

### Supplementary Information 3

**Supplementary Table 1:** All Acheulean sites used in the present study. The full database containing all retrieved information for each site is available in Supplementary Information 1.

Rank	European Acheulean Sites	Central Date	Date Range	Rank	European Acheulean Sites	Central Date	Date Range
1	Barranc de la Boella (Spain)	885000	990000 - 780000	42	Atapuerca Gran Dolina (Spain)	400000	450000-350000
2	Cueva Negra (Spain)	850000	990000-772000	43	Gruta da Aroeira (Portugal)	400000	436000-389000
3	la Noira (France)	690000	720000-660000	44	Foxhall Road (UK)	399000	424000-374000
4	Moulin Quignon (France)	660000	670000-650000	45	Terra Amata (France)	399000	424000-374000
5	Notarchirico (Italy)	640000	670000-610000	46	Malagrotta (Italy)	399000	424000-374000
6	Rampart Field (UK)	592000	621000-563000	47	Lademagne (Italy)	397000	405000-389000
7	Farnham Terrace A (UK)	592000	621000-563000	48	Solana del Zamborino (Spain)	390000	480000-300000
8	Brandon Fields (UK)	592000	621000 - 563000	49	Isoletta (Italy)	388500	403000-374000
9	Carrière Carpentier (France)	592000	621000-563000	50	St Pierre-les-Elbeuf (France)	385000	400000-370000
10	Malderscross Hill (UK)	580000	631000-529000	51	La Cansaladeta (Spain)	385000	395000-372000
11	Loreto (Italy)	555000	630000-480000	52	Aridos 2 (Spain)	381500	384000-379000
12	Valle Giumentina (Italy)	531000	536000-526000	53	Ambrona (Spain)	375000	400000-350000
13	Abbeville (France)	525000	550000-500000	54	Soucy (France)	356000	370000-342000
14	Old Park (UK)	505500	533000-478000	55	Torre in Pietra (Italy)	350000	374000-337000
15	Highland's Farm (UK)	505500	533000-478000	56	Vale do Forno (Portugal)	330000	335000-325000
16	Brooksby (UK)	505500	533000-478000	57	Soucy (France)	320000	340000-300000
17	Kent's Cavern (UK)	505500	533000-478000	58	Rodafnidia (Greece)	320000	476000-164000
18	Waverley Wood (UK)	505000	533000-478000	59	Stoke Newington (UK)	318500	337000-300000
19	Warren Hill (UK)	501000	524000-478000	60	Wolvercote (UK)	318500	337000-300000
20	Boxgrove (UK)	501000	524000-478000	61	Dovercourt (UK)	318500	337000-300000
21	Happisburgh Site 1 (UK)	501000	524000-478000	62	Broom (UK)	303000	324000-282000
22	High Lodge (UK)	492000	506000-478000	63	Cagny-l'Épinette (France)	296000	349000-243000
23	Aldène Cave (France)	478000	498000-458000	64	Cien Fanegas (Spain)	292000	309000-275000
24	Fontana Ranuccio (Italy)	458000	458000-	65	Plachy-Buyon (France)	290000	350000-270000

			458000				
<b>25</b>	Grande Vallée (France)	450000	500000-400000	<b>66</b>	El Sotillo (Spain)	280500	303000-258000
<b>26</b>	la Noira (France)	449000	494000-404000	<b>67</b>	Revelles (France)	278000	292000-264000
<b>27</b>	Atapuerca Sima de los Huesos (Spain)	427000	439000-415000	<b>68</b>	Cueva del Ángel (Spain)	266500	350000-183000
<b>28</b>	Beeches Pit (UK)	414000	444000-384000	<b>69</b>	Orgnac 3 (France)	265000	269000-261000
<b>29</b>	Castle di Guido (Italy)	412000	414000-410000	<b>70</b>	Valdocarros (Spain)	258000	262000-254000
<b>30</b>	Elveden (UK)	411000	426000-396000	<b>71</b>	Atapuerca Galería-GIIb (Spain)	253000	269000-237000
<b>31</b>	Hitchin (UK)	411000	426000-396000	<b>72</b>	Pinedo (Spain)	253000	280000-226000
<b>32</b>	Hoxne (UK)	410000	426000-394000	<b>73</b>	Harnham (UK)	250000	267000-229000
<b>33</b>	La Celle (France)	405500	424000-387000	<b>74</b>	Vale do Forno (Portugal)	240000	325000-155000
<b>34</b>	East Burnham (UK)	405000	420000-390000	<b>75</b>	Barbas 1 (France)	239000	283000-195000
<b>35</b>	Barnfield Pit (UK)	403500	411000-396000	<b>76</b>	Cuxton (UK)	230000	260000-200000
<b>36</b>	Barnham (UK)	400500	411000-390000	<b>77</b>	Tera River (Spain)	220000	246000-216000
<b>37</b>	Menez-Dregan 1 (France)	400000	430000-310000	<b>78</b>	Prince Cave (Italy)	230000	340000-170000
<b>38</b>	Cagny-la-Garenne (France)	400000	500000-300000	<b>79</b>	Porto Maior (Spain)	211000	236000-186000
<b>39</b>	Londigny (France)	400000	424000-374000	<b>80</b>	Gentelles (France)	199000	219000-179000
<b>40</b>	Caune de l'Arago (France)	400000	450000-350000	<b>81</b>	Lazaret Cave (France)	165000	174000-156000
<b>41</b>	Atapuerca Galería-GIIa (Spain)	400000	450000-350000	<b>82</b>	Arbo (Spain)	160500	191000-130000

