Appendix 9: QHSS data suite- raw data and report

Scientific Services

Enquiries: J. Hegarty
Phone: (07) 327 49072
Fax: (07) 3274 9181
Our Ref: 03MG427/526; MG530/531:JH:mb
Your Ref
Your O/No:

ANALYTICAL REPORT

TO: James Cook University
Earth Sciences Department
TOWNSVILLE QLD 4811

CONTACT	**:**	Stephen Lewis
SAMPLE TYPE	**:**	Coral
SAMPLE IDENT	**:**	As per results
NUMBER OF SAMPLES	**:**	102
DATE RECEIVED	**:**	12.11.03
DATE COMPLETED	**:**	18.12.03

ANALYSIS REQUESTED	**METHOD OF ANALYSIS**
Calcium, Strontium Barium, Magnesium, Manganese, Phosphorus	• Hydrochloric Acid Digestion • MGM-017; ICPAES

ICPAES – Inductively Coupled Plasma Atomic Emission Spectrometry

RESULTS: **Results as per attached**

COMMENTS:

(1) Reference standard solution was prepared freshly in the laboratory and was measured after each sample for ratio purposes. Concentrations for elements in Ref. are in milligrams per litre (mg/L).

(2) Intensity measurements (shown as counts per second) are not corrected for dilution i.e. these are observed intensities in the prepared samples and Ref. solution.

(3) Digestions were conducted in 50mL standard flasks so that blank vials (176-179) could not be used as blanks. For blanks, we used our digestion vessels and all reagents.

(4) The samples were digested with 2.5mls water and 2.5ml concentrated hydrochloric acid and then heated on a water bath for 2 hrs. The samples were made up to 50mLs with deionized water.

(5) The results are expressed in milligrams per kilogram (mg/kg). Dilution factors based on weights supplied, were applied to the final results shown above. Results shown are not blank corrected (Blk sample = 176, 177, 178, 179).

(6) Lower reporting limits in milligrams per kilogram (mg/kg) are as follows: Ba 0.14, Mg 7, Mn 4, P 11.

(7) The concentrations of elements in the reference standard solution in milligrams per litre (mg/L) are as follows Ca 700, Mg 1.5, Sr 13, Ba 0.01, Mn 0.05, P 0.05. For repeats the Mn is 0.3.

(8) As a result of an incorrect dilution involving manganese, the concentrations of manganese reported for samples 03MG427/526, MG530/31 are incorrect by a factor of 10. **All results for manganese for these samples should be divided by 10**. Please note that intensity measurements reported are correct.

……

J. Hegarty
Chemist
18 December, 2003

NEL01D mid-Holocene coral

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
Lab Control Sample					0.0104	719	1.551	0.05	13.3
MG427	10-15	0.1006	50	497	5.3080	387792	817.4	10.78	7698
Lab Control Sample					0.0102	714	1.523	0.0476	13.26
MG428	15-20	0.1129	50	443	4.6220	391501	876	10.5	7697
Lab Control Sample					0.0103	714	1.539	0.0511	13.27
MG429	20-25	0.1201	50	416	3.8790	394504	858	9.801	7745
Lab Control Sample					0.0103	713	1.541	0.0498	13.27
MG430	25-30	0.1004	50	498	4.9530	389831	832.8	22.58	7694
Lab Control Sample					0.0102	709	1.529	0.0481	13.16
MG431	30-35	0.1142	50	438	4.5890	389532	830.4	9.916	7719
Lab Control Sample					0.0103	713	1.529	0.0494	13.24
MG432	35-40	0.1007	50	497	4.8030	392398	854.7	15.52	7779
Lab Control Sample					0.0103	716	1.539	0.0511	13.29
MG433	40-45	0.1011	50	495	4.5410	388654	898.4	11.16	7659
Lab Control Sample					0.0104	715	1.544	0.0504	13.27
Lab Control Sample					0.0104	706	1.52	0.2994	13.13
MG434	45-50	0.1037	50	482	5.3950	391496	908.8	42.15	7783
Lab Control Sample					0.0103	705	1.51	0.2972	13.09
Lab Control Sample					0.0104	718	1.538	0.0504	13.31
MG435	50-55	0.1011	50	495	4.3830	390855	894	7.621	7825
Lab Control Sample					0.0103	711	1.539	0.0493	13.18
MG436	55-60	0.1006	50	497	5.6580	376346	1026	204.6	7383
Lab Control Sample					0.0101	703	1.501	0.0495	13.02
MG436DUP	55-60 DUP	0.1058	50	473				146.4	
Lab Control Sample					0.0103	716	1.523	0.0505	13.33
MG437	60-65	0.1047	50	478	4.0370	391424	884.6	8.129	7740
Lab Control Sample					0.0104	714	1.53	0.0497	13.2
MG438	65-70	0.1026	50	487	4.6560	393212	885	7.273	7733
Lab Control Sample					0.0101	708	1.5	0.0501	13.06
MG439	70-75	0.1006	50	497	5.9800	389753	863.6	22.1	7665
Lab Control Sample					0.0104	719	1.534	0.0502	13.27
MG440	75-80	0.1035	50	483	5.1780	392810	887.1	10.07	7693
Lab Control Sample					0.0101	704	1.509	0.049	13.02
MG441	80-85	0.1046	50	478	5.4780	397406	867.2	10.48	7828
Lab Control Sample					0.0101	704	1.508	0.0496	13.09
MG442	85-90	0.1084	50	461	5.5880	391170	905	50.31	7672
Lab Control Sample					0.0101	697	1.493	0.0482	12.92
MG443	90-95	0.1015	50	493	4.8650	388179	927.6	15.56	7651
Lab Control Sample					0.0103	702	1.509	0.0503	13.03
MG444	95-100	0.1089	50	459	5.6090	396928	934.7	16.82	7795
Lab Control Sample					0.0103	717	1.538	0.0489	13.3
MG445	100-105	0.1020	50	490	5.0130	385345	889.3	7.192	7600
Lab Control Sample					0.0104	718	1.539	0.0497	13.28
MG446	105-110	0.1006	50	497	4.8980	385847	892.7	20.93	7623
Lab Control Sample					0.0103	715	1.528	0.0498	13.27
MG520	Pandora	0.1023	50	489	3.2890	387104	890.1	10.93	7571
Lab Control Sample					0.0100	694	1.488	0.0468	12.88

NEL01D mid-Holocene coral

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
MG521	Pandora	0.1011	50	495	3.3880	390291	904.3	14.5	7618
Lab Control Sample					0.0101	708	1.517	0.0488	13.09
MG522	Pandora	0.1017	50	492	3.4070	391873	904.2	7.9	7635
Lab Control Sample					0.0106	726	1.554	0.0505	13.46
MG523	Pandora	0.1017	50	492	3.3340	387675	902.8	6.547	7564
Lab Control Sample					0.0103	711	1.526	0.0478	13.22
MG524	Pandora	0.1008	50	496	3.7450	392996	922.2	4.959	7651
Lab Control Sample					0.0105	722	1.561	0.0504	13.41
Lab Control Sample					0.0103	717	1.527	0.051	13.34
MG447	110-115	0.1019	50	491	5.2340	394106	908.7	4.8	7702
Lab Control Sample					0.0104	721	1.547	0.0504	13.41
MG448	115-120	0.1119	50	447	4.9610	394659	900.2	3.772	7757
Lab Control Sample					0.0102	708	1.511	0.0497	13.16
MG449	120-125	0.1009	50	496	4.4840	395414	929.1	15.48	7781
Lab Control Sample					0.0103	713	1.522	0.0495	13.26
MG450	125-130	0.1056	50	473	4.8930	390845	904.7	8.459	7685
Lab Control Sample					0.0102	711	1.531	0.0502	13.16
MG451	5-10	0.1046	50	478	4.8770	395770	866.9	10.77	7806

NEL03D mid-Holocene coral

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
Lab Control Sample					0.0105	712	1.525	0.0489	13.22
MG452	65-70	0.1021	50	490	5.6500	390253	901.9	10.16	7663
Lab Control Sample					0.0105	732	1.563	0.0525	13.55
MG453	60-65	0.1012	50	494	5.7770	390360	887.1	10.02	7614
Lab Control Sample					0.0104	723	1.552	0.0513	13.37
MG454	55-60	0.1019	50	491	7.4320	391201	883	14.27	7667
Lab Control Sample					0.0103	717	1.535	0.0505	13.36
MG455	50-55	0.1008	50	496	7.0000	398023	924	8.948	7770
Lab Control Sample					0.0103	720	1.549	0.0483	13.38
MG456	45-50	0.1032	50	484	9.3820	398918	878.7	6.924	7809
Lab Control Sample					0.0105	720	1.539	0.0499	13.38
Lab Control Sample					0.0105	728	1.559	0.0505	13.52
Lab Control Sample					0.0103	710	1.516	0.3064	13.18
MG457	40-45	0.1088	50	460	8.1040	393132	926.5	8.055	7628
Lab Control Sample					0.0102	707	1.513	0.3047	13.12
Lab Control Sample					0.0105	726	1.566	0.0492	13.43
MG458	35-40	0.1014	50	493	9.3590	397425	888.1	11.27	7812
Lab Control Sample					0.0105	726	1.559	0.0501	13.43
MG459	30-35	0.1068	50	468	7.2900	396129	906.2	10.61	7673
Lab Control Sample					0.0104	719	1.557	0.0496	13.3
MG460	25-30	0.1115	50	448	7.1640	411285	949.7	9.258	7996
Lab Control Sample					0.0105	729	1.557	0.052	13.52
MG461	20-25	0.1011	50	495	6.2590	401061	936.6	14.08	7844
Lab Control Sample					0.0105	729	1.569	0.0512	13.49
MG462	15-20	0.1033	50	484	8.5760	394012	906.9	16.89	7736
Lab Control Sample					0.0106	724	1.555	0.0499	13.37
MG463	10-15	0.1018	50	491	7.2720	400467	905	19.86	7881
Lab Control Sample					0.0107	727	1.577	0.0502	13.47
MG464	5-10	0.1042	50	480	9.1940	393222	913.3	23.56	7724
Lab Control Sample					0.0107	734	1.562	0.0498	13.58

MAG01D modern coral 1810-1985

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
MG465	1810-1815	0.1013	50	494	2.1470	395527	834.7	3.874	7861
Lab Control Sample					0.0104	716	1.546	0.0492	13.25
MG466	1815-1820	0.1034	50	484	2.0980	389898	830.1	4.408	7742
Lab Control Sample					0.0104	711	1.533	0.0492	13.18
MG520	Pandora	0.1023	50	489	3.2840	392058	900.9	11.15	7675
Lab Control Sample					0.0106	725	1.555	0.0505	13.44
MG521	Pandora	0.1011	50	495	3.4700	395905	915.4	13.94	7738
Lab Control Sample					0.0105	728	1.56	0.051	13.46
MG522	Pandora	0.1017	50	492	3.5300	397541	918	7.382	7741
Lab Control Sample					0.0109	732	1.575	0.0504	13.58
MG523	Pandora	0.1017	50	492	3.4510	394972	926.2	6.833	7715
Lab Control Sample					0.0106	725	1.57	0.0507	13.46
MG524	Pandora	0.1008	50	496	3.7790	394298	930.6	4.297	7710
Lab Control Sample					0.0105	725	1.568	0.0501	13.46
Lab Control Sample					0.0106	729	1.569	0.0532	13.54
MG467	1820-1825	0.1013	50	494	2.2650	397456	892.3	0.6253	7860
Lab Control Sample					0.0107	732	1.584	0.051	13.59
MG468	1825-1830	0.1046	50	478	2.0200	400196	919.9	3.105	7855
Lab Control Sample					0.0108	738	1.602	0.0511	13.67
MG469	1830-1835	0.1020	50	490	2.1440	404220	942.1	2.019	7894
Lab Control Sample					0.0108	744	1.59	0.0513	13.78
MG470	1835-1840	0.1005	50	498	2.1840	405245	912.6	1.327	7919
Lab Control Sample					0.0106	734	1.57	0.0521	13.57
MG471	1840-1845	0.1021	50	490	2.0730	404937	912.6	0.9204	7917
Lab Control Sample					0.0108	737	1.582	0.0503	13.69
MG472	1845-1850	0.1034	50	484	2.3470	403897	859.7	1.573	7975
Lab Control Sample					0.0106	729	1.574	0.0505	13.53
MG473	1850-1855	0.1021	50	490	2.5580	408781	884.4	56.85	8046
Lab Control Sample					0.0106	739	1.588	0.0511	13.64
MG474	1855-1860	0.1023	50	489	3.0080	406260	898.6	69.78	7947
Lab Control Sample					0.0104	735	1.563	0.0516	13.62
MG475	1860-1865	0.1070	50	467	2.3000	407119	919.5	34.13	7903
Lab Control Sample					0.0104	734	1.573	0.0517	13.63
MG476	1865-1870	0.1005	50	498	3.2300	398551	932.4	46.54	7798
Lab Control Sample					0.0107	745	1.598	0.0518	13.87
Lab Control Sample					0.0104	730	1.567	0.0493	13.52
MG477	1870-1875	0.1042	50	480	3.7160	401164	935.4	43.97	7846
Lab Control Sample					0.0105	729	1.569	0.0503	13.53
Lab Control Sample					0.0105	729	1.569	0.0503	13.53
MG478	1875-1880	0.1097	50	456	3.4540	403778	902	17.47	7879
Lab Control Sample					0.0105	727	1.561	0.0503	13.53
MG479	1880-1885	0.1021	50	490	3.9810	398633	894	33.72	7823
Lab Control Sample					0.0105	733	1.578	0.0512	13.59
MG480	1885-1890	0.1020	50	490	4.6350	401202	884.2	31.85	7885
Lab Control Sample					0.0105	734	1.565	0.0516	13.6
MG481	1890-1895	0.1007	50	497	4.9390	404045	882.2	23	7935

MAG01D modern coral 1810-1985

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
Lab Control Sample					0.0104	735	1.572	0.0519	13.64
MG482	1895-1900	0.1119	50	447	4.9250	401154	882.7	9.36	7910
Lab Control Sample					0.0102	716	1.538	0.0489	13.25
MG483	1900-1905	0.1012	50	494	4.0210	399025	885.5	13.39	7819
Lab Control Sample					0.0105	735	1.576	0.0516	13.66
MG484	1905-1910	0.1108	50	451	4.0750	400981	920	3.31	7862
Lab Control Sample					0.0103	723	1.547	0.0509	13.41
MG485	1910-1915	0.1029	50	486	3.4240	395212	909.7	1.304	7761
Lab Control Sample					0.0102	725	1.559	0.0512	13.43
MG486	1915-1920	0.1013	50	494	3.4890	392505	873.4	4.313	7729
Lab Control Sample					0.0102	718	1.537	0.0492	13.37
MG520	Pandora	0.1023	50	489	3.2690	391128	898.5	11.66	7653
Lab Control Sample					0.0104	728	1.563	0.0496	13.53
MG521	Pandora	0.1011	50	495	3.2970	384167	887.7	13.32	7480
Lab Control Sample					0.0102	712	1.522	0.0488	13.23
MG522	Pandora	0.1017	50	492	3.3930	387146	893.2	8.187	7576
Lab Control Sample					0.0100	706	1.516	0.0498	13.12
MG523	Pandora	0.1017	50	492	3.3040	386937	900.1	6.615	7549
Lab Control Sample					0.0101	704	1.525	0.0484	13.06
MG524	Pandora	0.1008	50	496	3.6430	387221	909.2	3.723	7543
Lab Control Sample					0.0105	725	1.556	0.05	13.49
Lab Control Sample					0.0103	719	1.549	0.0484	13.32
MG487	1920-1925	0.1038	50	482	3.6510	387368	898.7	2.571	7574
Lab Control Sample					0.0105	728	1.577	0.0529	13.49
MG488	1925-1930	0.1111	50	450	4.0940	383897	861.8	5.518	7526
Lab Control Sample					0.0101	707	1.513	0.0495	13.16
MG489	1930-1935	0.1091	50	458	4.4030	393115	891.8	9.534	7728
Lab Control Sample					0.0100	701	1.507	0.0494	13
MG490	1935-1940	0.1153	50	434	2.8250	390574	886.1	5.074	7629
Lab Control Sample					0.0100	706	1.523	0.049	13.12
MG491	1940-1945	0.1032	50	484	3.7300	395946	823	3.212	7833
Lab Control Sample					0.0101	707	1.52	0.0497	13.14
MG492	1945-1950	0.1047	50	478	3.5710	395987	893.2	12.81	7733
Lab Control Sample					0.0102	715	1.541	0.049	13.24
MG493	1950-1955	0.1010	50	495	3.6720	385125	854.9	8.757	7522
Lab Control Sample					0.0100	706	1.516	0.0488	13.12
MG494	1955-1960	0.1028	50	486	3.8020	398777	856.2	6.49	7875
Lab Control Sample					0.0102	721	1.545	0.0515	13.39
MG495	1960-1965	0.1017	50	492	3.4540	390381	883	2.481	7662
Lab Control Sample					0.0100	703	1.52	0.0496	13.06
MG496	1965-1970	0.1018	50	491	3.2630	394750	897.2	5.297	7731
Lab Control Sample					0.0104	727	1.559	0.0514	13.48
Lab Control Sample					0.0105	730	1.588	0.0509	13.6
MG497	1970-1975	0.1178	50	424	4.6870	397902	905.8	5.457	7788
Lab Control Sample					0.0104	719	1.542	0.3084	13.35
Lab Control Sample					0.0104	719	1.542	0.3084	13.35
MG498	1975-1980	0.1068	50	468	4.6680	385626	844.8	0.9248	7570
Lab Control Sample					0.0104	717	1.531	0.3031	13.34
MG499	1980-1985	0.1072	50	466	4.8350	388044	859.4	1.048	7633
Lab Control Sample					0.0104	720	1.546	0.3115	13.35

