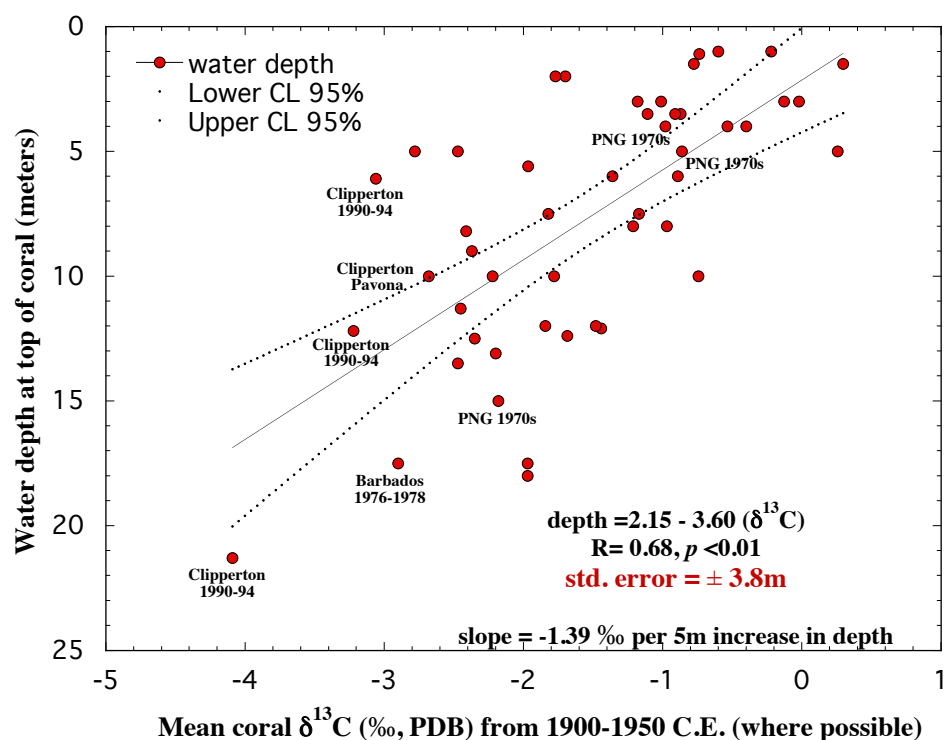


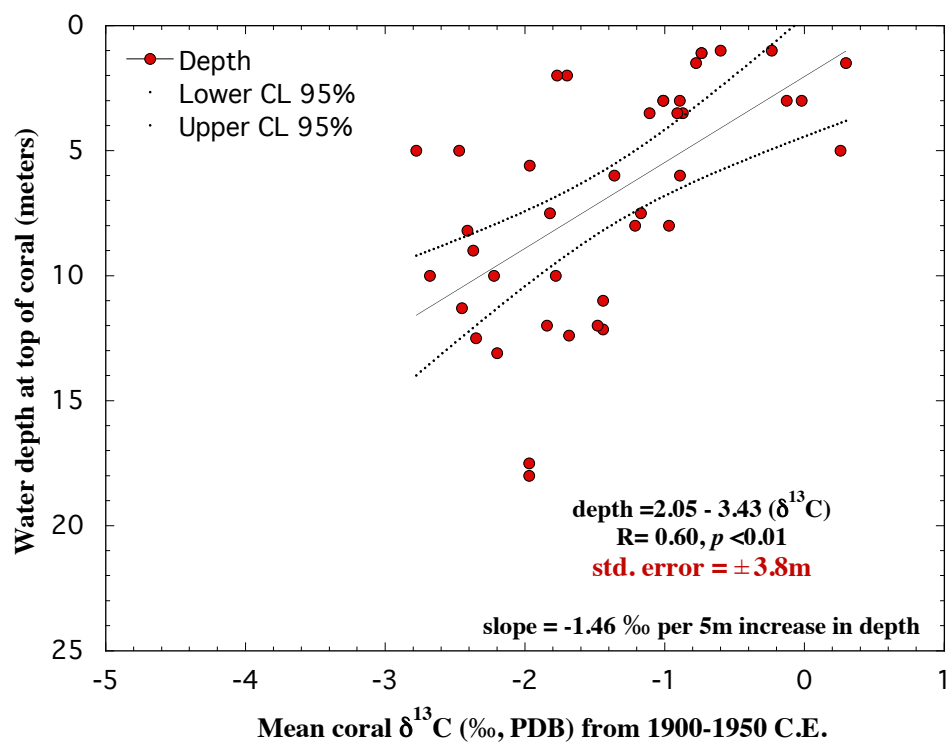
Supplementary Information

Coral Carbon Isotope Sensitivity to Growth Rate and Water Depth with Paleo-Sea Level Implications

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Supplementary Figure 1: Coral skeletal $\delta^{13}\text{C}$ vs. water depth at top of coral (same data as displayed in Figure 5). The 95% upper and lower confidence levels (CL) for the slope are indicated. The standard error of the relationship of 3.8m suggests that we can use mean pre-Suess Effect coral $\delta^{13}\text{C}$ to potentially constrain the water depth of fossil corals to within 7m of their actual growth position depth. Source data are provided as a Source Data file in the Supplement.



