

Supporting file for “Comment on ‘A global environmental crisis 42,000 years ago’ ”

Andrea Picin¹, Stefano Benazzi^{2,1}, Ruth Blasco^{3,4}, Mateja Hajdinjak^{5,6}, Kristofer M. Helgen⁷, Jean-Jacques Hublin^{1,8}, Jordi Rosell^{3,4}, Pontus Skoglund⁶, Chris Stringer⁹, Sahra Talamo^{10,1}

¹Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, Leipzig 04103, Germany.

²Department of Cultural Heritage, University of Bologna, Via Degli Ariani 1, Ravenna 48121, Italy.

³Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA), Zona Educacional 4, Campus Sescelades URV (Edifici W3), Tarragona 43007, Spain.

⁴Departament d’Història i Història de l’Art, Universitat Rovira i Virgili, Avinguda de Catalunya 35, Tarragona 43002, Spain.

⁵Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, Leipzig 04103, Germany.

⁶Francis Crick Institute, 1 Midland Rd, London NW1 1AT, UK.

⁷Australian Museum, 1 William Street, Sydney NSW 2010, Australia.

⁸Chaire de Paléanthropologie, Collège de France, 11 Place Marcelin Berthelot, Paris 75231, France.

⁹CHER, Department of Earth Sciences, Natural History Museum, London SW7 5BD, UK.

¹⁰Department of Chemistry “G. Ciamician”, University of Bologna, Via Selmi 2, Bologna 40126, Italy.

Table 1: All the radiocarbon dates shown in Figure 1. The ¹⁴C ages were calibrated using IntCal20 (P. Reimer *et al.* (2020)) in the OxCal program 4.4 (C. B. Ramsey (2009)). UF = collagen extracted with the ultrafiltration step; MPI-EVA UF = collagen extracted at MPI-EVA using the ultrafiltration step; No UF= collagen extracted without using the ultrafiltration step; HYP = amino acid hydroxyproline.

Site	AMS lab Code	¹⁴ C date	1s Err	Cal BP 68,3%	Cal BP 95,4%	Pretreatment	References
Neanderthals							
Les Rochers-de-Villeneuve	OxA-15257	45200	1100	48664-46210	50946-45440	UF	C. Beauval, <i>et al.</i> , Direct radiocarbon dating and stable isotopes of the Neandertal femur from Les Rochers-de-Villeneuve (Lussac-les-Châteaux, Vienne). <i>Bulletins et Memoires de la Societe d'Anthropologie de Paris</i> 18 , 35-42 (2006)
Saint-Césaire SP28	OxA-18099	36200	750	41861-40697	42206-39960	MPI-EVA UF	J.-J. Hublin <i>et al.</i> , Radiocarbon dates from the Grotte du Renne and Saint-Césaire support a Neandertal origin for the Châtelperronian. <i>Proceedings of the National Academy of Sciences</i> 109 , 18743-18748 (2012)
Grotte du Renne	MAMS-25149	36840	660	42080-41276	42370-40778	MPI-EVA UF	F. Welker <i>et al.</i> , Palaeoproteomic evidence identifies archaic hominins associated with the Châtelperronian at the Grotte du Renne. <i>Proceedings of the National Academy of Sciences</i> 113 , 11162-11167 (2016)
Les Cottés	MAMS-26196	39485	271	42969-42684	43150-42545	MPI-EVA UF	K. Jaouen <i>et al.</i> , Exceptionally high ¹⁵ N values in collagen single amino acids confirm Neandertals as high-trophic level carnivores. <i>Proceedings of the National Academy of Sciences</i> 116 , 4928-4933 (2019)
La Ferrassie 8	ETH-99102.1.1	36171	222	41400-41021	41701-40826	MPI-EVA UF	A. Balzeau <i>et al.</i> , Pluridisciplinary evidence for burial for the La Ferrassie 8 Neandertal child. <i>Scientific Reports</i> 10 , 21230 (2020)
Spy II 92b	GrA-32626	36350	310	41648-41114	41916-40897	No UF	P. Semal <i>et al.</i> , New data on the late Neandertals: Direct dating of the Belgian Spy fossils. <i>American Journal of Physical Anthropology</i> 138 , 421-428 (2009)
Spy I 94a	GrA-32623	35810	260	41166-40713	41380-40444	No UF	P. Semal <i>et al.</i> , (2009)
Goyet Q53-4	GrA-54022	39870	400	43402-42725	44028-42640	No UF	H. Rougier <i>et al.</i> , Neandertal cannibalism and Neandertal bones used as tools in Northern Europe. <i>Scientific Reports</i> 6 , 29005 (2016).
Goyet Q55-1	GrA-54257	37890	350	42370-42099	42511-41935	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q56-1	GrA-46170	38440	340	42557-42287	42731-42166	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q57-1	GrA-46173	41200	500	44609-43447	44876-43161	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q57-2	GrA-54024	36590	300	41800-41310	41996-41109	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q57-3	GrA-60019	38260	350	42495-42225	42663-42089	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q305-4	GrA-46176	40690	480	44171-43276	44490-42989	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q376-1	GrA-46178	39140	390	42861-42510	43096-42356	No UF	H. Rougier <i>et al.</i> , (2016)
Goyet Q376-20	GrA-60018	37250	320	42172-41795	42276-41478	No UF	H. Rougier <i>et al.</i> , (2016)
El Sidrón	OxA-21776	48400	3200	54825-49222	...-46980	UF	R. E. Wood <i>et al.</i> , A new date for the Neanderthals from El Sidrón Cave (Asturias, northern Spain). <i>Archaeometry</i> 55 , 148-158 (2013)

