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Aeolian dust and diatoms at Roosevelt Island (Ross Sea, Antarctica) over the last 2 millennia reveal the local expression of climate changes and the history of the Ross Sea polynya

Serena Lagorio et al.

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FIGURE S1

Mean dust fluxes (bars) calculated for different East Antarctic sites. Data are referred to particles smaller than 5 micron in diameter and are calculated over the entire Holocene (from Delmonte et al., 2020 and references therein). The altitude of each drilling site is also reported (crosses). The Late Holocene dust fluxes for RICE (this work) and WAIS (Koffman et al., 2014) are indicated by ellipses.

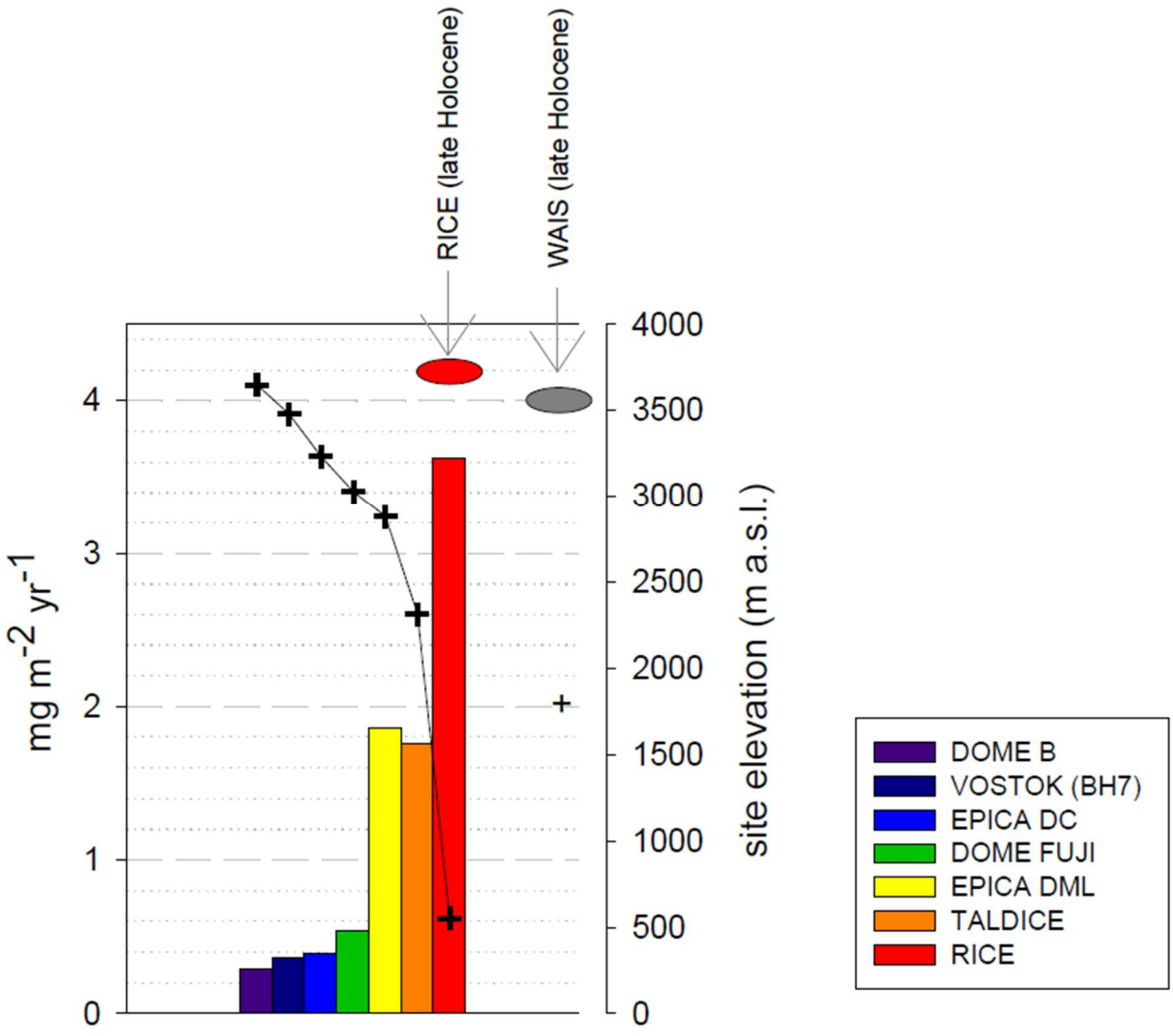


FIGURE S2

Fine Particle Percent (FPP, %) vs Coarse Particle Percent (CPP, %) calculated according to Delmonte et al., (2005) for East Antarctic plateau sites (Dome B, Dome C) and for RICE. Small 'x' symbols correspond to Holocene data from Dome B (pink) and Dome C (red) while large 'X' symbols correspond to data for the same sites but from the last 2700 years. Similarly, open and filled circles represent RICE data for the Holocene and the last 2000 years, respectively.