Supplementary Figure 2: Coral skeletal $\delta^{13}\text{C}$ vs. water depth at top of coral for all corals with data between 1900 and 1950. All corals younger than 1950 shown in Figures 5 and Supplementary Figure 1 are excluded. The 95% upper and lower confidence levels (CL) for the slope are indicated. The standard error of the relationship of 3.8m suggests that we can use mean pre-Suess Effect coral $\delta^{13}\text{C}$ to potentially constrain the water depth of fossil corals to within 7m of their actual growth position depth.

Supplementary Table 1: (A & B) Pearson correlation coefficients for Fiji, Tonga, Rarotonga and American Samoa (Ta'u) coral $\delta^{13}\text{C}$ and extension rates to sea surface temperature. Here we evaluated correlations to both ERSST (Rayner et al., 2003 ¹) and coral Sr/Ca derived SST estimates (Linsley et al., 2000 ² ; Linsley et al., 2004 ³ ; Wu et al., 2013 ⁴ ; Linsley et al., 2015 ⁵) over the period from 1855 to the top of each core in the late 20th century.

(A) Correlation coefficients for coral skeletal $\delta^{13}\text{C}$ -Suess effect and SST and coral Sr/Ca SST

	R All data ERSST	R All data Sr/Ca SST
Fiji 1F	0.04 <0.001	-0.21 <0.001
Fiji AB	0.04 <0.001	0.17 <0.001
Tonga TNI2	0.22 <0.001	0.06 <0.001
Rarotonga 2R	0.05 <0.001	0.32 <0.001
Ta'u-1	0.05 <0.001	n.a <0.001
Average R	0.08	0.09

(B) Correlation coefficients for coral skeletal extension rates and SST and coral Sr/Ca SST

	R All data ERSST	R All data Sr/Ca SST
Fiji 1F	0.20 <0.001	0.11 <0.001
Fiji AB	0.06 <0.001	0.25 <0.001
Tonga TNI2	0.00 <0.001	0.29 <0.001
Rarotonga 2R	0.09 <0.001	0.23 <0.001
Ta'u-1	0.00 <0.001	n.a <0.001
Average R	0.07	0.22

Supplementary Table 2: Average $\delta^{13}\text{C}$ and water depth data plotted in Figure 5. Location, sample ID, coral genera, year interval over which coral $\delta^{13}\text{C}$ was averaged, water depth to top of coral, average $\delta^{13}\text{C}$ (in ‰ PDB), reference for data.

Location	Core/Sample ID	Genera	Year Interval	water depth (m)*	Average $\delta^{13}\text{C}$ in interval	Reference
Clipperton Atoll	C4B	<i>Porites</i>	1900-1950	8.2	-2.41	Linsley et al., 2000b ⁶
Clipperton Atoll	C2B	<i>Porites</i>	1937-1950	13.1	-2.20	Linsley et al., 2000b ⁶
Clipperton Atoll	CDT20	<i>Porites</i>	1990-1994	6.1	-3.06	this study
Clipperton Atoll	CDT40	<i>Porites</i>	1990-1994	12.2	-3.22	this study
Clipperton Atoll	CDT70	<i>Porites</i>	1990-1994	21.3	-4.09	this study
Clipperton Atoll	C3C	<i>Porites</i>	1900-1950	12.5	-2.35	Linsley et al., 1999 ⁷
Clipperton Atoll	6A	<i>Porites</i>	1945-1950	11.3	-2.45	Linsley et al., 2000b ⁶
Clipperton Atoll	B101	<i>Pavona</i>	1946-1958	10	-2.68	this study
Fiji	1F, Savusavu Bay	<i>Porites</i>	1900-1950	10	-1.78	Linsley et al. 2004 ³ , this study
Fiji	AB, Savusavu Bay	<i>Porites</i>	1900-1950	8	-0.97	Linsley et al., 2004 ³ , this study
Fiji	FVB1, Vanua Balavu	<i>Porites</i>	1900-1950	6	-1.36	Dassie et al., 2013 ⁸ ; 2014 ⁹
Fiji	16F, Aiwa Island	<i>Porites</i>	1900-1950	3.5	-0.87	Dassie et al., 2013 ⁸ ; 2014 ⁹
Fiji	FVB2, Vanua Balavu	<i>Porites</i>	1900-1950	1	-0.60	Dassie et al., 2013 ⁸ ; 2014 ⁹
Fiji	Diplo LH, Savusavu Bay	<i>Diploastrea</i>	1900-1950	1.5	0.30	Bagnato et al., 2004 ¹⁰ , this study
Tonga	TF1, Funoifua Island	<i>Porites</i>	1900-1950	7.5	-1.82	Linsley et al., 2008 ¹¹ , this study
Tonga	TNI2, Nomuka Iki Island	<i>Porites</i>	1900-1950	3.5	-0.91	Linsley et al., 2008 ¹¹ this study
Tonga	TM1, Malinoa Island	<i>Porites</i>	1900-1950	6	-0.89	Linsley et al., 2008 ¹¹ , this study
Rarotonga	2R, west side	<i>Porites</i>	1900-1950	18	-1.97	Ren et al., 2002 ¹² , Linsley et al., 2004 ³ ; this study
Rarotonga	99, west side	<i>Porites</i>	1906-1950	17.5	-1.97	Linsley et al., 2006