Klein Feldhofer Grotte- NN4	ETH-19661	40360	760	44110-42975	44660-42621	No UF	R. W. Schmitz <i>et al.</i> , The Neandertal type site revisited: Interdisciplinary investigations of skeletal remains from the Neander Valley, Germany. <i>Proceedings of the National Academy of Sciences</i> 99 , 13342-13347 (2002)
Klein Feldhofer Grotte- Nean 1	ETH-20981	39900	620	43846-42734	44284-42538	No UF	R. W. Schmitz <i>et al.</i> , (2002)
Klein Feldhofer Grotte- NN1	ETH-19660	39240	670	43147-42394	44031-42252	No UF	R. W. Schmitz <i>et al.</i> , (2002)
Vindija Cave Vi-207	OxA-X-2689-10	43900	2000	48904-44579	54603-43424	HYP	T. Devièse <i>et al.</i> , Direct dating of Neanderthal remains from the site of Vindija Cave and implications for the Middle to Upper Paleolithic transition. <i>Proceedings of the National Academy of Sciences</i> 114 , 10606-10611 (2017)
Vindija Cave Vi-208	OxA-X-2689-09	42700	1600	47256-44126	49976-42918	HYP	T. Devièse <i>et al.</i> (2017)
Vindija Cave Vi-28	OxA-X-2687-57	46200	1500	50823-46849	54895-45987	HYP	T. Devièse <i>et al.</i> (2017)
Vindija Cave Vi-33.19	OxA-X-2717-11	44300	1200	47977-45556	49922-44696	HYP	T. Devièse <i>et al.</i> (2017)
Vindija Cave Vi-33.26	OxA-V-2291-18	44450	550	47321-46080	48091-45761	MPI-EVA UF	R. E. Green <i>et al.</i> , A Draft Sequence of the Neandertal Genome. <i>Science</i> 328 , 710-722 (2010)
Mezmaiskaya Cave	OxA-21839	39700	110	43007-42831	43115-42749	UF	R. Pinhasi, <i>et al.</i> , Revised age of late Neanderthal occupation and the end of the Middle Paleolithic in the northern Caucasus. <i>Proceedings of the National Academy of Sciences</i> 108 , 8611-8616 (2011)
Okladnikov Cave	OxA-15481	37800	450	42382-42018	42599-41743	UF (R_Combine failed)	J. Krause <i>et al.</i> , Neanderthals in central Asia and Siberia. <i>Nature</i> 449 , 902 (2007)
<i>Homo sapiens</i>							
Goyet Q376-3	GrA-60034	29370	180	34200-33760	34350-33430	No UF	C. Posth <i>et al.</i> , Pleistocene Mitochondrial Genomes Suggest a Single Major Dispersal of Non-Africans and a Late Glacial Population Turnover in Europe. <i>Current Biology</i> 26 , 827-833 (2016)
Goyet Q116-1-1	GrA-46175	30880	170	35470-34920	35630-34720	No UF	C. Posth <i>et al.</i> , (2016)
Buran-Kaya III	GrA-37938	31900	240	36520-36010	36840-35680	No UF	S. Prat <i>et al.</i> , The Oldest Anatomically Modern Humans from Far Southeast Europe: Direct Dating, Culture and Behavior. <i>PLOS ONE</i> 6 , e20834 (2011)
Kostienki 14	OxA-X-2395-15	33250	500	38850-37260	39380-36670	HYP	A. Marom, J. <i>et al.</i> , Single amino acid radiocarbon dating of Upper Paleolithic modern humans. <i>Proceedings of the National Academy of Sciences</i> 109 , 6878-6881 (2012)
Kostienki 1	OxA-15055	32070	190	36590-36180	36880-36070	UF	S. G. Keates, Y. V. Kuzmin, G. S. Burr, Chronology of Late Pleistocene Humans in Eurasia: Results and Perspectives. <i>Radiocarbon</i> 54 , 339-350 (2012)
Sungir 2	OxX-2395-6	30100	550	35200-34150	35790-33430	HYP	A. Marom, <i>et al.</i> , (2012)
Sungir 3	OxX-2395-7	30000	550	35140-34040	35640-33270	HYP	A. Marom, <i>et al.</i> , (2012)
Pokrovka 2	OxA-19850	27740	150	31830-31460	31970-31260	UF	E. Akimova <i>et al.</i> , A new direct radiocarbon AMS date for an Upper Palaeolithic human bone from Siberia. <i>Archaeometry</i> 52 , 1122-1130 (2010)