NEL09D modern 1992-1996

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
Lab Control Sample					0.0104	720	1.546	0.3115	13.35
MG500	1992A	0.1038	50	482	5.8160	397363	982.7	17.02	7846
Lab Control Sample					0.0103	721	1.56	0.0495	13.39
MG501	1992B	0.1031	50	485	4.9530	389131	913.3	23.9	7774
Lab Control Sample					0.0104	722	1.561	0.0518	13.43
MG502	1992C	0.1037	50	482	3.5780	392542	956.7	5.91	7716
Lab Control Sample					0.0104	721	1.565	0.0501	13.4
MG503	1992D	0.1013	50	494	4.2530	394173	984.8	9.567	7737
Lab Control Sample					0.0103	719	1.554	0.0503	13.35
MG504	1993A	0.1027	50	487	4.3360	395738	931.1	15.13	7823
Lab Control Sample					0.0105	728	1.585	0.0507	13.53
MG505	1993B	0.1009	50	496	3.4290	393252	944	13.98	7777
Lab Control Sample					0.0103	718	1.561	0.0527	13.35
MG506	1993C	0.1119	50	447	3.8820	391778	985.3	9.011	7735
Lab Control Sample					0.0100	704	1.526	0.0484	13.14
MG520	Pandora	0.1023	50	489	3.2550	390318	911.4	11.47	7647
Lab Control Sample					0.0103	718	1.566	0.0502	13.35
MG521	Pandora	0.1011	50	495	3.3370	392675	916.4	10.91	7661
Lab Control Sample					0.0105	731	1.586	0.0507	13.57
MG522	Pandora	0.1017	50	492	3.5010	395126	923.8	7.082	7740
Lab Control Sample					0.0100	705	1.53	0.0492	13.11
MG523	Pandora	0.1017	50	492	3.3230	392240	930.4	7.193	7641
Lab Control Sample					0.0103	718	1.565	0.0494	13.3
MG524	Pandora	0.1008	50	496	3.7540	390720	932.6	5.538	7659
Lab Control Sample					0.0103	714	1.553	0.048	13.31
Lab Control Sample					0.0102	708	1.542	0.0502	13.17
MG507	1993D	0.1055	50	474	3.5710	392217	1013	5.528	7665
Lab Control Sample					0.0105	724	1.57	0.0497	13.42
Lab Control Sample					0.0104	715	1.533	0.308	13.31
MG508	1994A	0.1012	50	494	4.2990	383480	959.8	4.322	7514
Lab Control Sample					0.0103	715	1.541	0.3065	13.25
Lab Control Sample					0.0105	729	1.574	0.0502	13.6
MG509	1994B	0.1038	50	482	4.1390	391595	958.9	5.097	7815
Lab Control Sample					0.0103	721	1.573	0.0496	13.39
MG510	1994C	0.1047	50	478	3.5650	399293	977.2	11.44	7960
Lab Control Sample					0.0105	723	1.57	0.0502	13.47
MG511	1994D	0.1022	50	489	3.6050	391148	1029	30.67	7685
Lab Control Sample					0.0101	708	1.53	0.0505	13.18
MG512	1995A	0.1008	50	496	4.0500	398014	1013	7.53	7818
Lab Control Sample					0.0104	727	1.574	0.0506	13.48
MG513	1995B	0.1031	50	485	3.8950	398004	949.7	6.649	7898
Lab Control Sample					0.0104	732	1.557	0.0517	13.54
MG514	1995C	0.1019	50	491	4.5640	398587	1024	8.488	7804
Lab Control Sample					0.0105	730	1.558	0.051	13.53
MG515	1995D	0.1028	50	486	5.5610	399436	991.4	9.598	7843

NEL09D modern 1992-1996

Our Reference	Your Reference (years)	Weight (gm)	Final Volume	Dilution Factor	Ba (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Sr (mg/kg)
Lab Control Sample					0.0106	738	1.583	0.0527	13.63
MG516	1996A	0.1083	50	462	4.6840	401361	928.8	7.918	8000
Lab Control Sample					0.0103	731	1.555	0.0503	13.56
Lab Control Sample					0.0102	727	1.561	0.0506	13.47
MG517	1996B	0.1037	50	482	5.0270	399092	960.9	4.9	7902
Lab Control Sample					0.0105	739	1.581	0.0517	13.69
MG518	1996C	0.1006	50	497	4.8030	396938	920.5	8.56	7933
Lab Control Sample					0.0103	732	1.567	0.0516	13.55
MG519	1996D	0.1047	50	478	4.7170	400530	949.7	4.913	7977
Lab Control Sample					0.0105	737	1.588	0.0519	13.59
Lab Control Sample					0.0106	742	1.588	0.0524	13.75
	Blank	0.1000	50	500	-0.4004	1747	-13.14	1.836	31.28
Lab Control Sample					0.0104	733	1.57	0.0522	13.57
MG526	Blank	0.1000	50	500	-0.2400	1744	-13.54	1.183	31.56
Lab Control Sample					0.0105	734	1.578	0.0499	13.57
MG530	Blank	0.1000	50	500	-0.2426	1868	-10.38	-1.845	31.63
Lab Control Sample					0.0105	739	1.575	0.0521	13.68
MG531	Blank	0.1000	50	500	-0.1275	1747	-11.65	2.964	32.04
Lab Control Sample					0.0104	739	1.575	0.0506	13.7
MG520	Pandora	0.1023	50	489	3.2840	394974	913.4	11.87	7675
Lab Control Sample					0.0105	734	1.565	0.052	13.58
MG521	Pandora	0.1011	50	495	3.3170	403521	920.1	12.65	7843
Lab Control Sample					0.0105	740	1.572	0.0524	13.66
MG522	Pandora	0.1017	50	492	3.4450	399835	921.4	7.579	7788
Lab Control Sample					0.0104	738	1.586	0.0519	13.63
MG523	Pandora	0.1017	50	492	3.4210	403132	945.7	6.974	7852
Lab Control Sample					0.0104	736	1.574	0.0498	13.63
MG524	Pandora	0.1008	50	496	3.7410	398520	933.1	4.444	7759

NEL01D mid-Holocene coral

Years	Adjusted Sr/Ca	Atomic Sr/Ca	Sr/Ca-SST C	Adjusted Mg/Ca	Atomic Mg/Ca	Mg/Ca-SST C	Adjusted Ba/Ca	Atomic Ba/Ca	Adjusted Mn (ppm)
5-10	1.98E-02	9.04E-03	24.30	2.19E-03	3.60E-03	24.37	1.21E-05	3.53E-06	0.9419
10-15	1.99E-02	9.10E-03	23.26	2.11E-03	3.47E-03	23.91	1.36E-05	3.97E-06	0.9590
15-20	1.97E-02	8.99E-03	24.97	2.24E-03	3.69E-03	24.68	1.18E-05	3.43E-06	0.9188
20-15	1.96E-02	8.97E-03	25.32	2.16E-03	3.56E-03	24.23	9.73E-06	2.84E-06	0.8264
25-30	1.97E-02	9.02E-03	24.52	2.12E-03	3.50E-03	23.99	1.26E-05	3.67E-06	2.1606
30-35	1.98E-02	9.07E-03	23.82	2.12E-03	3.50E-03	24.01	1.17E-05	3.41E-06	0.8715
35-40	1.98E-02	9.07E-03	23.78	2.17E-03	3.58E-03	24.31	1.21E-05	3.54E-06	0.8715
40-45	1.97E-02	9.02E-03	24.55	2.30E-03	3.79E-03	25.05	1.15E-05	3.37E-06	0.8715
45-50	1.99E-02	9.08E-03	23.56	2.32E-03	3.82E-03	25.14	1.34E-05	3.91E-06	0.8715
50-55	2.01E-02	9.17E-03	22.14	2.28E-03	3.75E-03	24.91	1.11E-05	3.23E-06	0.8715
55-60	1.97E-02	8.99E-03	25.00	2.72E-03	4.48E-03	27.50	1.49E-05	4.34E-06	0.8715
60-65	1.98E-02	9.06E-03	24.00	2.27E-03	3.74E-03	24.86	1.02E-05	2.97E-06	0.8715
65-70	1.98E-02	9.05E-03	24.12	2.26E-03	3.73E-03	24.84	1.17E-05	3.42E-06	0.8715
70-75	1.98E-02	9.05E-03	24.04	2.23E-03	3.68E-03	24.65	1.53E-05	4.45E-06	0.8715
75-80	1.97E-02	9.00E-03	24.83	2.26E-03	3.73E-03	24.83	1.31E-05	3.81E-06	0.8715
80-85	1.97E-02	9.03E-03	24.48	2.18E-03	3.60E-03	24.36	1.37E-05	4.01E-06	0.8715
85-90	1.96E-02	8.97E-03	25.29	2.31E-03	3.82E-03	25.13	1.42E-05	4.13E-06	0.8715
90-95	1.97E-02	9.02E-03	24.50	2.39E-03	3.93E-03	25.55	1.23E-05	3.58E-06	0.8715
95-100	1.97E-02	8.99E-03	25.01	2.35E-03	3.88E-03	25.34	1.39E-05	4.06E-06	0.8715
100-105	1.98E-02	9.04E-03	24.20	2.31E-03	3.80E-03	25.08	1.29E-05	3.76E-06	0.8715
105-110	1.98E-02	9.05E-03	24.04	2.32E-03	3.82E-03	25.14	1.25E-05	3.66E-06	0.8715
110-115	1.95E-02	8.93E-03	26.03	2.31E-03	3.81E-03	25.12	1.32E-05	3.85E-06	0.8715
115-120	1.96E-02	8.98E-03	25.19	2.28E-03	3.77E-03	24.95	1.25E-05	3.64E-06	0.8715
120-125	1.96E-02	8.99E-03	25.07	2.36E-03	3.89E-03	25.39	1.12E-05	3.28E-06	0.8715
125-130	1.97E-02	9.00E-03	24.85	2.31E-03	3.81E-03	25.13	1.24E-05	3.62E-06	0.8715

NEL03D mid-Holocene coral

Years	Adjusted Sr/Ca	Atomic Sr/Ca	Sr/Ca-SST C	Adjusted Mg/Ca	Atomic Mg/Ca	Mg/Ca-SST C	Adjusted Ba/Ca	Atomic Ba/Ca	Adjusted Mn (ppm)
5-10	1.97E-02	9.01E-03	24.70	2.32E-03	3.82E-03	25.14	2.28E-05	6.65E-06	0.8569
10-15	1.98E-02	9.04E-03	24.28	2.24E-03	3.70E-03	24.72	1.77E-05	5.15E-06	0.8191
15-20	1.97E-02	9.02E-03	24.52	2.29E-03	3.78E-03	25.01	2.14E-05	6.25E-06	1.2565
20-25	1.96E-02	8.97E-03	25.32	2.33E-03	3.85E-03	25.25	1.55E-05	4.52E-06	0.7607
25-30	1.95E-02	8.92E-03	26.14	2.30E-03	3.80E-03	25.06	1.72E-05	5.03E-06	0.5600
30-35	1.94E-02	8.90E-03	26.50	2.27E-03	3.75E-03	24.89	1.82E-05	5.30E-06	0.6458
35-40	1.97E-02	9.03E-03	24.45	2.23E-03	3.67E-03	24.61	2.33E-05	6.79E-06	0.9900
40-45	1.94E-02	8.87E-03	26.84	2.36E-03	3.89E-03	25.41	2.03E-05	5.94E-06	0.9193
45-50	1.96E-02	8.95E-03	25.72	2.20E-03	3.63E-03	24.46	2.33E-05	6.79E-06	0.7661
50-55	1.95E-02	8.91E-03	26.24	2.32E-03	3.82E-03	25.16	1.75E-05	5.12E-06	1.2181
55-60	1.96E-02	8.97E-03	25.32	2.26E-03	3.72E-03	24.79	1.89E-05	5.51E-06	1.5256
60-65	1.96E-02	8.95E-03	25.61	2.27E-03	3.75E-03	24.90	1.47E-05	4.29E-06	1.8392
65-70	1.97E-02	8.99E-03	24.99	2.31E-03	3.82E-03	25.13	1.42E-05	4.15E-06	2.2112

MAG01D 1810-1985 modern coral

Calendar years	Adjusted Sr/Ca	Atomic Sr/Ca	Sr/Ca-SST C	Adjusted Mg/Ca	Atomic Mg/Ca	Mg/Ca-SST C	Adjusted Ba/Ca	Atomic Ba/Ca	Adjusted Mn (ppm)
1810-1815	1.99E-02	9.12E-03	23.01	2.11E-03	3.48E-03	23.92	5.32E-06	1.55E-06	0.2464
1815-1820	1.99E-02	9.11E-03	23.21	2.11E-03	3.49E-03	23.95	5.27E-06	1.54E-06	0.3030
1820-1825	1.98E-02	9.05E-03	24.09	2.23E-03	3.68E-03	24.64	5.58E-06	1.63E-06	0.0000
1825-1830	1.97E-02	8.99E-03	25.00	2.27E-03	3.75E-03	24.89	4.93E-06	1.44E-06	0.1591
1830-1835	1.96E-02	8.95E-03	25.59	2.32E-03	3.82E-03	25.16	5.20E-06	1.52E-06	0.0522
1835-1840	1.96E-02	8.97E-03	25.32	2.26E-03	3.72E-03	24.80	5.32E-06	1.55E-06	0.0000
1840-1845	1.96E-02	8.96E-03	25.44	2.25E-03	3.72E-03	24.78	5.03E-06	1.47E-06	0.0000
1845-1850	1.97E-02	9.03E-03	24.38	2.12E-03	3.49E-03	23.98	5.68E-06	1.66E-06	0.0112
1850-1855	1.97E-02	9.03E-03	24.37	2.15E-03	3.55E-03	24.18	6.19E-06	1.81E-06	5.4492
1855-1860	1.96E-02	8.98E-03	25.15	2.22E-03	3.66E-03	24.56	7.42E-06	2.17E-06	6.6448
1860-1865	1.94E-02	8.89E-03	26.65	2.27E-03	3.74E-03	24.85	5.70E-06	1.66E-06	3.1555
1865-1870	1.95E-02	8.94E-03	25.80	2.34E-03	3.86E-03	25.28	8.12E-06	2.37E-06	4.3463
1870-1875	1.96E-02	8.96E-03	25.44	2.33E-03	3.83E-03	25.20	9.24E-06	2.70E-06	4.2697
1875-1880	1.95E-02	8.92E-03	26.08	2.23E-03	3.67E-03	24.62	8.48E-06	2.47E-06	1.5917
1880-1885	1.96E-02	8.97E-03	25.27	2.24E-03	3.69E-03	24.67	9.92E-06	2.89E-06	3.1766
1885-1890	1.97E-02	9.01E-03	24.76	2.20E-03	3.63E-03	24.48	1.15E-05	3.36E-06	2.9510
1890-1895	1.97E-02	9.00E-03	24.91	2.19E-03	3.61E-03	24.41	1.23E-05	3.58E-06	2.0747
1895-1900	1.98E-02	9.04E-03	24.27	2.20E-03	3.63E-03	24.46	1.24E-05	3.60E-06	0.7837
1900-1905	1.96E-02	8.97E-03	25.27	2.22E-03	3.65E-03	24.55	1.01E-05	2.94E-06	1.1875
1905-1910	1.96E-02	8.97E-03	25.39	2.29E-03	3.78E-03	25.02	1.02E-05	2.97E-06	0.1779
1910-1915	1.97E-02	9.00E-03	24.92	2.30E-03	3.79E-03	25.04	8.74E-06	2.55E-06	0.0000
1915-1920	1.97E-02	9.00E-03	24.80	2.22E-03	3.66E-03	24.59	8.98E-06	2.62E-06	0.2847
1920-1925	1.96E-02	8.96E-03	25.47	2.30E-03	3.79E-03	25.05	9.36E-06	2.73E-06	0.1089
1925-1930	1.96E-02	8.96E-03	25.42	2.23E-03	3.68E-03	24.66	1.06E-05	3.10E-06	0.3937
1930-1935	1.96E-02	8.99E-03	25.07	2.27E-03	3.74E-03	24.85	1.12E-05	3.27E-06	0.8190
1935-1940	1.95E-02	8.94E-03	25.80	2.26E-03	3.72E-03	24.80	7.27E-06	2.12E-06	0.3707
1940-1945	1.98E-02	9.04E-03	24.18	2.07E-03	3.41E-03	23.69	9.46E-06	2.76E-06	0.1805
1945-1950	1.95E-02	8.94E-03	25.80	2.25E-03	3.70E-03	24.73	9.02E-06	2.63E-06	1.1528
1950-1955	1.95E-02	8.94E-03	25.81	2.21E-03	3.64E-03	24.52	9.58E-06	2.80E-06	0.7501
1955-1960	1.97E-02	9.03E-03	24.43	2.14E-03	3.54E-03	24.13	9.62E-06	2.81E-06	0.5022
1960-1965	1.96E-02	8.98E-03	25.25	2.25E-03	3.71E-03	24.76	8.91E-06	2.60E-06	0.1005
1965-1970	1.96E-02	8.96E-03	25.49	2.26E-03	3.73E-03	24.82	8.28E-06	2.41E-06	0.3796
1970-1975	1.95E-02	8.94E-03	25.85	2.26E-03	3.72E-03	24.80	1.17E-05	3.40E-06	0.3924
1975-1980	1.96E-02	8.97E-03	25.37	2.19E-03	3.62E-03	24.42	1.19E-05	3.48E-06	0.0000
1980-1985	1.97E-02	9.00E-03	24.94	2.22E-03	3.65E-03	24.56	1.23E-05	3.59E-06	0.0000

