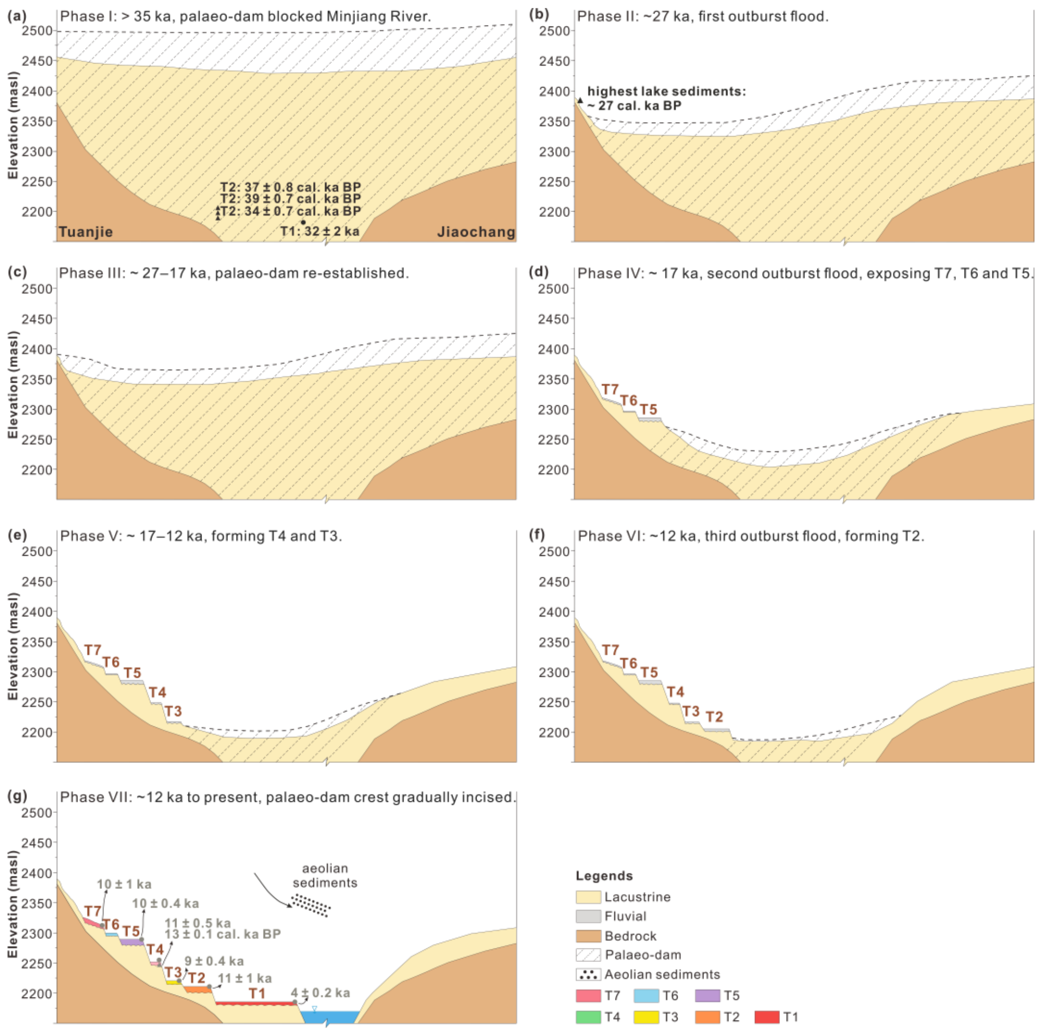

Figure 9. Schematic model of the evolution of the Diexi palaeo-dam and Tuanjie terraces. See Section 5.5 for detailed descriptions of each phase. Brown text denotes the ages of loess and palaeosol units.

3. Table 4 on L290:

Table. 4 Summary of the radiocarbon results for Tuanjie and Taiping.

Samples	Lab code	Material	Elevation (masl)	$\delta^{13}C$ (‰)	Radiocarbon age (a BP)	Calibration age (cal. ka BP)
TP-max	Beta-520926	bulk sediment	2342.95	-19.1	14050±50	17.15±0.18
TP23-03	*Beta-664881*	*bulk sediment*	*2311.00*	*-18.5*	*26040±120*	*30.44±0.34*
TP23-02	*Beta-664890*	*bulk sediment*	*2279.00*	*-19.9*	*29350±160*	*34.00±0.39*
TP23-01	*Beta-664882*	*bulk sediment*	*2269.00*	*-16.1*	*26010±120*	*30.45±0.34*
TJ-max	Beta-520925	bulk sediment	2390.00	-19.2	22740±90	27.11±0.18
TJ-T4-HT	Beta-520924	bulk sediment	2280.00	-21.6	11490±40	13.38±0.08
TJ23-03	*Beta-664879*	*bulk sediment*	*2179.50*	*-17.7*	*32670±240*	*37.27±0.83*
TJ23-02	*Beta-664878*	*bulk sediment*	*2178.60*	*-17.3*	*34170±280*	*39.41±0.74*
TJ23-01	*Beta-664877*	*bulk sediment*	*2178.00*	*-17.2*	*29300±170*	*33.98±0.74*

References:

Cheng, H., Edwards, R. L., Sinha, A., Spötl, C., Yi, L., Chen, S., Kelly, M., Kathayat, G., Wang, X., Li, X., Wang, X., Wang, Y., Ning, Y., and Zhang, H.: The Asian monsoon over the past 640,000 years and ice age terminations, Nature, 534, 640-646, https://doi.org/10.1038/nature18591, 2016.

Grootes, P. M., Stulver, M., White, J. W. C., Johnsen, S. J., and Jouzel, J.: Comparison of oxygen records from the GISP2 and GRIP Greenland ice cores, Nature, 366, 6455, https://doi.org/10.1038/366552a0, 1993.

Malatesta, L. C. and Avouac, J.-P.: Contrasting river incision in north and south Tian Shan piedmonts due to variable glacial imprint in mountain valleys, Geology, 46, 659-662, 10.1130/g40320.1, 2018.

Tian, Q., Kirby, E., Zheng, W., Zhang, H., Liang, H., Li, Z., Wang, W., Li, T., Zhang, Y., Xu, B., and Zhang, P.: Late Quaternary variations in paleoerosion rates in the northern Qilian Shan revealed by 10Be in fluvial terraces, Geomorphology, 386, 10.1016/j.geomorph.2021.107751, 2021.

Wang, Y., Cheng, H., Edwards, R. L., An, Z., Wu, J., Shen, C.-C., and Dorale, J. A.: A high-resolution absolute-dated late Pleistocene monsoon record from Hulu cave, China, Science, 294, 2345-2348, https://doi.org/10.1126/science.1064618, 2001.

Wang, Y., Cheng, H., Edwards, R. L., Kong, X., Shao, X., Chen, S., Wu, J., Jiang, X., Wang, X., and Wang, Z.: Millennial- and orbital-scale changes in the East Asian monsoon over the past 224,000 years, Nature, 451, 1090-1093, https://doi.org/10.1038/nature06692, 2008.

Yu, Y., Wang, X., Yi, S., Miao, X., Vandenberghe, J., Li, Y., and Lu, H.: Late Quaternary aggradation and incision in the headwaters of the Yangtze River, eastern Tibetan Plateau, China, GSA Bulletin, 134, 371-388, 10.1130/b35983.1, 2021.