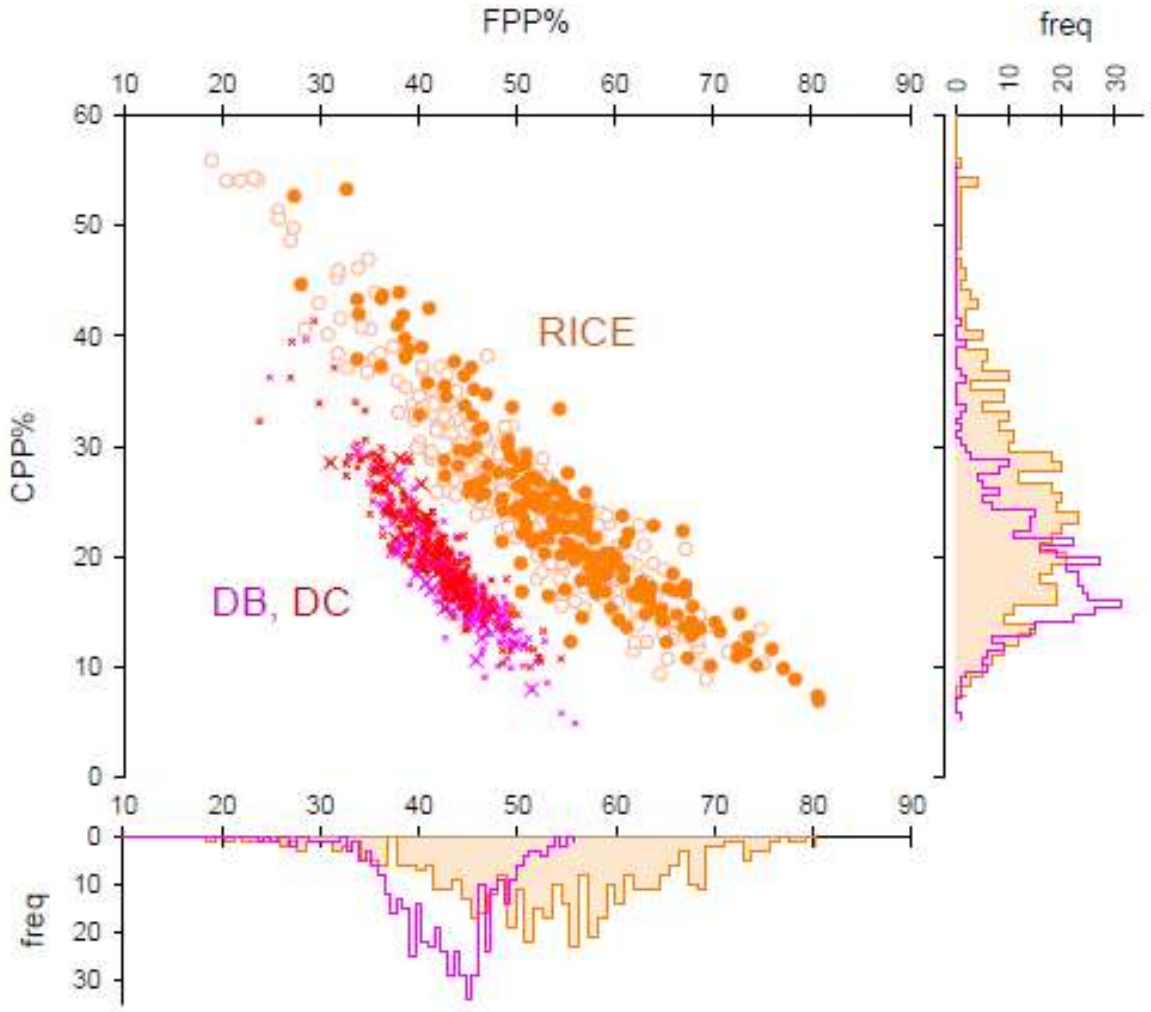


FIGURE S3

Plots (a) and (b) show the lack of correlation between snow accumulation rate and dust concentration. Plot (c) shows the lack of correlation between snow accumulation rate and the Fine Particle Percentage (FPP%) while plots (d) and (e) display dust concentration data (< 5 µm, ppb, log scale) and flux (mg m-2 yr-1) versus FPP%. The Pearson Product Moment Correlation confirms that the two variables are moderately correlated and tend to increase together (plot d: correlation coefficient 0.335, P_value=2.45 × 10^{-6}; plot e: correlation coefficient 0.311, P_value=1.29 × 10^{-5}, n. samples=189).

