DR2011048
Supplementary material

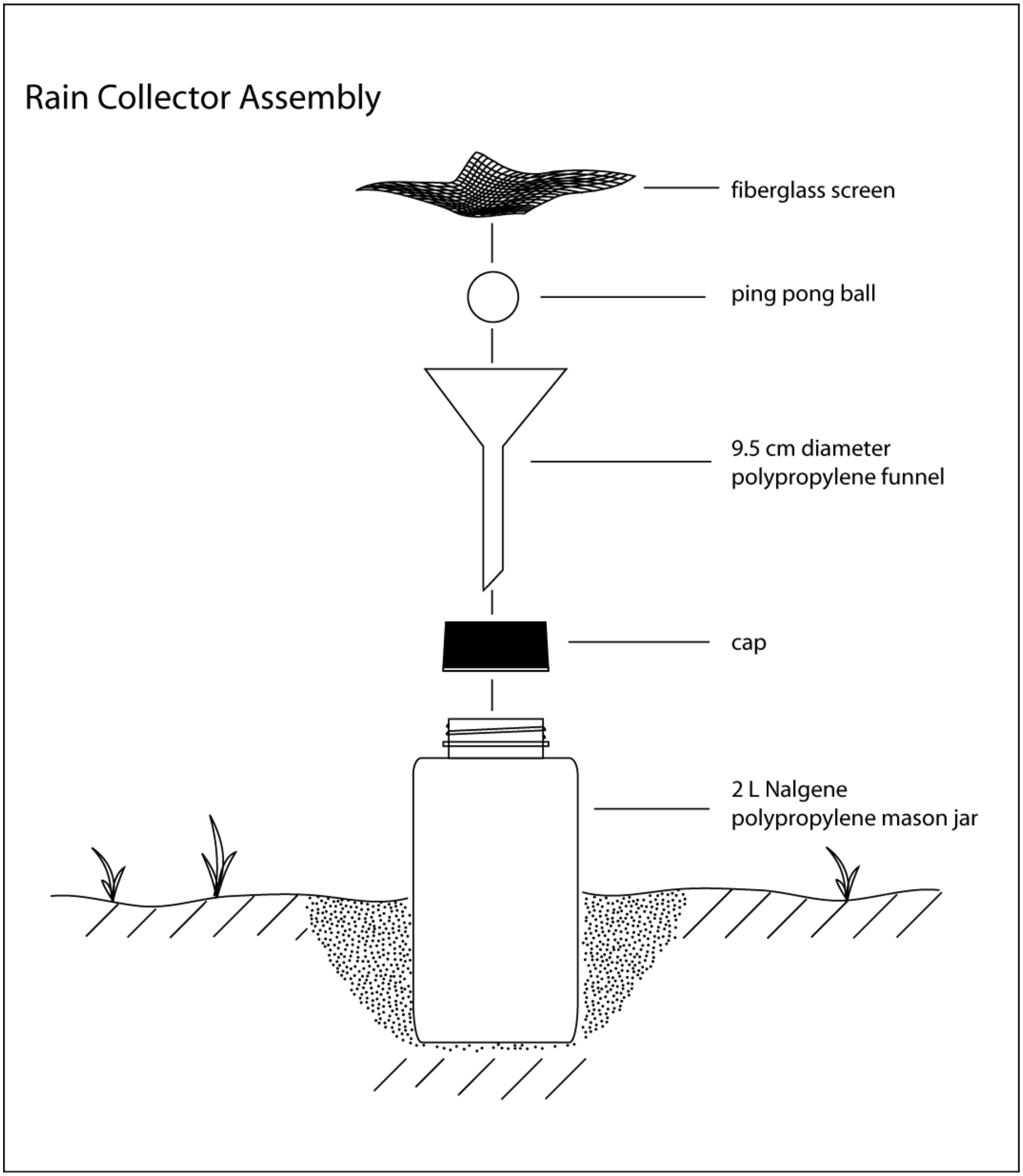

Figure DR1. Schematic diagram of the rain collector assembly. Modeled after Scholl et al., (1996)