NEL09D 1992-1996 modern coral

Calendar years	Adjusted Sr/Ca	Atomic Sr/Ca	Sr/Ca-SST C	Adjusted Mg/Ca	Atomic Mg/Ca	Mg/Ca-SST C	Adjusted Ba/Ca	Atomic Ba/Ca	Adjusted Mn (ppm)
1992A	1.98E-02	9.04E-03	24.24	2.46E-03	4.05E-03	25.99	1.46E-05	4.25E-06	1.3699
1992B	2.00E-02	9.13E-03	22.77	2.33E-03	3.84E-03	25.20	1.27E-05	3.70E-06	2.2141
1992C	1.96E-02	8.98E-03	25.16	2.41E-03	3.98E-03	25.70	9.03E-06	2.64E-06	0.4349
1992D	1.96E-02	8.98E-03	25.22	2.47E-03	4.08E-03	26.06	1.07E-05	3.13E-06	0.8080
1993A	1.98E-02	9.04E-03	24.19	2.32E-03	3.83E-03	25.19	1.09E-05	3.18E-06	1.3530
1993B	1.98E-02	9.04E-03	24.23	2.36E-03	3.90E-03	25.43	8.66E-06	2.53E-06	1.2056
1993C	1.97E-02	9.01E-03	24.79	2.48E-03	4.09E-03	26.13	9.92E-06	2.89E-06	0.7463
1993D	1.95E-02	8.94E-03	25.86	2.55E-03	4.20E-03	26.49	8.99E-06	2.62E-06	0.4085
1994A	1.96E-02	8.96E-03	25.48	2.49E-03	4.11E-03	26.20	1.11E-05	3.23E-06	0.2769
1994B	1.99E-02	9.10E-03	23.26	2.42E-03	3.98E-03	25.73	1.05E-05	3.07E-06	0.3659
1994C	1.99E-02	9.10E-03	23.30	2.41E-03	3.97E-03	25.68	8.85E-06	2.58E-06	1.0014
1994D	1.96E-02	8.96E-03	25.50	2.60E-03	4.29E-03	26.82	9.14E-06	2.67E-06	2.9007
1995A	1.96E-02	8.98E-03	25.15	2.52E-03	4.16E-03	26.35	1.02E-05	2.97E-06	0.5999
1995B	1.99E-02	9.10E-03	23.26	2.38E-03	3.93E-03	25.54	9.81E-06	2.86E-06	0.5048
1995C	1.96E-02	8.98E-03	25.13	2.58E-03	4.26E-03	26.72	1.14E-05	3.34E-06	0.6810
1995D	1.97E-02	9.02E-03	24.60	2.49E-03	4.10E-03	26.15	1.38E-05	4.04E-06	0.7794
1996A	2.00E-02	9.15E-03	22.52	2.32E-03	3.83E-03	25.18	1.17E-05	3.42E-06	0.6232
1996B	1.98E-02	9.08E-03	23.68	2.41E-03	3.97E-03	25.68	1.27E-05	3.72E-06	0.3339
1996C	2.00E-02	9.16E-03	22.30	2.32E-03	3.83E-03	25.17	1.22E-05	3.57E-06	0.6829
1996D	2.00E-02	9.15E-03	22.48	2.36E-03	3.90E-03	25.43	1.19E-05	3.47E-06	0.3293

Standards

Years	Adjusted Sr/Ca	Atomic Sr/Ca	Sr/Ca-SST C	Adjusted Mg/Ca	Atomic Mg/Ca	Mg/Ca-SST C	Adjusted Ba/Ca	Atomic Ba/Ca	Adjusted Mn (ppm)
Pandora	1.96E-02	8.95E-03	25.69	2.30E-03	3.79E-03	25.05	8.42E-06	2.46E-06	11.3016
Pandora	1.96E-02	8.97E-03	25.35	2.29E-03	3.78E-03	24.99	8.18E-06	2.39E-06	15.1380
Pandora	1.95E-02	8.93E-03	25.94	2.30E-03	3.79E-03	25.02	8.38E-06	2.45E-06	7.9553
Pandora	1.95E-02	8.94E-03	25.88	2.30E-03	3.79E-03	25.06	8.35E-06	2.44E-06	6.6583
Pandora	1.95E-02	8.91E-03	26.21	2.33E-03	3.83E-03	25.20	8.37E-06	2.44E-06	5.0483
Pandora	1.96E-02	8.95E-03	25.70	2.32E-03	3.82E-03	25.14	8.65E-06	2.52E-06	11.1835
Pandora	1.96E-02	8.97E-03	25.41	2.31E-03	3.81E-03	25.11	8.62E-06	2.51E-06	13.7309
Pandora	1.94E-02	8.90E-03	26.50	2.31E-03	3.81E-03	25.11	8.57E-06	2.50E-06	7.2787
Pandora	1.95E-02	8.92E-03	26.11	2.30E-03	3.79E-03	25.04	8.46E-06	2.47E-06	6.7578
Pandora	1.95E-02	8.93E-03	25.94	2.30E-03	3.78E-03	25.02	8.24E-06	2.40E-06	4.2626
Pandora	1.95E-02	8.94E-03	25.85	2.31E-03	3.81E-03	25.10	8.60E-06	2.51E-06	11.7999
Pandora	1.95E-02	8.93E-03	25.95	2.30E-03	3.80E-03	25.07	8.65E-06	2.52E-06	13.5331
Pandora	1.95E-02	8.94E-03	25.83	2.31E-03	3.80E-03	25.08	8.78E-06	2.56E-06	8.3016
Pandora	1.96E-02	8.96E-03	25.54	2.31E-03	3.81E-03	25.10	8.87E-06	2.59E-06	6.7341
Pandora	1.96E-02	8.96E-03	25.51	2.31E-03	3.81E-03	25.11	8.70E-06	2.54E-06	3.7826
Pandora	1.95E-02	8.93E-03	25.99	2.33E-03	3.84E-03	25.22	8.45E-06	2.47E-06	11.6306
Pandora	1.95E-02	8.94E-03	25.81	2.33E-03	3.84E-03	25.21	8.45E-06	2.47E-06	10.8118
Pandora	1.95E-02	8.92E-03	26.11	2.31E-03	3.81E-03	25.11	8.55E-06	2.50E-06	7.0891
Pandora	1.95E-02	8.92E-03	26.18	2.34E-03	3.85E-03	25.26	8.48E-06	2.48E-06	7.2937
Pandora	1.96E-02	8.94E-03	25.76	2.34E-03	3.87E-03	25.31	8.59E-06	2.51E-06	5.6820
Pandora	1.95E-02	8.90E-03	26.49	2.33E-03	3.85E-03	25.25	9.37E-06	2.74E-06	11.5614
Pandora	1.96E-02	8.95E-03	25.71	2.34E-03	3.85E-03	25.26	9.41E-06	2.74E-06	12.0934
Pandora	1.95E-02	8.91E-03	26.36	2.33E-03	3.85E-03	25.24	9.32E-06	2.72E-06	7.2531
Pandora	1.96E-02	8.96E-03	25.47	2.35E-03	3.87E-03	25.34	9.54E-06	2.78E-06	6.8554
Pandora	1.95E-02	8.93E-03	26.04	2.34E-03	3.87E-03	25.31	9.48E-06	2.77E-06	4.4529
Standard deviation (1)	4.38E-05	2.01E-05	0.31	1.74E-05	2.87E-05	0.10	4.03E-07	1.18E-07	3.2555
Average	1.95E-02	8.93E-03	25.89	2.32E-03	3.82E-03	25.15	8.70E-06	2.54E-06	8.7276
RSD	**0.22%**	**0.22%**	**1.21%**	**0.75%**	**0.75%**	**0.41%**	**4.64%**	**4.64%**	**37.30%**

Appendix 10: ACQUIRE data suite- raw data

MAG01D 1812-1986 modern coral

Calendar years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
1984-1986	0.4534	991	399664	0.5156	0.3810	4952	7804	223.11	9.101	11.228	11.263	3.265	3855.08	1.5614	2.933
1982-1984	0.4019	937	385452	0.4690	0.3326	4050	7541	241.28	4.913	11.910	9.428	4.464	89.82	1.1810	2.848
1980-1982	0.3592	942	386216	0.4567	0.2940	2914	7590	241.03	5.084	12.408	8.419	4.024	65.52	0.8007	2.850
1978-1980	0.4189	927	373032	0.4700	0.2815	6753	7259	231.07	4.945	11.292	8.085	4.071	56.08	1.1078	2.710
1976-1978	0.3636	907	373637	0.4901	0.4742	10649	7299	238.83	4.326	13.548	12.421	4.254	72.19	1.2962	2.740
1974-1976	0.3720	927	376379	0.5089	0.3587	3967	7316	241.56	4.541	13.314	13.599	4.128	260.19	0.6930	2.681
1972-1974	0.4351	915	373689	0.4725	0.2042	3536	7269	229.92	4.191	12.004	12.508	3.799	83.79	0.7544	2.656
1970-1972	0.3866	867	376679	0.4497	2.1342	7372	7372	206.56	3.876	9.948	16.419	3.566	132.00	0.9755	2.935
1968-1970	0.4108	869	371074	0.3777	0.2555	5080	7285	216.16	3.700	11.720	8.642	3.875	62.55	0.7158	2.752
1966-1968	0.3651	889	372859	0.4448	0.3724	14364	7303	204.73	3.484	8.062	10.182	3.708	1227.14	0.8764	2.745
1964-1966	0.4146	875	372694	0.4080	0.2556	4654	7302	197.91	3.900	8.755	8.955	3.345	69.12	0.6072	2.814
1962-1964	0.3772	888	361416	0.5060	0.4116	46274	7058	192.86	10.552	8.884	10.566	3.287	157.49	0.9700	2.583
1960-1962	0.3731	925	378452	0.6325	0.3621	12579	7355	198.68	3.647	9.368	11.243	3.180	81.29	0.9491	2.667
1960-1962	0.4256	898	368266	0.6047	0.3893	5726	7155	199.52	3.449	10.360	7.731	3.006	65.63	1.6836	2.645
1958-1960	0.3603	920	387818	0.6147	0.8311	7058	7585	238.23	4.854	14.430	11.084	4.169	107.25	3.2491	2.865
1956-1958	0.4177	949	384082	0.6459	0.4805	3726	7489	226.99	3.879	10.120	9.958	3.415	71.00	0.9133	2.717
1954-1956	0.3762	875	357868	0.5503	0.2936	4315	7006	220.55	3.683	13.215	11.669	3.891	80.93	0.8213	2.550
1952-1954	0.3929	952	385136	1.1787	0.6133	9525	7532	225.77	4.014	11.293	10.231	3.744	108.25	0.9895	2.789
1950-1952	0.3507	906	366134	1.1509	0.7674	2999	7150	222.03	3.828	12.248	12.575	3.989	58.73	0.9831	2.611
1948-1950	0.3607	901	370258	1.4506	0.2433	4682	7220	205.03	3.394	10.590	11.286	3.756	127.11	0.9255	2.595
1946-1948	0.3965	874	374539	0.9452	0.4108	34899	7316	243.20	4.387	11.827	9.651	4.604	273.78	1.3738	2.786
1944-1946	0.3574	910	371617	0.5745	1.0074	10871	7244	206.42	3.916	10.324	9.021	3.726	75.87	1.0488	2.547
1942-1944	0.3621	880	355060	0.5433	0.3263	6671	6905	191.67	5.152	8.993	7.907	3.411	89.13	0.7633	2.438
1940-1942	0.3389	818	366062	0.5296	0.4601	8544	7203	239.91	5.303	10.547	12.262	4.078	100.61	1.0816	2.807

Calendar years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
1938-1940	0.3694	806	367909	0.6500	0.2422	6064	7223	195.48	3.366	9.019	10.938	3.224	66.29	0.8079	2.857
1936-1938	0.3692	895	367327	0.5562	0.3096	4114	7193	195.44	5.428	10.146	8.470	3.249	61.28	1.0371	2.613
1934-1936	0.3471	853	359195	0.5289	0.3774	8380	7085	182.89	7.083	8.462	7.242	3.300	70.55	0.5927	2.599
1932-1934	0.4084	858	360703	0.8436	0.3100	16940	7088	182.67	4.329	9.318	6.293	2.725	89.81	0.6925	2.605
1930-1932	0.3766	871	352650	0.6748	0.3379	13756	6932	177.72	4.942	8.700	7.286	2.805	92.46	0.7346	2.562
1928-1930	0.3697	849	372559	0.7701	0.4733	6370	7366	217.32	5.856	10.434	9.441	3.447	66.51	0.5674	2.873
1926-1928	0.3990	901	372652	0.6449	0.2016	5964	7332	204.05	5.020	10.150	10.503	3.572	120.23	0.9882	2.728
1924-1926	0.3844	887	367269	0.4515	0.1460	6842	7244	197.74	6.024	8.845	9.621	3.281	71.44	1.0490	2.691
1922-1924	0.3270	908	370040	0.5028	0.6268	5809	7246	174.03	3.600	7.842	7.788	2.729	105.34	0.5589	2.640
1920-1922	0.3703	898	366445	0.4222	0.4008	13392	7195	186.09	4.879	8.270	10.098	3.447	88.65	0.7171	2.651
1918-1920	0.3911	867	360548	0.4475	0.2993	8820	7102	196.57	6.447	10.240	10.216	2.983	125.35	1.1555	2.670
1916-1918	0.3726	913	366038	0.4353	0.1692	11827	7193	195.36	4.681	9.942	7.904	3.205	100.73	0.9890	2.610
1914-1916	0.3947	907	362837	0.4662	0.2523	3962	7150	179.74	3.454	7.764	10.071	3.303	74.72	0.7738	2.597
1912-1914	0.3758	879	366223	0.4743	0.4209	7288	7288	205.07	4.548	9.519	10.622	3.810	107.81	1.0429	2.694
1910-1912	0.3584	887	361848	0.4905	0.2196	5482	7098	202.30	4.262	11.593	10.960	3.398	82.15	0.8279	2.463
1908-1910	0.4098	932	375438	0.5027	0.2182	5475	7360	182.94	5.465	9.028	8.426	2.826	72.47	0.7854	2.642
1906-1908	0.4153	874	357672	0.4122	0.4274	3361	7061	205.95	4.654	9.955	8.224	3.997	56.87	0.9366	2.585
1904-1906	0.3897	915	363379	0.4741	0.2273	6688	7196	183.45	4.269	9.689	10.704	3.546	108.92	1.2109	2.678
1902-1904	0.4411	844	361112	0.7744	0.1506	4362	7152	196.01	5.349	10.529	9.977	3.527	103.47	1.1604	2.669
1900-1902	0.4476	919	376395	0.6635	0.1818	7949	7405	183.16	4.924	9.811	6.136	3.032	120.79	1.9332	2.630
1898-1900	0.3807	826	367830	1.2070	0.2896	9690	7292	214.23	5.242	10.515	10.523	3.861	72.19	0.8451	2.792
1896-1898	0.4030	905	374847	1.3333	0.2098	10239	7371	223.45	5.724	11.087	11.596	3.587	79.71	0.8756	2.655
1894-1896	0.4109	865	361255	1.5307	0.1741	8764	7153	211.75	6.419	11.337	11.238	3.351	82.41	0.9100	2.630
1892-1894	0.3754	895	372808	1.7719	0.2184	7357	7337	194.03	4.292	10.816	9.602	3.408	74.69	0.8028	2.646
1890-1892	0.4001	862	369751	1.7479	0.3394	4465	7317	214.27	4.938	11.151	11.451	3.753	63.53	1.2563	2.678

Calendar years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
1888-1890	0.3730	879	371242	1.6761	0.2243	10874	7349	186.83	4.553	8.133	7.715	3.312	72.39	1.4320	2.740
1886-1888	0.3208	864	371334	2.0175	0.2091	5844	7358	181.33	4.900	8.121	7.003	2.954	37.67	1.1535	2.735
1884-1886	0.3894	884	368091	3.6115	0.2604	10126	7261	177.77	4.831	8.196	8.620	2.904	40.88	0.8446	2.653
1882-1884	0.3499	906	379161	4.5762	0.3894	12539	7467	187.86	5.489	10.074	11.253	3.025	70.18	10.1449	2.777
1880-1882	0.3702	904	371957	3.1056	0.5643	8160	7325	188.29	4.238	9.962	6.772	3.361	46.34	1.5895	2.676
1878-1880	0.3884	912	371426	2.2945	0.2267	6286	7263	170.95	5.576	8.040	7.512	3.047	45.02	0.9100	2.596
1876-1878	0.3942	898	378707	1.1606	0.1666	6357	7436	190.38	4.365	9.044	10.583	2.865	27.93	0.9151	2.666
1874-1876	0.3930	943	379523	3.2126	0.2134	13238	7442	185.98	4.206	8.407	8.412	2.836	41.26	1.0596	2.613
1872-1874	0.3440	895	366913	2.0067	0.5011	5229	7204	181.23	4.023	8.240	11.194	3.009	54.73	0.8750	2.633
1870-1872	0.4108	949	368980	2.8654	0.3060	10452	7221	174.81	4.204	8.277	7.664	2.809	46.04	0.8121	2.490
1868-1870	0.3966	940	368532	4.2317	0.0673	10491	7261	161.30	3.350	6.515	5.457	2.579	33.65	0.5774	2.638
1866-1868	0.3793	917	370443	5.0842	0.3128	15806	7285	159.72	2.811	6.503	5.175	2.058	44.09	1.1811	2.654
1864-1866	0.3808	910	374530	9.6373	0.2021	7948	7380	164.46	4.017	7.202	8.255	2.480	227.40	0.9476	2.689
1862-1864	0.4002	892	371257	4.2046	0.2048	8846	7329	163.90	3.054	6.816	8.705	2.823	28.26	1.1809	2.604
1860-1862	0.3899	835	369614	8.1452	0.2216	10969	7305	176.07	3.550	8.143	8.026	2.381	37.16	0.8418	2.719
1858-1860	0.3571	863	364003	8.9819	0.5213	11114	7201	162.57	3.417	6.932	6.052	2.580	61.31	1.1071	2.628
1856-1858	0.4098	910	370511	6.4567	0.2489	5986	7312	145.02	4.042	5.307	7.014	2.548	41.12	0.8196	2.609
1854-1856	0.4096	878	366985	5.8633	0.3620	5283	7234	139.39	2.896	5.605	2.618	2.573	32.11	0.7491	2.670
1852-1854	0.4049	859	375848	0.7981	0.9697	9472	7455	168.39	5.495	5.728	6.529	2.745	44.81	0.6433	2.799
1850-1852	0.4221	864	367286	0.7924	0.9718	108314	7228	141.48	3.298	4.755	4.795	2.334	399.92	0.6976	2.658
1848-1850	0.3636	852	367316	0.4800	0.3484	8939	7276	150.21	2.490	5.911	3.546	2.157	78.44	0.8965	2.666
1846-1848	0.3969	846	362816	0.5911	0.3084	13278	7173	141.72	2.759	5.843	6.232	2.340	52.17	0.9571	2.613
1844-1846	0.3841	900	371651	0.6018	0.3919	17949	7267	143.03	3.486	6.461	7.071	2.229	92.24	2.2516	2.626
1842-1844	0.3840	890	364336	0.4728	0.5814	7897	7143	142.51	2.776	6.277	8.681	2.381	53.55	0.9476	2.613
1840-1842	0.3883	948	373980	0.7594	0.4187	9598	7301	162.19	2.988	13.027	8.452	2.914	174.91	16.3336	2.637