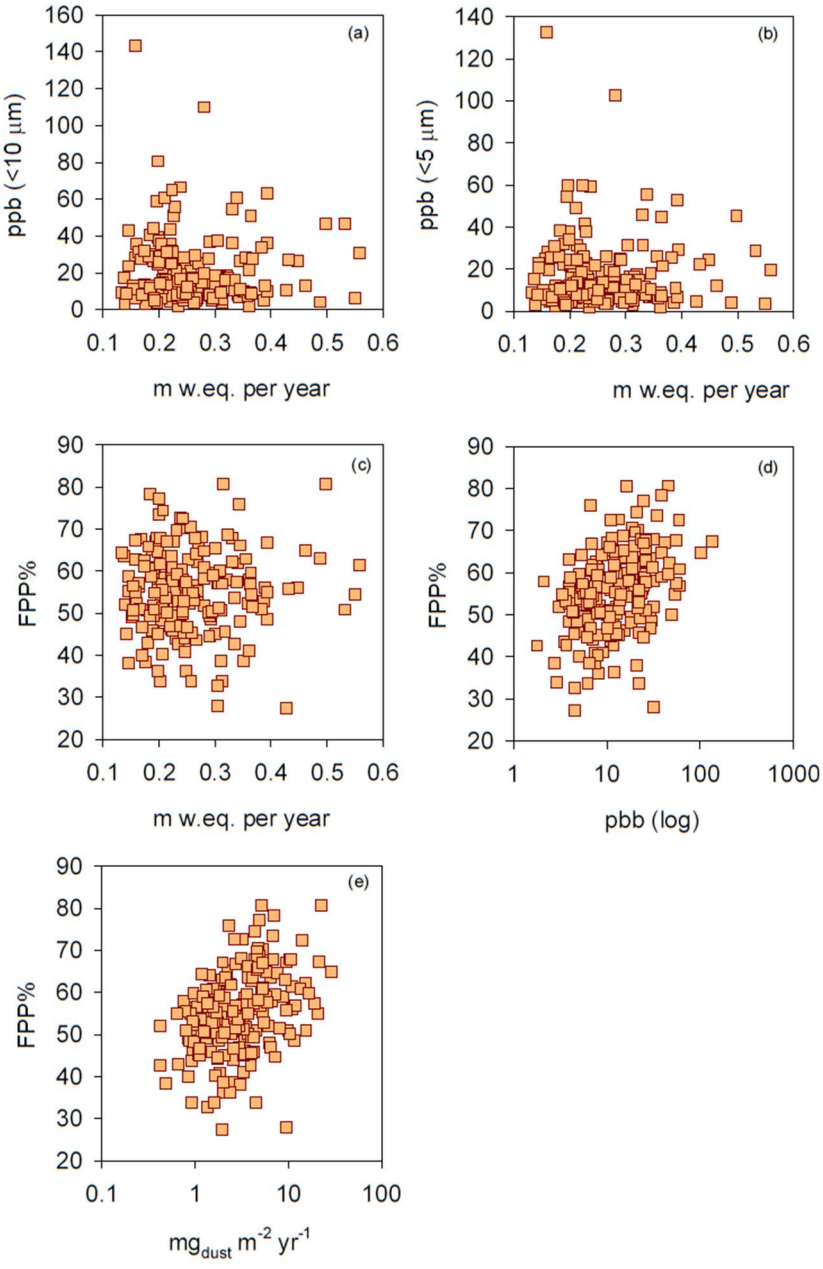


FIGURE S4

Boxplots of the logarithm of dust concentration and flux for the three climatic periods discussed in the text.

Statistical t-tests performed on the concentrations (log) and fluxes (log) from the 550-1500 CE and the 1500-1900 CE periods highlighted that differences between these two periods are statistically significant.

T-test statistics were performed on dust concentrations (log_ppb) and dust flux (log_mg*m^-2 per yr). Both series passed the normality and the equal variance test. P value <0.001 (t = 5.205 with 122 degrees of freedom) was obtained for Log_ppb. Also, P-value <0.001(t = 6.103 with 122 degrees of freedom) was obtained for the logarithm of dust flux. This means that the difference in the mean values of the two series between 550-1500 CE and 1500-1900 CE is greater than would be expected by chance, hence there is a statistically significant difference between the two groups.