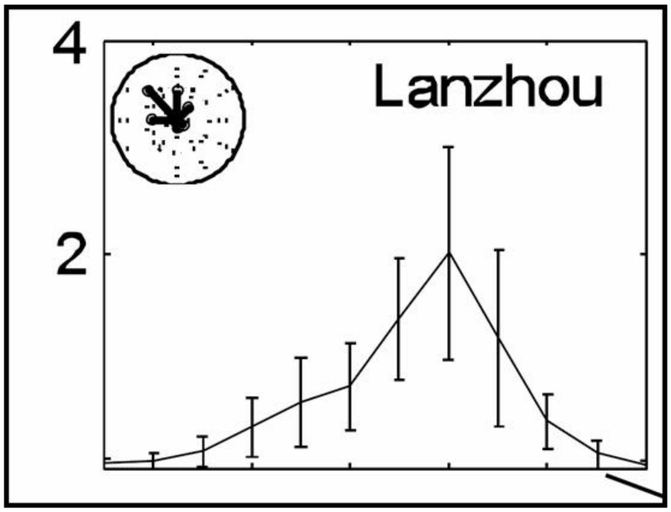

Figure DR2. Monthly average of precipitation (mm/day). Wind rose is for the rainiest month (August). Bars point toward the downwind wind direction. Length of bar is normalized to precipitation. The data used to create this wind rose were obtained from WMO station data.

