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Appendix for

Ancient DNA and multi-method dating confirm the late arrival of anatomically modern humans in southern China

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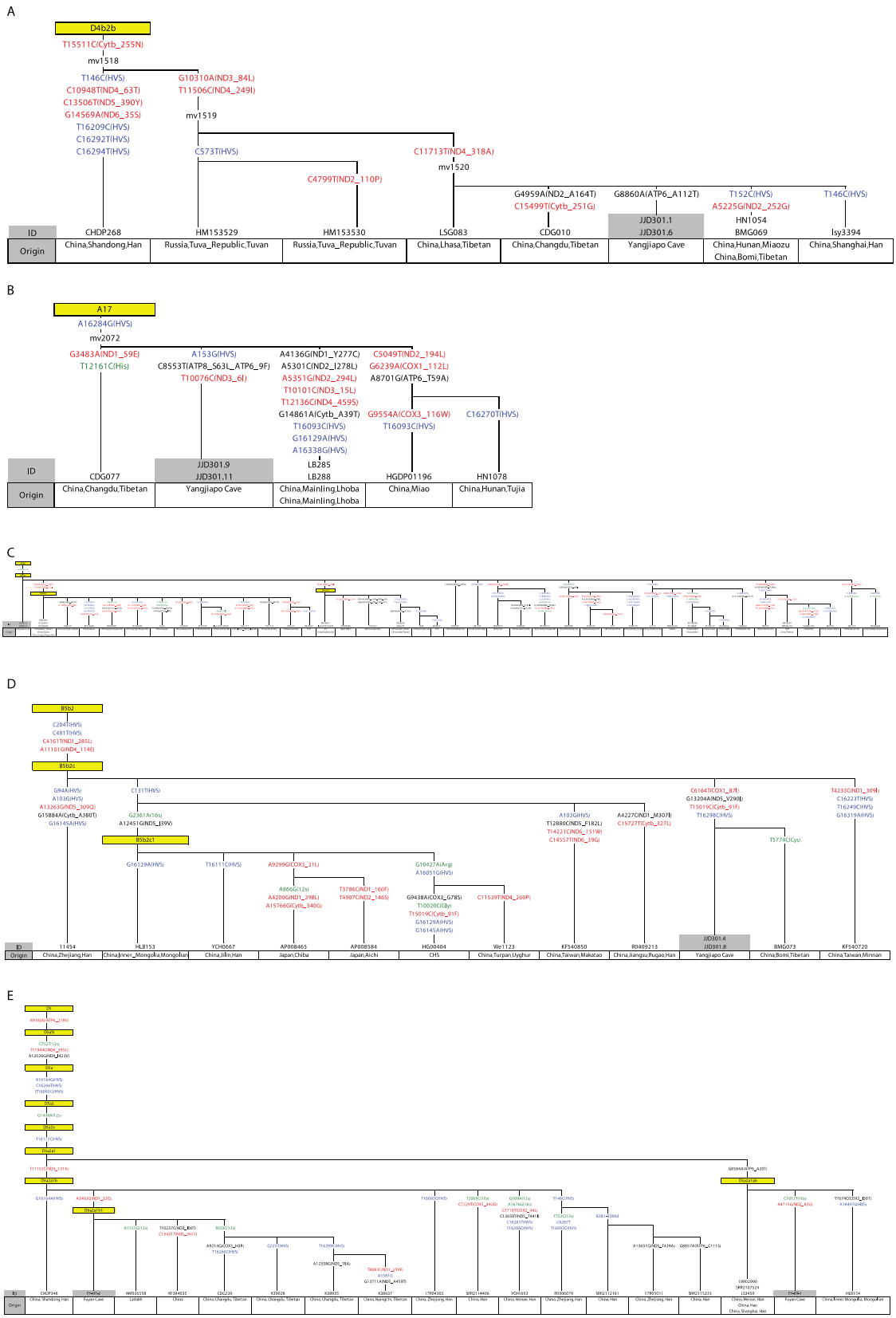


Figure S1. mtDNA haplogroups. A. D4b2b. B. A17. C. B4a4. D. B5b2. E. D5.