Calendar years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
1838-1840	0.3708	880	371880	0.4746	0.2449	6501	7346	149.85	2.250	5.623	4.193	2.071	40.79	0.9037	2.734
1836-1838	0.3487	878	350991	0.4842	0.0570	7354	6891	147.91	2.426	5.832	5.726	2.315	23.53	1.4117	2.530
1834-1836	0.3714	922	368658	0.4507	0.1696	5673	7260	154.77	3.336	6.020	7.665	2.581	30.88	1.1331	2.628
1832-1834	0.3982	918	379508	0.5315	0.2556	9629	7464	154.38	2.377	5.241	4.537	2.458	47.64	1.0970	2.713
1830-1832	0.3633	945	366104	0.4938	0.1960	13077	7178	154.35	2.379	5.658	7.379	2.620	60.08	1.4747	2.665
1828-1830	0.3517	931	371074	0.9125	0.1396	6747	7314	149.41	2.289	5.610	6.108	2.548	59.36	1.0830	2.788
1826-1828	0.4519	886	365509	0.5226	0.1357	9306	7216	155.57	2.741	6.667	6.147	3.022	44.25	0.7959	2.753
1824-1826	0.3937	903	365515	0.5031	0.2736	8234	7195	154.78	2.664	5.650	3.790	2.306	37.46	1.1068	2.588
1822-1824	0.4341	896	362729	0.5892	0.3619	9286	7153	170.16	2.416	6.058	5.086	2.670	77.76	0.9385	2.664
1820-1822	0.4364	887	364487	0.5050	0.3221	9556	7184	137.70	2.189	5.107	6.048	2.072	57.61	0.5012	2.610
1818-1820	0.3958	854	372509	0.5376	0.2946	17491	7413	165.45	2.313	8.202	9.954	3.106	80.20	1.3933	2.884
1816-1818	0.3619	851	360863	0.7246	0.3534	7119	7149	159.35	3.124	7.131	10.024	2.579	41.32	1.0610	2.730
1814-1816	0.3999	818	367649	0.6673	0.1767	16450	7335	168.92	2.140	7.629	5.752	3.240	54.78	1.3447	2.765
1812-1814	0.3721	889	365497	0.7243	0.1673	16578	7242	168.41	2.320	8.702	9.084	2.439	64.49	0.8317	2.697

Standards

	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
jcp-1b	0.4798	970	380425	0.7055	0.2366	554	7275	338.21	10.164	11.675	8.495	2.906	229.66	20.99	2.796
jcp-1b	0.4442	981	378284	0.7183	0.5822	839	7238	334.67	9.877	10.911	8.349	2.585	240.18	21.91	2.785
jcp-1b	0.4883	961	375444	0.6991	0.4676	436	7232	322.71	10.197	11.916	8.738	2.592	234.49	21.68	2.791
jcp-1b	0.4299	982	375247	0.7208	0.6159	753	7251	332.91	10.192	11.776	6.729	2.656	239.09	22.27	2.769
jcp-1b	0.4306	972	375312	0.6983	0.3389	528	7254	339.84	10.192	11.193	6.931	2.858	238.39	20.18	2.778
jcp-1b	0.4614	971	376939	0.6974	0.4992	1012	7248	336.33	10.210	10.533	6.824	2.904	229.95	21.26	2.754
standard devaition (1)	0.0249	7.65	2084	0.0105	0.1451	219	14.94	6.10	0.1291	0.5462	0.9413	0.1553	4.665	0.7425	0.0156
Average	0.4557	973	376942	0.7066	0.4567	687	7250	334.11	10.139	11.334	7.678	2.750	235.29	21.38	2.779
RSD	**5.47%**	**0.79%**	**0.55%**	**1.48%**	**31.78%**	**31.84%**	**0.21%**	**1.83%**	**1.27%**	**4.82%**	**12.26%**	**5.65%**	**1.98%**	**3.47%**	**0.56%**

MAG01D 1812-1986 modern coral

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
1984-1986	1.95E-02	8.93E-03	25.95	7.34E-06	1.24E-06	27.12	2.48E-03	4.09E-03	27.03	2.28E-05	6.65E-06	68.34
1982-1984	1.96E-02	8.95E-03	25.68	7.39E-06	1.24E-06	26.95	2.43E-03	4.01E-03	26.41	1.27E-05	3.72E-06	54.05
1980-1982	1.97E-02	8.99E-03	25.04	7.38E-06	1.24E-06	26.98	2.44E-03	4.02E-03	26.52	1.32E-05	3.84E-06	59.90
1978-1980	1.95E-02	8.90E-03	26.44	7.27E-06	1.22E-06	27.39	2.49E-03	4.10E-03	27.13	1.33E-05	3.87E-06	56.76
1976-1978	1.95E-02	8.94E-03	25.88	7.33E-06	1.23E-06	27.15	2.43E-03	4.00E-03	26.38	1.16E-05	3.38E-06	56.15
1974-1976	1.94E-02	8.89E-03	26.58	7.12E-06	1.20E-06	27.90	2.46E-03	4.06E-03	26.82	1.21E-05	3.52E-06	58.52
1972-1974	1.95E-02	8.90E-03	26.47	7.11E-06	1.20E-06	27.96	2.45E-03	4.04E-03	26.64	1.12E-05	3.27E-06	60.53
1970-1972	1.96E-02	8.95E-03	25.62	7.79E-06	1.31E-06	25.49	2.30E-03	3.80E-03	24.78	1.03E-05	3.00E-06	57.93
1968-1970	1.96E-02	8.98E-03	25.18	7.42E-06	1.25E-06	26.84	2.34E-03	3.86E-03	25.30	9.97E-06	2.91E-06	55.78
1966-1968	1.96E-02	8.96E-03	25.52	7.36E-06	1.24E-06	27.04	2.38E-03	3.93E-03	25.82	9.34E-06	2.73E-06	55.22
1964-1966	1.96E-02	8.96E-03	25.47	7.55E-06	1.27E-06	26.35	2.35E-03	3.87E-03	25.36	1.05E-05	3.05E-06	59.16
1962-1964	1.95E-02	8.93E-03	25.94	7.15E-06	1.20E-06	27.81	2.46E-03	4.05E-03	26.76	2.92E-05	8.52E-06	58.68
1960-1962	1.94E-02	8.89E-03	26.60	7.05E-06	1.19E-06	28.18	2.44E-03	4.03E-03	26.60	9.64E-06	2.81E-06	62.47
1960-1962	1.94E-02	8.89E-03	26.64	7.18E-06	1.21E-06	27.69	2.44E-03	4.02E-03	26.53	9.37E-06	2.73E-06	66.37
1958-1960	1.96E-02	8.95E-03	25.72	7.39E-06	1.24E-06	26.95	2.37E-03	3.91E-03	25.67	1.25E-05	3.65E-06	57.14
1956-1958	1.95E-02	8.92E-03	26.14	7.08E-06	1.19E-06	28.08	2.47E-03	4.07E-03	26.92	1.01E-05	2.95E-06	66.46
1954-1956	1.96E-02	8.95E-03	25.58	7.12E-06	1.20E-06	27.90	2.45E-03	4.03E-03	26.61	1.03E-05	3.00E-06	56.69
1952-1954	1.96E-02	8.95E-03	25.73	7.24E-06	1.22E-06	27.47	2.47E-03	4.08E-03	26.96	1.04E-05	3.04E-06	60.31
1950-1952	1.95E-02	8.93E-03	25.93	7.13E-06	1.20E-06	27.87	2.47E-03	4.08E-03	26.98	1.05E-05	3.05E-06	55.65
1948-1950	1.95E-02	8.92E-03	26.14	7.01E-06	1.18E-06	28.32	2.43E-03	4.01E-03	26.46	9.17E-06	2.68E-06	54.58

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
1946-1948	1.95E-02	8.94E-03	25.89	7.44E-06	1.25E-06	26.77	2.33E-03	3.85E-03	25.16	1.17E-05	3.42E-06	52.83
1944-1946	1.95E-02	8.92E-03	26.18	6.85E-06	1.15E-06	28.88	2.45E-03	4.04E-03	26.66	1.05E-05	3.08E-06	55.40
1942-1944	1.94E-02	8.90E-03	26.51	6.87E-06	1.16E-06	28.83	2.48E-03	4.09E-03	27.05	1.45E-05	4.23E-06	56.19
1940-1942	1.97E-02	9.00E-03	24.87	7.67E-06	1.29E-06	25.93	2.23E-03	3.68E-03	23.91	1.45E-05	4.23E-06	58.83
1938-1940	1.96E-02	8.98E-03	25.18	7.77E-06	1.31E-06	25.58	2.19E-03	3.61E-03	23.36	9.15E-06	2.67E-06	60.64
1936-1938	1.96E-02	8.96E-03	25.55	7.11E-06	1.20E-06	27.94	2.44E-03	4.02E-03	26.50	1.48E-05	4.31E-06	60.16
1934-1936	1.97E-02	9.02E-03	24.52	7.24E-06	1.22E-06	27.49	2.38E-03	3.92E-03	25.72	1.97E-05	5.75E-06	55.42
1932-1934	1.96E-02	8.99E-03	25.06	7.22E-06	1.22E-06	27.55	2.38E-03	3.92E-03	25.75	1.20E-05	3.50E-06	67.03
1930-1932	1.97E-02	8.99E-03	25.01	7.27E-06	1.22E-06	27.39	2.47E-03	4.07E-03	26.91	1.40E-05	4.09E-06	63.37
1928-1930	1.98E-02	9.04E-03	24.19	7.71E-06	1.30E-06	25.77	2.28E-03	3.76E-03	24.48	1.57E-05	4.59E-06	63.05
1926-1928	1.97E-02	9.00E-03	24.87	7.32E-06	1.23E-06	27.19	2.42E-03	3.99E-03	26.27	1.35E-05	3.93E-06	57.13
1924-1926	1.97E-02	9.02E-03	24.53	7.33E-06	1.23E-06	27.17	2.41E-03	3.98E-03	26.22	1.64E-05	4.79E-06	60.27
1922-1924	1.96E-02	8.96E-03	25.56	7.13E-06	1.20E-06	27.86	2.45E-03	4.05E-03	26.72	9.73E-06	2.84E-06	63.77
1920-1922	1.96E-02	8.98E-03	25.18	7.23E-06	1.22E-06	27.50	2.45E-03	4.04E-03	26.66	1.33E-05	3.89E-06	53.99
1918-1920	1.97E-02	9.01E-03	24.72	7.41E-06	1.25E-06	26.88	2.41E-03	3.97E-03	26.10	1.79E-05	5.22E-06	65.90
1916-1918	1.97E-02	8.99E-03	25.06	7.13E-06	1.20E-06	27.88	2.50E-03	4.11E-03	27.24	1.28E-05	3.73E-06	60.95
1914-1916	1.97E-02	9.01E-03	24.66	7.16E-06	1.21E-06	27.78	2.50E-03	4.12E-03	27.32	9.52E-06	2.78E-06	54.41
1912-1914	1.99E-02	9.10E-03	23.27	7.36E-06	1.24E-06	27.06	2.40E-03	3.96E-03	26.03	1.24E-05	3.62E-06	53.82
1910-1912	1.96E-02	8.97E-03	25.31	6.81E-06	1.15E-06	29.05	2.45E-03	4.04E-03	26.67	1.18E-05	3.44E-06	59.54
1908-1910	1.96E-02	8.97E-03	25.40	7.04E-06	1.18E-06	28.21	2.48E-03	4.10E-03	27.10	1.46E-05	4.25E-06	64.74
1906-1908	1.97E-02	9.03E-03	24.41	7.23E-06	1.22E-06	27.52	2.44E-03	4.03E-03	26.58	1.30E-05	3.80E-06	51.53

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
1904-1906	1.98E-02	9.06E-03	23.95	7.37E-06	1.24E-06	27.01	2.52E-03	4.15E-03	27.54	1.17E-05	3.43E-06	51.73
1902-1904	1.98E-02	9.06E-03	23.94	7.39E-06	1.24E-06	26.93	2.34E-03	3.86E-03	25.24	1.48E-05	4.32E-06	55.57
1900-1902	1.97E-02	9.00E-03	24.90	6.99E-06	1.18E-06	28.39	2.44E-03	4.03E-03	26.57	1.31E-05	3.82E-06	60.42
1898-1900	1.98E-02	9.07E-03	23.80	7.59E-06	1.28E-06	26.21	2.25E-03	3.70E-03	24.06	1.43E-05	4.16E-06	55.49
1896-1898	1.97E-02	8.99E-03	24.95	7.08E-06	1.19E-06	28.05	2.41E-03	3.98E-03	26.20	1.53E-05	4.46E-06	62.29
1894-1896	1.98E-02	9.06E-03	23.99	7.28E-06	1.23E-06	27.34	2.39E-03	3.95E-03	25.96	1.78E-05	5.19E-06	63.20
1892-1894	1.97E-02	9.00E-03	24.85	7.10E-06	1.19E-06	28.00	2.40E-03	3.96E-03	26.03	1.15E-05	3.36E-06	56.94
1890-1892	1.98E-02	9.05E-03	24.07	7.24E-06	1.22E-06	27.47	2.33E-03	3.85E-03	25.16	1.34E-05	3.90E-06	57.10
1888-1890	1.98E-02	9.05E-03	24.01	7.38E-06	1.24E-06	26.97	2.37E-03	3.90E-03	25.61	1.23E-05	3.58E-06	56.41
1886-1888	1.98E-02	9.06E-03	23.87	7.37E-06	1.24E-06	27.02	2.33E-03	3.84E-03	25.08	1.32E-05	3.85E-06	61.38
1884-1886	1.97E-02	9.02E-03	24.51	7.21E-06	1.21E-06	27.60	2.40E-03	3.96E-03	26.06	1.31E-05	3.83E-06	61.23
1882-1884	1.97E-02	9.01E-03	24.75	7.32E-06	1.23E-06	27.18	2.39E-03	3.94E-03	25.90	1.45E-05	4.23E-06	62.11
1880-1882	1.97E-02	9.01E-03	24.76	7.19E-06	1.21E-06	27.65	2.43E-03	4.01E-03	26.43	1.14E-05	3.32E-06	56.02
1878-1880	1.96E-02	8.94E-03	25.75	6.99E-06	1.18E-06	28.39	2.45E-03	4.05E-03	26.72	1.50E-05	4.38E-06	56.10
1876-1878	1.96E-02	8.98E-03	25.17	7.04E-06	1.19E-06	28.20	2.37E-03	3.91E-03	25.65	1.15E-05	3.36E-06	66.44
1874-1876	1.96E-02	8.97E-03	25.35	6.88E-06	1.16E-06	28.77	2.48E-03	4.10E-03	27.09	1.11E-05	3.23E-06	65.58
1872-1874	1.96E-02	8.98E-03	25.17	7.18E-06	1.21E-06	27.71	2.44E-03	4.02E-03	26.53	1.10E-05	3.20E-06	60.22
1870-1872	1.96E-02	8.95E-03	25.64	6.75E-06	1.14E-06	29.26	2.57E-03	4.24E-03	28.22	1.14E-05	3.32E-06	62.23
1868-1870	1.97E-02	9.01E-03	24.68	7.16E-06	1.21E-06	27.78	2.55E-03	4.21E-03	27.97	9.09E-06	2.65E-06	62.54
1866-1868	1.97E-02	9.00E-03	24.95	7.17E-06	1.21E-06	27.75	2.47E-03	4.08E-03	26.98	7.59E-06	2.21E-06	77.62
1864-1866	1.97E-02	9.01E-03	24.67	7.18E-06	1.21E-06	27.70	2.43E-03	4.01E-03	26.41	1.07E-05	3.13E-06	66.30