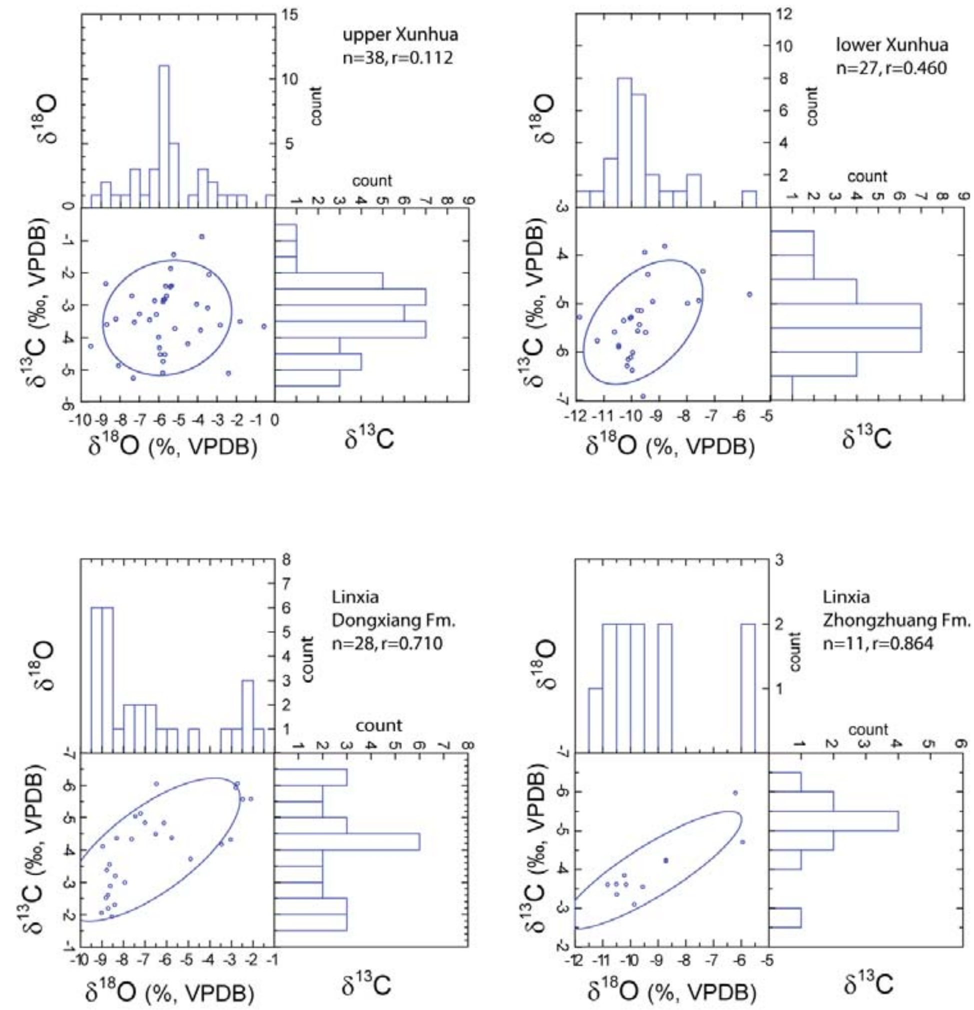

Figure DR3. Cross plots of $\delta^{18}O$ and $\delta^{13}C$ showing the degree of covariance in lacustrine sediments from the A) Xunhua and B) Linxia basins. Covariance is an indicator of basin closure (Talbot, 1990; Li and Ku, 1997)

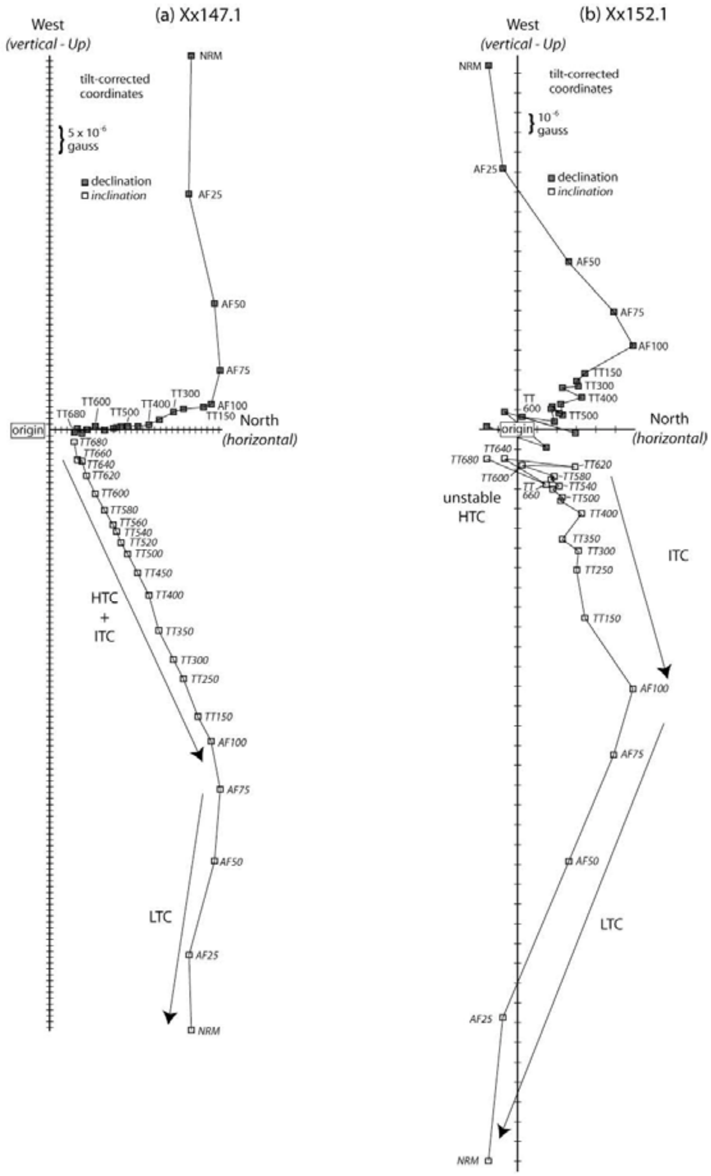

Fig. Orthog.