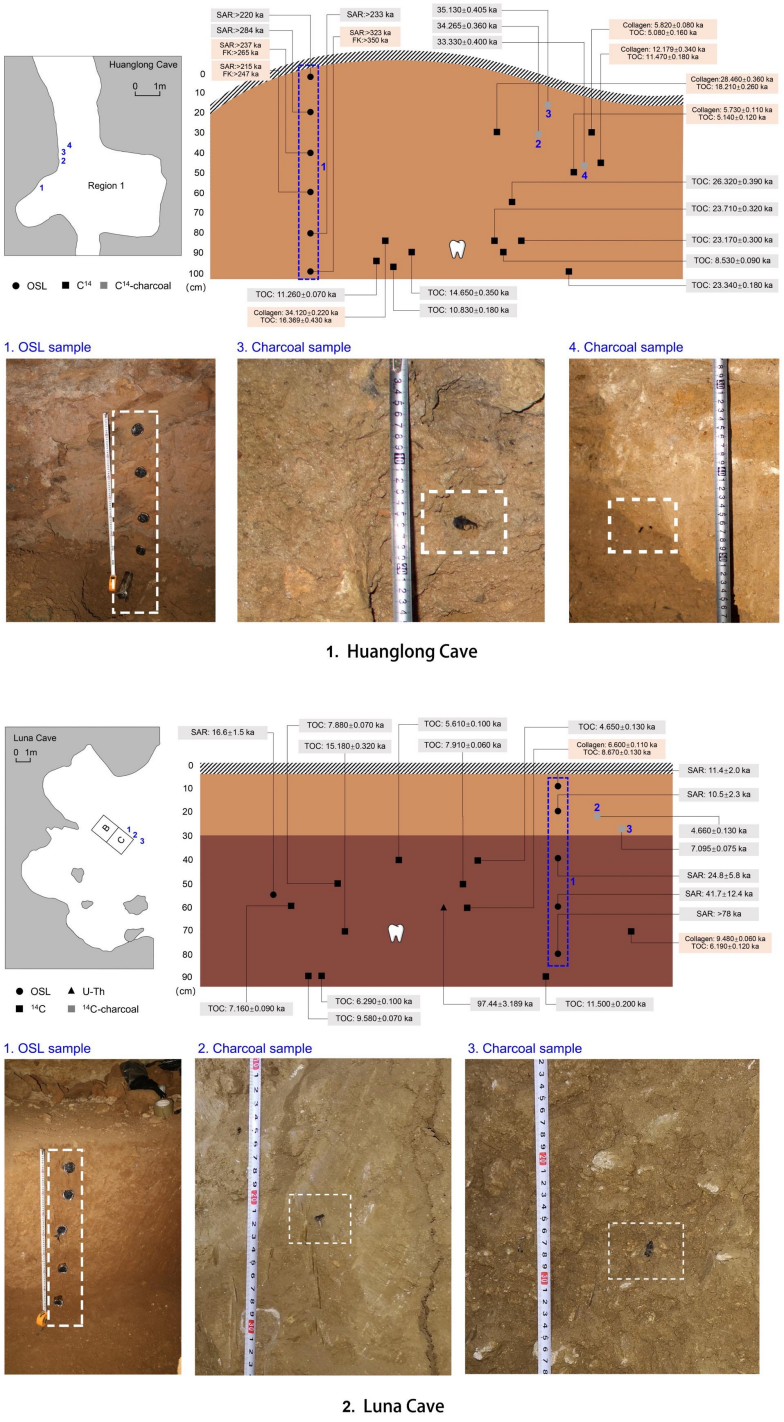


Figure S2. Above: Huanglong Cave plan and stratigraphic sections showing dating results (above) and sampling locations for OSL dating and recovery location of charcoal used for AMS ^{14}C dating (below). Below: Luna Cave plan and stratigraphic sections sampled showing dating results (above) and sampling locations for OSL dating and recovery location of charcoal used for AMS ^{14}C dating (below).

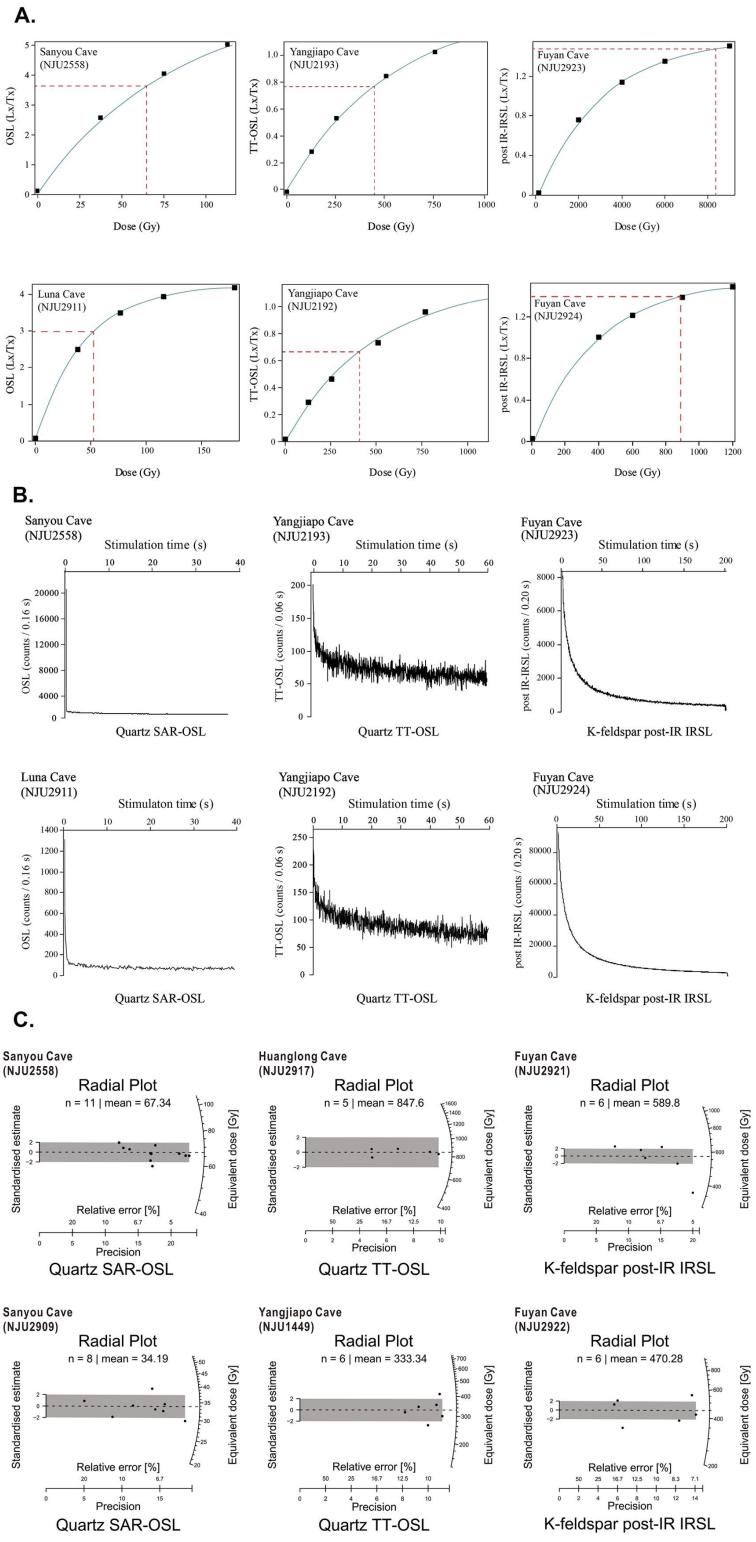
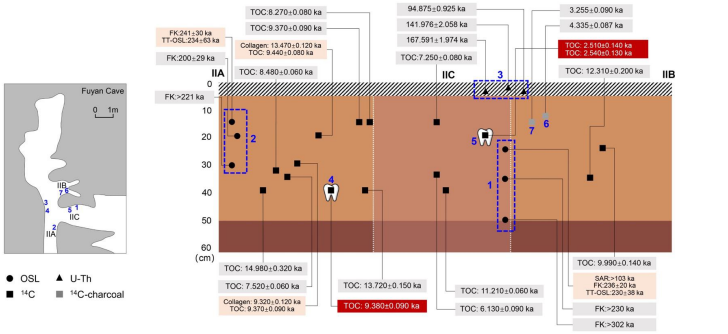
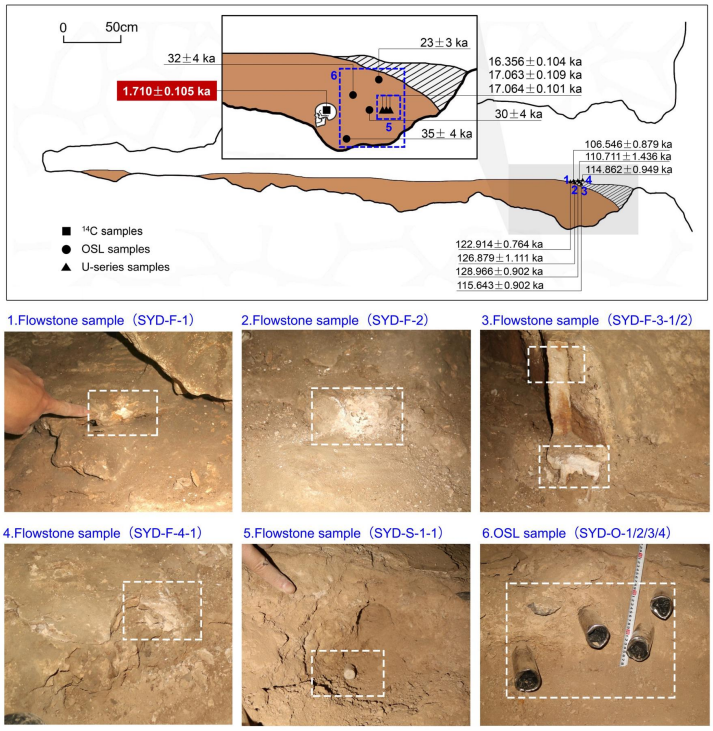


Figure S3. Results of Quartz SAR-OSL, Quartz TT-OSL, and feldspar $pIRIR_{290}$ dating. A. Representative growth curves. B. Representative decay curves. C. De values of aliquots plotted on radial plots.