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22 **Supplementary Table 2:** The sites used in each spatial scenario, organised from earliest (top)  
 23 to most recent (bottom).  
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Europe (S1)	Europe (S2)	Northern Europe	Southern Europe	Iberia
Barranc de la Boella	Barranc de la Boella	Moulin Quignon	Barranc de la Boella	Barranc de la Boella
Cueva Negra	Cueva Negra	Rampart Field	Cueva Negra	Cueva Negra
la Noira (lower)	la Noira (lower)	Farnham Terrace A	Notarchirico	Sima de los Huesos
Moulin Quignon	Moulin Quignon	Brandon Fields	Loreto	Atapuerca Galería-GIIa
Notarchirico	Notarchirico	Carrière Carpentier	Valle Giumentina	Gran Dolina TD10
Rampart Field	Rampart Field	Maidscross Hill	Aldène cave	Gruta da Aroeira
Carrière Carpentier	Farnham Terrace A	Abbeville	Fontana Ranuccio	Solana del Zamborino
Maidscross Hill	Brandon Fields	Old Park	Sima de los Huesos	La Cansaladeta
Loreto	Carrière Carpentier	Highland's Farm	Castle di Guido	Aridos 2
Valle Giumentina	Maidscross Hill	Brooksby	Caune de l'Arago	Ambrona
Abbeville	Loreto	Kent's Cavern	Atapuerca Galería-GIIa	Vale do Forno
Old Park	Valle Giumentina	Waverley Wood	Gran Dolina TD10	Cien Fanegas
Kent's Cavern	Abbeville	Warren Hill	Gruta da Aroeira	El Sotillo
Waverley Wood	Old Park	Boxgrove	Terra Amata	Cueva del Ángel
Warren Hill	Highland's Farm	Happisburgh Site 1	Malagrotta	Valdocarros
Boxgrove	Brooksb	High Lodge	Lademagne	Atapuerca Galería-GIIb
Happisburgh Site 1	Kent's Cavern	Beeches Pit	Solana del Zamborino	Pinedo
High Lodge	Waverley Wood	Elveden	Isoletta	Vale do Forno
Fontana Ranuccio	Warren Hill	Hitchin	La Cansaladeta	Tera River
Grande Vallée	Boxgrove	Hoxne	Aridos 2	Porto Maior
la Noira (upper)	Happisburgh Site	East Burnham	Ambrona	Arbo
Sima de los Huesos	High Lodge	Barnfield Pit	Torre in Pietra	
Beeches Pit	Aldène Cave	Barnham	Vale do Forno	
Castle di Guido	Fontana Ranuccio	Cagny-la-Garenne	Rodafnidia	
Elveden	Grande Vallée	Foxhall Road	Cien Fanegas	
Hoxne	la Noira (upper)	St Pierre-les-Elbeuf	El Sotillo	
La Celle	Atapuerca Sima de los Huesos	Stoke Newington	Cueva del Ángel	
Barnfield Pit	Beeches Pit	Wolvercote	Orgnac 3	
Barnham	Castle di Guido	Dovercourt	Valdocarros	
Menez-Dregan 1	Elveden	Broom	Atapuerca Galería-GIIb	

Cagny-la-Garenne	Hitchin	Cagny-l'Épinette	Pinedo
Londigny	Hoxne	Plachy-Buyon	Vale do Forno
Caune de l'Arago	La Celle	Revelles	Barbas 1
Atapuerca Galería-GIIa	East Burnham	Harnham	Prince Cave
Atapuerca Gran Dolina	Barnfield Pit	Cuxton	Tera River
Gruta da Aroeira	Barnham	Gentelles	Porto Maior
Malagrotta	Menez-Dregan 1		Lazaret Cave
Lademagne	Cagny-la-Garenne		Arbo
Solana del Zamborino	Londigny		
Isoletta	Caune de l'Arago		
St Pierre-les-Elbeuf	Atapuerca Galería-GIIa		
La Cansaladeta	Atapuerca Gran Dolina		
Aridos 2	Gruta da Aroeira		
Ambrona	Foxhall Road		
Soucy	Terra Amata		
Torre in Pietra	Malagrotta		
Vale do Forno (Lower Gravels Unit)	Lademagne		
Soucy (Layer P)	Solana del Zamborino		
Broom	Isoletta		
Cagny-l'Épinette	St Pierre-les-Elbeuf		
Cien Fanegas	La Cansaladeta		
El Sotillo	Aridos 2		
Revelles	Ambrona		
Cueva del Ángel	Soucy		
Orgnac 3	Torre in Pietra		
Valdocarros	Vale do Forno		
Atapuerca Galería-GIIb	Soucy(Layer P)		
Pinedo	Rodafnidia		
Harnham	Stoke Newington		
Vale do Forno	Wolvercote		
Cuxton	Dovercourt		
Tera River	Broom		
Prince Cave	Cagny-l'Épinette		

Porto Maior	Cien Fanegas			
Gentelles	Plachy-Buyon			
Lazaret Cave	El Sotillo			
Arbo	Revelles			
	Cueva del Ángel			
	Orgnac 3			
	Valdocarros			
	Atapuerca Galería-GIIb			
	Pinedo			
	Harnham			
	Vale do Forno			
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	Cuxton			
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**Supplementary Table 3:** Results for scenario 1 across all model and data conditions. ‘na’ indicates the model could not be used as all dates from the relevant site sample were the same. Result in **bold** indicate significance when  $\alpha = 0.05$ .