Figure DR4. Examples of paleomagnetic results from stepwise alternating-field (AF) and thermal (TT) demagnetization of selected samples from the upper Xunhua section in stratigraphic (tilt-corrected) coordinates. Orthogonal plots show declination and inclination with demagnetization steps (AF, TT) and magnetic components (LTC – low-temperature component, ITC – intermediate-temperature component, HTC – high-temperature component) labeled. The LTC is interpreted to be a viscous overprint. In (a) note the stable ITC and HTC; both define the ChRM. In (b) note the stable ITC followed by the unstable HTC; here only the ITC defines the ChRM.

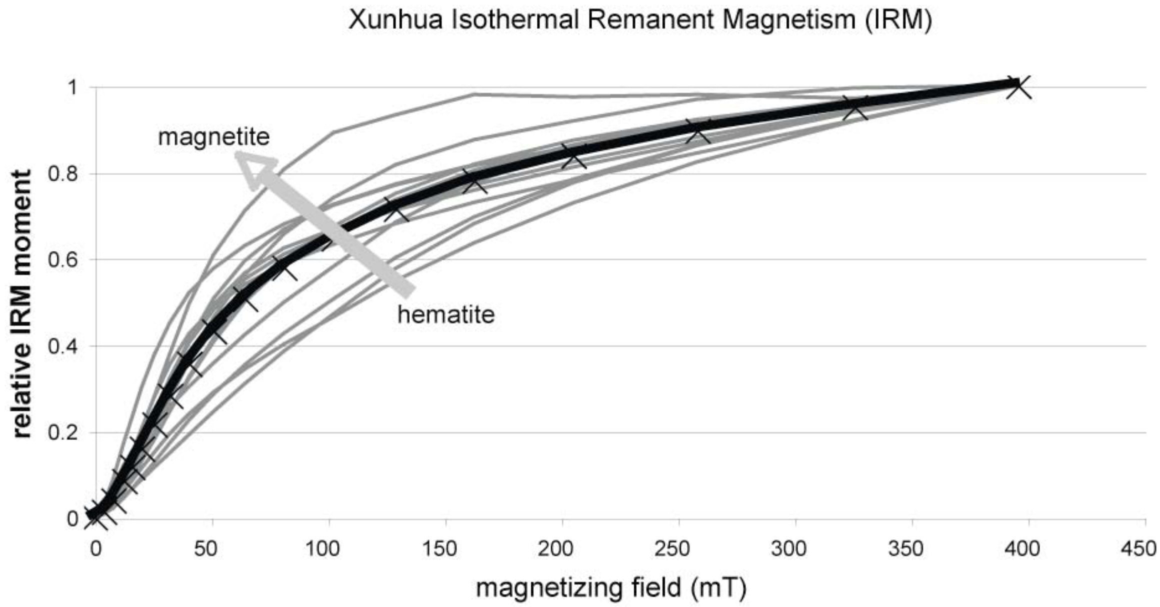

Fig. IRM

Figure DR5. Relative Isothermal Remanent Magnetism (IRM) moment within an increasing magnetic field shown for 13 specimens (grey lines) and their average (black line) from the upper Xunhua section. Hematite is indicated by gradual acquisition of IRM with increasing field strength, whereas (titano-)magnetite is indicated by saturation of IRM at low field strengths < 200 mT. The average IRM moment shows that primary magnetism is typically carried by a combination of hematite and magnetite.