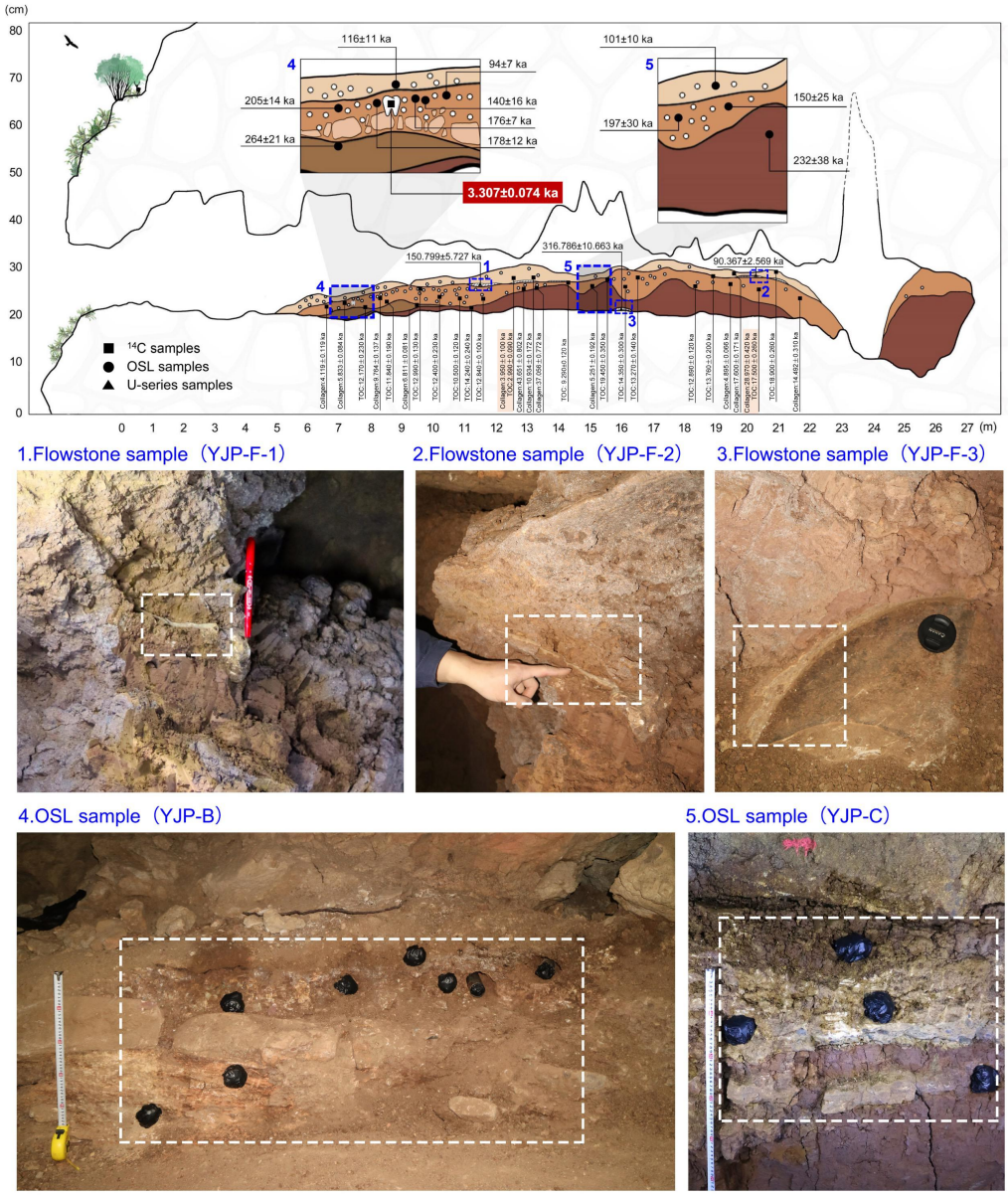


3. Fuyan Cave



5. Sanyou Cave

Figure S4. Above: Fuyan Cave plan and stratigraphic sections showing dating results (above) and sampling locations for OSL dating, U-Th dating of flowstones and recovery location of human tooth used for AMS ^{14}C dating (below). Below: Sanyou Cave cross-section and mapped stratigraphic sections showing dating results (above), sampling locations for U-Th dating of flowstones (middle) and sampling locations for flowstone and OSL dating (below).



4. Yangjiapo Cave

Figure S5. Yangjiapo Cave cross-section and mapped stratigraphic sections showing dating results (above), sampling locations for U-Th dating of flowstones (middle) and sampling locations for OSL dating (below).

Table S1. Summary of OSL dating results.

A. Summary of sample codes, radionuclide concentrations, dose rates, equivalent doses and Quartz SAR-OSL, Quartz TT-OSL, and feldspar $pIRIR_{290}$ ages for samples from Huanglong Cave (HLD), Luna Cave (LND) and Fuyan (FYD).