Investigated Temporal Gap (Between Acheulean Sites)	Forwards Model				Reverse Model			
	<i>P</i> (Central Age)		<i>P</i> (Resampling)		<i>P</i> (Central Age)		<i>P</i> (Resampling)	
	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10
Barranc de la Boella ↔ Cueva Negra	-	-	-	-	0.829	0.786	0.898	0.910
Cueva Negra ↔ la Noira	-	-	-	-	0.191	0.263	0.234	0.275
la Noira ↔ Moulin Quignon	-	-	-	-	0.629	0.714	0.678	0.747
Moulin Quignon ↔ Notarchirico	-	-	-	-	0.751	0.750	0.775	0.801
Notarchirico ↔ Rampart Field	0.820	-	0.835	-	0.503	0.419	0.651	0.621
Rampart Field ↔ Carrière Carpentier	1.000	-	1.002	-	1.000	1.000	1.150	1.197
Carrière Carpentier ↔ Maidscross Hill	0.881	-	0.960	-	0.825	0.685	0.961	1.004
Maidscross Hill ↔ Loreto	0.737	-	0.830	-	0.527	0.444	0.745	0.782
Loreto ↔ Valle Giumentina	0.753	-	0.853	-	0.321	0.665	0.564	0.703
Valle Giumentina ↔ Abbeville	0.871	0.980	0.996	1.002	0.687	0.902	0.933	0.975
Abbeville ↔ Old Park	0.735	0.935	0.847	0.959	<b>0.050</b>	0.674	0.807	0.928
Old Park ↔ Kent's Cavern	1.000	1.000	1.054	1.028	1.000	1.000	2.041	1.193
Kent's Cavern ↔ Waverley Wood	0.990	0.996	1.236	1.080	0.963	0.993	1.605	1.139
Waverley Wood ↔ Warren Hill	0.866	0.965	1.238	1.082	0.926	0.939	1.118	1.093
Warren Hill ↔ Boxgrove	1.000	1.000	1.451	1.147	1.000	1.000	1.138	1.125
Boxgrove ↔ Happisburgh Site 1	1.000	1.000	1.890	1.167	1.000	1.000	1.044	1.057
Happisburgh Site 1 ↔ High Lodge	0.205	0.887	1.197	1.073	0.843	0.801	0.868	0.851
High Lodge ↔ Fontana Ranuccio	0.078	0.547	0.367	0.625	0.486	0.330	0.637	0.563
Fontana Ranuccio ↔ Grande Vallée	0.724	0.819	0.809	0.831	0.788	0.732	1.139	1.290
Grande Vallée ↔ la Noira	0.974	0.977	1.117	1.193	0.959	0.952	1.078	1.174
la Noira ↔ Sima de los Huesos	0.668	0.459	0.872	0.880	0.179	0.195	0.431	0.927
Sima de los Huesos ↔ Beeches Pit	0.816	0.716	0.874	0.858	0.269	0.218	0.798	1.586
Beeches Pit ↔ Castle di Guido	0.943	0.960	1.041	1.033	0.790	0.723	1.246	2.195
Castle di Guido ↔ Elveden	0.971	0.982	1.117	1.079	0.903	0.807	1.367	2.254
Elveden ↔ Hoxne	0.977	0.985	1.167	1.091	0.875	0.741	1.316	2.177