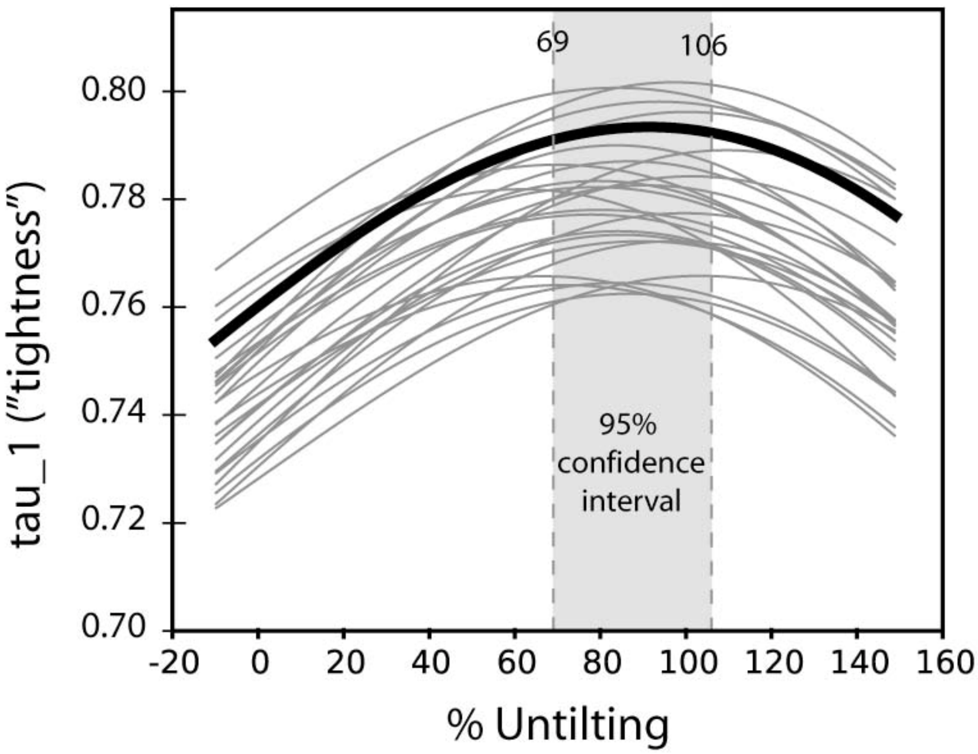

Fig. Foldtest

Figure DR6. Positive fold test for ChRM directions shown by the 95% confidence interval for tau_1 overlapping with 100% untilting of ChRM vectors corrected for strata orientation (Tauxe, 1998). The tau_1 maximum reflects the tightest grouping of the ChRM directions during progressive untilting of the strata and is defined as the eigenvalues of the orientation matrix. Solid black line shows original dataset composed of all acceptable measured paleomagnetic ChRM directions, whereas solid grey lines display bootstrapped para-datasets.

