SUPPLEMENTARY MATERIALS

for

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1. Introduction

We summarize here in tabular form reduced data used in this study. Our purposes are to enable independent confirmation of data from referenced sources, facilitate independent replication of all results of this study, and support further independent analysis of the ACO. We also summarize measurements on cycle coherency across drill sites and the geophysical properties of drill sites used to construct regressions against latency in the main paper.

2. Tables

Table S1. Timing of ACO peaks at indicated drill sites, ~21-9 Kyb1950.

ACO cycle #	ACO cycle label	Law Dome	Talos Dome	Siple Dome	Dome Fuji	James Ross Island	EPICA Dronning Maud Land	Dome C	Dome B	Byrd Dome	Taylor Dome	Vostok
114	79		20197				20630			19760		20197
113	78	20960	20035	20480			20390		20415	19640		20035
112	**77c**	20600	19953	20420					20195	19460		**19953**
111	**77b**	20480	19782	20120			20150	21109	19965	19340		**19782**
110	**77a**	20180	19443	20000			19990	20823	19855	19100		**19443**
109	77	19940	19362	19700			19750	20541	19640	18920		19362
108	76a	19640	18950	19520			19430	20118	19308	18680		18950
107	76	19580	18870	19160			19270	19699	19090	18500		18870
106	75a	19280	18615	18920			19030	19318	18765	18200		18615
105	75	19040	18365	18860			18790	19183	18545	17960		18365
104	74b	18860	18283				18630	18907		17720		18283
103	74a	18740	18283	18560			18310	18449	18125	17540		17949
102	74	18500	17868	18320			18230	18038	17908	17360		17868
101	73	18020	17544				17990	17631	17590	17060		17544
100	72	17780	17298				17750	17499	17275	16940		17298
99	71b	17600	17139				17590		16955	16640		17139
98	71a	17180	16729				17350	17233	16730	16280		16729
97	71	16880	16502				16950	16986	16495	16100		16502
96	70a	16640	16201				16710	16627	16405	15920		16201
95	70	16520	16057				16550	16516	16165	15620		16057
94	69	16280	15777				16150	16300	15895	15380		15777

93	68	16040	15639				15990	16096	15625	15260		15639
92	67	15860	15366				15830	15894	15380	15020		15366
91	66b	15740	15234				15590	15797		14900		15234
90	66a	15560	15032				15510	15612	15290	14780		15032
89	66	15380	14968				15350	15427	15120	14600		14968
88	65a	15140	14775					15097	14965	14420	14670	14775
87	65	15080	14713				15190	14850	14810	14300	14540	14713
86	64	14900	14466				14950	14493	14855	14000	14490	14466
85	63	14420	13938				14310	14273	14280	13640	13690	13938
84	62	14300	13828				14150	14131	14070	13400	13560	13828
83	61b	14000	13600			14089	13910	13979	13855	13160	13430	13600
82	61a	13940	13355			13831		13742	13560	12980	13320	13355
81	61	13820	13296			13691	13670	13494	13415	12860	13230	13296
80	60b	13640	13116			13403	13430	13249	13185	12680	13130	13116
79	60a	13520	12934			13225		13170	13115	12380	12970	12934
78	60	13400	12815			13129	13190	13005	12965	12260	12820	12815
77	59a	13160	12507			13039		12840	12820	12080	12530	12507
76	59	12446	12920			12954	13030	12673	12665	11900	12430	12446
75	58a	12202	12860			12901		12427	12440	11780	12270	12202
74	58	12144	12620			12825	12710	12274	12295	11720	12190	12144
73	57	12680	11973	12440		12751	12470	12204	12155	11600	12100	11973
72	56c	12560	11805	12260		12496	12235	12015	12020	11300	11770	11805
71	56b		11642	11960		12366				11180	11630	11642
70	56a		11485	11900		12145	11990			11060	11480	11485
69	56	12140	11334	11720	11690	12051	11910	11631	11575	10940	11420	11334
68	55	11900	11191	11660	11580	11841	11590	11465	11335	10700	11320	11191
67	54a	11720	11053	11540	11240	11727		11302	11165	10640	11220	11053
66	54	11660	10957	11420	10980	11649	11350	11192	10985	10460	11020	10957
65	53	11540	10764	11300	10800	11530	11190	11024	10805	10280	10830	10764
64	52a	11060	10415	11060	10660	11253	10790	10802	10565	9980	10530	10564
63	52	10940	10218	10760	10450	10997	10630	10479	10335	9920	10280	10415
62	51	10700	10027	10580	10360	10853	10390	10369	10155	9620	10030	10218
61	50	10460	9905	10400	10190	10757	10230	10259	10045	9500	9880	10027
60	49	10280	9635	10160	10100	10472	9990	10047	9743	9200	9680	9881
59	48		9494	10040	10010	10210	9910	9884		9080	9580	9635
58	47a	9920	9252	9920	9820	10093	9670	9669	9441	9080	9320	9494
57	47	9740	9058	9800	9570	9870	9510	9560	9263		9180	9252