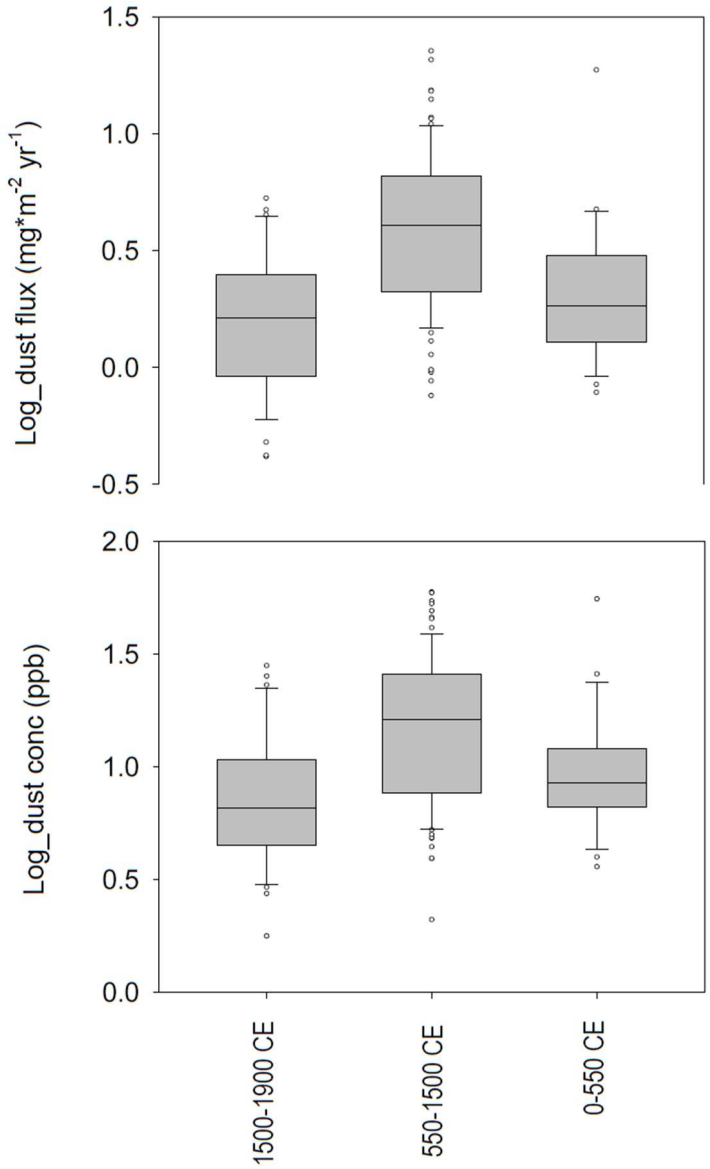


FIGURE S5

Diatom data from RICE. (a) 50-years running average of RICE δD (‰VSMOW), (b) diatom valves (entire) per liter per year, (c) Fragilariopsis