Hoxne ↔ La Celle	0.799	0.942	1.147	1.051	0.350	0.094	1.915	2.297
La Celle ↔ Barnfield Pit	0.743	0.974	1.352	1.065	0.388	0.378	2.174	2.588
Barnfield Pit ↔ Barnham	0.651	0.934	1.096	1.060	<b>0.004</b>	0.424	2.089	2.799
Barnham ↔ Menez-Dregan 1	0.945	0.988	1.265	1.096	na	0.954	2.202	2.704
Menez-Dregan 1 ↔ Cagny-la-Garenne	1.000	1.000	2.503	1.867	na	1.000	2.487	3.041
Cagny-la-Garenne ↔ Londigny	1.000	1.000	3.005	3.461	na	1.000	2.484	2.846
Londigny ↔ Caune de l'Arago	1.000	1.000	3.053	4.463	1.000	1.000	2.539	2.822
Caune de l'Arago ↔ Atapuerca Galería-GIIa	1.000	1.000	2.748	4.834	1.000	1.000	2.417	2.906
Atapuerca Galería-GIIa ↔ Gran Dolina TD10	na	1.000	2.603	4.084	1.000	1.000	2.349	2.626
Gran Dolina TD10 ↔ Gruta da Aroeira	na	1.000	2.452	3.848	1.000	1.000	2.199	1.719
Gruta da Aroeira ↔ Malagrotta	na	0.840	2.137	3.609	0.921	0.975	1.894	1.552
Malagrotta ↔ Lademagne	0.063	0.619	1.955	3.418	0.788	0.965	1.811	1.317
Lademagne ↔ Solana del Zamborino	0.063	<b>0.016</b>	1.479	2.776	0.443	0.889	1.886	1.298
Solana del Zamborino ↔ Isoletta	0.785	0.579	1.885	2.622	0.895	0.979	1.229	1.041
Isoletta ↔ St Pierre-les-Elbeuf	0.697	0.443	1.803	2.228	0.900	0.950	1.034	1.019
St Pierre-les-Elbeuf ↔ La Cansaladeta	1.000	1.000	2.000	2.148	1.000	1.000	1.068	1.033
La Cansaladeta ↔ Aridos 2	0.769	0.647	1.970	1.977	0.931	0.947	0.978	0.985
Aridos 2 ↔ Ambrona	0.440	0.543	1.760	1.664	0.872	0.890	0.889	0.928
Ambrona ↔ Soucy	0.218	0.277	0.477	1.056	0.692	0.713	0.737	0.797
Soucy ↔ Torre in Pietra	0.724	0.753	0.816	1.114	0.873	0.879	0.934	0.961
Torre in Pietra ↔ Vale do Forno	0.520	0.475	0.562	0.753	0.537	0.631	0.667	0.747
Vale do Forno ↔ Soucy	0.792	0.744	0.803	0.859	0.741	0.775	0.863	0.942
Soucy ↔ Broom	0.720	0.618	0.726	0.765	0.480	0.571	0.813	0.942
Broom ↔ Cagny-l'Epinette	0.854	0.854	0.881	0.893	0.781	0.770	1.262	1.287
Cagny-l'Epinette ↔ Cien Fanegas	0.926	0.925	1.087	1.112	0.830	0.883	1.200	1.232
Cien Fanegas ↔ El Sotillo	0.740	0.831	0.965	0.993	0.586	0.731	1.132	1.179
El Sotillo ↔ Revelles	0.935	0.965	1.111	1.060	0.885	0.921	1.421	1.385
Revelles ↔ Cueva del Ángel	0.620	0.857	0.904	0.950	0.395	0.722	1.327	1.461
Cueva del Ángel ↔ Orgnac 3	0.940	0.977	1.456	1.270	0.875	0.963	1.031	1.366
Orgnac 3 ↔ Valdocarros	0.772	0.901	1.361	1.202	0.690	0.860	1.400	1.330
Valdocarros ↔ Atapuerca Galería-GIIb	0.778	0.911	1.335	1.186	0.821	0.937	1.460	1.296
Atapuerca Galería-GIIb ↔ Pinedo	1.000	1.000	1.514	1.297	1.000	1.000	1.545	1.367

Pinedo ↔ Harnham	0.794	0.923	1.753	1.383	0.888	-	1.576	-
Harnham ↔ Vale do Forno	0.545	0.754	0.878	1.181	0.695	-	1.474	-
Vale do Forno ↔ Cuxton	0.507	0.768	1.325	1.391	0.737	-	1.380	-
Cuxton ↔ Tera River	1.000	1.000	1.506	1.578	1.000	-	1.324	-
Tera River ↔ Prince Cave	0.641	0.748	1.245	1.328	0.832	-	1.201	-
Prince cave ↔ Porto Maior	0.730	1.724	1.204	1.314	-	-	-	-
Porto Maior ↔ Gentelles	0.630	0.698	1.065	1.086	-	-	-	-
Gentelles ↔ Lazaret Cave	0.281	0.375	0.568	0.631	-	-	-	-
Lazaret Cave ↔ Arbo	0.911	0.896	0.935	0.947	-	-	-	-

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**Supplementary Table 4:** Results for scenario 2 across all model and data conditions. 'na' indicates the model could not be used as all dates from the relevant site sample were the same. Result in **bold** indicate significance when  $\alpha = 0.05$ .

Investigated Temporal Gap (Between Acheulean Sites)	Forwards Model				Reverse Model			
	<i>P</i> (Central Age)		<i>P</i> (Resampling)		<i>P</i> (Central Age)		<i>P</i> (Resampling)	
	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10
Barranc de la Boella ↔ Cueva Negra	-	-	-	-	0.829	0.752	0.900	0.903
Cueva Negra ↔ la Noira	-	-	-	-	0.191	0.220	0.231	0.245
la Noira ↔ Moulin Quignon	-	-	-	-	0.547	0.701	0.645	0.726
Moulin Quignon ↔ Notarchirico	-	-	-	-	0.469	0.797	0.676	0.813
Notarchirico ↔ Rampart Field	0.820	-	0.835	-	0.095	0.501	0.464	0.697
Rampart Field ↔ Farnham Terrace A	1.000	-	1.002	-	1.000	1.000	1.571	1.265
Farnham Terrace A ↔ Brandon Fields	1.000	-	1.093	-	1.000	1.000	1.208	1.256
Brandon Fields ↔ Carrière Carpentier	1.000	-	1.172	-	1.000	1.000	1.156	1.198
Carrière Carpentier ↔ Maidscross Hill	0.823	-	1.049	-	0.825	0.693	0.956	1.012
Maidscross Hill ↔ Loreto	0.058	0.914	0.719	0.960	0.527	0.318	0.748	0.782
Loreto ↔ Valle Giumentina	0.374	0.916	0.797	0.955	0.310	0.159	0.560	0.522
Valle Giumentina ↔ Abbeville	0.871	0.949	0.998	1.005	0.564	0.718	0.939	0.997
Abbeville ↔ Old Park	0.735	0.820	0.847	0.888	<b>&lt;0.001</b>	0.505	0.879	0.948
Old Park ↔ Highland's Farm	1.000	1.000	1.052	1.046	1.000	1.000	2.116	1.402
Highland's Farm ↔ Brooksby	1.000	1.000	1.237	1.151	1.000	1.000	2.011	1.304
Brooksby ↔ Kent's Cavern	1.000	1.000	1.443	1.181	1.000	1.000	2.006	1.242
Kent's Cavern ↔ Waverley Wood	0.980	0.993	1.661	1.190	0.963	0.992	1.575	1.145
Waverley Wood ↔ Warren Hill	<b>0.002</b>	0.950	1.730	1.155	0.862	0.944	1.253	1.090
Warren Hill ↔ Boxgrove	1.000	1.000	1.828	1.210	1.000	1.000	1.161	1.116
Boxgrove ↔ Happisburgh Site 1	1.000	1.000	2.054	1.408	1.000	1.000	1.050	1.046
Happisburgh Site 1 ↔ High Lodge	0.205	0.731	1.211	1.236	0.757	0.807	0.855	0.867
High Lodge ↔ Aldène Cave	0.285	0.595	0.720	0.845	0.739	0.652	0.817	0.792
Aldène Cave ↔ Fontana Ranuccio	0.289	0.142	0.549	0.573	0.644	0.493	0.828	0.801
Fontana Ranuccio ↔ Grande Vallée	0.769	0.626	0.816	0.797	0.788	0.689	1.138	1.306
Grande Vallée ↔ la Noira	0.978	0.959	1.127	1.197	0.959	0.945	1.085	1.273