Lab.N	Sample N.	Depth(cm)	^{238}U (Bq kg^{-1})	^{236}Ra (Bq kg^{-1})	^{232}Th (Bq kg^{-1})	^{40}K (Bq kg^{-1})	W.C.(%)	Q-SAR-De(Gy)	FK-De(Gy)	TT-OSL-De(Gy)	Q-Dose rate(Gy/ka)	FK-Dose rate(Gy/ka)	Q-SAR-Age(ka)	FK-Age(ka)	TT-OSL-Age(ka)
NJU-2915	HLD-0	0	33.7±6.0	22.2±0.4	22.2±0.4	345.1±6.8	39.33	>349	---	977±50	1.60±0.26	---	>220	---	---
NJU-2916	HLD-20	20	21.4±5.6	15.3±0.4	10.8±0.3	188.3±4.7	34.85	>267	---	---	0.94±0.14	---	>284	---	---
NJU-2917	HLD-40	40	30.8±6.3	17.8±0.4	24.6±0.4	296.2±6.3	46.60	>328	>487	848±33	1.38±0.25	1.84±0.15	>237	>265	---
NJU-2918	HLD-60	60	24.7±6.0	21.3±0.4	25.8±0.4	307.9±6.3	47.70	>308	>430	947±23	1.44±0.26	1.74±0.14	>215	>247	---
NJU-2919	HLD-80	80	38.1±6.2	17.1±0.4	18.4±0.3	215.3±5.2	31.97	>299	---	---	1.28±0.18	---	>233	---	---
NJU-2920	HLD-100	100	29.0±5.3	14.9±0.4	13.8±0.3	131.6±3.8	24.90	>320	>512	---	0.99±0.12	1.46±0.18	>323	>350	---
NJU-2910	LND-A-10	10	59.8±7.3	32.4±0.6	73.2±0.7	88.0±3.3	10.50	24±4	---	---	2.09±0.15	---	11.4±2.0	---	---
NJU-2911	LND-A-20	20	51.6±6.9	29.8±0.5	69.3±0.7	83.9±3.2	9.76	22±4	---	---	2.10±0.15	---	10.5±2.3	---	---
NJU-2912	LND-A-40	40	55.3±7.0	33.4±0.5	72.6±0.7	87.7±3.2	15.22	51±11	---	---	2.08±0.14	---	24.8±5.8	---	---
NJU-2913	LND-A-60	60	55.9±7.2	33.6±0.6	76.6±0.7	90.8±3.3	17.13	83±24	---	---	1.98±0.13	---	41.7±12.4	---	---
NJU-2914	LND-A-80	80	50.8±6.9	28.4±0.5	71.3±0.7	74.9±3.1	18.83	>146	---	---	1.86±0.12	---	>78	---	---
NJU-2909	LND-B-55	55	56.0±7.0	34.1±0.5	71.2±0.7	90.9±3.2	15.23	34±2	---	---	2.06±0.14	---	16.6±1.5	---	---
NJU-2921	FYD-A-15	15	52.6±6.2	23.9±0.5	37.4±0.5	334.3±6.6	13.32	---	590±64	492±128	2.10±0.15	2.44±0.15	---	241±30	234±63
NJU-2922	FYD-A-20	20	50.2±6.1	25.4±0.5	35.0±0.4	305.8±6.2	12.17	---	470±61	---	---	2.35±0.15	---	200±29	---
NJU-2923	FYD-A-30	30	48.6±6.2	26.2±0.5	41.1±0.5	388.7±7.3	14.57	>234	622±35	528±79	2.30±0.16	2.64±0.16	>103	236±20	230±38
NJU-2924	FYD-B-25	25	40.1±6.6	29.7±0.5	48.7±0.5	477.8±8.6	11.45	---	>686	---	---	3.10±0.20	---	>221	---
NJU-2925	FYD-B-35	35	44.2±6.6	27.7±0.5	48.9±0.5	499.7±9.0	11.31	---	>728	413±56	2.83±0.21	3.17±0.21	---	>230	---
NJU-2926	FYD-B-50	50	28.2±5.9	23.5±0.4	38.6±0.5	369.4±7.0	9.38	---	>768	375±202	2.20±0.16	2.54±0.16	---	>302	---

Note: a. --- means poor signals and ages or no measurement; b. > means saturated.

B. Summary of sample codes, radionuclide concentrations, dose rates, equivalent doses and TT-OSL ages for samples from Yangjiapo Cave (YJP) and Sanyou Cave (SYD).

Lab No.	Sample No.	Depth (cm)	U(ppm)	Th(ppm)	K(%)	WC (%)	N	De(Gy)	Dose rate(Gy/ka)	Age(ka)
NJU-1449	YJP-B-layer1-1	15	2.91±0.10	14.9±0.40	1.51±0.06	18.07	6	333±25	2.87±0.14	116±11
NJU-1451	YJP-B-layer2-1	18	3.55±0.12	17.6±0.48	2.70±0.08	19.89	10	389±19	4.12±0.20	94±7
NJU-1452	YJP-B-layer2-2	27	2.14±0.09	10.8±0.30	1.12±0.05	5.99	9	424±14	2.41±0.13	176±7
NJU-2191	YJP-B-layer2-3	28	2.91±0.33	16.3±0.24	1.31±0.02	22.25	5	373±37	2.67±0.13	140±16
NJU-2192	YJP-B-layer 2-4	23	1.86±0.28	12.1±0.19	1.22±0.02	19.83	7	432±17	2.21±0.11	178±12
NJU-2193	YJP-B-layer 2-5	26	1.70±0.24	10.7±0.17	0.97±0.02	20.55	14	453±19	1.87±0.09	205±14
NJU-2201	YJP-B-layer3-1	45	2.69±0.32	14.5±0.22	1.16±0.02	20.85	6	494±29	2.43±0.12	264±21
NJU-1453	YJP-C-layer1-1	10	3.01±0.11	13.8±0.37	2.18±0.06	19.05	10	341±21	3.37±0.16	101±8
NJU-1455	YJP-C-layer2-1	25	2.48±0.10	11.5±0.32	1.03±0.04	19.18	10	321±19	2.14±0.10	150±12
NJU-2194	YJP-C-layer2-2	30	2.74±0.32	14.2±0.22	1.20±0.02	20.19	6	486±30	2.47±0.12	197±16
NJU-2203	YJP-C-layer4-1	38	1.53±0.23	9.83±0.16	0.96±0.02	18.71	6	720±57	3.10±0.15	232±22
NJU-2555	SYD-O-1	10	2.9±0.68	6.69±0.12	0.87±0.02	0.99	12	42±2	1.81±0.24	23±3
NJU-2556	SYD-O-2	15	2.0±0.60	6.77±0.12	0.91±0.02	2.16	12	54±3	1.68±0.20	32±4
NJU-2557	SYD-O-3	20	3.8±0.69	7.83±0.13	1.11±0.03	2.01	14	67±3	2.24±0.27	30±4
NJU-2558	SYD-O-4	30	2.5±0.62	7.45±0.12	1.11±0.03	2.07	11	67±2	1.93±0.23	35±4

Table S2. Results of all U-series dating of flowstone samples from Luna Cave (2), Fuyan Cave (3), Yangjiapo Cave (4) and Sanyou Cave (5) in the text and published U-series dating ages of flowstone samples from Huanglong Cave (1), Luna Cave(2) and Fuyan Cave (3).