spp. Valves (entire) per liter per, (d) Valve fragments per liter per year, (e) Valves per liter.

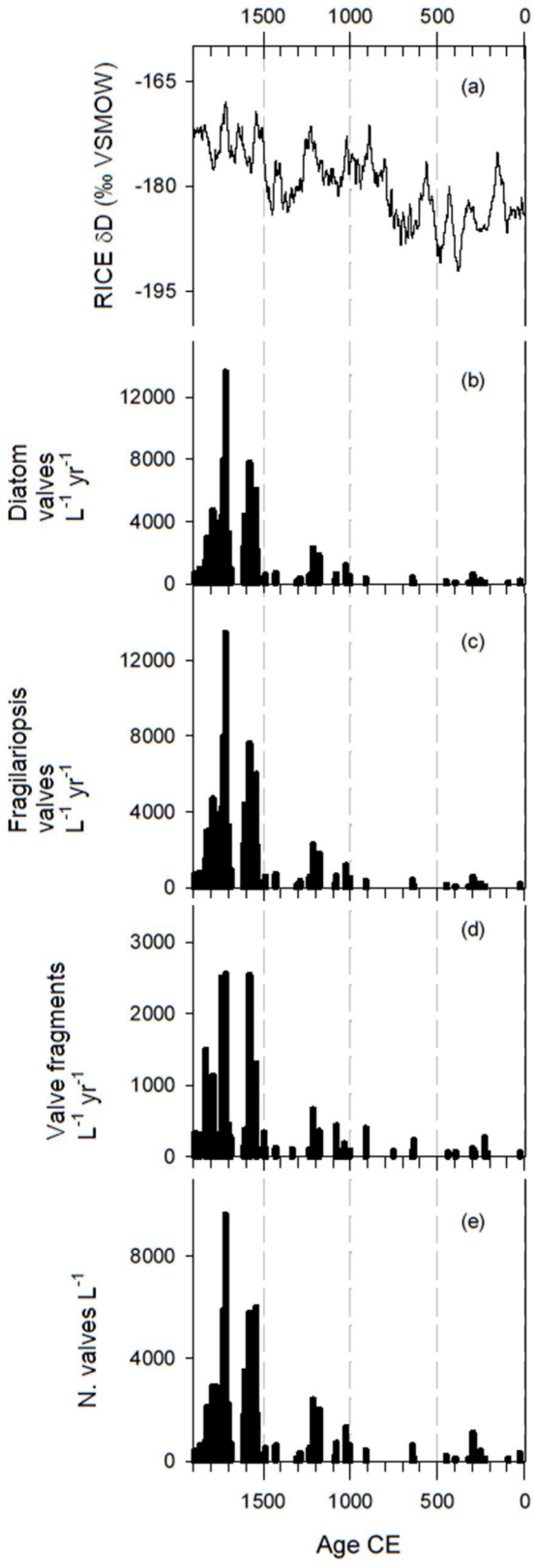
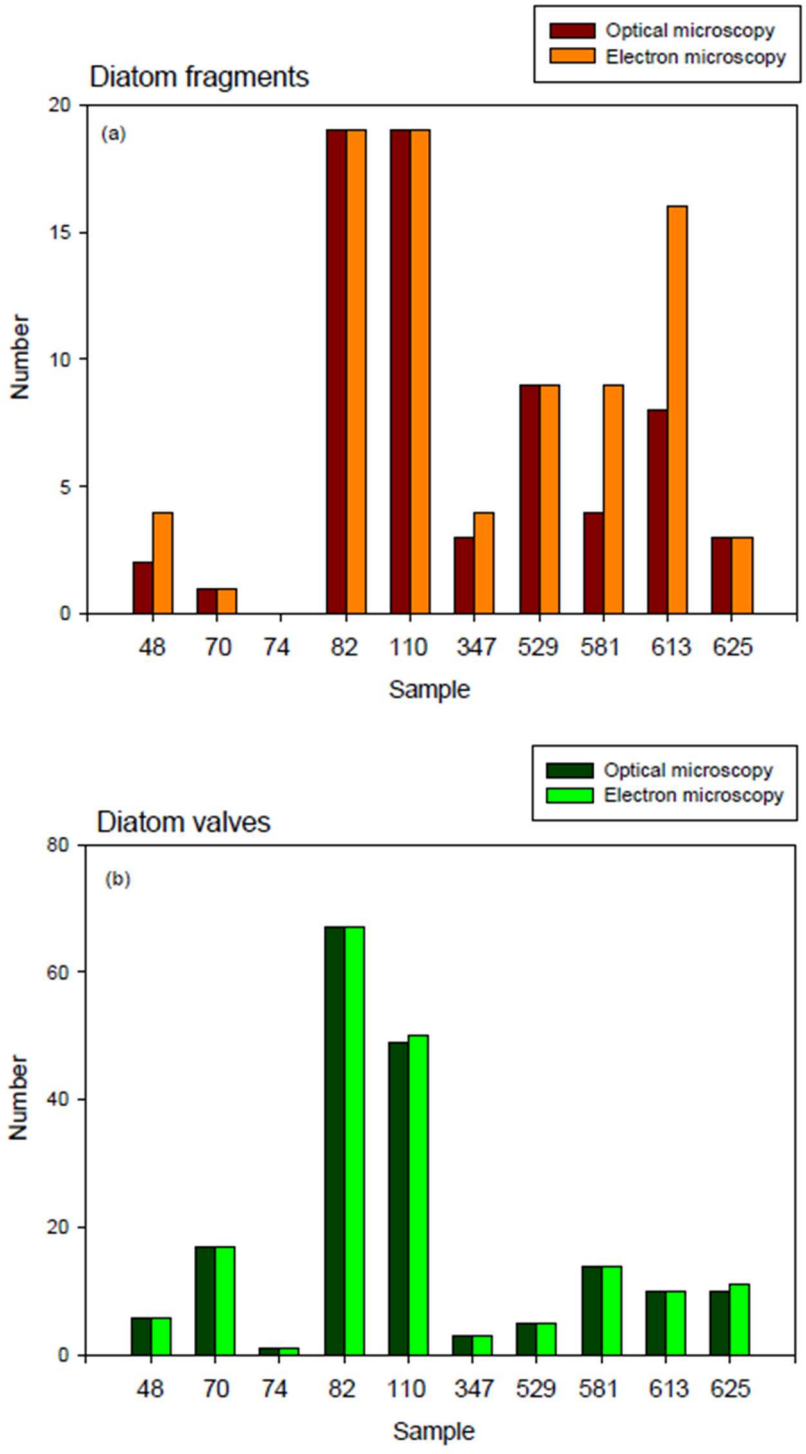