la Noira ↔ Atapuerca Sima de los Huesos	0.624	0.495	0.864	0.878	0.148	0.222	0.433	0.409
Atapuerca Sima de los Huesos ↔ Beeches Pit	0.755	0.730	0.840	0.857	0.053	0.284	0.795	0.918
Beeches Pit ↔ Castle di Guido	0.943	0.959	1.039	1.045	0.762	0.777	1.437	2.665
Castle di Guido ↔ Elveden	0.971	0.983	1.116	1.083	0.846	0.856	2.240	2.671
Elveden ↔ Hitchin	1.000	1.000	1.219	1.113	1.000	1.000	1.563	2.488
Hitchin ↔ Hoxne	0.949	0.985	1.427	1.121	0.882	0.773	1.319	2.317
Hoxne ↔ La Celle	0.371	0.926	1.377	1.078	0.444	0.161	1.287	2.232
La Celle ↔ East Burnham	0.891	0.988	1.463	1.138	0.869	0.729	2.274	2.719
East Burnham ↔ Barnfield Pit	0.732	0.962	1.423	1.162	0.482	0.477	2.115	2.594
Barnfield Pit ↔ Barnham	0.661	0.933	1.224	1.129	<b>0.004</b>	0.094	2.106	2.680
Barnham ↔ Menez-Dregan 1	0.945	0.977	1.357	1.261	na	0.579	2.373	2.842
Menez-Dregan 1 ↔ Cagny-la-Garenne	1.000	1.000	2.847	3.799	na	1.000	2.774	3.425
Cagny-la-Garenne ↔ Londigny	1.000	1.000	3.115	5.544	na	1.000	2.375	2.973
Londign ↔Caune de l'Arago	1.000	1.000	3.064	5.092	1.000	1.000	2.324	2.867
Caune de l'Arago ↔ Atapuerca Galería-Glla	1.000	1.000	2.791	4.721	1.000	1.000	2.730	2.874
Atapuerca Galería-Glla ↔ Atapuerca Gran Dolina	na	1.000	1.597	4.180	1.000	1.000	2.803	2.934
Atapuerca Gran Dolina ↔ Gruta da Aroeira	na	1.000	2.401	3.910	1.000	1.000	2.268	2.903
Gruta da Aroeira ↔ Foxhall Road	na	0.824	2.156	3.684	0.912	0.949	2.289	2.435
Foxhall Road ↔ Terra Amata	1.000	1.000	2.141	3.627	1.000	1.000	2.156	1.711
Terra Amata ↔ Malagrotta	1.000	1.000	2.211	3.383	1.000	1.000	1.967	1.582
Malagrotta ↔ Lademagne	0.198	<b>0.026</b>	1.911	3.187	0.788	0.965	1.840	1.299
Lademagne ↔ Solana del Zamborino	0.100	<b>0.006</b>	1.188	2.394	0.443	0.889	1.917	1.280
Solana del Zamborino ↔ Isoletta	0.749	0.604	2.007	2.423	0.895	0.971	1.246	1.240
Isoletta ↔ St Pierre-les-Elbeuf	0.660	0.461	1.892	2.162	0.900	0.925	1.040	1.219
St Pierre-les-Elbeuf ↔ La Cansaladeta	1.000	1.000	1.999	2.183	1.000	1.000	1.066	1.275
La Cansaladeta ↔ Aridos 2	0.769	0.654	1.905	2.092	0.931	0.889	0.978	1.301
Aridos 2 ↔ Ambrona	0.440	0.550	1.729	1.724	0.872	0.848	0.891	1.260
Ambrona ↔ Soucy	0.218	0.253	0.472	1.077	0.534	0.605	1.095	1.177
Soucy ↔ Torre in Pietra	0.724	0.741	0.815	1.112	0.742	0.839	1.446	1.574
Torre in Pietra ↔ Vale do Forno	0.520	0.475	0.567	0.744	0.102	0.496	1.458	1.594
Vale do Forno ↔ Soucy	0.792	0.744	0.803	0.854	<b>0.009</b>	0.738	2.379	2.272