Shown are the times of ACO peaks for filtered and labeled data used in this study. Numerical filtering algorithms are given in [1] and summarized in the caption to Text-Figure 3 in the form of start times and bin widths used for averaging. ACO cycle numbers and names (alphanumeric labels) are based on original nomenclature for Vostok data on the GT4 glaciological terminology [1]. Empty cells signify absence of data, usually because the sample frequency of older data was insufficient to resolve centennial-scale climate cycles (Taylor Dome, James Ross Island) or in some cases because a cycle that appeared in the Vostok record was not matched at the drill site showing the blank. Black, red and blue font in the Vostok column correspond to definitions 1, 2 and 3 of the ACO, respectively [11]. The data in this table reproduce Text-Figure 3a in the main paper.

28 **Table S2. Timing of peak ACO cycles at different Antarctic drill sites, ~4-0 Kyb1950**

ACO cycle #	ACO cycle name	Taylor Dome	Dome B	Dome C	Dome Fuji	James Ross Island	Vostok	mean latency for five signpost cycles
29	23	3726	3612	3920	3960	3579	3870	92.80
28	22	3527	3520	3822	3470	3442	3646	75.40
27	21	3376	3368	3672	3320	3352	3422	8.20
26	**20a**	3281	3261	3474	3170	3264	3334	38.20
25	20	3175	3157	3375	2930	3171	3201	30.80
24	19	3027	3069	3129	2780	3035	3070	38.20
23	18	2820	2965	2870	2580	2946	2847	-4.40
22	17	2723	2864	2818	2510	2858	2670	-63.40
21	**16a**	2628	2716	2678	2390	2721	2628	-12.80
20	16	2575	2660	2625	2270	2676	2501	-55.00
19	**15a**	2471	2551	2481	2160	2586	2418	-19.80
18	15	2216	2364	2424	2000	2497	2291	-1.20
17	**14a**	2168	2162	2327	1910	2226	2129	-15.40
16	14	2025	2011	2271	1750	2093	2049	15.00
15	13	1927	1913	2078	1600	2003	1931	19.60
14	12	1827	1710	1922	1440	1822	1692	-57.60
13	11	1623	1618	1771	1300	1687	1573	-27.80
12	10	1529	1511	1479	1200	1552	1461	16.00
11	9	1277	1360	1273	1100	1462	1356	35.60
10	8	1177	1310	1125	1010	1241	1176	12.80
9	7	1081	1161	1026	920	1102	1074	14.80
8	**6a**	973	1069	976	830	967	976	32.20
7	6	873	909	831	680	921	912	53.20
6	5	630	865	672	630	831	788	62.80
5	4	527	712	522	540	700	637	27.50
4	**3a**	426	610	425	440	608	469	-26.83
3	3	379	562	377	330	472	397	-1.83
2	2	223	361	272	200	337	304	29.33
1	1	72	212	78	90	202	190	62.00

29 As in Table S1, except data are for the most recent Holocene. The last column contains the
30 average latency associated with ACO cycle peaks as shown in Text-Figure 18**f**. The data in this
31 table reproduce peaks in Text-Figure 17 of the main paper.