FIGURE S6

Number of diatom fragments (a) and entire diatom valves (b) identified in a set of 10 different samples along the RICE ice core using two independent microscopic techniques: optical microscopy (a: dark orange, b: dark green) and Scanning Electron Microscopy (a: light orange, b: light green). Sample number (x-axis) corresponds to the approximate depth of the sample. For this comparison, the age of samples span the whole Holocene.



References:

Delmonte, Barbara, et al. "Ice core evidence for secular variability and 200-year dipolar oscillations in atmospheric circulation over East Antarctica during the Holocene." Climate dynamics 24 (2005): 641-654.

Delmonte, Barbara, et al. "Holocene dust in East Antarctica: Provenance and variability in time and space." *The Holocene* 30.4 (2020): 546-558.

Koffman, Bess G., et al. "Centennial-scale variability of the Southern Hemisphere westerly wind belt in the eastern Pacific over the past two millennia." *Climate of the Past* 10.3 (2014): 1125-1144.

Table S1

Aeolian dust and diatoms at Roosevelt Island (Ross Sea, Antarctica) over the last two millennia reveal the local expression of climate changes and the history of the Ross Sea polynya.

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col 1: Age dust sample (regularly reinterpolated)

col 2: Dust concentration (ppb) _ particles <5 micron

col 3: Dust grain size (FPP, %)

Age	[ppb]	FPP%
1890.2	26.5	50.7
1885.2	24.2	50.6
1880.2	21.8	50.4
1875.2	19.5	50.2
1870.2	17.1	50.0
1865.2	14.8	49.8
1860.2	12.5	49.6
1855.2	10.1	49.4
1850.2	7.8	49.2
1845.2	5.5	49.0
1840.2	5.7	48.9
1835.2	5.9	48.7
1830.2	6.1	48.6
1825.2	5.7	53.3
1820.2	8.0	52.4
1815.2	6.4	49.9
1810.2	10.0	55.1
1805.2	15.4	62.0
1800.2	20.7	69.0
1795.2	13.1	59.7
1790.2	13.4	54.8
1785.2	18.6	57.2
1780.2	10.6	50.7
1775.2	4.4	45.0
1770.2	3.7	46.1
1765.2	4.2	50.4
1760.2	4.6	54.6
1755.2	5.8	54.6
1750.2	7.5	51.5
1745.2	4.5	44.3
1740.2	5.2	52.0
1735.2	8.4	51.9
1730.2	11.6	48.8
1725.2	9.3	41.8

1720.2	5.2	36.7
1715.2	3.7	38.4
1710.2	5.4	48.4
1705.2	7.2	58.4
1700.2	4.6	47.0
1695.2	4.5	47.0
1690.2	7.2	60.3
1685.2	20.3	59.5
1680.2	12.3	51.6
1675.2	17.1	67.5
1670.2	17.4	69.8
1665.2	16.2	68.9
1660.2	15.1	68.0
1655.2	13.9	67.0
1650.2	12.7	66.1
1645.2	11.1	62.6
1640.2	7.3	45.5
1635.2	4.3	36.4
1630.2	3.6	51.4
1625.2	3.7	48.2
1620.2	4.0	40.1
1615.2	4.4	32.0
1610.2	3.4	33.6
1605.2	2.7	44.8
1600.2	5.1	50.5
1595.2	7.1	55.4
1590.2	7.0	55.8
1585.2	7.0	56.2
1580.2	7.2	56.1
1575.2	21.8	33.9
1570.2	16.9	43.2
1565.2	11.9	52.5
1560.2	7.0	61.8
1555.2	5.9	59.3
1550.2	4.9	56.7
1545.2	3.9	54.1
1540.2	3.2	51.8
1535.2	4.0	51.1
1530.2	4.8	50.4
1525.2	5.6	49.7
1520.2	6.3	48.8
1515.2	6.5	47.2
1510.2	6.8	45.7
1505.2	7.0	44.1
1500.2	7.2	42.5
1495.2	7.5	40.9

1490.2	4.9	52.2
1485.2	4.2	55.9
1480.2	4.5	54.7
1475.2	5.5	53.2
1470.2	10.3	49.8
1465.2	15.0	46.4
1460.2	46.7	65.0
1455.2	47.3	70.6
1450.2	28.1	67.6
1445.2	28.6	66.7
1440.2	39.8	65.7
1435.2	31.5	58.1
1430.2	26.5	53.5
1425.2	21.6	48.9
1420.2	16.7	44.3
1415.2	11.8	39.8
1410.2	9.0	39.6
1405.2	12.2	51.8
1400.2	11.1	51.9
1395.2	10.0	52.1
1390.2	8.8	52.2
1385.2	10.4	60.8
1380.2	13.2	67.7
1375.2	10.8	50.8
1370.2	4.9	55.0
1365.2	9.9	66.7
1360.2	8.8	67.1
1355.2	7.4	66.9
1350.2	4.5	62.5
1345.2	11.4	61.1
1340.2	29.4	67.0
1335.2	17.9	60.9
1330.2	13.3	57.3
1325.2	10.5	54.3
1320.2	7.7	51.4
1315.2	4.9	48.5
1310.2	14.1	49.2
1305.2	12.4	41.9
1300.2	9.4	37.5
1295.2	18.1	48.0
1290.2	19.8	50.7
1285.2	21.3	53.2
1280.2	22.9	55.8
1275.2	24.4	58.4
1270.2	37.1	59.0
1265.2	18.4	54.8

1260.2	10.8	54.5
1255.2	18.6	57.6
1250.2	21.4	56.9
1245.2	24.2	56.1
1240.2	24.6	57.7
1235.2	24.9	59.2
1230.2	11.9	68.2
1225.2	20.4	57.6
1220.2	24.3	60.2
1215.2	28.2	62.8
1210.2	15.7	56.4
1205.2	6.2	55.0
1200.2	11.2	67.7
1195.2	11.1	71.2
1190.2	15.2	67.2
1185.2	16.4	57.5
1180.2	7.3	46.7
1175.2	15.7	45.8
1170.2	19.1	45.5
1165.2	9.4	44.4
1160.2	15.6	47.0
1155.2	24.4	49.8
1150.2	26.9	51.6
1145.2	11.7	57.2
1140.2	7.4	56.2
1135.2	10.9	52.4
1130.2	11.6	57.4
1125.2	12.3	62.5
1120.2	10.7	54.9
1115.2	9.1	46.9
1110.2	7.4	38.9
1105.2	5.0	55.4
1100.2	8.5	60.5
1095.2	16.5	55.9
1090.2	24.5	51.4
1085.2	22.4	50.5
1080.2	7.4	55.5
1075.2	25.6	61.0
1070.2	39.7	68.3
1065.2	45.1	79.9
1060.2	36.3	61.4
1055.2	25.5	49.2
1050.2	12.5	56.9
1045.2	6.9	57.4
1040.2	7.4	53.0
1035.2	10.1	55.5