						¹³ ; this study
Rarotonga	3R, north side	<i>Porites</i>	1900-1950	10	-2.22	Linsley et al., 2006 ¹³ ; this study
Am. Samoa	Tau-1, Ta'u Island	<i>Porites</i>	1900-1950	7.5	-1.17	Linsley et al., 2017 ¹⁴ Tangri et al., 2018 ¹⁵ ; this study
Fanning Atoll	FII <i>Astreopora</i> , east side	<i>Astreopora</i>	1900-1950	3	-0.02	Stolorow 2006 ¹⁶ ; this study
Gulf of Chiriquí, Panamá	Secas Island	<i>Porites</i>	1900-1950	3	-0.13	Linsley et al., 1994 ¹⁷ ; Brenner et al., 2016 ¹⁸ ; this study
Gulf of Chiriquí, Panamá	Coiba Island	<i>Porites</i>	1900-1950	3	-1.18	Brenner et al., 2016 ¹⁸ ; this study
Heron Is., Great Barrier Reef	Her13	<i>Isopora</i>	2008-2012	13.5	-2.47	Brenner et al., 2017 ¹⁹ ; this study
Papua New Guinea	PNG0036	<i>Isopora</i>	1970s	4	-0.98	Lemley 2012 ²⁰ ; this study
Papua New Guinea	PNG0089	<i>Isopora</i>	1970s	5	-0.86	Lemley 2012 ²⁰ ; this study
Papua New Guinea	PNG0021A	<i>Isopora</i>	1970s	15	-2.18	Lemley 2012 ²⁰ ; this study
Rabaul, W. Pacific	Rabaul	<i>Porites</i>	1900-1950	8	-1.21	Quinn et al., 2006 ²¹
Christmas Is., Line Islands	Christmas Is.	<i>Porites</i>	1900-1950	9	-2.37	Evans et al., 1999 ²²
New Caledonia	New Caledonia	<i>Porites</i>	1900-1950	3	-1.01	Quinn et al., 1998 ²³
Nauru	Nauru	<i>Porites</i>	1900-1950	12.1	-1.44	Guilderson and Schrag 1999 ²⁴
Nauru	Nauru	<i>Porites</i>	1900-1950	12.4	-1.68	Guilderson and Schrag ²⁴
Great Barrier Reef	Abraham Reef	<i>Porites</i>	1900-1950	10	-0.74	Druffel and Griffin 1993 ²⁵ ; 1999 ²⁶
Tabago	Tabago	<i>Sidereastrea</i>	1932-1952	4	-0.53	Moses and Swart 2006 ²⁶
Western Australia	Houtmann-Abrolhos	<i>Porites</i>	1900-1950	5	-2.78	Kuhert et al., 1999 ²⁸

Red Sea	Aqaba	<i>Porites</i>	1900-1950	3.5	-1.11	Hess et al., 1994 ²⁹
Madagascar	Mayotte	<i>Porites</i>	1900-1950	2	-1.70	Zinke et al 2009 ³⁰
Madagascar	Ifaty Reef	<i>Porites</i>	1900-1950	1.1	-0.73	Zinke et al 2004 ³¹
Moorea	Nigaloo Reef	<i>Porites</i>	1900-1950	5	0.26	Boiseau et al., 1999 ³²
Japan	Ogasawara	<i>Porites</i>	1900-1950	5.6	-1.97	Felis et al 2009 ³³
Palau	Rock Island	<i>Porites</i>	1900-1950	12	-1.48	Osborne et al., 2014 ³⁴
Palau	Rock Island	<i>Porites</i>	1900-1950	2	-1.77	Osborne et al., 2014 ³⁴
Vanuatu	Espiritu Santo	<i>Porites</i>	1928-1950	1.5	-0.77	Kilbourne et al., 2004 ³⁵
Vanuatu	Tangoa Island off Espiritu	<i>Platygyra</i>	1900-1950	1	-0.22	Quinn et al., 1993 ³⁶
Florida	Florida Bay	<i>Montastrea</i>	1900-1950	5	-2.47	Swart et al., 1996 ³⁷
Bermuda	NE breakers	<i>Pseudodiploria</i>	1927-1950	12	-1.84	Kuhnert et al., 2005 ³⁸
Bermuda	North Rock	<i>Diploria</i>	1900-1950	4	-0.40	Nozaki et al., 1978 ³⁹
Barbados	Barbados	<i>Montastrea</i>	1976-1978	17.5	-2.90	Guilderson et al., 2001 ⁴⁰

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