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
1862-1864	1.97E-02	9.03E-03	24.40	7.01E-06	1.18E-06	28.30	2.40E-03	3.96E-03	26.05	8.22E-06	2.40E-06	58.06
1860-1862	1.98E-02	9.04E-03	24.25	7.36E-06	1.24E-06	27.06	2.26E-03	3.72E-03	24.22	9.61E-06	2.80E-06	73.94
1858-1860	1.98E-02	9.05E-03	24.11	7.22E-06	1.22E-06	27.56	2.37E-03	3.91E-03	25.65	9.39E-06	2.74E-06	63.01
1856-1858	1.97E-02	9.03E-03	24.45	7.04E-06	1.19E-06	28.20	2.46E-03	4.05E-03	26.74	1.09E-05	3.18E-06	56.92
1854-1856	1.97E-02	9.02E-03	24.62	7.28E-06	1.22E-06	27.35	2.39E-03	3.95E-03	25.94	7.89E-06	2.30E-06	54.18
1852-1854	1.98E-02	9.07E-03	23.74	7.45E-06	1.25E-06	26.73	2.29E-03	3.77E-03	24.56	1.46E-05	4.27E-06	61.35
1850-1852	1.97E-02	9.00E-03	24.85	7.24E-06	1.22E-06	27.49	2.35E-03	3.88E-03	25.41	8.98E-06	2.62E-06	60.61
1848-1850	1.98E-02	9.06E-03	23.93	7.26E-06	1.22E-06	27.41	2.32E-03	3.83E-03	25.01	6.78E-06	1.98E-06	69.64
1846-1848	1.98E-02	9.04E-03	24.20	7.20E-06	1.21E-06	27.61	2.33E-03	3.84E-03	25.14	7.61E-06	2.22E-06	60.55
1844-1846	1.96E-02	8.94E-03	25.75	7.07E-06	1.19E-06	28.11	2.42E-03	3.99E-03	26.32	9.38E-06	2.74E-06	64.18
1842-1844	1.96E-02	8.97E-03	25.38	7.17E-06	1.21E-06	27.73	2.44E-03	4.03E-03	26.59	7.62E-06	2.22E-06	59.85
1840-1842	1.95E-02	8.93E-03	25.97	7.05E-06	1.19E-06	28.16	2.54E-03	4.18E-03	27.76	7.99E-06	2.33E-06	55.66
1838-1840	1.98E-02	9.04E-03	24.32	7.35E-06	1.24E-06	27.08	2.37E-03	3.90E-03	25.60	6.05E-06	1.77E-06	72.37
1836-1838	1.96E-02	8.98E-03	25.19	7.21E-06	1.21E-06	27.60	2.50E-03	4.13E-03	27.34	6.91E-06	2.02E-06	63.89
1834-1836	1.97E-02	9.01E-03	24.76	7.13E-06	1.20E-06	27.89	2.50E-03	4.12E-03	27.31	9.05E-06	2.64E-06	59.96
1832-1834	1.97E-02	9.00E-03	24.93	7.15E-06	1.20E-06	27.81	2.42E-03	3.99E-03	26.28	6.26E-06	1.83E-06	62.82
1830-1832	1.96E-02	8.97E-03	25.37	7.28E-06	1.23E-06	27.34	2.58E-03	4.25E-03	28.33	6.50E-06	1.90E-06	58.92
1828-1830	1.97E-02	9.02E-03	24.62	7.51E-06	1.27E-06	26.49	2.51E-03	4.14E-03	27.44	6.17E-06	1.80E-06	58.63
1826-1828	1.97E-02	9.03E-03	24.39	7.53E-06	1.27E-06	26.42	2.42E-03	4.00E-03	26.33	7.50E-06	2.19E-06	51.47
1824-1826	1.97E-02	9.00E-03	24.82	7.08E-06	1.19E-06	28.06	2.47E-03	4.07E-03	26.92	7.29E-06	2.13E-06	67.12
1822-1824	1.97E-02	9.02E-03	24.56	7.34E-06	1.24E-06	27.10	2.47E-03	4.07E-03	26.94	6.66E-06	1.94E-06	63.73

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
1820-1822	1.97E-02	9.02E-03	24.63	7.16E-06	1.21E-06	27.77	2.43E-03	4.01E-03	26.45	6.01E-06	1.75E-06	66.47
1818-1820	1.99E-02	9.10E-03	23.27	7.74E-06	1.30E-06	25.67	2.29E-03	3.78E-03	24.65	6.21E-06	1.81E-06	53.27
1816-1818	1.98E-02	9.06E-03	23.91	7.57E-06	1.27E-06	26.30	2.36E-03	3.89E-03	25.48	8.66E-06	2.53E-06	61.80
1814-1816	2.00E-02	9.13E-03	22.90	7.52E-06	1.27E-06	26.46	2.22E-03	3.67E-03	23.78	5.82E-06	1.70E-06	52.14
1812-1814	1.98E-02	9.06E-03	23.89	7.38E-06	1.24E-06	26.97	2.43E-03	4.01E-03	26.43	6.35E-06	1.85E-06	69.06

Standards

	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
jcp-1b	1.91E-02	8.75E-03	28.83	7.35E-06	1.24E-06	27.08	2.55E-03	4.20E-03	27.92	2.67E-05	7.80E-06	116.40
jcp-1b	1.91E-02	8.75E-03	28.76	7.36E-06	1.24E-06	27.04	2.59E-03	4.27E-03	28.48	2.61E-05	7.62E-06	129.47
jcp-1b	1.93E-02	8.81E-03	27.83	7.43E-06	1.25E-06	26.78	2.56E-03	4.22E-03	28.06	2.72E-05	7.93E-06	124.51
jcp-1b	1.93E-02	8.84E-03	27.40	7.38E-06	1.24E-06	26.98	2.62E-03	4.31E-03	28.78	2.72E-05	7.93E-06	125.34
jcp-1b	1.93E-02	8.84E-03	27.37	7.40E-06	1.25E-06	26.89	2.59E-03	4.27E-03	28.45	2.72E-05	7.93E-06	118.92
jcp-1b	1.92E-02	8.80E-03	28.07	7.30E-06	1.23E-06	27.24	2.58E-03	4.25E-03	28.27	2.71E-05	7.90E-06	115.82
standard devaition (1)	8.91E-05	4.08E-05	0.64	4.43E-08	7.45E-09	0.16	2.43E-05	4.01E-05	0.31	4.23E-07	1.23E-07	5.51
Average	1.92E-02	8.80E-03	28.04	7.37E-06	1.24E-06	27.00	2.58E-03	4.25E-03	28.33	2.69E-05	7.85E-06	121.74
RSD	**0.46%**	**0.46%**	**2.28%**	**0.60%**	**0.60%**	**0.59%**	**0.94%**	**0.94%**	**1.10%**	**1.57%**	**1.57%**	**4.53%**

NEL01D mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
128-130	0.4841	1007	373360	1.1042	0.0124	11063	7296	297.77	5.877	23.070	21.559	5.910	363.20	5.388	3.070
126-128	0.4486	913	362730	0.9606	-0.1655	10133	7138	219.86	4.657	10.248	10.484	3.787	68.59	2.051	2.960
124-126	0.4507	905	366254	0.6596	-0.1404	8167	7193	194.05	4.422	4.698	8.020	3.123	48.08	0.758	3.055
122-124	0.4627	944	369415	0.7540	-0.2334	14786	7258	192.37	4.914	5.021	4.711	3.234	39.78	0.764	3.118
120-122	0.3882	889	370932	0.6796	-0.2612	8454	7285	206.62	5.262	7.119	3.270	3.365	36.05	1.132	3.265
118-120	0.4079	833	340722	0.5794	-0.2228	6360	6728	170.32	4.935	5.909	3.510	2.328	31.05	1.206	2.945
116-118	0.4009	910	366021	0.5769	0.0717	7998	7223	189.47	5.312	6.322	7.403	3.260	34.24	1.440	3.143
114-116	0.3699	944	368760	0.6222	-0.0232	11667	7229	203.07	5.814	6.388	8.876	2.826	295.92	1.504	2.993
112-114	0.4298	942	371381	0.6366	-0.0331	14969	7297	189.18	5.877	6.357	8.055	2.398	97.99	1.886	3.053
110-112	0.4343	905	369430	0.6580	-0.1136	14123	7258	193.91	6.409	5.599	5.688	2.942	44.71	1.213	3.035
108-110	0.5532	919	367780	0.7407	1.2893	12340	7234	171.32	5.820	5.340	4.124	2.513	121.68	1.465	3.091
106-108	0.3650	928	371311	0.7617	-0.2868	5744	7319	187.11	5.770	4.589	5.911	2.455	62.43	1.546	3.058
104-106	0.4033	947	370609	0.9774	-0.0537	4760	7294	169.26	6.079	4.485	3.466	2.636	63.83	1.495	2.867
102-104	0.4120	918	369669	0.7421	-0.0513	7388	7293	196.66	6.297	6.004	5.128	2.979	43.67	4.081	3.017
100-102	0.4842	939	367906	1.3058	-0.2287	14890	7242	256.63	6.050	10.111	12.123	5.860	62.00	2.794	3.111
98-100	0.4312	895	369517	1.0374	-0.1414	13052	7229	209.98	5.682	6.808	8.527	4.263	45.20	1.782	3.047
96-98	0.3992	919	375276	0.7574	-0.1659	7309	7309	222.56	5.160	7.221	5.474	4.064	52.78	1.664	3.184
94-96	0.4428	902	378211	0.8408	-0.0977	6095	7496	248.52	4.574	5.806	8.276	4.384	56.61	1.653	3.375
92-94	0.3902	929	373968	0.6943	-0.0907	7151	7307	240.99	4.909	10.137	8.287	3.742	32.03	2.418	2.986
90-92	0.4388	913	372153	0.8317	-0.1013	19592	7300	204.71	4.805	6.054	5.913	3.347	47.82	1.414	3.033
88-90	0.4143	920	370846	0.7293	-0.1392	11341	7210	196.23	4.997	5.607	6.763	2.490	137.03	1.233	2.960
86-88	0.4362	945	380083	0.7767	-0.2318	13096	7358	206.54	5.945	8.074	6.997	3.094	72.50	1.229	2.851
84-86	0.4103	952	378341	0.9260	-0.1849	7544	7374	202.97	4.734	7.108	6.974	3.317	40.85	1.837	2.813
82-84	0.4385	950	376267	0.8656	0.1152	5676	7303	169.89	4.618	7.039	7.888	2.756	105.81	1.599	2.734

NEL01D mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
80-82	0.4045	898	370210	0.6529	-0.1589	11539	7263	189.43	5.061	5.319	6.117	3.301	87.76	1.426	2.946
78-80	0.4458	914	372988	0.7403	0.0722	5944	7296	204.75	7.163	6.440	3.992	3.303	30.30	1.690	2.816
76-78	0.4269	935	372031	0.6609	-0.2061	6325	7258	169.05	5.906	5.185	2.204	2.679	61.67	1.754	2.778
74-76	0.4416	888	367479	0.6389	-0.1017	2278	7289	194.22	5.462	6.319	6.245	3.429	50.65	2.692	2.959
72-74	0.4174	922	373976	0.8646	-0.1470	2518	7328	212.37	6.513	7.640	7.883	3.177	34.11	1.791	2.992
70-72	0.4808	916	370089	0.7569	-0.0871	4581	7297	207.57	6.388	8.832	8.660	3.607	78.49	7.239	3.004
68-70	0.3971	905	368046	0.9740	-0.2743	2933	7245	252.20	6.290	10.807	11.490	3.763	30.40	2.012	2.958
66-68	0.4362	894	369698	0.7401	-0.0959	345	7301	223.90	4.572	6.722	7.773	3.698	48.64	1.324	3.023
64-66	0.4468	943	369975	0.7000	-0.4496	5087	7258	209.21	4.202	7.132	4.390	3.243	36.56	1.668	2.755
62-64	0.4950	979	365140	2.1401	0.0528	4627	7211	405.37	5.289	69.417	51.259	11.208	165.34	134.222	2.927
60-62	0.4819	909	367465	0.8133	-0.3079	3768	7303	289.75	5.409	9.048	8.272	5.947	37.82	3.706	13.339
58-60	0.4040	901	371664	0.8200	-0.3364	-1328	7434	257.38	4.429	5.512	8.992	4.636	48.21	2.516	3.142
56-58	0.4503	908	370838	0.9149	0.0655	4856	7377	247.65	4.863	7.454	4.706	5.345	57.93	2.234	3.162
54-56	0.4293	948	369084	0.9843	-0.3372	4524	7287	187.75	4.339	5.238	6.328	3.040	39.25	1.692	2.763
52-54	0.4467	951	371036	0.8709	-0.2195	4585	7312	215.96	5.419	6.463	6.049	3.638	41.65	3.040	2.855
50-52	0.4369	942	373424	0.9548	-0.1697	9249	7365	219.50	4.542	6.628	10.995	3.901	53.14	2.342	2.908
48-50	0.4267	979	372900	0.8701	-0.0458	9053	7337	187.80	4.328	5.164	6.666	2.912	44.58	1.361	2.726
46-48	0.4492	971	364264	0.9335	-0.1886	43077	7138	202.71	4.877	17.891	11.698	3.840	81.72	13.110	2.694
44-46	0.3924	892	373407	0.8430	-0.2840	5596	7363	204.68	5.743	7.376	6.060	3.540	54.55	1.815	3.188
42-44	0.4443	877	375870	0.8616	-0.2148	16820	7409	198.88	5.417	7.828	6.525	3.384	66.99	2.028	3.222
40-42	0.4183	892	370882	0.7491	-0.2460	14454	7302	167.92	5.497	4.759	10.096	2.378	54.94	1.850	3.118
38-40	0.4313	856	372434	0.6752	-0.1078	13740	7415	194.02	4.940	5.548	4.943	3.243	56.25	1.698	3.313
36-38	0.4254	895	371503	1.3823	-0.1350	13483	7322	252.06	5.329	29.059	24.111	5.496	77.56	27.246	3.143
34-36	0.3816	895	376565	0.7352	0.0226	-1469	7355	178.33	4.993	5.197	5.986	2.895	44.98	1.650	3.006

NEL01D mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
32-34	0.3918	843	376434	0.8866	-0.0331	-1607	7411	211.24	5.768	7.089	11.996	3.352	89.86	1.797	3.205
30-32	0.4455	869	376657	0.7749	0.1451	-6169	7395	194.72	4.858	7.596	11.560	2.555	133.01	2.147	3.070
28-30	0.3796	886	371875	0.8001	-0.0669	3150	7353	177.58	4.407	5.922	5.111	2.867	56.56	4.563	3.026
26-28	0.4270	931	371916	0.8084	0.0375	-1541	7308	168.11	4.665	4.656	3.897	2.103	33.78	1.873	2.884
24-26	0.4218	980	373795	1.1267	0.0319	-2294	7294	174.18	6.332	5.891	6.174	2.610	146.58	3.574	2.768
22-24	0.4269	921	368514	0.7325	-0.1691	4217	7248	167.35	4.752	3.883	4.932	2.164	39.92	1.258	2.800
20-22	0.4159	937	376034	0.8426	0.0216	-920	7370	174.79	5.736	5.692	3.345	2.893	121.23	5.911	2.739
18-20	0.4102	900	373716	1.0093	-0.1137	-2549	7298	178.86	7.473	7.428	5.118	3.018	246.39	2.422	2.862
16-18	0.4065	882	373212	0.7428	-0.2469	10864	7307	183.24	6.680	5.047	6.933	2.662	416.30	1.279	2.859
14-16	0.4114	903	373202	0.9738	-0.0044	-5588	7305	194.10	5.058	7.028	5.517	3.384	22.34	2.089	2.797
12-14	0.3864	863	376298	0.8392	0.3060	-3567	7465	181.81	6.376	4.346	5.298	2.967	61.54	1.523	3.175
10-12	0.4172	903	371707	1.0481	0.1529	-5782	7295	188.71	4.947	6.978	7.049	3.066	50.33	1.584	2.843
8-10	0.4153	920	379460	1.0584	-0.2098	-6225	7441	200.49	4.032	6.357	4.920	2.758	42.18	1.507	2.932
6-8	0.4088	962	375860	1.1321	-0.0860	6762	7346	205.27	13.965	6.475	6.734	3.142	106.44	1.814	2.737
4-6	0.3694	941	372751	1.1100	-0.1135	-5706	7348	222.09	5.347	7.348	9.578	3.232	100.12	1.820	2.786

NEL01D mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
128-130	1.95E-02	8.94E-03	25.83	8.22E-06	1.38E-06	23.93	2.70E-03	4.45E-03	29.81	1.57E-05	4.59E-06	50.39
126-128	1.97E-02	9.00E-03	24.85	8.16E-06	1.37E-06	24.15	2.52E-03	4.15E-03	27.54	1.28E-05	3.75E-06	58.06
124-126	1.96E-02	8.98E-03	25.15	8.34E-06	1.40E-06	23.49	2.47E-03	4.07E-03	26.92	1.21E-05	3.52E-06	62.15
122-124	1.96E-02	8.99E-03	25.07	8.44E-06	1.42E-06	23.13	2.56E-03	4.22E-03	28.03	1.33E-05	3.88E-06	59.48
120-122	1.96E-02	8.98E-03	25.14	8.80E-06	1.48E-06	21.82	2.40E-03	3.95E-03	25.98	1.42E-05	4.14E-06	61.41
118-120	1.97E-02	9.03E-03	24.36	8.64E-06	1.46E-06	22.40	2.45E-03	4.03E-03	26.61	1.45E-05	4.23E-06	73.15
116-118	1.97E-02	9.03E-03	24.46	8.59E-06	1.45E-06	22.61	2.49E-03	4.10E-03	27.12	1.45E-05	4.24E-06	58.12
114-116	1.96E-02	8.97E-03	25.39	8.12E-06	1.37E-06	24.31	2.56E-03	4.22E-03	28.08	1.58E-05	4.60E-06	71.86
112-114	1.96E-02	8.99E-03	25.07	8.22E-06	1.38E-06	23.93	2.54E-03	4.18E-03	27.78	1.58E-05	4.62E-06	78.89
110-112	1.96E-02	8.99E-03	25.08	8.22E-06	1.38E-06	23.95	2.45E-03	4.04E-03	26.67	1.73E-05	5.06E-06	65.91
108-110	1.97E-02	9.00E-03	24.92	8.40E-06	1.42E-06	23.27	2.50E-03	4.12E-03	27.28	1.58E-05	4.62E-06	68.17
106-108	1.97E-02	9.02E-03	24.62	8.23E-06	1.39E-06	23.88	2.50E-03	4.12E-03	27.30	1.55E-05	4.53E-06	76.21
104-106	1.97E-02	9.00E-03	24.83	7.73E-06	1.30E-06	25.69	2.56E-03	4.21E-03	28.01	1.64E-05	4.79E-06	64.22
102-104	1.97E-02	9.02E-03	24.50	8.16E-06	1.37E-06	24.15	2.48E-03	4.10E-03	27.11	1.70E-05	4.97E-06	66.02
100-102	1.97E-02	9.00E-03	24.82	8.46E-06	1.42E-06	23.08	2.55E-03	4.21E-03	27.98	1.64E-05	4.80E-06	43.79
98-100	1.96E-02	8.95E-03	25.69	8.25E-06	1.39E-06	23.84	2.42E-03	3.99E-03	26.30	1.54E-05	4.49E-06	49.25
96-98	1.95E-02	8.91E-03	26.30	8.48E-06	1.43E-06	22.98	2.45E-03	4.04E-03	26.64	1.37E-05	4.01E-06	54.77
94-96	1.98E-02	9.07E-03	23.84	8.92E-06	1.50E-06	21.39	2.38E-03	3.93E-03	25.82	1.21E-05	3.53E-06	56.69
92-94	1.95E-02	8.94E-03	25.86	7.98E-06	1.34E-06	24.79	2.48E-03	4.10E-03	27.09	1.31E-05	3.83E-06	64.39