Table S3. Coherency Indices for matches between ACOs in the Vostok record 1:1 matches with homologs in other Antarctic sites

1. Time period and drill sites	2. # Vostok Comparisons (*n*)	3. # matches with other drill site(s)	4. Percent matches	5. # other drill site comparisons	6. # matches with Vostok (*n*)	7. Percent matches
70-63 Ky b1950	**22**	**21**	**95.5**	**21**	**21**	**100**
Dome C	22	21	95.5	21	21	100
21-9 Kyb1950	**497**	**486**	**97.8**	**495**	**464**	**93.7**
Law Dome	60	56	93.3	58	55	94.8
Talos Dome	59	58	98.3	59	55	93.2
Siple Dome	60	56	93.3	64	58	90.6
Dome Fuji	13	13	100	13	13	100
James Ross	31	31	100	34	30	88.2
Island EDML	58	58	100	57	55	96.5
Dome C	61	61	100	57	55	96.5
Dome B	60	60	100	58	55	94.8
Byrd	60	58	96.7	61	55	90.2
Taylor Dome	35	35	100	34	33	97.1
4-0 Ky b1950	**116**	**116**	**100**	**117**	**116**	**99.2**
James Ross Isl.	29	29	100	29	29	100
Dome Fuji	29	29	100	29	29	100
Dome C	29	29	100	30	29	96.7
Taylor Dome	29	29	100	29	29	100
Totals	**635**	**623**	**98.1**	**633**	**601**	**94.9**

Summary of 1:1 matching between ACO cycles at Vostok at ten other Antarctic drill sites (columns 2-4) and, conversely, 1:1 matching between ACO cycles at other Antarctic drill sites and Vostok (columns 5-7). Shown are the summed ACO cycle matches for each of three time periods examined (bold red font) and the matches by individual sites (unbolded black font). Unweighted sums/averages in bold underlined red font across the bottom (Totals) summarize the analysis, illustrating that 98.1% of identified Vostok ACO cycles match with homologs at other drill sites while 94.9% ACO climate cycles from other drill sites match identified ACO cycles in the Vostok record. The overall Coherency Index is the mean of these two means, or 96.5%. These data were measured from the graphs in Text-Figure 6 [1] (70-63 Kyb1950), Text-Figure 4 (21-9 Kyb1950) and Text-Figure 17 (4-0 Kyb1950).

Table S4. Geophysical properties of drill sites.

Antarctic drill site	Distance from ocean (km)	Site temp. (°C)	Snow/ice accum. (cm eq./yr)	Site elevation (m)
Law Dome	90	-22.0	70	1,370
Siple Dome	450	-24.5	12.4	605
Dome B	1020	-57.5	3.8	3650
Byrd	620	-28.0	11.0	1530
Talos Dome	250	-41.5	8.5	2315
EDML	757	-44.6	6.4	2892
EPICA Dome C	870	-53.5	3.4	3240
Taylor Dome	120	-43.0	6.0	2365
Dome Fuji	924	-57.3	2.5	3810
James Ross Island	25	-13.8	62.0	1524
Vostok	1,260	-55.5	2.3	3488

These data were used as independent variables in Text-Figures 5, 11, and 15. Column 1 identifies Antarctic drill stations evaluated in this study. Columns 2-5 describe geophysical site properties obtained from [3] and [4] as supplemented and refined for site temperature and accumulation [5-10] site elevation [11], and distance from the ocean, based in part on measurements from the map of Antarctic drill sites created using software from the National Snow and Ice Data Center (NSIDC) [12]. Additional sources used for specific Antarctic sites are: **TALDICE** [13] except for distance from the ocean and temperature, which are from [14]. Distance from ocean is measured from the drill site to the edge of the "permanent" (summer) ice shelf. Site temperature is taken at a firn depth of 15 m. **DF,** elevation from [15], who cite [16] as the original source. Accumulation ranges from 0.5 (glacial) to 3.5 cm eq./yr. We used the value 2.5 [17] for the mean of 0-5 Kybp, compared with empirical measurements from present of 4.0-5.2 cm eq./yr. Distance to the ocean was calculated from longitude and latitudes of Dome Fuji and the Soysa station using an online calculator [18], **JRI** [19, 20]; **EDML**, [21] (Table 1, p. 1470), except for distance to ocean, which was obtained from longitude and latitude using the aforementioned online distance calculator. NA, not applicable. Elevation data are potentially variable. TALDICE, for example, currently at an elevation 2,315 m, is estimated to have changed elevation by ±170 m owing to isostatic rebound from historical changes in ice volume [13], while estimated accumulation rates at the same site vary from 2.5-10 cm/yr over the last deglaciation [3] (Figure 7). Elevations at other sites may be presumed to have changed similarly, introducing a small variance that may weakly affect regressions. Abbreviations are as in the main text.

3. References

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