Soucy ↔ Rodafnidia	1.000	1.000	1.025	1.068	1.000	1.000	2.708	2.761
Rodafnidia ↔ Stoke Newington	0.958	0.964	1.846	2.226	0.940	0.962	1.414	1.282
Stoke Newington ↔ Wolvercote	1.000	1.000	1.954	2.129	1.000	1.000	1.264	1.283
Wolvercote ↔ Dovercourt	1.000	1.000	2.858	2.056	1.000	1.000	1.225	1.216
Dovercourt ↔ Broom	<b>0.006</b>	0.756	2.033	1.527	0.498	0.637	0.977	1.090
Broom ↔ Cagny-l'Épinette	0.513	0.885	1.748	1.541	0.662	0.776	1.413	1.460
Cagny-l'Épinette ↔ Cien Fanegas	0.774	0.912	1.211	1.765	0.855	0.855	1.521	1.494
Cien Fanegas ↔ Plachy-Buyon	0.917	0.955	1.291	1.800	0.906	0.939	1.500	1.507
Plachy-Buyon ↔ El Sotillo	0.740	0.698	1.057	1.947	0.640	0.699	1.216	1.251
El Sotillo ↔ Revelles	0.879	0.885	1.189	1.864	0.885	0.923	1.433	1.402
Revelles ↔ Cueva del Ángel	0.504	0.641	0.923	1.458	0.395	0.633	1.315	1.494
Cueva del Ángel ↔ Orgnac 3	0.927	0.952	1.469	1.518	0.875	0.954	1.031	1.500
Orgnac 3 ↔ Valdocarros	0.752	0.828	1.342	1.323	0.690	0.824	1.372	1.442
Valdocarros ↔ Atapuerca Galería-GIIb	0.778	0.894	1.338	1.252	0.702	0.891	1.558	1.584
Atapuerca Galería-GIIb ↔ Pinedo	1.000	1.000	1.483	1.368	1.000	1.000	1.603	1.415
Pinedo ↔ Harnham	0.794	0.906	1.756	1.385	0.820	0.958	1.647	1.368
Harnham ↔ Vale do Forno	0.545	0.726	0.895	1.176	0.621	-	1.694	-
Vale do Forno ↔ Barbas 1	0.929	0.972	1.810	1.641	0.962	-	1.741	-
Barbas 1 ↔ Cuxton	0.475	0.739	1.506	1.603	0.759	-	1.469	-
Cuxton ↔ Prince Cave	1.000	1.000	1.608	1.733	1.000	-	1.336	-
Prince Cave ↔ Tear River	0.628	0.667	1.381	1.560	0.832	-	0.936	-
Tera River ↔ Porto Maior	0.577	0.734	1.219	1.313	-	-	-	-
Porto Maior ↔ Gentelles	0.615	0.648	0.949	1.080	-	-	-	-
Gentelles ↔ Lazaret Cave	0.281	0.330	0.571	0.650	-	-	-	-
Lazaret Cave ↔ Arbo	0.911	0.900	0.934	0.946	-	-	-	-

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**Supplementary Table 5:** Results for scenario 3 across all model and data conditions. 'na' indicates the model could not be used as all dates from the relevant site sample were the same. Result in **bold** indicate significance when  $\alpha = 0.05$ .

Investigated Temporal Gap (Between Acheulean Sites)	Forwards Model				Reverse Model			
	<i>P</i> (Central Age)		<i>P</i> (Resampling)		<i>P</i> (Central Age)		<i>P</i> (Resampling)	
	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10
Moulin Quignon ↔ Rampart Field	-	-	-	-	<b>0.048</b>	0.335	0.312	0.533
Rampart Field ↔ Farnham Terrace A	-	-	-	-	1.000	1.000	1.204	1.256
Farnham Terrace A ↔ Brandon Fields	-	-	-	-	1.000	1.000	1.144	1.234
Brandon Fields ↔ Carrière Carpentier	-	-	-	-	1.000	1.000	1.089	1.172
Carrière Carpentier ↔ Maidscross Hill	0.870	-	1.033	-	0.759	0.598	0.848	0.859
Maidscross Hill ↔ Abbeville	<b>0.009</b>	-	0.355	-	<b>0.030</b>	0.070	0.265	0.206
Abbeville ↔ Old Park	0.606	-	0.730	-	<b>&lt;0.001</b>	0.822	0.883	0.979
Old Park ↔ Highland's Farm	1.000	-	1.022	-	1.000	1.000	2.185	1.177
Highland's Farm ↔ Brooksby	1.000	-	1.091	-	1.000	1.000	2.016	1.173
Brooksby ↔ Kent's Cavern	1.000	1.000	1.166	1.101	1.000	1.000	1.877	1.162
Kent's Cavern ↔ Waverley Wood	0.980	0.991	1.674	1.194	0.963	0.993	1.580	1.138
Waverley Wood ↔ Warren Hill	<b>0.002</b>	0.942	1.780	1.147	0.963	0.932	1.058	1.102
Warren Hill ↔ Boxgrove	1.000	1.000	1.822	1.160	1.000	1.000	1.075	1.143
Boxgrove ↔ Happisburgh Site 1	1.000	1.000	2.015	1.173	1.000	1.000	1.030	1.055
Happisburgh Site 1 ↔ High Lodge	0.205	0.897	1.209	1.097	0.814	0.726	0.854	0.855
High Lodge ↔ Beeches Pit	<b>0.012</b>	0.077	0.125	0.155	<b>0.009</b>	0.064	0.093	0.318
Beeches Pit ↔ Elveden	0.937	0.880	0.958	0.976	0.687	0.969	1.308	1.212
Elveden ↔ Hitchin	1.000	1.000	1.070	1.117	1.000	1.000	1.450	1.250
Hitchin ↔ Hoxne	0.989	0.978	1.072	1.118	0.873	0.987	2.214	1.251
Hoxne ↔ East Burnham	0.952	0.914	1.035	1.053	0.393	0.940	2.087	1.235
East Burnham ↔ Barnfield Pit	0.812	0.978	1.348	1.062	0.930	0.981	1.907	1.282
Barnfield Pit ↔ Barnham	0.600	0.960	1.095	1.033	0.970	0.959	1.207	1.322
Barnham ↔ Cagny-la-Garenne	0.946	0.994	1.231	1.044	0.994	0.993	1.249	1.332
Cagny-la-Garenne ↔ Foxhall Road	0.908	0.990	2.473	1.265	0.983	0.989	1.006	1.006
Foxhall Road ↔ St Pierre-les-Elbeuf	0.149	0.866	1.609	1.114	0.773	0.862	0.780	0.865