U ID	^{238}U (ppb)	^{232}Th (ppt)	^{230}Th / ^{232}Th (atomic $\times10^{-6}$)	$\delta^{234}U$* (measured)	^{230}Th / ^{238}U (activity)	^{230}Th Age (yr) (uncorrected)	^{230}Th Age (yr) (corrected)	$\delta^{234}U_{Initial}$** (corrected)	^{230}Th Age (yr BP)*** (corrected)	Layer	Depth (cm)
Luna Cave											
LND-2	55.7±0.1	9365±188	68±1	122.4±3.4	0.691±0.0035	101803±1004	97508±3189	161±5	97440±3189	C-6	60
Fuyan Cave											
FY2-A-1	2198.4±12.2	12180±253	2046±43	-47.8±2.9	0.6875±0.0041	142218±2059	142044±2058	-71±4	141976±2058	1	2
FY2-A-3	669.8±1.7	29711±599	267±5	201.9±2.6	0.7183±0.0022	95969±582	94943±925	264±3	94875±925	1	4
FY2-C	108.0±0.2	11807±237	156±3	253.7±2.4	1.0314±0.0022	169942±1162	167659±1974	407±5	167591±1974	1	4
Yangjiapo											
YJP-FS-1	166.6±0.1	82856±231	34.0±0.7	272.4±2.5	1.0264±0.0020	161589±1024	150867±5727	418±8	150799±5727	2	25
YJP-FS-2	169.6±0.1	42292±99	55.3±1.7	383.3±2.4	0.8350±0.0015	95387±381	90425±2569	495±5	90367±2569	2	15
YJP-FS-3	84.4±0.1	61175±167	27.2±0.5	192.9±2.8	1.1973±0.0026	332229±6700	316854±10663	472±16	316786±10663	4	60
Sanyou Cave											
SYD-F-1	1611.3±4.1	5421±109	4909±99	415.4±2.3	1.0018±0.0031	123042±763	122980±764	588±4	122914±764	1	2
SYD-F-2	5315.1±21.8	256±6	358215±8017	446.6±2.7	1.0048±0.0047	126946±1111	126945±1111	639±4	126879±1111	1	2
SYD-F-3-1	1886.5±5.5	7202±146	4469±91	421.8±2.5	1.0348±0.0035	129101±901	129032±902	607±4	128966±902	1	2
SYD-F-3-2	3712.0±14.0	2340±48	25244±518	414.0±2.6	0.9651±0.0041	115721±902	115709±902	574±4	115643±902	1	2
SYD-F-4-1	1246.2±3.0	60983±1227	321±6	397.2±2.3	0.9531±0.0030	115851±696	114928±949	549±3	114862±949	1	2
SYD-F-4-2	751.7±1.6	73940±1486	158±3	408.2±2.2	0.9452±0.0026	112629±601	110777±1436	558±4	110711±1436	1	2
SYD-F-5	3082.0±13.3	4152±85	14383±296	776.9±3.7	1.1752±0.0056	106546±879	106527±879	1049±6	1065461±879	1	2
SYD-S-1-1	2856.6±10.8	12879±263	814±17	570.8±3.1	0.2225±0.0010	16504±86	16422±104	598±3	16356±104	1	20
SYD-S-1-2	3671.6±16.6	10858±223	1287±27	569.9±3.6	0.2309±0.0012	17182±102	17129±109	591±3	17063±109	1	20
SYD-S-1-3	3280.3±12.9	10614±216	1172±24	563.1±3.2	0.2299±0.0010	17189±92	17130±101	519±4	17064±101	1	20

Huanglong Cave (Ref. 101)											
HL-1	--	--	--	--	--	--	103.739±1.616	--	--	3	100
HL-2	--	--	--	--	--	--	103.119±1.348	--	--	3	100
Huanglong Cave (Ref. 20)											
[a]HLD-6	--	--	--	--	--	--	28.1±0.3	--	--	1	3
[a]HLD-7	--	--	--	--	--	--	32.5±1.0	--	--	1	4
HLD-10-1	--	--	--	--	--	--	40.3±0.3	--	--	1	15
HLD-10-2	--	--	--	--	--	--	42.3±0.4	--	--	1	16
HLD-10-3	--	--	--	--	--	--	42.8±0.5	--	--	1	17
HLD-10-4	--	--	--	--	--	--	45.6±-0.7	--	--	1	18
HLD-8(1)	--	--	--	--	--	--	85.7±2.8	--	--	2	30
HLD-8(2)	--	--	--	--	--	--	76.1±1.8	--	--	2	30
HLD-9-1	--	--	--	--	--	--	92.4±2.1	--	--	2	32
HLD-9-2	--	--	--	--	--	--	81.4±1.1	--	--	2	32
HLD-1	--	--	--	--	--	--	96.8±1.0	--	--	2	58
HLD-2	--	--	--	--	--	--	102.1±0.9	--	--	2	60
HLD-12	--	--	--	--	--	--	99.3±1.6	--	--	2	70
HLD-13	--	--	--	--	--	--	99.5±2.2	--	--	2	75
HLD-3	--	--	--	--	--	--	55.0±1.1	--	--	1	45
HLD-4	--	--	--	--	--	--	78.7±1.2	--	--	1	52
HLD-5	--	--	--	--	--	--	79.1±0.7	--	--	1	62
Luna Cave (Ref. 21)											
LN12-03	--	--	--	--	--	--	126.9±1.5	--	--	3	75
LN12-07	--	--	--	--	--	--	70.2±1.4	--	--	3	75
Fuyan Cave (Ref. 22)											
FYS-S1	--	--	--	--	--	--	80.1±1.2	--	--	IID/layer1	0
FYS-S2	--	--	--	--	--	--	79.5±2.8	--	--	IID/layer1	0
FYS-1	--	--	--	--	--	--	158.3±4.6	--	--	IIA/layer2	10

FYS-2	--	--	--	--	--	--	121.0±1.5	--	--	IIA/layer2	10
FYS-3	--	--	--	--	--	--	556.8±61.9	--	--	IC/layer2	20
FYS-4	--	--	--	--	--	--	120.7±0.9	--	--	IB/layer2	50
FYS-5	--	--	--	--	--	--	348.3±8.2	--	--	IB/layer2	50
FYS-6	--	--	--	--	--	--	141.8±12.1	--	--	IA/layer2	60
FYS-7	--	--	--	--	--	--	192.9±4.3	--	--	IID/layer2	10
FYS-8	--	--	--	--	--	--	140.7±5.2	--	--	IID/layer2	20

U decay constants: $\lambda_{238} = 1.55125\times10^{-10}$ (Ref. 102) and $\lambda_{234} = 2.82206\times10^{-6}$ (Ref. 83). Th decay constant: $\lambda_{230} = 9.1705\times10^{-6}$ (Ref. 83).

*$\delta^{234}U$ = ([$^{234}U/^{238}U$] activity – 1) ×1000. **$\delta^{234}U$initial was calculated based on ^{230}Th age (T), i.e., $\delta^{234}U$initial = $\delta^{234}U_{measured}\times e^{\lambda234\times T}$.