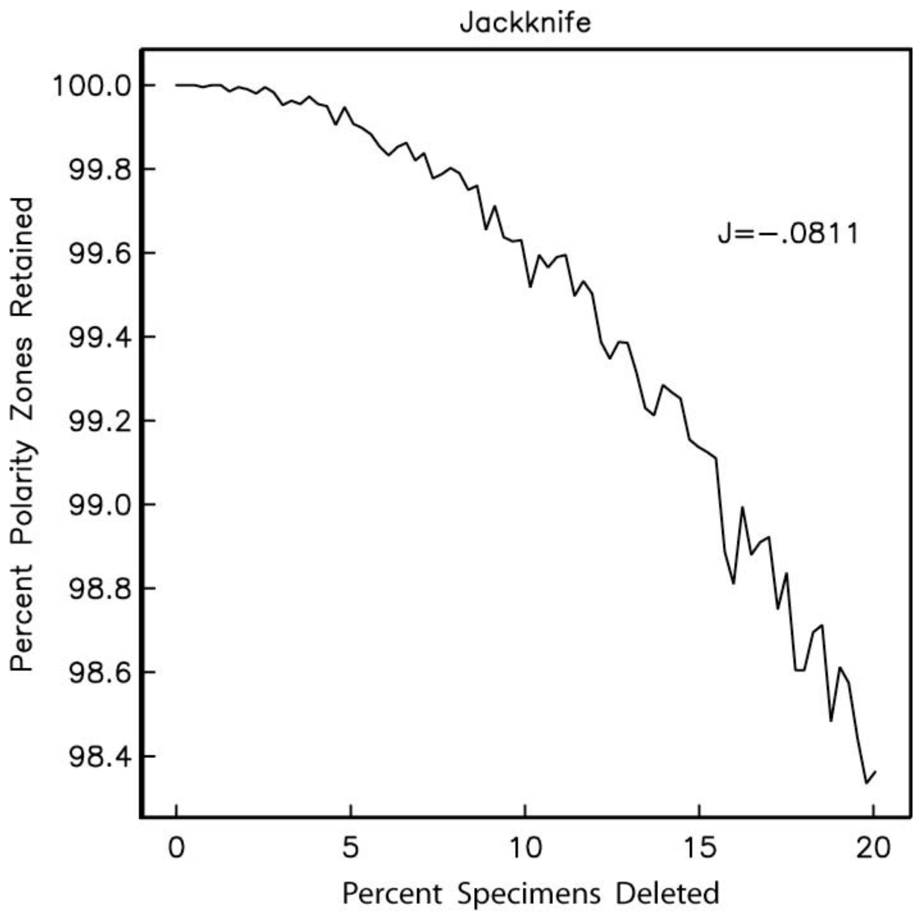

Fig. Jackknife

Figure DR7. Magnetostratigaphic jackknife resampling affirming the robustness of the Xunhua magnetostratigraphy (Tauxe and Gallet, 1991). Plot shows that >98% of polarity magnetozones are retained during random deletion of up to 20% of specimens, with the slope J related to the statistical robustness of the magnetostratigraphy.

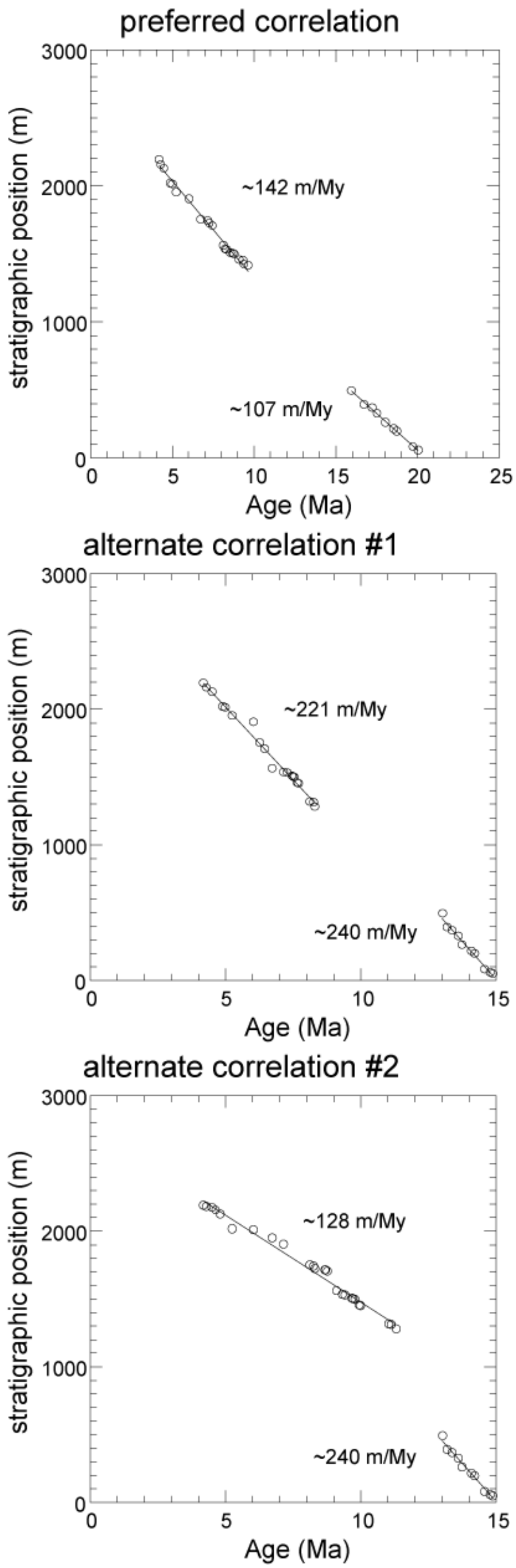

Figure DR8. Sediment accumulation rate graphs for our preferred and alternate magnetostratigraphic correlations.