St Pierre-les-Elbeuf ↔ Stoke Newington	<b>0.031</b>	<b>0.024</b>	0.384	0.349	0.124	0.537	0.279	0.600
Stoke Newington ↔ Wolvercote	1.000	1.000	1.017	1.048	1.000	-	1.356	-
Wolvercote ↔ Dovercourt	1.000	1.000	1.073	1.124	1.000	-	1.168	-
Dovercourt ↔ Broom	0.835	0.8729	0.914	0.904	0.762	-	0.962	-
Broom ↔ Cagny-l'EpINETTE	0.926	0.882	0.947	0.945	0.899	-	1.121	-
Cagny-l'EpINETTE ↔ Plachy-Buyon	0.685	0.914	1.142	1.051	0.933	-	1.039	-
Plachy-Buyon ↔ Revelles	0.621	0.856	0.915	0.976	-	-	-	-
Revelles ↔ Harnham	0.499	0.738	0.611	0.814	-	-	-	-
Harnham ↔ Cuxton	0.608	0.834	0.714	0.846	-	-	-	-
Cuxton ↔ Gentelles	0.565	0.763	0.656	0.774	-	-	-	-

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**Supplementary Table 6:** Results for scenario 4 across all model and data conditions. 'na' indicates the model could not be used as all dates from the relevant site sample were the same. Result in **bold** indicate significance when  $\alpha = 0.05$ .

Investigated Temporal Gap (Between Acheulean Sites)	Forwards Model				Reverse Model			
	<i>P</i> (Central Age)		<i>P</i> (Resampling)		<i>P</i> (Central Age)		<i>P</i> (Resampling)	
	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10
Barranc de la Boella ↔ Cueva Negra	-	-	-	-	0.876	0.823	0.920	0.922
Cueva Negra ↔ Notarchirico	-	-	-	-	0.276	0.163	0.279	0.228
Notarchirico ↔ Loreto	-	-	-	-	0.495	0.312	0.529	0.466
Loreto ↔ Valle Giumentina	-	-	-	-	0.775	0.624	0.775	0.732
Valle Giumentina ↔ Aldène cave	0.854	-	0.877	-	0.467	0.191	0.493	0.421
Aldène cave ↔ Fontana Ranuccio	0.951	-	0.951	-	0.615	0.393	0.709	0.650
Fontana Ranuccio ↔ Sima de los Huesos	0.845	-	0.845	-	0.214	0.205	0.587	0.693
Sima de los Huesos ↔ Castle di Guido	0.878	-	0.880	-	0.143	0.358	1.019	1.311
Castle di Guido ↔ Caune de l'Arago	0.904	-	0.904	-	<b>0.007</b>	0.434	1.521	1.941
Caune de l'Arago ↔ Atapuerca Galería-Glla	1.000	1.000	1.076	1.125	1.000	1.000	2.531	2.858
Atapuerca Galería-Glla ↔ Gran Dolina TD10	1.000	1.000	1.251	1.036	1.000	1.000	2.424	2.458
Gran Dolina TD10 ↔ Gruta da Aroeira	1.000	1.000	1.750	1.107	1.000	1.000	2.420	1.650
Gruta da Aroeira ↔ Terra Amata	0.936	0.993	1.953	1.166	0.909	0.984	2.081	1.357
Terra Amata ↔ Malagrotta	1.000	1.000	2.129	1.200	1.000	1.000	1.961	1.357
Malagrotta ↔ Lademagne	0.130	0.974	1.986	1.345	0.855	0.978	1.807	1.217
Lademagne ↔ Solana del Zamborino	0.081	0.892	1.407	1.283	0.643	0.924	1.661	1.211
Solana del Zamborino ↔ Isoletta	0.792	0.954	1.916	2.089	0.965	0.984	1.043	1.103
Isoletta ↔ La Cansaladeta	0.660	0.821	1.861	2.140	0.941	0.957	0.978	1.090
La Cansaladeta ↔ Aridos 2	0.761	0.582	1.789	1.976	0.938	0.954	1.157	1.114
Aridos 2 ↔ Ambrona	0.656	0.489	1.507	1.663	0.915	0.905	1.076	1.100
Ambrona ↔ Torre in Pietra	0.171	0.158	0.829	0.919	0.672	0.605	0.972	1.019
Torre in Pietra ↔ Vale do Forno	0.485	0.397	0.509	0.726	0.706	0.675	1.121	1.255
Vale do Forno ↔ Rodafnidia	0.783	0.716	0.793	0.853	0.778	0.780	1.291	1.529
Rodafnidia ↔ Cien Fanegas	0.610	0.503	1.039	1.260	0.392	0.490	0.666	0.826
Cien Fanegas ↔ El Sotillo	0.856	0.803	1.104	1.193	0.604	0.757	1.079	1.202