Corrected ^{230}Th ages assume the initial $^{230}Th/^{232}Th$ atomic ratio of $4.4 \pm2.2 \times10^{-6}$. Those are the values for a material at secular

equilibrium, with the bulk earth $^{232}Th/^{238}U$ value of 3.8. The errors are arbitrarily assumed to be 50%.

***B.P. stands for “Before Present” where the “Present” is defined as the year 1950 A.D.

Table S3. Results of all AMS ^{14}C dating of mammal tooth and bone, human remains and charcoal samples from Huanglong Cave (1), Luna Cave (2), Fuyan Cave (3, Yangjiapo Cave (4), Sanyou Cave (5). "#" denotes that the graphite target was too weak due to small sample amount so that the sample age is older than the true age and the date is unreliable (we do not give provide Calendric age in such instances). The shaded zone indicates the AMS ^{14}C ages of the different components from the same tooth. TOC = Total Organic Carbon. pMC = percent of Modern Carbon (in 1σ error).

Lab Code	Sample ID	Material	Faunas identified	Type	pMC (%)	^{14}C Age (yr BP)	Calendric age (yr BP)	68% Cal age range (yr BP)	N%	C%	C/N	$\delta^{15}N$ (air)	$\delta^{13}C$ (VPDB)	Depth (cm)
Huanglong Cave														
NTUAMS-5062-D	HLD-1	Tooth	*Bubalus bubalis*	TOC	29.45±0.28	9820±75	11260±70	11200 - 11330	0.09	1.11	11.1	-	-	95
NTUAMS-5056-D	HLD-2	Tooth	*Bubalus bubalis*	TOC	21.32±0.21	12414±80	14650±350	14300 - 15000	0.07	0.89	10.5	-	-	90
NTUAMS-5122-A	HLD-3#	Tooth	*Rhinoceros sinensis*	Collagen	6.58±0.80	21854±976	-	-	-	-	-	-	-	85
NTUAMS-5122-D	HLD-3	Tooth	*Rhinoceros sinensis*	TOC	8.51±0.15	19789±137	23710±320	23400 - 24020	0.04	2	58.3	-	-7.54	85
NTUAMS-5123-A	HLD-4	Tooth	*Bubalus bubalis*	Collagen	53.23±0.42	5065±64	5820±80	5740 - 5890	-	-	-	-	-	30
NTUAMS-5123-D	HLD-4	Tooth	*Bubalus bubalis*	TOC	57.71±0.61	4416±85	5080±160	4920 - 5230	0.23	1.6	8.1	3.57	-20.33	30
NTUAMS-5223-A	HLD-5	Tooth	*Bubalus bubalis*	Collagen	54.04±0.58	4944±86	5730±110	5620 - 5840	-	-	-	-	-	50
NTUAMS-5223-D	HLD-5	Tooth	*Bubalus bubalis*	TOC	57.19±0.46	4489±65	5140±120	5020 - 5260	0.48	2.1	5.1	3.84	-20.42	50
NTUAMS-5157-D	HLD-6	Tooth	*Bubalus bubalis*	TOC	30.73±0.29	9478±76	10830±180	10650 - 11010	0.14	1.2	10.0	-	-12.62	98
NTUAMS-5239-D	HLD-7	Tooth	*Rhinoceros sinensis*	TOC	8.78±0.13	19544±119	23340±350	22990 - 23690	0.08	0.3	4.4	-	-17.78	100
NTUAMS-5240-D	HLD-8	Tooth	*Bubalus bubalis*	TOC	8.94±0.14	19395±125	23170±300	22870 - 23470	0.09	0.5	6.5	-	-	85
NTUAMS-5171-A	HLD-9	Tooth	*Cervus sp.*	Collagen	2.45±0.06	29806±188	34120±220	33910 - 34340	-	-	-	-	-	85
NTUAMS-5171-D	HLD-9	Tooth	*Cervus sp.*	TOC	18.83±0.21	13413±89	16370±430	15930 - 16780	0.27	2.44	10.5	6.66	-15.38	85
NTUAMS-5245-D	HLD-10-1	Tooth	*Bubalus bubalis*	TOC	38.18±0.42	7735±89	8530±90	8450 - 8620	0.09	0.9	11.7	-	-	90
NTUAMS-5063-D	HLD-11	Tooth	*Bubalus bubalis*	TOC	6.53±0.11	21926±131	26320±390	25940 - 26700	0.10	0.46	5.5	-	-13.51	65
NTUAMS-5124-A	HLD-30	Tooth	*Bubalus bubalis*	Collagen	5.34±0.09	23536±142	28460±360	28100 - 28810	-	-	-	-	-	30
NTUAMS-5124-D	HLD-30	Tooth	*Bubalus bubalis*	TOC	15.65±0.20	14901±102	18210±260	17950 - 18460	0.55	3.5	7.4	4.62	-16.39	30
NTUAMS-5125-A	HLD-45	Bone	Unidentified	Collagen	27.53±0.59	10361±173	12180±340	11840 - 12510	-	-	-	-	-	45