NEL01D mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
90-92	1.96E-02	8.97E-03	25.30	8.15E-06	1.37E-06	24.19	2.45E-03	4.05E-03	26.71	1.29E-05	3.77E-06	61.15
88-90	1.94E-02	8.89E-03	26.54	7.98E-06	1.34E-06	24.79	2.48E-03	4.09E-03	27.07	1.35E-05	3.93E-06	78.82
86-88	1.94E-02	8.85E-03	27.16	7.50E-06	1.26E-06	26.53	2.49E-03	4.10E-03	27.12	1.56E-05	4.56E-06	66.75
84-86	1.95E-02	8.91E-03	26.21	7.44E-06	1.25E-06	26.77	2.52E-03	4.15E-03	27.52	1.25E-05	3.65E-06	61.20
82-84	1.94E-02	8.88E-03	26.79	7.27E-06	1.22E-06	27.39	2.53E-03	4.16E-03	27.63	1.23E-05	3.58E-06	61.65
80-82	1.96E-02	8.97E-03	25.29	7.96E-06	1.34E-06	24.88	2.42E-03	4.00E-03	26.35	1.37E-05	3.99E-06	57.38
78-80	1.96E-02	8.95E-03	25.69	7.55E-06	1.27E-06	26.36	2.45E-03	4.04E-03	26.66	1.92E-05	5.60E-06	61.98
76-78	1.95E-02	8.92E-03	26.07	7.47E-06	1.26E-06	26.66	2.51E-03	4.14E-03	27.47	1.59E-05	4.63E-06	63.10
74-76	1.98E-02	9.07E-03	23.73	8.05E-06	1.36E-06	24.55	2.42E-03	3.99E-03	26.25	1.49E-05	4.34E-06	56.64
72-74	1.96E-02	8.96E-03	25.46	8.00E-06	1.35E-06	24.73	2.47E-03	4.07E-03	26.86	1.74E-05	5.08E-06	66.85
70-72	1.97E-02	9.02E-03	24.57	8.12E-06	1.37E-06	24.31	2.47E-03	4.08E-03	26.97	1.73E-05	5.04E-06	57.54
68-70	1.97E-02	9.00E-03	24.80	8.04E-06	1.35E-06	24.59	2.46E-03	4.05E-03	26.77	1.71E-05	4.99E-06	67.02
66-68	1.97E-02	9.03E-03	24.35	8.18E-06	1.38E-06	24.09	2.42E-03	3.99E-03	26.28	1.24E-05	3.61E-06	60.55
64-66	1.96E-02	8.97E-03	25.29	7.45E-06	1.25E-06	26.74	2.55E-03	4.20E-03	27.94	1.14E-05	3.31E-06	64.51
62-64	1.97E-02	9.03E-03	24.36	8.01E-06	1.35E-06	24.68	2.68E-03	4.42E-03	29.61	1.45E-05	4.23E-06	36.17
60-62	1.99E-02	9.09E-03	23.45	3.63E-05	6.11E-06	-77.72	2.47E-03	4.08E-03	26.97	1.47E-05	4.30E-06	48.72
58-60	2.00E-02	9.15E-03	22.54	8.45E-06	1.42E-06	23.09	2.42E-03	4.00E-03	26.34	1.19E-05	3.48E-06	55.52
56-58	1.99E-02	9.10E-03	23.31	8.53E-06	1.44E-06	22.82	2.45E-03	4.04E-03	26.65	1.31E-05	3.83E-06	46.33
54-56	1.97E-02	9.03E-03	24.39	7.49E-06	1.26E-06	26.59	2.57E-03	4.24E-03	28.19	1.18E-05	3.43E-06	61.76

NEL01D mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
52-54	1.97E-02	9.01E-03	24.65	7.69E-06	1.30E-06	25.83	2.56E-03	4.22E-03	28.10	1.46E-05	4.26E-06	59.36
50-52	1.97E-02	9.02E-03	24.54	7.79E-06	1.31E-06	25.50	2.52E-03	4.16E-03	27.60	1.22E-05	3.55E-06	56.27
48-50	1.97E-02	9.00E-03	24.87	7.31E-06	1.23E-06	27.22	2.63E-03	4.33E-03	28.92	1.16E-05	3.39E-06	64.49
46-48	1.96E-02	8.96E-03	25.45	7.40E-06	1.25E-06	26.92	2.66E-03	4.39E-03	29.41	1.34E-05	3.91E-06	52.79
44-46	1.97E-02	9.02E-03	24.58	8.54E-06	1.44E-06	22.78	2.39E-03	3.94E-03	25.90	1.54E-05	4.49E-06	57.82
42-44	1.97E-02	9.02E-03	24.61	8.57E-06	1.44E-06	22.65	2.33E-03	3.85E-03	25.17	1.44E-05	4.21E-06	58.77
40-42	1.97E-02	9.01E-03	24.79	8.41E-06	1.42E-06	23.26	2.41E-03	3.97E-03	26.10	1.48E-05	4.33E-06	70.62
38-40	1.99E-02	9.11E-03	23.20	8.89E-06	1.50E-06	21.49	2.30E-03	3.79E-03	24.74	1.33E-05	3.87E-06	59.82
36-38	1.97E-02	9.02E-03	24.63	8.46E-06	1.42E-06	23.06	2.41E-03	3.97E-03	26.14	1.43E-05	4.19E-06	45.86
34-36	1.95E-02	8.93E-03	25.90	7.98E-06	1.34E-06	24.79	2.38E-03	3.92E-03	25.74	1.33E-05	3.87E-06	61.59
32-34	1.97E-02	9.00E-03	24.80	8.51E-06	1.43E-06	22.87	2.24E-03	3.69E-03	23.98	1.53E-05	4.47E-06	63.02
30-32	1.96E-02	8.98E-03	25.19	8.15E-06	1.37E-06	24.18	2.31E-03	3.80E-03	24.84	1.29E-05	3.76E-06	76.20
28-30	1.98E-02	9.04E-03	24.18	8.14E-06	1.37E-06	24.24	2.38E-03	3.93E-03	25.81	1.19E-05	3.46E-06	61.94
26-28	1.97E-02	8.99E-03	25.05	7.75E-06	1.31E-06	25.62	2.50E-03	4.13E-03	27.34	1.25E-05	3.66E-06	79.93
24-26	1.95E-02	8.93E-03	26.03	7.40E-06	1.25E-06	26.89	2.62E-03	4.32E-03	28.85	1.69E-05	4.94E-06	66.74
22-24	1.97E-02	9.00E-03	24.93	7.60E-06	1.28E-06	26.19	2.50E-03	4.12E-03	27.30	1.29E-05	3.76E-06	77.33
20-22	1.96E-02	8.96E-03	25.43	7.28E-06	1.23E-06	27.32	2.49E-03	4.11E-03	27.22	1.53E-05	4.45E-06	60.42
18-20	1.95E-02	8.93E-03	25.94	7.66E-06	1.29E-06	25.97	2.41E-03	3.97E-03	26.15	2.00E-05	5.84E-06	59.27
16-18	1.96E-02	8.96E-03	25.58	7.66E-06	1.29E-06	25.96	2.36E-03	3.90E-03	25.57	1.79E-05	5.22E-06	68.84

NEL01D mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
14-16	1.96E-02	8.95E-03	25.60	7.49E-06	1.26E-06	26.56	2.42E-03	3.99E-03	26.29	1.36E-05	3.96E-06	57.36
12-14	1.98E-02	9.07E-03	23.71	8.44E-06	1.42E-06	23.15	2.29E-03	3.78E-03	24.66	1.69E-05	4.95E-06	61.27
10-12	1.96E-02	8.98E-03	25.23	7.65E-06	1.29E-06	26.00	2.43E-03	4.01E-03	26.42	1.33E-05	3.88E-06	61.56
8-10	1.96E-02	8.97E-03	25.36	7.73E-06	1.30E-06	25.72	2.42E-03	4.00E-03	26.34	1.06E-05	3.10E-06	72.70
6-8	1.95E-02	8.94E-03	25.81	7.28E-06	1.23E-06	27.33	2.56E-03	4.22E-03	28.05	3.72E-05	1.08E-05	65.33
4-6	1.97E-02	9.02E-03	24.61	7.47E-06	1.26E-06	26.63	2.52E-03	4.16E-03	27.61	1.43E-05	4.19E-06	68.72

NEL03D mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
Top of slice	0.5147	937	374554	3.2994	0.0248	11277	7313	451.75	10.402	32.457	24.968	11.245	192.49	5.339	2.909
	0.4183	878	376483	1.9017	0.0985	15291	7381	385.40	13.510	13.860	22.275	8.141	157.83	3.588	2.983
	0.3715	906	380158	1.6806	-0.0487	12497	7394	336.05	15.597	11.320	16.364	7.009	136.96	5.560	2.967
	0.3931	879	374968	1.4716	-0.1270	9601	7343	296.52	11.384	8.012	8.126	5.501	82.18	2.115	2.974
	0.4252	867	372710	1.1747	-0.1192	7467	7263	273.75	10.458	7.257	7.623	4.327	86.71	1.249	2.967
	0.3659	891	369575	1.1411	0.0948	23962	7215	213.32	8.224	5.208	6.886	3.191	77.81	0.886	2.836
	0.3676	934	376726	0.9922	0.0529	10518	7295	197.99	8.345	4.480	6.760	3.198	60.82	0.896	2.808
bottom of top slice	0.3860	911	372631	1.3194	0.0394	16008	7220	197.90	8.828	6.010	4.610	2.690	54.40	0.982	2.791
	0.3869	932	375203	1.1676	0.4561	12044	7290	189.35	6.837	5.844	6.017	2.608	49.21	1.054	2.789
	0.3922	926	373859	1.7399	0.0573	9578	7268	195.86	6.816	17.713	12.987	3.541	110.33	6.625	2.844
top of bottom slice	0.3831	941	375165	1.1693	-0.1313	10494	7264	173.72	8.461	4.499	3.431	2.520	43.63	0.748	3.026
	0.3831	918	375649	1.2035	-0.0472	15866	7281	190.77	10.604	6.834	7.017	3.098	57.80	4.346	2.901
	0.3910	905	382584	1.3457	-0.0062	14851	7445	185.53	9.967	7.332	9.658	2.768	121.97	1.418	3.058
	0.3796	898	378716	1.0047	0.1713	13283	7405	181.61	11.076	5.774	4.944	2.741	43.15	1.421	3.105
	0.3806	906	377714	1.0377	-0.0212	8122	7352	181.37	12.006	6.704	8.354	2.730	67.09	1.518	3.029
	0.4023	893	377405	0.9902	-0.1683	21624	7368	174.52	10.021	5.474	4.419	2.012	127.38	0.916	3.096
	0.4615	891	380137	1.0107	-0.1138	16042	7446	183.02	9.764	5.532	4.604	2.565	99.50	1.236	3.114
bottom of bottom slice	0.4108	904	372156	1.1494	-0.0126	12490	7196	167.05	11.047	4.405	7.086	2.439	52.08	0.837	2.977
	0.3696	933	379258	1.3913	-0.1000	10678	7364	178.81	11.192	6.567	8.785	2.878	57.26	2.764	3.002
	0.3744	947	379792	1.4957	-0.0769	11385	7371	184.10	9.153	5.624	4.244	2.691	400.35	2.019	2.977

NEL03D mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
Top of slice	1.95E-02	8.93E-03	25.96	7.77E-06	1.31E-06	25.58	2.50E-03	4.12E-03	27.33	2.78E-05	8.10E-06	40.17
	1.96E-02	8.97E-03	25.38	7.92E-06	1.33E-06	25.00	2.33E-03	3.85E-03	25.18	3.59E-05	1.05E-05	47.34
	1.95E-02	8.90E-03	26.49	7.81E-06	1.31E-06	25.43	2.38E-03	3.93E-03	25.82	4.10E-05	1.20E-05	47.95
	1.96E-02	8.96E-03	25.55	7.93E-06	1.34E-06	24.98	2.34E-03	3.87E-03	25.31	3.04E-05	8.86E-06	53.90
	1.95E-02	8.91E-03	26.23	7.96E-06	1.34E-06	24.87	2.33E-03	3.84E-03	25.08	2.81E-05	8.19E-06	63.26
	1.95E-02	8.93E-03	25.98	7.67E-06	1.29E-06	25.91	2.41E-03	3.98E-03	26.17	2.23E-05	6.49E-06	66.85
	1.94E-02	8.86E-03	27.10	7.45E-06	1.26E-06	26.70	2.48E-03	4.09E-03	27.05	2.22E-05	6.46E-06	61.90
bottom of top slice	1.94E-02	8.86E-03	27.03	7.49E-06	1.26E-06	26.58	2.44E-03	4.03E-03	26.59	2.37E-05	6.91E-06	73.57
	1.94E-02	8.89E-03	26.64	7.43E-06	1.25E-06	26.78	2.48E-03	4.09E-03	27.09	1.82E-05	5.32E-06	72.59
	1.94E-02	8.89E-03	26.56	7.61E-06	1.28E-06	26.15	2.48E-03	4.08E-03	27.00	1.82E-05	5.32E-06	55.32
top of bottom slice	1.94E-02	8.86E-03	27.13	8.07E-06	1.36E-06	24.49	2.51E-03	4.13E-03	27.40	2.26E-05	6.58E-06	68.95
	1.94E-02	8.87E-03	26.99	7.72E-06	1.30E-06	25.73	2.44E-03	4.03E-03	26.57	2.82E-05	8.24E-06	61.57
	1.95E-02	8.90E-03	26.43	7.99E-06	1.35E-06	24.75	2.36E-03	3.90E-03	25.57	2.61E-05	7.60E-06	67.03
	1.96E-02	8.94E-03	25.76	8.20E-06	1.38E-06	24.01	2.37E-03	3.91E-03	25.67	2.92E-05	8.54E-06	66.25
	1.95E-02	8.90E-03	26.40	8.02E-06	1.35E-06	24.66	2.40E-03	3.96E-03	26.01	3.18E-05	9.28E-06	66.43
	1.95E-02	8.93E-03	25.97	8.20E-06	1.38E-06	23.99	2.37E-03	3.90E-03	25.58	2.66E-05	7.75E-06	86.73
	1.96E-02	8.96E-03	25.52	8.19E-06	1.38E-06	24.03	2.34E-03	3.86E-03	25.30	2.57E-05	7.50E-06	71.36
bottom of bottom slice	1.93E-02	8.84E-03	27.31	8.00E-06	1.35E-06	24.73	2.43E-03	4.01E-03	26.40	2.97E-05	8.66E-06	68.49
	1.94E-02	8.88E-03	26.73	7.91E-06	1.33E-06	25.04	2.46E-03	4.06E-03	26.80	2.95E-05	8.61E-06	62.12
	1.94E-02	8.88E-03	26.79	7.84E-06	1.32E-06	25.32	2.49E-03	4.11E-03	27.22	2.41E-05	7.03E-06	68.42

NEL06A mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
Top of slice	0.5062	1064	373127	10.1097	0.3254	15710	7301	531.56	11.428	86.924	72.024	13.343	249.58	99.371	3.131
	0.3879	897	374064	3.0746	0.2976	12849	7308	375.80	11.497	21.951	24.555	9.648	78.71	16.213	3.164
	0.3682	897	377924	1.9867	0.1227	8219	7431	328.62	10.998	12.587	11.574	6.855	71.50	2.482	3.030
	0.3348	927	376991	2.0724	-0.1403	30993	7375	303.84	20.261	8.776	12.555	5.651	154.34	1.335	3.008
	0.3710	947	381860	3.4749	0.0902	11687	7507	290.05	11.357	9.584	6.324	4.978	230.12	2.014	2.920
	0.3728	943	376351	2.3383	0.0715	11659	7378	280.31	10.991	9.628	9.974	5.172	81.61	2.186	2.805
	0.3896	945	379665	1.9951	0.1881	8341	7412	271.49	11.579	10.006	11.564	4.831	47.57	0.904	2.820
bottom of top slice	0.3597	891	375583	1.8214	-0.1692	6360	7405	252.76	11.075	10.213	10.923	4.180	102.18	2.342	2.951
	0.3434	868	373991	1.5402	-0.1779	9548	7357	265.67	11.513	9.883	12.766	3.889	52.80	1.393	2.971
	0.4575	860	377582	1.6874	0.0059	14927	7410	298.05	11.895	10.436	11.722	5.428	67.03	2.045	3.062
top of bottom slice	0.3866	816	382542	1.6199	-0.0551	14165	7479	260.48	12.920	8.039	5.348	3.689	75.93	0.767	2.999
	0.3758	852	373586	1.5269	-0.1316	14037	7306	240.38	11.904	7.599	9.951	4.131	49.16	0.828	2.810
	0.3245	824	371769	1.5546	-0.2001	14792	7232	264.99	25.765	9.451	10.332	4.490	78.84	1.743	2.808
	0.3484	866	373767	1.6838	0.0426	9115	7289	227.37	14.148	7.095	6.237	3.323	53.08	1.265	2.792
	0.3568	839	368322	1.6859	-0.2069	10400	7165	233.94	10.672	7.605	7.308	3.898	37.53	1.152	2.718
	0.3783	867	379976	1.8186	0.0754	7080	7419	239.24	9.613	7.167	5.345	4.044	78.50	0.837	2.804
	0.3055	844	373744	1.6376	-0.2273	8183	7328	221.77	9.949	7.150	7.542	3.012	93.36	1.067	2.767
bottom of bottom slice	0.3352	807	376807	1.8735	-0.2082	17412	7436	240.34	19.409	8.139	6.480	4.483	121.84	1.249	2.968
	0.3030	840	382453	1.8299	-0.1947	9935	7484	245.74	12.231	8.244	6.439	4.140	189.44	73.126	2.890
	0.3268	834	383439	1.7528	-0.1212	15483	7474	255.97	13.228	10.721	8.531	4.661	99.74	0.746	2.902