Ust'-Ishim	OxA= Weighted mean	41410	960	44970-43340	45960-42890	UF	Q. Fu <i>et al.</i> , Genome sequence of a 45,000-year-old modern human from western Siberia. <i>Nature</i> 514 , 445-449 (2014)
Pe tera Cioclovina	OxA-15527	28510	170	33090-32230	33300-32010	UF	Andrei Soficaru <i>et al.</i> , The Human Cranium from the Pe tera Cioclovina Uscat , Romania: Context, Age, Taphonomy, Morphology, and Paleopathology. <i>Curr. Anthropol.</i> 48 , 611-619 (2007)
Pe tera Mureii1	OxA-15529	29930	170	34550-34270	34690-34120	UF	E. Trinkaus <i>et al.</i> , Stable isotope evidence for early modern human diet in southeastern Europe: Pe tera cu Oase, Pe tera Muierii and Pe tera Cioclovina Uscat . <i>Materiale i cercet ri arheologice</i> 5 , 5-14 (2009)
Pe tera Mureii2	OxA-16252	29110	190	33930-33350	34180-33140	UF	E. Trinkaus <i>et al.</i> , (2009)
Pe tera cu Oase	OxA+GrA= Weighted mean	34950	990	41180-39190	41910-37700	No UF	E. Trinkaus <i>et al.</i> , An early modern human from the Pe tera cu Oase, Romania. <i>Proceedings of the National Academy of Sciences</i> 100 , 11231-11236 (2003)
Mlade 1	VERA-3073	31190	400	36070-35240	36310-34700	No UF	E. M. Wild <i>et al.</i> , Direct dating of Early Upper Palaeolithic human remains from Mlade . <i>Nature</i> 435 , 332-335 (2005)
Mlade 2	VERA-3074	31320	390	36110-35350	36420-34790	No UF	E. M. Wild <i>et al.</i> , (2005)
Mlade 8	VERA-3075	30680	380	35390-34640	35930-34410	No UF	E. M. Wild <i>et al.</i> , (2005)
Mlade 9a	VERA-3076A	31500	420	36230-35430	36840-34930	No UF	E. M. Wild <i>et al.</i> , (2005)
Oblazowa Cave	OxA-4586	31000	550	35940-34810	36460-34400	No UF	E. Trinkaus, E. Haduch, P. W. Valde-Nowak, P. Wojtal, The Oblazowa 1 early modern human pollical phalanx and Late Pleistocene distal thumb proportions. <i>HOMO</i> 65 , 1-12 (2014).
La Crouzade VI	Erl-9415	30640	640	35650-34450	36400-33990	No UF	D. Henry-Gambier, D. Sacchi, La Crouzade V-VI (Aude, France): un des plus anciens fossiles d'anatomie moderne en Europe occidentale. <i>Bulletins et Mémoires de la Société d'Anthropologie de Paris</i> 20 , 79-104 (2008).
Bacho Kiro	ETH-86772	42450	510	45430-44640	45930-44420	MPI-EVA UF	J.-J. Hublin <i>et al.</i> , Initial Upper Palaeolithic <i>Homo sapiens</i> from Bacho Kiro Cave, Bulgaria. <i>Nature</i> 581 , 299-302 (2020). H. Fewlass <i>et al.</i> , A ¹⁴ C chronology for the Middle to Upper Palaeolithic transition at Bacho Kiro Cave, Bulgaria. <i>Nature Ecology & Evolution</i> 4 , 794–801 (2020).
Bacho Kiro	ETH-86770	41850	480	45010-44320	45550-43940	MPI-EVA UF	J.-J. Hublin <i>et al.</i> , (2020); H. Fewlass <i>et al.</i> , 2020
Bacho Kiro	ETH-86771	40600	420	44080-43240	44400-42990	MPI-EVA UF	J.-J. Hublin <i>et al.</i> , (2020); H. Fewlass <i>et al.</i> , 2020
Bacho Kiro	ETH-86769	39750	380	43240-42700	43930-42580	MPI-EVA UF	J.-J. Hublin <i>et al.</i> , (2020); H. Fewlass <i>et al.</i> , 2020
Kent's Cavern 4	OxA-1621	30900	900	36212-34471	38020-33604	No UF	R. E. M. Hedges, R. A. Housley, I. Law, C. R. Bronk, Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 9. <i>Archaeometry</i> 31 , 207-234 (1989).
Tianyuan Cave	BA-03222	34430	510	40320-39130	40850-38070	Unknown	H. Shang, H. Tong, S. Zhang, F. Chen, E. Trinkaus, An early modern human from Tianyuan Cave, Zhoukoudian, China. <i>Proceedings of the National Academy of Sciences</i> 104 , 6573-6578 (2007).