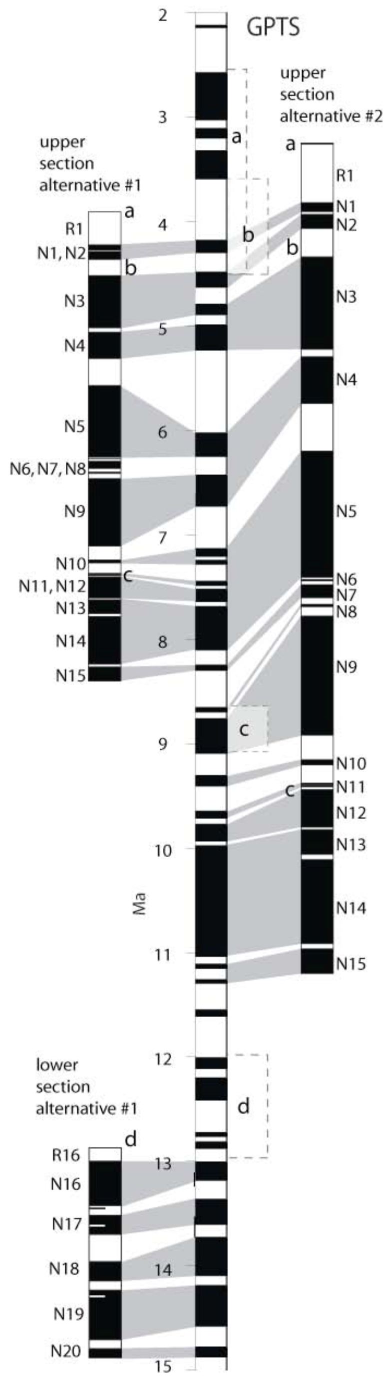

Figure DR9. Alternative correlations for the Xunhua magnetostratigraphy to the GPTS (Lourens et al., 2005), to be compared with our preferred correlation (Fig. 7). Upper section alternative #1 violates tie point c (table 2), whereas upper section alternative #2 violates tie points b and c. The alternative correlations imply more highly-variable short-term sediment accumulation rates than our preferred correlation and/or accumulation rates that differ for the upper vs. lower section