NTUAMS-5125-D	HLD-45	Bone	Unidentified	TOC	29.01±0.36	9940±100	11470±180	11300 - 11640	0.10	2.7	31.5	2.24	-11.88	45
Beta-516671	HL-16	Charcoal	-	TOC	2.05±0.04	31230±170	35130±405	34850 - 35540	-	-	-	-	-24.3	16
Beta-516673	HL-31	Charcoal	-	TOC	2.32±0.05	30230±180	34265±360	34250 - 34570	-	-	-	-	-25.0	31
Beta-516674	HL-47	Charcoal	-	TOC	2.66±0.05	29130±150	33330±400	33290 - 33920	-	-	-	-	-23.1	47
Luna Cave														
NTUAMS-5057-D	LND-B-60-70-1	Tooth	Bovidae	TOC	41.61±0.35	7044±67	7880±70	7810 - 7940	0.09	1.27	15.9	-	-	50
NTUAMS-5058-D	LND-B-60-70-2	Tooth	Bovidae	TOC	41.42±0.32	7080±63	7910±60	7850 - 7970	0.08	0.97	13.9	-	-	50
NTUAMS-5115-A	LND-C-4-1#	Tooth	*Sus scrofa*	Collagen	18.63±1.77	13497±764	-	-	0.08	4.6	67.1	-	-22.98	40
NTUAMS-5116-D	LND-C-4-2	Tooth	*Sus scrofa*	TOC	60.06±0.51	4095±68	4650±130	4530 - 4780	0.03	0.8	31.1	-	-14.30	40
NTUAMS-5117-D	LND-C-4-3	Bone	*Sus scrofa*	TOC	54.55±0.50	4868±74	5610±100	5510 - 5700	0.03	1.3	50.6	-	-10.68	40
NTUAMS-5118-D	LND-C-6-1	Tooth	*Cervus sp.*	TOC	45.90±0.36	6255±62	7160±90	7070 - 7250	0.03	1.1	42.8	-	-10.27	60
NTUAMS-5119-A	LND-C-6-2	Tooth	*Cervus sp.*	Collagen	48.67±0.58	5785±96	6600±110	6490 - 6710	-	-	-	-	-	60
NTUAMS-5119-D	LND-C-6-2	Tooth	*Cervus sp.*	TOC	37.76±0.38	7824±81	8670±130	8540 - 8790	0.04	1	29.2	-	-7.96	60
NTUAMS-5120-D	LND-C-6-3	Tooth	*Sus scrofa*	TOC	20.44±0.24	12755±95	15180±320	14860 - 15500	0.02	0.5	29.2	-	-14.03	70
NTUAMS-5121-A	LND-C-6-4	Tooth	*Sus scrofa*	Collagen	34.84±0.32	8470±74	9480±60	9420 - 9530	-	-	-	-	-	70
NTUAMS-5121-D	LND-C-6-4	Tooth	*Sus scrofa*	TOC	50.90±0.58	5424±92	6190±120	6070 - 6300	0.1	2	23.3	6.79	-11.98	70
NTUAMS-5246-D	LND-C-8-1	Tooth	*Sus scrofa*	TOC	50.52±0.57	5486±91	6290±100	6190 - 6380	0.11	1.45	15.4	-	-13.10	90
NTUAMS-5247-D	LND-C-8-2	Tooth	*Sus scrofa*	TOC	34.40±0.32	8572±75	9580±70	9510 - 9640	0.1	2.1	24.5	-	-13.03	90
NTUAMS-5141-A	LND-C-8-3#	Bone	Unidentified	Collagen	5.17±1.03	23794±1607	-	-	-	-	-	-	-	90
NTUAMS-5141-D	LND-C-8-3	Bone	Unidentified	TOC	28.95±0.40	9958±110	11500±200	11300 - 11690	0.10	3.98	47.1	-	-10.11	90
Beta-516677	LN-2-22	Charcoal	-	TOC	60.10±0.22	4090±30	4660±130	4550 – 4780	-	-	-	-	28.8	22
Beta-516676	LN-2-28	Charcoal	-	TOC	46.22±0.17	6200±30	7095±75	7040 - 7160	-	-	-	-	-	28
Fuyan Cave														
NTUAMS-5220b-D	FY5-5	Tooth	*Cervus sp.*	TOC	45.59±0.24	6311±72	7250±80	7170 - 7320	0.1	1.7	19.8	-	-	15
NTUAMS-5290-D	FY1-1	Tooth	*Cervus sp.*	TOC	43.86±0.42	6620±76	7520±60	7460 - 7570	0.03	1.01	39.3	-	-9.58	35
NTUAMS-5215-D	FY1-6	Tooth	*Cervus sp.*	TOC	38.52±0.33	7664±68	8480±60	8420 - 8540	0.1	0.9	10.5	-	-11.01	35
NTUAMS-5291-A	FY3-1	Tooth	*Cervus sp.*	Collagen	23.65 ±0.43	11583±426	13640±540	13350 - 13590	-	-	-	-	-	20

NTUAMS-5291-D	FY3-1	Tooth	*Cervus sp.*	TOC	23.65±0.19	11583±65	13470±120	13350 - 13590	-	-	-	6.64	-17.94	20
NTUAMS-5216-D	FY3-3	Tooth	*Cervus sp.*	TOC	35.00±0.29	8432±67	9440±80	9360 - 9510	-	-	-	-	-13.43	37
NTUAMS-5217-A	FY3-5	Tooth	*Sus scrofa*	Collagen	35.68±0.33	8278±75	9270±120	9160 - 9390	-	-	-	-	-	30
NTUAMS-5217-D	FY3-5	Tooth	*Sus scrofa*	TOC	35.48±0.34	8323±78	9320±120	9200 - 9430	0.13	0.6	5.4	6.42	-17.21	30
NTUAMS-5292-D	FY5-1	Tooth	*Cervus sp.*	TOC	35.30±0.34	8364±77	9370±90	9280 - 9460	0.4	1.7	5.0	-	-13.83	15
NTUAMS-5218-D	FY5-2	Tooth	*Cervus sp.*	TOC	51.41±0.31	5345±48	6130±90	6050 - 6210	-	-	-	-	-9.47	33
NTUAMS-5219-D	FY5-3	Tooth	*Hystrix subcristata*	TOC	27.44±0.27	10387±79	12310±200	12110 - 12510	0.1	0.7	8.2	-	-10.12	35
NTUAMS-5310-D	DX5-4 10-20	Tooth	*Cervus sp.*	TOC	39.61±0.38	7439±76	8270±80	8200 - 8340	-	-	-	-	-	15
NTUAMS-5311-D	DX1-2 20-30	Tooth	*Cervus sp.*	TOC	33.13±0.24	8873±59	9990±140	9860 - 10130	-	-	-	-	-	25
NTUAMS-5276-D	FY-8	Tooth	*Sus scrofa*	TOC	20.79±0.22	12618±86	14980±320	14660 – 15290	-	-	-	-	-	40
NTUAMS-5308-D	FY-10	Tooth	*Hystrix subcristata*	TOC	23.00±0.25	11805±88	13720±150	13570 – 13870						40
NTUAMS-5309-D	FY-11	Tooth	*Cervus sp.*	TOC	29.57±0.27	9787±72	11210±60	11150 - 11260						40
Beta-516145	DX-1	Charcoal	-	TOC	68.49±0.26	3040±30	3255±90	3230 - 3330	-	-	-	-	-29.6	13
Beta-516147	DX-3	Charcoal	-	TOC	61.46±0.23	3910±30	4335±87	4300 - 4410	-	-	-	-	-25.8	15
NTUAMS-5260b-D	FY-HT-1	tooth	*Homo sapiens*	TOC	74.34±0.58	2382±63	2510±140	2370 - 2640	0.6	2.3	4.5	-	-7.53	20
NTUAMS-5260-D	FY-HT-1	tooth	*Homo sapiens*	TOC	73.88±0.57	2432±62	2540±130	2410 - 2670	0.6	2.3	4.5	-	-7.53	20
NTUAMS-5259-D	FY-HT-2	tooth	*Homo sapiens*	TOC	35.27±0.35	8372±80	9380±90	9290 - 9470	0.04	1.6	46.7	10.89	-16.85	40
Yangjiapo Cave*														
NTUAMS-5224-D	YJP-600	Tooth	*Cervus sp.*	TOC	22.91±0.38	11836±135	13760±200	13570 - 13960	0.35	2.13	7.1	5.23	-16.98	28.5
NTUAMS-5225-A	YJP-1054	Tooth	*Cervus sp.*	Collagen	4.92±0.12	24189±195	28970±420	28550 - 29390	-	-	-	-	-	40
NTUAMS-5225-D	YJP-1054	Tooth	*Cervus sp.*	TOC	16.82±0.20	14320±95	17500±260	17240 - 17760	0.45	2.7	7.0	5.47	-17.75	40
NTUAMS-5061-A	YJP-1241#	Tooth	Bovidae	Collagen	14.06±1.82	15758±1038	-	-	-	-	-	-	-	15
NTUAMS-5061-D	YJP-1241	Tooth	Bovidae	TOC	35.59±0.33	8300±74	9290±120	9170 - 9410	0.14	2.43	20.6	0.14	-15.65	15
NTUAMS-5226-D	YJP-1458	Tooth	*Cervus sp.*	TOC	27.00±0.45	10518±135	12400±230	12170 - 12630	0.22	2	10.6	-	-16.90	30
NTUAMS-5064-D	YJP-2041	Tooth	Bovidae	TOC	25.86±0.29	10864±90	12840±100	12740 - 12940	0.24	2.1	0.1	-0.81	-17.62	35
NTUAMS-5065-D	YJP-2306	Tooth	Bovidae	TOC	31.40±0.30	9306±77	10500±120	10380 - 10610	0.34	2.9	9.9	-0.15	-16.98	35
NTUAMS-5227-D	YJP-2560	Tooth	*Sus scrofa*	TOC	13.21±0.24	16263±145	19450±350	19100 - 19800	0.1	0.74	8.6	-	-15.18	40