1030.2	12.9	56.4
1025.2	15.9	54.4
1020.2	30.6	69.9
1015.2	30.5	71.9
1010.2	14.8	59.1
1005.2	14.0	58.2
1000.2	23.6	60.6
995.15	43.2	62.1
990.15	32.5	49.2
985.15	21.2	40.4
980.15	22.3	49.2
975.15	23.7	56.7
970.15	25.6	61.6
965.15	21.7	71.0
960.15	17.7	78.3
955.15	27.3	60.4
950.15	29.1	53.0
945.15	23.8	54.9
940.15	18.6	56.9
935.15	13.4	58.8
930.15	8.1	60.8
925.15	9.8	62.9
920.15	11.7	65.0
915.15	13.6	67.2
910.15	15.2	67.8
905.15	16.3	65.0
900.15	27.5	64.7
895.15	48.7	67.1
890.15	53.7	61.8
885.15	53.7	55.1
880.15	58.6	56.6
875.15	56.0	59.3
870.15	51.2	62.5
865.15	46.4	65.6
860.15	41.6	68.7
855.15	36.8	71.9
850.15	32.7	69.0
845.15	29.4	59.3
840.15	26.1	49.5
835.15	24.8	46.2
830.15	25.4	49.4
825.15	25.3	53.1
820.15	24.1	57.1
815.15	21.6	59.0
810.15	19.1	60.8
805.15	16.7	62.6

800.15	16.2	65.3
795.15	18.2	69.0
790.15	20.1	72.7
785.15	20.8	73.6
780.15	20.5	72.0
775.15	20.1	70.5
770.15	23.4	67.4
765.15	30.3	62.8
760.15	37.2	58.1
755.15	44.1	53.5
750.15	46.4	50.7
745.15	35.9	52.8
740.15	25.3	54.9
735.15	14.7	57.0
730.15	12.4	56.4
725.15	11.0	55.5
720.15	9.6	54.6
715.15	8.2	53.7
710.15	6.8	52.8
705.15	6.0	53.0
700.15	5.8	54.4
695.15	5.5	55.8
690.15	7.7	47.0
685.15	8.4	49.6
680.15	8.0	58.4
675.15	10.9	62.9
670.15	10.3	61.8
665.15	6.4	56.0
660.15	8.8	57.2
655.15	11.9	59.3
650.15	15.1	61.3
645.15	18.2	63.4
640.15	21.6	61.6
635.15	25.1	59.2
630.15	17.8	56.7
625.15	8.9	54.1
620.15	15.4	55.4
615.15	24.3	57.3
610.15	24.4	58.3
605.15	22.2	59.0
600.15	20.0	59.6
595.15	17.7	60.3
590.15	15.5	61.0
585.15	13.2	61.7
580.15	11.0	62.4
575.15	8.7	63.1

570.15	6.5	63.8
565.15	5.2	62.1
560.15	5.0	57.6
555.15	4.8	53.1
550.15	4.6	48.6
545.15	4.8	45.8
540.15	6.1	46.8
535.15	7.4	47.9
530.15	8.7	48.9
525.15	10.0	50.0
520.15	11.3	51.0
515.15	12.3	52.1
510.15	10.3	52.9
505.15	8.3	53.7
500.15	6.3	54.5
495.15	4.4	55.3
490.15	5.4	52.0
485.15	7.1	47.8
480.15	8.9	43.6
475.15	10.6	39.4
470.15	11.9	36.7
465.15	11.9	38.0
460.15	11.8	39.4
455.15	11.8	40.8
450.15	11.8	42.1
445.15	10.5	46.9
440.15	8.4	53.5
435.15	7.3	56.2
430.15	7.2	55.0
425.15	7.7	53.2
420.15	8.5	51.0
415.15	9.4	48.9
410.15	10.2	46.7
405.15	10.6	44.5
400.15	9.3	42.4
395.15	8.0	40.3
390.15	8.3	41.8
385.15	8.6	43.3
380.15	8.9	44.7
375.15	9.3	46.2
370.15	9.6	47.7
365.15	9.9	49.2
360.15	10.2	50.7
355.15	10.7	50.3
350.15	11.1	49.4
345.15	11.6	48.5

340.15	12.0	47.6
335.15	15.4	47.7
330.15	26.4	50.4
325.15	37.5	53.1
320.15	48.6	55.7
315.15	51.4	57.0
310.15	40.2	56.0
305.15	29.0	54.9
300.15	17.8	53.8
295.15	6.7	52.8
290.15	6.8	53.1
285.15	6.9	53.5
280.15	7.0	53.9
275.15	7.1	54.2
270.15	7.3	54.6
265.15	7.4	54.9
260.15	7.5	55.3
255.15	7.6	55.6
250.15	7.7	56.0
245.15	7.8	56.3
240.15	7.9	56.7
235.15	7.6	58.0
230.15	7.2	59.5
225.15	6.8	60.0
220.15	6.6	56.8
215.15	6.4	53.6
210.15	9.6	54.4
205.15	13.6	56.4
200.15	16.4	58.5
195.15	13.3	60.9
190.15	10.3	63.3
185.15	8.4	62.6
180.15	7.6	59.3
175.15	6.8	56.1
170.15	6.9	54.5
165.15	7.2	53.6
160.15	7.5	52.7
155.15	7.8	51.8
150.15	8.2	50.9
145.15	8.5	50.1
140.15	8.8	49.2
135.15	9.2	48.3
130.15	9.5	47.4
125.15	9.8	46.5
120.15	10.1	45.6
115.15	11.6	46.9

