GSA Bulletin, https://doi.org/10.1130/B37378.1.

SUPPLEMENTARY MATERIAL

Paleomagnetic investigation of the basal Maieberg Formation (Namibia) cap carbonate sequence (635 Ma): Implications for Snowball Earth postglacial dynamics

Thales Pescarini[1], Ricardo I.F. Trindade[1], Paul F. Hoffman[2, 3], Lucy Gomes Sant'Anna[4]

[1]*Department of Geophysics, University of Sao Paulo, Sao Paulo, SP, Brazil*
[2]*Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA, USA*

[3]*School of Earth and Ocean Sciences, University of Victoria, Victoria, BC, Canada*
[4]*Brazilian Institute of Energy and Environment, University of Sao Paulo, SP, Brazil*

1. Additional rock magnetism information

With the hysteresis curves, we also obtained the ΔM (difference between the two branches of the hysteresis curve with paramagnetic correction), and its first derivative $d(\Delta M)/dB$ (Fig. S.1). This method was introduced by Jackson *et al*. (1990) and explored by Tauxe *et al*. (1996) to separate mineral phases of different coercivities in a mixture. It is worth noting that both ΔM and $d(\Delta M)/dB$ are sensitive only to remanence-bearing phases and, therefore, do not provide any information about superparamagnetic (SP) type grains. In our samples, we see clearly that these carbonates have only one ferromagnetic phase that contributes to the remanence, since both the ΔM curve and the $d(\Delta M)/dB$ curve have only a single "ramp" (Fig. S.1). This phase is interpreted as magnetite, as predicted given the saturation below 250 mT and considering the other rock magnetic observations.

FORC diagrams are very enlightening in several aspects. In non-remagnetized samples carrying the C_1 component, the diagram is typical of PSD magnetites, where we observe a peak at the origin and a dispersion in both the coercivity axis (B_c) and the interaction axis (B_u), resulting in an approximately triangular three-lobed geometry. (NA-3E, Fig. S.2.). When we analyze the FORCs of the remagnetized samples carrying the C_2 component (NA-7A and 8D, Fig. S.2.) we observe that there is a shift of the main peak to higher values in B_c. Two peaks are frequently observed, one at the origin and the other shifted in B_c, around 50 mT. This can be especially well observed in the profiles along the $B_u = 0$ axis. We interpret these observations to be consistent with a population of mostly PSD in the non-remagnetized samples and a mixture between SD and PSD magnetites grains in the remagnetized samples.