NTUAMS-5228-D	YJP-2670	Tooth	Bovidae	TOC	21.77±0.24	12248±87	14350±300	14050 - 14640	0.16	1.15	8.4	-	-14.75	40
NTUAMS-5254-D	YJP-2777	Tooth	*Sus scrofa*	TOC	25.69±0.40	10916±125	12890±120	12760 - 13010	0.13	3.99	35.8	-	-14.36	35
NTUAMS-5090-D	YJP-2789	Tooth	*Cervus sp.*	TOC	25.14±0.25	11090±80	12990±130	12860 - 13120	0.21	2.09	11.6	3.14	-16.90	25
NTUAMS-5255-D	YJP-2920	Tooth	Bovidae	TOC	24.29±0.25	11367±83	13270±140	13130 - 13410	0.114	0.664	6.8	-	-14.87	10
NTUAMS-5256-A	YJP-2936	Tooth	*Cervus sp.*	Collagen	63.77±0.54	3614±68	3950±100	3850 - 4050	-	-	-	-	-	10
NTUAMS-5256-D	YJP-2936	Tooth	*Cervus sp.*	TOC	70.13±0.53	2850±61	2990±90	2900 - 3070	1.1	3.99	4.2	5.91	-24.54	10
NTUAMS-5257-D	YJP-3091	Tooth	*Rhinoceros sinensis*	TOC	21.92±0.19	12192±71	14240±240	13990 - 14480	0.185	1.755	11.1	4.10	-14.92	50
NTUAMS-5258-D	YJP-3102	Tooth	*Rhinoceros sinensis*	TOC	27.72±0.26	10306±75	12170±230	11940 - 12400	0.146	1.343	10.7	-	-14.19	42.5
NTUAMS-5096-D	YJP-3146	Tooth	*Cervus sp.*	TOC	14.32±0.28	15614±155	18900±260	18640 - 19160	0.06	1.56	30.3	-	-13.14	10
NTUAMS-5268-D	YJP-3147	Tooth	*Hystrix subcristata*	TOC	28.17±0.24	10178±68	11840±190	11650 - 12020	-	-	-	-	-	35
Beta-436939	S7W4-2	Bone	Unidentified	Collagen	33.60±0.13	8760±30	9765±140	9700 - 9850	-	-	-	-	-24.4	30
Beta-436940	S13W15-1C	Bone	Unidentified	Collagen	58.55±0.22	4300±30	4895±70	4850 - 4900	-	-	-	-	-27.1	30
Beta-436943	S13W15-1B	Bone	Unidentified	Collagen	16.59±0.06	14430±30	17600±175	17730 - 17820	-	-	-	-	-24.7	10
Beta-436944	S7W10-1C	Bone	Unidentified	Collagen	1.66±0.05	32900±230	37060±775	36730 - 38050	-	-	-	5.3	-22.2	20
Beta-436945	S4W2-2	Bone	Unidentified	Collagen	62.54±0.23	3770±30	4120±120	4100 - 4210	-	-	-	4.1	-23.9	40
Beta-436948	S7W5-2	Bone	Unidentified	Collagen	47.56±0.18	5970±30	6815±85	6770 - 6860	-	-	-	5.8	-23.9	49
Beta-436950	S7W10-1C	Bone	Unidentified	Collagen	0.69±0.04	39960±460	43655±805	43090 - 44370	-	-	-	6.2	-24	20
Beta-436951	S6E1-2	Bone	Unidentified	Collagen	53.00±0.20	5100±30	5835±85	5780 - 5910	-	-	-	4.2	-25	24
Beta-436952	S9W11-1B	Bone	Unidentified	Collagen	56.61±0.21	4570±30	5255±195	5110 - 5320	-	-	-	7.7	-24.1	40
Beta-436954	S7W10-1B	Bone	Unidentified	Collagen	30.31±0.11	9590±30	10935±175	10830 - 11060	-	-	-	5.8	-25.5	10
Beta-436956	S16W19-1C	Bone	Unidentified	Collagen	21.33±0.11	12410±40	14495±310	14310 - 14970	-	-	-	7.2	-21.4	50
Beta-470580	HBJS-DCD-H-T-488	tooth	*Homo sapiens*	Collagen	67.98±0.25	3100±30	3310±75	3280 - 3370	-	-	-	10.9	-10.7	35
Sanyou Cave														
Beta-471831	HBYC-SYD-H-ZG	Bone	*Homo sapiens*	TOC	80.22±0.30	1770±30	1710±105	1640 - 1730	-	-	-	-		20

No collagen was extracted from some samples in Yangjiapo Cave including: S4W1-2, S6E1-2, S8W7-2, S6W9-2, S9W11-2, S4W2-2, S11W11-2, S13W12-1C and S16W19-1C*.

Table S4. Comparison of AMS ^{14}C and tip date in the same sample of human teeth form Fuyan Cave (3) and Yangjiapo Cave (4) and. AMS ^{14}C dates are on different components: collagen and total organic carbon (TOC).

ID	^{14}C Age Type	Calendric age (year BP)	Tip date (year BP)	Species	Layer	Depth (cm)
Fuyan Cave (Human teeth)						
FY-1HT	TOC	2510±140	3709	Human	2	20
FY-1HT	TOC	2540±130	3709	Human	2	20
FY-2HT	TOC	9380±90	11977	Human	2	40
Yangjiapo Cave (Human teeth)						
HBJS-DCD-H-T-488	Collagen	3310	7561	Human	2	35