110.15	14.5	51.2
105.15	17.5	55.5
100.15	20.4	59.9
95.15	23.4	64.2
90.15	24.7	67.0
85.15	18.8	62.7
80.15	12.8	58.4
75.15	9.1	53.2
70.15	7.3	47.3
65.15	5.4	41.4
60.15	5.9	43.2
55.15	7.1	47.2
50.15	8.0	50.7
45.15	7.1	51.2
40.15	6.2	51.7
35.15	5.4	52.2
30.15	4.5	52.7
25.15	3.7	53.2
20.15	11.4	59.1
15.15	19.9	65.5
10.15	21.9	67.7
5.15	20.2	67.5
0.15	18.4	67.2

Table S2

Aeolian dust and diatoms at Roosevelt Island (Ross Sea, Antarctica) over the last two millennia reveal the local expression of climate changes and the history of the Ross Sea polynya.

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col 1: Age diatom sample
col 2: Number of diatoms per liter per year
col 3: Number of Fragliariopsis diatoms per liter per year
col 4: Number of diatom fragments per liter per year

AGE CE	Diat L^-1 yr^-1	Fragilariopsis L^-1 yr^-1	Fragments L^-1 yr^-1
1893.6	656.0	656.0	328.0
1885.4	166.7	166.7	166.7
1881.4	0.0	0.0	0.0
1866.4	923.1	769.2	307.7
1840.4	0.0	0.0	0.0
1832.6	424.6	424.6	1486.2
1829.4	1523.8	1523.8	0.0
1822.4	2964.6	2964.6	705.9
1790.8	4689.1	4689.1	1131.8
1785.4	161.0	161.0	0.0
1781.3	1965.6	1965.6	0.0
1773.2	3889.1	3889.1	134.1
1749.1	165.1	165.1	0.0
1748.0	0.0	0.0	320.7
1744.3	666.7	666.7	133.3
1739.3	4333.3	4166.7	2500.0
1727.3	7978.4	7978.4	676.1
1717.4	13578.5	13437.1	2546.0
1703.3	411.5	411.5	274.3
1698.4	3209.3	3209.3	437.6
1689.3	933.3	933.3	266.7
1679.3	0.0	0.0	0.0
1612.4	2272.7	2272.7	126.3
1607.2	4366.3	4366.3	374.3
1580.4	7733.3	7600.0	2533.3
1575.4	3791.5	3791.5	1390.2
1541.7	5982.9	5982.9	1296.3
1537.0	2159.1	2159.1	119.9
1526.4	0.0	0.0	0.0
1495.0	334.3	334.3	334.3
1488.2	567.3	567.3	113.5
1429.4	682.1	682.1	113.7
1353.2	0.0	0.0	0.0
1347.2	0.0	0.0	0.0

1334.1	0.0	0.0	99.9
1315.1	0.0	0.0	0.0
1308.1	105.6	105.6	0.0
1289.2	312.5	312.5	0.0
1257.2	0.0	0.0	0.0
1234.1	527.6	527.6	105.5
1214.2	2255.6	2255.6	657.9
1192.9	512.8	512.8	102.6
1179.9	1782.5	1782.5	356.5
1157.4	0.0	0.0	0.0
1151.2	0.0	0.0	0.0
1102.9	0.0	0.0	0.0
1087.4	171.1	171.1	0.0
1080.6	604.5	604.5	431.8
1065.2	0.0	0.0	0.0
1048.2	0.0	0.0	83.3
1032.2	0.0	0.0	181.7
1024.6	1161.4	1161.4	89.3
1002.4	482.9	482.9	80.5
911.3	316.0	316.0	394.9
894.4	0.0	0.0	0.0
851.9	0.0	0.0	0.0
751.4	0.0	0.0	73.2
644.9	378.8	378.8	63.1
634.3	75.1	75.1	225.2
625.4	0.0	0.0	0.0
471.3	0.0	0.0	0.0
448.3	135.0	135.0	0.0
438.4	0.0	0.0	61.1
394.8	58.7	58.7	58.7
317.0	66.1	66.1	0.0
295.3	605.1	550.1	110.0
283.2	126.6	63.3	63.3
251.6	211.0	211.0	0.0
226.3	53.1	53.1	265.4
213.8	0.0	0.0	51.3
200.8	0.0	0.0	0.0
91.3	49.8	0.0	0.0
24.3	172.3	172.3	57.4