NEL06A mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
Top of slice	1.96E-02	8.95E-03	25.65	8.39E-06	1.41E-06	23.32	2.85E-03	4.70E-03	31.79	3.06E-05	8.94E-06	39.84
	1.95E-02	8.94E-03	25.87	8.46E-06	1.42E-06	23.07	2.40E-03	3.96E-03	26.02	3.07E-05	8.97E-06	38.95
	1.97E-02	8.99E-03	24.96	8.02E-06	1.35E-06	24.66	2.37E-03	3.91E-03	25.67	2.91E-05	8.49E-06	47.94
	1.96E-02	8.95E-03	25.68	7.98E-06	1.34E-06	24.80	2.46E-03	4.05E-03	26.78	5.37E-05	1.57E-05	53.77
	1.97E-02	8.99E-03	24.99	7.65E-06	1.29E-06	26.01	2.48E-03	4.09E-03	27.05	2.97E-05	8.68E-06	58.26
	1.96E-02	8.97E-03	25.39	7.45E-06	1.25E-06	26.71	2.51E-03	4.13E-03	27.39	2.92E-05	8.52E-06	54.20
	1.95E-02	8.93E-03	25.97	7.43E-06	1.25E-06	26.80	2.49E-03	4.10E-03	27.15	3.05E-05	8.90E-06	56.20
bottom of top slice	1.97E-02	9.02E-03	24.58	7.86E-06	1.32E-06	25.25	2.37E-03	3.91E-03	25.69	2.95E-05	8.61E-06	60.47
	1.97E-02	9.00E-03	24.91	7.94E-06	1.34E-06	24.93	2.32E-03	3.83E-03	25.03	3.08E-05	8.98E-06	68.32
	1.96E-02	8.98E-03	25.24	8.11E-06	1.37E-06	24.33	2.28E-03	3.75E-03	24.45	3.15E-05	9.19E-06	54.91
top of bottom slice	1.96E-02	8.94E-03	25.77	7.84E-06	1.32E-06	25.31	2.13E-03	3.52E-03	22.60	3.38E-05	9.86E-06	70.61
	1.96E-02	8.95E-03	25.73	7.52E-06	1.27E-06	26.46	2.28E-03	3.76E-03	24.51	3.19E-05	9.30E-06	58.19
	1.95E-02	8.90E-03	26.48	7.55E-06	1.27E-06	26.34	2.22E-03	3.65E-03	23.67	6.93E-05	2.02E-05	59.01
	1.95E-02	8.92E-03	26.13	7.47E-06	1.26E-06	26.65	2.32E-03	3.82E-03	24.97	3.79E-05	1.10E-05	68.42
	1.95E-02	8.90E-03	26.48	7.38E-06	1.24E-06	26.98	2.28E-03	3.76E-03	24.46	2.90E-05	8.46E-06	60.01
	1.95E-02	8.93E-03	25.95	7.38E-06	1.24E-06	26.98	2.28E-03	3.76E-03	24.52	2.53E-05	7.38E-06	59.16
	1.96E-02	8.97E-03	25.36	7.40E-06	1.25E-06	26.89	2.26E-03	3.72E-03	24.22	2.66E-05	7.77E-06	73.64
bottom of bottom slice	1.97E-02	9.03E-03	24.45	7.88E-06	1.33E-06	25.17	2.14E-03	3.53E-03	22.73	5.15E-05	1.50E-05	53.61
	1.96E-02	8.95E-03	25.64	7.56E-06	1.27E-06	26.34	2.20E-03	3.62E-03	23.42	3.20E-05	9.33E-06	59.36
	1.95E-02	8.92E-03	26.18	7.57E-06	1.27E-06	26.29	2.18E-03	3.59E-03	23.15	3.45E-05	1.01E-05	54.91

NEL07C mid-Holocene coral

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
Top of slice	0.3582	926	374008	2.8230	0.1378	28592	7297	325.19	5.317	28.549	21.161	7.207	131.98	17.771	2.851
	0.3517	879	374243	1.5054	0.5523	13150	7289	179.01	6.103	8.193	5.462	3.586	169.62	1.249	2.788
	0.3864	922	380374	3.3118	-0.2174	18367	7423	188.14	6.267	8.697	7.899	3.568	48.60	3.549	2.879
	0.3552	906	378010	3.9181	-0.2038	8752	7367	173.20	4.916	5.572	4.871	3.424	32.34	0.855	2.852
	0.3500	883	374660	1.3589	-0.1275	21830	7340	176.98	5.973	6.356	5.365	2.963	52.57	1.049	2.844
	0.3657	892	376154	1.4441	-0.1813	12035	7310	161.65	6.802	6.698	8.893	2.898	49.58	1.698	2.905
	0.3632	921	368948	1.5450	-0.1540	23835	7204	163.60	6.381	6.987	4.700	2.134	31.43	2.194	2.909
bottom of top slice	0.3743	896	376997	1.5589	-0.2749	11733	7344	185.68	6.550	7.702	6.600	2.837	36.04	1.760	3.100
	0.3602	890	373494	1.6052	0.1566	23737	7302	181.24	6.150	9.062	6.956	3.012	200.86	1.201	3.058
	0.3894	934	378218	1.6119	-0.2699	12768	7337	186.74	9.497	7.053	8.516	3.067	307.82	1.961	2.912
top of bottom slice	0.3491	885	375407	2.0220	-0.2281	6110	7363	209.09	16.662	9.362	8.787	3.349	67.91	6.506	3.020
	0.3457	855	374979	2.1919	-0.3555	17079	7370	231.88	12.759	9.624	10.374	4.287	1696.28	2.397	3.111
	0.3606	892	374818	2.1332	-0.1733	14673	7352	219.08	9.568	8.409	11.715	3.206	4046.93	3.769	3.010
	0.3315	862	368253	1.7180	-0.0336	10531	7186	208.98	7.202	10.717	9.475	4.040	59.06	5.198	2.894
	0.3377	948	375176	2.0078	-0.2505	10175	7302	186.18	6.243	7.161	8.724	3.283	179.12	2.690	2.727
	0.3273	867	370795	1.3917	-0.2349	13966	7200	177.71	6.062	6.938	6.432	2.889	33.95	0.934	2.741
	0.3570	940	380590	1.6825	-0.1766	11620	7331	177.92	7.278	7.472	9.489	2.785	46.11	1.857	2.778
bottom of bottom slice	0.3671	886	372044	1.8572	-0.2522	7530	7179	184.25	5.909	9.621	11.362	3.119	94.85	4.014	2.808
	0.3708	914	374808	2.3279	-0.0584	25600	7284	189.10	6.722	8.252	3.640	3.264	61.09	3.148	2.851
	0.4058	921	375298	2.1855	-0.1961	20739	7263	195.07	6.709	9.712	8.397	3.514	65.25	2.566	2.779

NEL07C mid-Holocene coral

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
Top of slice	1.95E-02	8.92E-03	26.07	7.62E-06	1.28E-06	26.09	2.48E-03	4.08E-03	26.99	1.42E-05	4.15E-06	45.12
	1.95E-02	8.91E-03	26.30	7.45E-06	1.25E-06	26.72	2.35E-03	3.87E-03	25.36	1.63E-05	4.76E-06	49.92
	1.95E-02	8.93E-03	26.02	7.57E-06	1.27E-06	26.30	2.42E-03	4.00E-03	26.33	1.65E-05	4.81E-06	52.72
	1.95E-02	8.91E-03	26.22	7.55E-06	1.27E-06	26.37	2.40E-03	3.95E-03	25.99	1.30E-05	3.80E-06	50.58
	1.96E-02	8.96E-03	25.48	7.59E-06	1.28E-06	26.21	2.36E-03	3.89E-03	25.49	1.59E-05	4.65E-06	59.73
	1.94E-02	8.89E-03	26.61	7.72E-06	1.30E-06	25.73	2.37E-03	3.91E-03	25.66	1.81E-05	5.28E-06	55.77
	1.95E-02	8.93E-03	25.95	7.89E-06	1.33E-06	25.14	2.50E-03	4.12E-03	27.25	1.73E-05	5.05E-06	76.67
bottom of top slice	1.95E-02	8.91E-03	26.27	8.22E-06	1.38E-06	23.93	2.38E-03	3.92E-03	25.72	1.74E-05	5.07E-06	65.44
	1.96E-02	8.94E-03	25.77	8.19E-06	1.38E-06	24.05	2.38E-03	3.93E-03	25.80	1.65E-05	4.81E-06	60.18
	1.94E-02	8.87E-03	26.85	7.70E-06	1.30E-06	25.82	2.47E-03	4.07E-03	26.93	2.51E-05	7.33E-06	60.89
top of bottom slice	1.96E-02	8.97E-03	25.33	8.04E-06	1.35E-06	24.57	2.36E-03	3.89E-03	25.48	4.44E-05	1.30E-05	62.44
	1.97E-02	8.99E-03	25.02	8.30E-06	1.40E-06	23.66	2.28E-03	3.76E-03	24.50	3.40E-05	9.93E-06	54.09
	1.96E-02	8.97E-03	25.31	8.03E-06	1.35E-06	24.62	2.38E-03	3.93E-03	25.78	2.55E-05	7.45E-06	68.34
	1.95E-02	8.93E-03	26.05	7.86E-06	1.32E-06	25.24	2.34E-03	3.86E-03	25.29	1.96E-05	5.71E-06	51.72
	1.95E-02	8.90E-03	26.40	7.27E-06	1.22E-06	27.37	2.53E-03	4.17E-03	27.66	1.66E-05	4.86E-06	56.71
	1.94E-02	8.88E-03	26.72	7.39E-06	1.24E-06	26.93	2.34E-03	3.86E-03	25.24	1.63E-05	4.77E-06	61.50
	1.93E-02	8.81E-03	27.84	7.30E-06	1.23E-06	27.26	2.47E-03	4.07E-03	26.93	1.91E-05	5.58E-06	63.88
bottom of bottom slice	1.93E-02	8.83E-03	27.59	7.55E-06	1.27E-06	26.36	2.38E-03	3.92E-03	25.77	1.59E-05	4.64E-06	59.07
	1.94E-02	8.89E-03	26.61	7.61E-06	1.28E-06	26.16	2.44E-03	4.02E-03	26.53	1.79E-05	5.23E-06	57.93
	1.94E-02	8.85E-03	27.20	7.41E-06	1.25E-06	26.88	2.45E-03	4.05E-03	26.71	1.79E-05	5.22E-06	55.52

Standards- mid-Holocene sample run

	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	66Zn ppb	88Sr ppm	89Y ppb	138Ba ppm	141Pr ppb	149Sm ppb	165Ho ppb	208Pb ppb	232Th ppb	238U ppm
jcp-1b	0.5701	974	380286	0.7452	0.1406	182	7280	353.95	10.196	12.303	8.862	3.170	261.39	26.07	2.802
jcp-1b	0.4913	965	380565	0.7482	0.1043	57	7270	351.14	10.132	14.087	12.960	3.052	254.03	24.12	2.790
jcp-1a	0.4541	966	379444	0.6616	0.2634	1390	7288	339.21	9.913	10.643	6.121	2.866	204.55	14.66	2.738
jcp-1a	0.4498	970	378710	0.6465	-0.1677	-3126	7265	334.99	9.545	10.113	10.221	2.625	189.96	13.99	2.760
jcp-1a	0.4444	976	382284	0.7033	0.3134	977	7275	336.15	9.892	10.282	4.478	2.449	207.83	14.74	2.764
jcp-1a	0.4692	963	380209	0.6433	-0.0092	-6728	7272	342.71	14.647	9.609	7.958	2.315	206.77	14.20	2.737
jcp-1a	0.4147	966	379907	0.6570	0.0739	-9511	7293	345.82	9.913	9.275	8.719	2.325	219.75	13.71	2.779
standard deviation (1)	0.0497	4.74	1108	0.0456	0.1623	4248	10.11	7.28	1.794	1.708	2.743	0.348	26.87	5.33	0.0249
Average	0.4705	969	380201	0.6865	0.1026	-2394	7278	343.43	10.605	10.902	8.474	2.686	220.61	17.36	2.767
RSD	**10.57%**	**0.49%**	**0.29%**	**6.65%**	**158.14%**	**-177.45%**	**0.14%**	**2.12%**	**16.92%**	**15.67%**	**32.37%**	**12.97%**	**12.18%**	**30.71%**	**0.90%**

Standards- mid-Holocene sample run

	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	Ba/Ca	atomic Ba/Ca	Y/Ho
jcp-1b	1.91E-02	8.76E-03	28.68	7.37E-06	1.24E-06	27.02	2.56E-03	4.22E-03	28.07	2.68E-05	7.82E-06	111.65
jcp-1b	1.91E-02	8.74E-03	28.98	7.33E-06	1.23E-06	27.15	2.54E-03	4.18E-03	27.76	2.66E-05	7.77E-06	115.06
jcp-1a	1.92E-02	8.79E-03	28.23	7.22E-06	1.22E-06	27.57	2.55E-03	4.20E-03	27.88	2.61E-05	7.62E-06	118.37
jcp-1a	1.92E-02	8.77E-03	28.40	7.29E-06	1.23E-06	27.31	2.56E-03	4.22E-03	28.08	2.52E-05	7.36E-06	127.64
jcp-1a	1.90E-02	8.70E-03	29.50	7.23E-06	1.22E-06	27.51	2.55E-03	4.21E-03	27.96	2.59E-05	7.55E-06	137.25
jcp-1a	1.91E-02	8.75E-03	28.80	7.20E-06	1.21E-06	27.63	2.53E-03	4.18E-03	27.72	3.85E-05	1.12E-05	148.02
jcp-1a	1.92E-02	8.78E-03	28.30	7.32E-06	1.23E-06	27.20	2.54E-03	4.19E-03	27.85	2.61E-05	7.61E-06	148.74
standard deviation (1)	6.24E-05	2.85E-05	0.45	6.44E-08	1.09E-08	0.23	1.13E-05	1.86E-05	0.14	4.72E-06	1.38E-06	15.43
Average	1.91E-02	8.76E-03	28.70	7.28E-06	1.23E-06	27.34	2.55E-03	4.20E-03	27.90	2.79E-05	8.14E-06	129.53
RSD	**0.33%**	**0.33%**	**1.56%**	**0.89%**	**0.89%**	**0.85%**	**0.44%**	**0.44%**	**0.52%**	**16.91%**	**16.91%**	**11.91%**

H_2O_2 treated samples 1958-1986

Calendar years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	86Sr ppm	138Ba ppm	238U ppm
1984-1986	0.5807	947	389509	0.4502	-0.1183	7579	8.793	2.849
1982-1984	0.4002	850	368938	0.4770	0.0153	7192	4.712	2.760
1980-1982	0.4062	887	380005	0.4977	0.1463	7407	4.958	2.810
1978-1980	0.3477	831	362794	0.4821	0.1791	7044	4.805	2.703
1976-1978	0.3131	750	326607	0.4654	0.0063	6332	4.653	2.396
1974-1976	0.3481	828	355028	0.4644	-0.0106	6937	4.177	2.623
1972-1974	0.4984	918	384617	0.4961	0.0803	7464	4.660	2.756
1970-1972	0.3687	767	343757	0.4120	-0.0528	6685	3.475	2.628
1968-1970	0.4184	821	363111	0.3535	0.0247	7073	3.701	2.707
1966-1968	0.6664	841	379374	0.5658	0.2375	7408	5.349	2.880
1964-1966	0.3803	781	362759	0.4307	0.1288	7058	3.465	2.824
1962-1964	0.3535	872	351762	0.4844	0.0470	6782	3.271	2.446
1960-1962	0.3595	759	350826	0.6345	0.1136	6789	4.813	2.620
1960-1962	0.3737	834	368401	0.7164	-0.0941	7129	3.781	2.712
1958-1960	0.3810	831	367795	0.4921	0.0906	7133	4.268	2.726