El Sotillo ↔ Cueva del Ángel	0.802	0.786	1.054	1.090	0.331	0.723	1.225	1.344
Cueva del Ángel ↔ Orgnac 3	0.974	0.979	1.287	1.353	0.939	0.983	1.432	1.120
Orgnac 3 ↔ Valdocarros	0.887	0.917	1.383	1.252	0.672	0.917	1.333	1.205
Valdocarros ↔ Atapuerca Galería-GIIb	0.862	0.947	1.229	1.196	0.802	-	1.634	-
Atapuerca Galería-GIIb ↔ Pinedo	1.000	1.000	1.476	1.210	1.000	-	1.645	-
Pinedo ↔ Vale do Forno	0.400	0.853	1.230	1.121	0.649	-	1.469	-
Vale do Forno ↔ Barbas 1	0.952	0.986	1.674	1.336	0.987	-	1.262	-
Barbas 1 ↔ Prince Cave	0.600	0.877	1.457	1.400	0.870	-	1.154	-
Prince Cave ↔ Tera River	0.598	0.803	1.299	1.333	-	-	-	-
Tera River ↔ Porto Maior	0.742	0.801	1.146	1.216	-	-	-	-
Porto Maior ↔ Lazaret Cave	0.189	0.260	0.605	0.609	-	-	-	-
Lazaret Cave ↔ Arbo	0.916	0.908	0.942	0.946	-	-	-	-

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**Supplementary Table 7:** Results for scenario 5 across all model and data conditions. 'na' indicates the model could not be used as all dates from the relevant site sample were the same. Result in **bold** indicate significance when  $\alpha = 0.05$ .

Investigated Temporal Gap (Between Acheulean Sites)	Forwards Model				Reverse Model			
	<i>P</i> (Central Age)		<i>P</i> (Resampling)		<i>P</i> (Central Age)		<i>P</i> (Resampling)	
	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10	<i>k</i> = 5	<i>k</i> = 10
Barranc de la Boella ↔ Cueva Negra	-	-	-	-	0.862	0.819	0.926	0.913
Cueva Negra ↔ Sima de los Huesos	-	-	-	-	<b>0.002</b>	<b>0.041</b>	<b>0.026</b>	<b>0.047</b>
Sima de los Huesos ↔ Atapuerca Galería-GIIa	-	-	-	-	0.249	0.777	1.044	1.011
Atapuerca Galería-GIIa ↔ Gran Dolina TD10	-	-	-	-	1.000	1.000	1.958	1.227
Gran Dolina TD10 ↔ Gruta da Aroeira	1.000	-	1.029	-	1.000	1.000	1.707	1.170
Gruta da Aroeira ↔ Solana del Zamborino	0.982	-	1.012	-	0.865	0.896	1.105	1.092
Solana del Zamborino ↔ La Cansladeta	0.881	-	1.438	-	0.951	0.936	0.972	0.971
La Cansladeta ↔ Aridos 2	0.715	-	1.544	-	0.962	0.954	0.988	0.988
Aridos 2 ↔ Ambrona	0.671	-	1.369	-	0.923	0.923	0.935	0.935
Ambrona ↔ Vale do Forno	0.208	0.914	0.568	0.946	0.458	0.529	0.551	0.583
Vale do Forno ↔ Cien Fanegas	0.402	0.930	0.550	0.935	0.343	0.705	0.573	0.776
Cien Fanegas ↔ El Sotillo	0.838	0.849	0.846	0.868	0.559	-	1.051	-
El Sotillo ↔ Cueva del Ángel	0.855	0.774	0.875	0.866	0.583	-	1.229	-
Cueva del Ángel ↔ Valdocarros	0.926	0.887	1.026	1.066	0.815	-	1.119	-
Valdocarros ↔ Atapuerca Galería-GIIb	0.935	0.944	1.106	1.090	0.887	-	1.244	-
Atapuerca Galería-GIIb ↔ Pinedo	1.000	1.000	1.300	1.128	1.000	-	1.134	-
Pinedo ↔ Vale do Forno	0.661	0.880	1.098	1.028	-	-	-	-
Vale do Forno ↔ Tera River	0.443	0.841	1.081	1.018	-	-	-	-
Tera River ↔ Porto Maior	0.717	0.931	0.971	1.007	-	-	-	-
Porto Maior ↔ Arbo	0.269	0.582	0.488	0.653	-	-	-	-