Table DR1. Rainwater isotope data

sample ID	sample date	effective month	temp (°C)	precip (mm)	%RH	δ18O	δD	d-excess
XH-020607	02/06/07	Jan-07	-4.8	0.3	43	––	––	--
XH-030607	03/06/07	Feb-07	-1.1	0.6	34	––	––	--
XH-040607	04/06/07	Mar-07	4.7	2.1	46	––	––	--
XH-050607	05/06/07	Apr-07	10.9	9.2	44	––	––	--
XH-060607	06/06/07	May-07	14.6	30.3	49	0.8	19.8	13.0
XH-070607	07/06/07	Jun-07	17.5	43.9	60	–6.4	–38.7	12.3
XH-080607	08/06/07	Jul-07	19.6	72.1	63	–6.9	–42.1	13.1
XH-090607	09/06/07	Aug-07	19.4	57.8	65	–7.4	–43.6	15.8
XH-100607	10/06/07	Sep-07	15	34.7	72	–12.3	–83.8	14.5
XH-110607	11/06/07	Oct-07	9.2	13.3	70	–10.4	–75.1	8.2
XH-110607r						–10.2	–74.1	7.7
XH-120607	12/06/07	Nov-07	2.2	1.3	55	––	––	--
XH-010608	01/06/08	Dec-07	-3.4	0.2	51	––	––	--
XH-020608	02/06/08	Jan-08	-4.1	4.6	52	–12.6	–115.7	-14.8
XH-020608r						–12.4	–115.9	-16.4
XH-030608	03/06/08	Feb-08	-2.0	0.6	52	––	––	--
XH-040608	04/06/08	Mar-08	9.3	15.4	41	––	––	--
XH-050608	05/06/08	Apr-08	13.9	17.6	47	–6.5	–37.5	14.8
XH-050608r						–6.6	–36.9	16.1
XH-050608r						–6.7		
XH-060608	06/06/08	May-08	19.1	23.1	46	–1.7	–8.1	5.6
XH-060608r							–8.6	
XH-070608	07/06/08	Jun-08	20.8	58.5	60	–4.2	–19.2	14.7
XH-070608r						–4.0	–17.8	
XH-080608	08/06/08	Jul-08	22.9	118.2	62	–7.0	–43.4	12.2
XH-080608r							–44.8	
XH-090608	09/06/08	Aug-08	21.0	78.6	66	–11.6	–74.4	18.6
XH-090608r						–11.3		
XH-100608	10/06/08	Sep-08	17.2	80.3	74	–9.7	–64.7	12.7
XH-100608r						–9.5		
XH-110608	11/06/08	Oct-08	12.6	13.1	68	–7.4	–44.2	15.0
XH-110608r						–7.2		
LX-020907	02/09/07	Jan-07	-6.2	1.8	64	––	––	--
LX-030907	03/09/07	Feb-07	0.6	0.1	52	––	––	--
LX-040907	04/09/07	Mar-07	3.8	24.9	67	––	––	--
LX-050907	05/09/07	Apr-07	8.5	44.6	60	––	––	--
LX-060907	06/09/07	May-07	15.4	58.8	60	–1.6	0.4	13.2
LX-070907	07/09/07	Jun-07	16.8	86	70	–8.0	–49.5	14.5
LX-080907	08/09/07	Jul-07	18.4	87.1	75	–5.3	–32.8	9.6
LX-090907	09/09/07	Aug-07	18.7	174.1	75	–9.9	–61.8	17.4
LX-100907	10/09/07	Sep-07	12.9	109	75	–12.4	–83.1	16.1
LX-100907r						–12.2		
LX-110907	11/09/07	Oct-07	6.9	108.5	81	––	––	--
LX-120907	12/09/07	Nov-07	1.7	6.5	72	––	––	--
LX-010908	01/09/08	Dec-07	--	--	--	–11.6	–70.3	22.2
LX-020908	02/09/08	Jan-08	-8	14.7	68	–15.3	–115.3	7.3

LX-030908	03/09/08	Feb-08	-6.7	4.6	71	–10.0	–62.9	17.1
LX-030908r						–10.1		
LX-040908	04/09/08	Mar-08	5.4	27.1	59	–6.1	–37.9	10.7
LX-040908r						–6.0		
LX-050908	05/09/08	Apr-08	9.9	56.4	60	–1.4	–12.1	-1.2
LX-050908r						–1.2		
LX-050908r						–1.3		
LX-060908	06/09/08	May-08	15.1	52.9	56	–3.8	–21.3	8.8
LX-060908r						–3.9		
LX-060908r						–4.0		
LX-070908	07/09/08	Jun-08	16.8	116.6	69	–1.7	–3.0	10.5
LX-070908r						–1.7		
LX-070908r						–1.9		
LX-080908	08/09/08	Jul-08	18.8	78.8	71	–9.4	–65.3	10.1
LX-080908r						–9.3		
LX-090908	09/09/08	Aug-08	16.9	131.4	80	–11.9	–81.1	14.2
LX-100908	10/09/08	Sep-08	13.5	93.6	87	–11.4	–71.0	20.4
LX-100908r							–71.4	
LX-110908	11/09/08	Oct-08	8.5	42.1	83	–10.3	–60.8	21.6
LX-110908r							–61.8	

Rain water samples from May-Sept 2007 were analyzed for δD at the University of Georgia's Savannah River Ecology Lab using a TCEA. All analyses for $\delta^{18}O$ were conducted at the University of Rochester using a Gasbench II and for δD (Oct 2007-Oct 2008) at the University of Arizona using a Los Gatos water analyzer. Samples designated with "r" are replicate analyses.