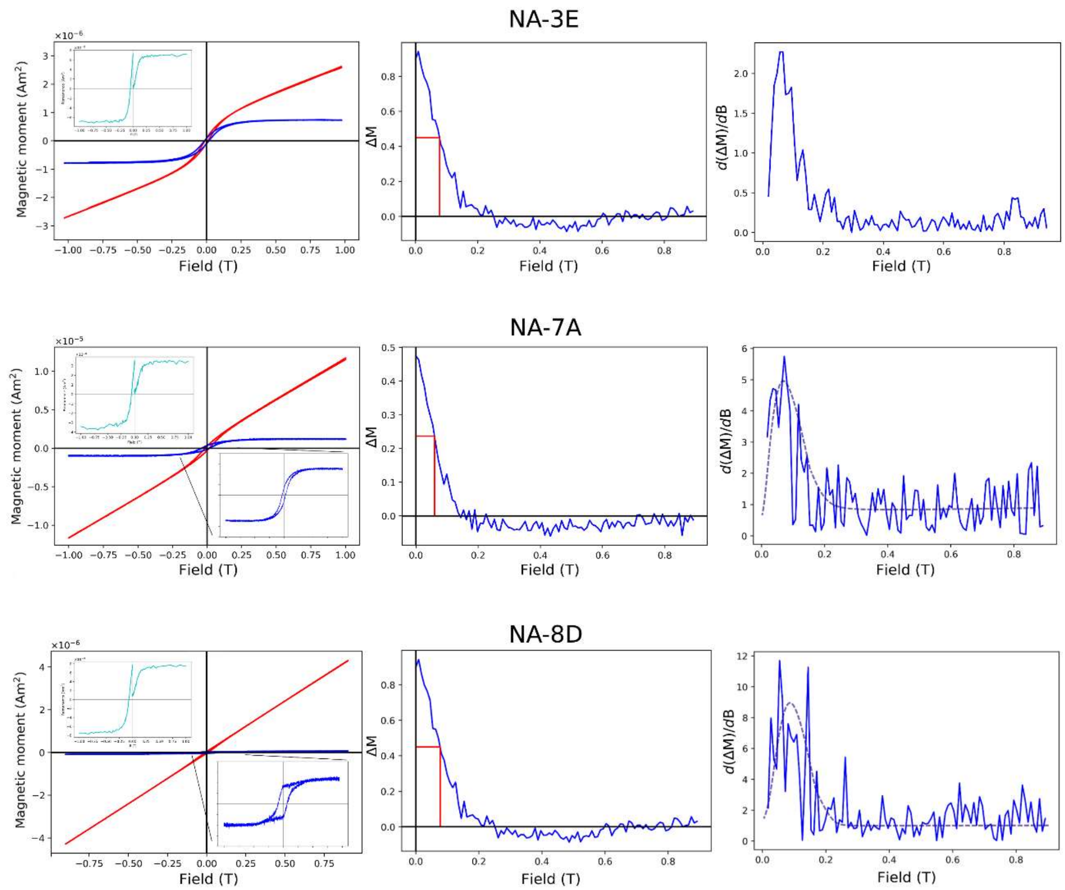

Figure S1. Representative hysteresis loops of Maieberg carbonates. The curves in red are without the application of paramagnetic correction and those in blue are with it. The ΔM curve is the difference between the two branches of the corrected hysteresis curve. The $d(\Delta M)/dB$ curve is the first derivative of the ΔM curve. The NA-3E sample has the C_1 magnetization component. Samples NA-7A and NA-8D have the C_2 magnetization component (remagnetization).

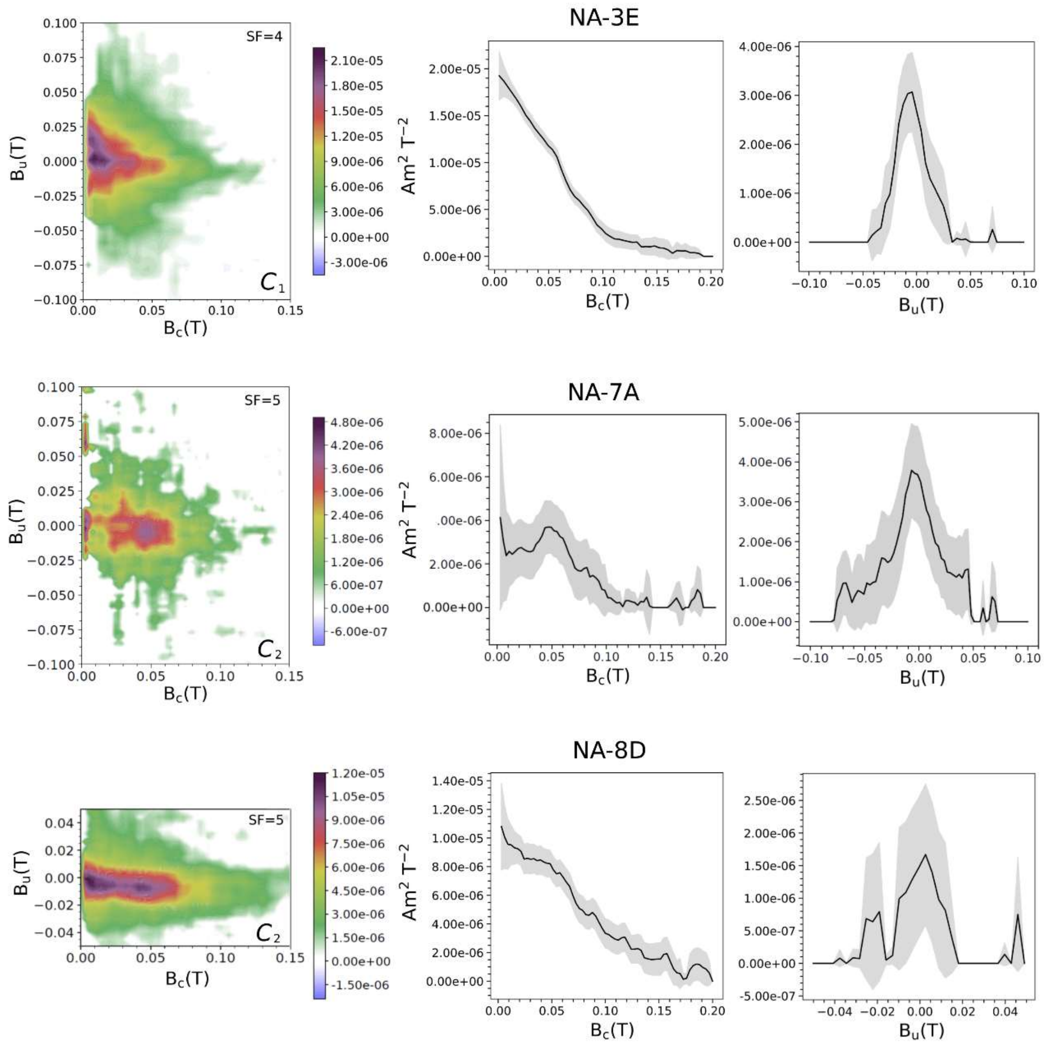

Figure S2. FORC diagrams of Maieberg carbonate samples. In the center and right are the profiles along the coercivity axis (B_c) and the interaction axis (B_u), respectively. The NA-3E sample carries the C_1 component and the NA-7A and 8D samples the C_2 component (remagnetization). Note the displacement of the main peak in the B_c axis in the remagnetized samples, indicative of a greater SD contribution in these samples. SF = Smoothing factor.

2. Bayesian reversal test

As stated in the main text, the calculated Bayes Factor (BF) for the hypothesis asserting a common mean for the two polarity sets of C_1 is 3.10. Correspondingly, the associated hypothesis probability ($p(H_A|X)$) is 76%. The plot of the directions rotated to the same polarity during the test execution is shown in Figure S.3.

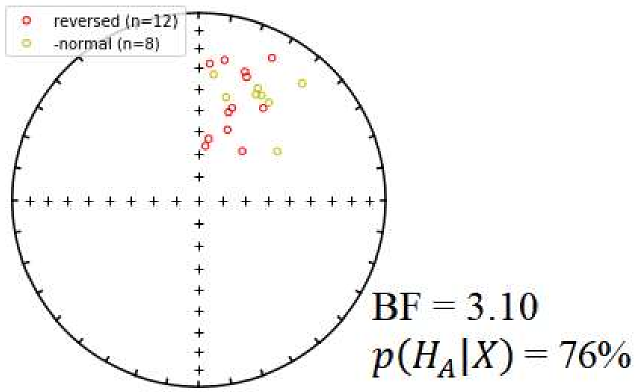

Figure S3. Bayesian reverse test of component C_1. The directions of polarity with positive inclination (here treated as "normal polarity") were rotated to their antipodes. The numerical result of the test produces a BF = 3.10 and e $p(H_A|X)$ = 76%, which corresponds to a test with positive support and a probability of 76% of the polarities presenting a common mean.

3. Individual remanence directions

Table S.1. shows statistical information about the discretized components in each of the samples that passed our minimum criteria (MAD < 13°, $n \geq 4$) to enter the paleomagnetic pole calculations.

Table S1

Individual sample remanence directions. *D*: Declination; *I*: Inclination; *n*: demagnetization steps computed at the mean; MAD: maximum angular deviation.

Sample	*D* (°)	*I* (°)	*n*	MAD (°)
		C_1		
NA2A	215.5	36.1	7	5.3
NA2B	238.1	49.1	5	7.8
NA2D	22.1	-52.3	4	12.8
NA2E	256.2	53.6	5	10.1
NA2G	16.3	-49.4	5	5.9
NA2H	28.5	-14.7	11	5.2
NA2J	18.2	-49.1	4	5.7
NA2N	21.8	-29.4	4	7.7
NA3E	210.1	32.5	5	9.0

NA4A	208.3	36.0	4	2.3
NA4B	13.5	-28.3	4	5.8
NA4E	212.1	32.7	4	10.9
NA4F	221.4	16.0	6	11.5
NA4H	6.1	-61.4	5	1.1
NA4I	6.7	-66.2	4	5.9
NA4J	41.7	-61.3	5	11.8
NA5A	186.7	33.0	4	6.5
NA6U	10.4	-24.9	15	9.4
NA10L	40.0	-37.2	7	7.4
NA10M	8.9	-40.7	7	1.5
		C_2		
NA7D	327.8	62.9	4	9.2
NA7E	4.8	58.6	4	11
NA7H	344.8	37.2	4	5
NA7I	329.4	69.4	4	8.3
NA7J	357.4	42.7	4	4.4
NA7L	330.5	51.3	5	4.5
NA7N	312.9	72.9	6	8.2
NA7O	334.3	56.1	8	6.8
NA7P	343.7	55.2	16	5.5
NA7Q	340.5	56.1	13	4.7
NA7R	342.8	65.7	9	3.5
NA7S	345.9	56.3	5	5.6
NA7T	344.1	47.9	13	4.4
NA7U	344.1	48.9	13	4.7
NA7V	348.6	49.1	8	6.8

NA8A	348.4	43.4	10	5
NA8B	338.5	43.2	10	2
NA8C	330.1	40.4	10	3.0
NA8D	339.4	42.0	7	5.5
NA8F	337.7	46	12	3.1
NA10H	27.5	58.1	8	3.9
NA10I	14.2	54.8	5	3.4
NA10J	7.3	53.4	7	5.0
NA10K	346.6	60.0	5	3.9

REFERENCES

Jackson, M., Worm, H-U., Banerjee, S.K., 1990. Fourier analysis of digital hysteresis data: rock magnetic applications. Physics of the Earth and Planetary Interiors. 65, 78-87.

Tauxe, L., Mullender, T.A.T., Pick, T. 1996. Potbellies, wasp-waists, and Superparamagnetism in Magnetic Hysteresis. Journal of Geophysical Res. 571-584.