H_2O_2 treated samples 1958-1986

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Ba/Ca	atomic Ba/Ca
1984-1986	1.95E-02	8.90E-03	26.43	2.43E-03	4.01E-03	26.41	7.31E-06	1.23E-06	27.21	2.26E-05	6.59E-06
1982-1984	1.95E-02	8.92E-03	26.18	2.30E-03	3.80E-03	24.80	7.48E-06	1.26E-06	26.61	1.28E-05	3.73E-06
1980-1982	1.95E-02	8.92E-03	26.20	2.33E-03	3.85E-03	25.17	7.39E-06	1.25E-06	26.92	1.30E-05	3.81E-06
1978-1980	1.94E-02	8.88E-03	26.72	2.29E-03	3.78E-03	24.62	7.45E-06	1.25E-06	26.72	1.32E-05	3.87E-06
1976-1978	1.94E-02	8.87E-03	26.93	2.30E-03	3.79E-03	24.71	7.34E-06	1.24E-06	27.13	1.42E-05	4.16E-06
1974-1976	1.95E-02	8.94E-03	25.84	2.33E-03	3.85E-03	25.16	7.39E-06	1.24E-06	26.95	1.18E-05	3.43E-06
1972-1974	1.94E-02	8.88E-03	26.80	2.39E-03	3.93E-03	25.85	7.17E-06	1.21E-06	27.75	1.21E-05	3.54E-06
1970-1972	1.94E-02	8.90E-03	26.51	2.23E-03	3.68E-03	23.85	7.65E-06	1.29E-06	26.01	1.01E-05	2.95E-06
1968-1970	1.95E-02	8.91E-03	26.27	2.26E-03	3.73E-03	24.24	7.46E-06	1.26E-06	26.70	1.02E-05	2.97E-06
1966-1968	1.95E-02	8.93E-03	25.93	2.22E-03	3.65E-03	23.68	7.59E-06	1.28E-06	26.20	1.41E-05	4.11E-06
1964-1966	1.95E-02	8.90E-03	26.45	2.15E-03	3.55E-03	22.86	7.78E-06	1.31E-06	25.51	9.55E-06	2.79E-06
1962-1964	1.93E-02	8.82E-03	27.70	2.48E-03	4.09E-03	27.04	6.95E-06	1.17E-06	28.52	9.30E-06	2.71E-06
1960-1962	1.94E-02	8.85E-03	27.20	2.16E-03	3.57E-03	22.99	7.47E-06	1.26E-06	26.66	1.37E-05	4.00E-06
1960-1962	1.94E-02	8.85E-03	27.20	2.26E-03	3.73E-03	24.28	7.36E-06	1.24E-06	27.04	1.03E-05	3.00E-06
1958-1960	1.94E-02	8.87E-03	26.89	2.26E-03	3.73E-03	24.24	7.41E-06	1.25E-06	26.86	1.16E-05	3.39E-06

MAG01D modern coral two monthly resolution 1980-1984

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	86Sr ppm	138Ba ppm	238U ppm
1980A	0.3111	927	359351	0.5057	-0.2426	6890	6.014	2.497
1980B	0.4323	935	366444	0.3856	-0.1233	7090	5.853	2.618
1980C	0.4103	868	369866	0.2862	-0.1397	7299	5.813	2.957
1980D	0.3366	652	290714	0.2633	-0.0248	5765	2.922	2.411
1980E	0.3872	835	350334	0.5189	-0.1694	6811	5.032	2.708
1980F	0.3610	889	370588	0.4592	-0.2326	7187	4.035	2.743
1981A	0.3726	880	361068	0.5637	0.0602	6922	6.040	2.563
1981B	0.3980	988	385074	0.4969	-0.0800	7361	7.504	2.675
1981C	0.3936	892	366219	0.3432	-0.2337	7171	5.050	2.749
1981D	0.4617	790	358241	0.3273	-0.2319	7092	4.409	2.893
1981E	0.4368	890	388710	0.6307	1.7598	7615	8.431	3.004
1981F	0.4346	879	367954	0.3421	-0.1285	7217	4.344	2.780
1982A	0.3842	917	382232	0.4657	-0.2176	7414	4.556	2.840
1982B	0.3589	909	389638	0.5905	-0.3857	7458	4.589	2.750
1982C	0.3597	874	378506	0.5168	-0.2822	7294	6.107	2.692
1982D	0.4225	812	350697	0.2718	-0.2340	6906	4.273	2.685
1982E	0.4500	776	377017	0.3020	-0.3018	7519	3.494	3.196
1982F	0.3744	915	404530	0.4167	-0.0818	7967	4.127	3.136
1983A	0.3837	954	381080	0.4877	-0.2156	7392	4.826	2.625
1983B	0.3755	934	370214	0.4479	-0.3846	7108	3.815	2.509
1983C	0.3979	972	367975	0.4033	-0.3201	7064	9.606	2.486
1983D	0.3674	926	351429	0.4107	-0.3018	6794	4.256	2.357
1983E	0.3886	748	323114	0.3412	-0.1776	6340	4.789	2.483
1983F	0.4829	911	382612	0.4096	-0.3300	7457	5.183	2.873
1984A	0.3732	970	374144	0.4348	-0.2346	7218	5.051	2.579
1984B	0.3944	898	356649	0.4175	-0.0839	6911	4.765	2.513
1984C	0.3554	1007	391629	0.4676	-0.2871	7564	4.998	2.614
1984D	0.4190	1076	413276	0.5086	-0.3785	7933	5.326	2.721
1984E	0.4124	968	381267	0.4254	-0.2546	7386	4.698	2.626
1984F	0.4323	873	377765	0.3584	-0.3085	7467	4.537	2.954

MAG01D modern coral two-monthly resolution 1980-1984

Calendar years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Ba/Ca	atomic Ba/Ca
1980A	1.92E-02	8.77E-03	28.47	2.58E-03	4.25E-03	28.31	6.95E-06	1.17E-06	28.53	1.67E-05	4.88E-06
1980B	1.93E-02	8.85E-03	27.21	2.55E-03	4.21E-03	27.95	7.14E-06	1.20E-06	27.83	1.60E-05	4.66E-06
1980C	1.97E-02	9.03E-03	24.44	2.35E-03	3.87E-03	25.34	7.99E-06	1.35E-06	24.75	1.57E-05	4.59E-06
1980D	1.98E-02	9.07E-03	23.75	2.24E-03	3.69E-03	23.99	8.29E-06	1.40E-06	23.67	1.01E-05	2.93E-06
1980E	1.94E-02	8.89E-03	26.56	2.38E-03	3.93E-03	25.82	7.73E-06	1.30E-06	25.71	1.44E-05	4.19E-06
1980F	1.94E-02	8.87E-03	26.89	2.40E-03	3.95E-03	25.99	7.40E-06	1.25E-06	26.89	1.09E-05	3.18E-06
1981A	1.92E-02	8.77E-03	28.49	2.44E-03	4.02E-03	26.50	7.10E-06	1.20E-06	27.99	1.67E-05	4.88E-06
1981B	1.91E-02	8.74E-03	28.88	2.57E-03	4.23E-03	28.14	6.95E-06	1.17E-06	28.54	1.95E-05	5.69E-06
1981C	1.96E-02	8.96E-03	25.55	2.43E-03	4.01E-03	26.46	7.51E-06	1.26E-06	26.52	1.38E-05	4.02E-06
1981D	1.98E-02	9.06E-03	23.99	2.21E-03	3.64E-03	23.54	8.08E-06	1.36E-06	24.45	1.23E-05	3.59E-06
1981E	1.96E-02	8.96E-03	25.49	2.29E-03	3.78E-03	24.62	7.73E-06	1.30E-06	25.72	2.17E-05	6.33E-06
1981F	1.96E-02	8.97E-03	25.31	2.39E-03	3.94E-03	25.88	7.56E-06	1.27E-06	26.33	1.18E-05	3.45E-06
1982A	1.94E-02	8.87E-03	26.88	2.40E-03	3.96E-03	26.01	7.43E-06	1.25E-06	26.79	1.19E-05	3.48E-06
1982B	1.91E-02	8.76E-03	28.71	2.33E-03	3.85E-03	25.18	7.06E-06	1.19E-06	28.14	1.18E-05	3.44E-06
1982C	1.93E-02	8.82E-03	27.77	2.31E-03	3.81E-03	24.87	7.11E-06	1.20E-06	27.94	1.61E-05	4.71E-06
1982D	1.97E-02	9.01E-03	24.75	2.31E-03	3.81E-03	24.92	7.66E-06	1.29E-06	25.97	1.22E-05	3.56E-06
1982E	1.99E-02	9.12E-03	22.95	2.06E-03	3.39E-03	21.65	8.48E-06	1.43E-06	23.00	9.27E-06	2.70E-06
1982F	1.97E-02	9.01E-03	24.74	2.26E-03	3.73E-03	24.27	7.75E-06	1.31E-06	25.62	1.02E-05	2.98E-06
1983A	1.94E-02	8.87E-03	26.86	2.50E-03	4.13E-03	27.34	6.89E-06	1.16E-06	28.76	1.27E-05	3.70E-06
1983B	1.92E-02	8.78E-03	28.28	2.52E-03	4.16E-03	27.60	6.78E-06	1.14E-06	29.15	1.03E-05	3.01E-06
1983C	1.92E-02	8.78E-03	28.30	2.64E-03	4.36E-03	29.12	6.75E-06	1.14E-06	29.24	2.61E-05	7.62E-06
1983D	1.93E-02	8.84E-03	27.33	2.64E-03	4.35E-03	29.04	6.71E-06	1.13E-06	29.41	1.21E-05	3.53E-06
1983E	1.96E-02	8.98E-03	25.26	2.32E-03	3.82E-03	24.94	7.69E-06	1.29E-06	25.87	1.48E-05	4.33E-06
1983F	1.95E-02	8.92E-03	26.20	2.38E-03	3.93E-03	25.79	7.51E-06	1.26E-06	26.50	1.35E-05	3.95E-06
1984A	1.93E-02	8.82E-03	27.63	2.59E-03	4.27E-03	28.48	6.89E-06	1.16E-06	28.74	1.35E-05	3.94E-06
1984B	1.94E-02	8.86E-03	27.01	2.52E-03	4.15E-03	27.51	7.05E-06	1.19E-06	28.18	1.34E-05	3.90E-06
1984C	1.93E-02	8.84E-03	27.46	2.57E-03	4.24E-03	28.22	6.67E-06	1.12E-06	29.53	1.28E-05	3.72E-06
1984D	1.92E-02	8.78E-03	28.32	2.60E-03	4.29E-03	28.61	6.58E-06	1.11E-06	29.85	1.29E-05	3.76E-06
1984E	1.94E-02	8.86E-03	27.05	2.54E-03	4.19E-03	27.80	6.89E-06	1.16E-06	28.76	1.23E-05	3.60E-06
1984F	1.98E-02	9.04E-03	24.23	2.31E-03	3.81E-03	24.89	7.82E-06	1.32E-06	25.38	1.20E-05	3.50E-06

NEL03D mid-Holocene coral two-monthly resolution

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	86Sr ppm	138Ba ppm	238U ppm
1a	0.3493	1112	407313	2.2502	0.1080	7834	13.443	2.971
1b	1.1227	801	298948	1.5334	0.2792	5765	9.398	2.253
1c	0.3018	713	268816	1.1000	0.1073	5206	5.133	2.055
1d	0.3347	871	338619	1.2804	0.0097	6542	5.961	2.535
1e	0.3613	959	356948	1.4811	-0.0593	6901	6.476	2.637
1f	0.3452	858	333004	1.5793	0.1317	6393	9.111	2.557
2a	0.3411	844	338694	1.4217	0.1233	6545	8.095	2.589
2b	0.4429	853	363342	1.4276	-0.1419	7160	8.183	2.958
2c	0.4693	883	386777	1.3175	-0.0877	7637	8.239	3.085
2d	0.4117	975	374831	3.6413	13.9987	7210	10.483	8.081
2e	0.3991	961	379302	1.3818	-0.0852	7312	8.180	2.839
2f	0.4074	947	377821	1.2747	-0.1772	7308	8.493	2.869
3a	0.3614	823	358093	1.8165	4.4819	7059	7.471	2.938
3b	0.3986	948	389060	1.3533	-0.1540	7571	11.982	3.093
3c	0.3752	860	352671	1.2176	-0.1477	6828	9.537	2.768
3d	0.3262	928	383647	1.3532	-0.0853	7379	12.070	3.022
3e	0.3880	870	365893	1.1547	-0.0952	7098	12.263	2.893
3f	0.4151	844	386190	1.1619	-0.2108	7681	9.959	3.253
4a	0.3587	780	378441	1.0242	-0.1810	7548	10.283	3.225
4b	0.3905	950	371444	1.4631	0.0078	7153	15.191	2.739
4c	0.3646	874	364162	1.1345	-0.0867	7091	10.358	2.908
4d	0.4260	940	384855	1.1310	-0.3071	7496	10.675	3.102
4e	0.3813	831	359124	1.0215	-0.0477	7092	8.022	2.990
4f	0.4605	863	395959	0.9510	-0.2437	7865	7.330	3.249
5a	0.4232	897	364034	0.8683	-0.1460	7103	8.830	2.738
5b	0.3959	1023	384045	1.0176	-0.2057	7366	12.176	2.695
5c	0.3628	908	348297	1.4187	-0.1442	6663	7.071	2.432
5d	0.3347	923	349474	0.8597	-0.2137	6678	6.103	2.397
5e	0.3567	996	357431	0.9236	-0.1115	6823	6.741	2.432
5f	0.3630	999	361198	0.8426	-0.2570	6902	7.064	2.450

NEL03D mid-Holocene coral two-monthly resolution

Years	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Ba/Ca	atomic Ba/Ca
1a	1.92E-02	8.80E-03	28.04	2.73E-03	4.50E-03	30.23	7.29E-06	1.23E-06	27.29	3.30E-05	9.63E-06
1b	1.93E-02	8.82E-03	27.68	2.68E-03	4.42E-03	29.61	7.54E-06	1.27E-06	26.41	3.14E-05	9.17E-06
1c	1.94E-02	8.86E-03	27.09	2.65E-03	4.38E-03	29.27	7.64E-06	1.29E-06	26.02	1.91E-05	5.57E-06
1d	1.93E-02	8.84E-03	27.43	2.57E-03	4.24E-03	28.23	7.49E-06	1.26E-06	26.58	1.76E-05	5.14E-06
1e	1.93E-02	8.84E-03	27.32	2.69E-03	4.43E-03	29.68	7.39E-06	1.24E-06	26.94	1.81E-05	5.29E-06
1f	1.92E-02	8.78E-03	28.30	2.58E-03	4.25E-03	28.27	7.68E-06	1.29E-06	25.90	2.74E-05	7.98E-06
2a	1.93E-02	8.84E-03	27.39	2.49E-03	4.11E-03	27.20	7.64E-06	1.29E-06	26.01	2.39E-05	6.97E-06
2b	1.97E-02	9.01E-03	24.65	2.35E-03	3.87E-03	25.36	8.14E-06	1.37E-06	24.22	2.25E-05	6.57E-06
2c	1.97E-02	9.03E-03	24.38	2.28E-03	3.76E-03	24.53	7.98E-06	1.34E-06	24.82	2.13E-05	6.22E-06
2d	1.92E-02	8.80E-03	28.03	2.60E-03	4.29E-03	28.59	2.16E-05	3.63E-06	-24.36	2.80E-05	8.16E-06
2e	1.93E-02	8.82E-03	27.72	2.53E-03	4.18E-03	27.74	7.48E-06	1.26E-06	26.60	2.16E-05	6.29E-06
2f	1.93E-02	8.85E-03	27.26	2.51E-03	4.13E-03	27.38	7.59E-06	1.28E-06	26.20	2.25E-05	6.56E-06
3a	1.97E-02	9.02E-03	24.60	2.30E-03	3.79E-03	24.74	8.20E-06	1.38E-06	23.99	2.09E-05	6.09E-06
3b	1.95E-02	8.90E-03	26.42	2.44E-03	4.02E-03	26.49	7.95E-06	1.34E-06	24.91	3.08E-05	8.99E-06
3c	1.94E-02	8.86E-03	27.12	2.44E-03	4.02E-03	26.53	7.85E-06	1.32E-06	25.27	2.70E-05	7.89E-06
3d	1.92E-02	8.80E-03	28.04	2.42E-03	3.99E-03	26.26	7.88E-06	1.33E-06	25.18	3.15E-05	9.18E-06
3e	1.94E-02	8.87E-03	26.85	2.38E-03	3.92E-03	25.75	7.91E-06	1.33E-06	25.07	3.35E-05	9.78E-06
3f	1.99E-02	9.10E-03	23.35	2.19E-03	3.60E-03	23.28	8.42E-06	1.42E-06	23.20	2.58E-05	7.53E-06
4a	1.99E-02	9.12E-03	22.95	2.06E-03	3.40E-03	21.68	8.52E-06	1.43E-06	22.84	2.72E-05	7.93E-06
4b	1.93E-02	8.81E-03	27.86	2.56E-03	4.22E-03	28.03	7.37E-06	1.24E-06	27.00	4.09E-05	1.19E-05
4c	1.95E-02	8.91E-03	26.33	2.40E-03	3.96E-03	26.03	7.99E-06	1.34E-06	24.78	2.84E-05	8.30E-06
4d	1.95E-02	8.91E-03	26.29	2.44E-03	4.03E-03	26.56	8.06E-06	1.36E-06	24.51	2.77E-05	8.10E-06
4e	1.97E-02	9.03E-03	24.36	2.31E-03	3.81E-03	24.91	8.33E-06	1.40E-06	23.55	2.23E-05	6.52E-06
4f	1.99E-02	9.09E-03	23.53	2.18E-03	3.59E-03	23.22	8.20E-06	1.38E-06	23.99	1.85E-05	5.40E-06
5a	1.95E-02	8.93E-03	26.03	2.46E-03	4.06E-03	26.83	7.52E-06	1.27E-06	26.46	2.43E-05	7.08E-06
5b	1.92E-02	8.77E-03	28.42	2.66E-03	4.39E-03	29.39	7.02E-06	1.18E-06	28.29	3.17E-05	9.25E-06
5c	1.91E-02	8.75E-03	28.78	2.61E-03	4.30E-03	28.65	6.98E-06	1.18E-06	28.42	2.03E-05	5.92E-06
5d	1.91E-02	8.74E-03	28.93	2.64E-03	4.36E-03	29.12	6.86E-06	1.16E-06	28.86	1.75E-05	5.10E-06
5e	1.91E-02	8.73E-03	29.07	2.79E-03	4.59E-03	30.97	6.80E-06	1.15E-06	29.06	1.89E-05	5.50E-06
5f	1.91E-02	8.74E-03	28.93	2.77E-03	4.56E-03	30.71	6.78E-06	1.14E-06	29.13	1.96E-05	5.71E-06

Standards two-monthly resolution and H_2O_2 treatment analytical run

Years	7Li ppm	24Mg ppm	43Ca ppm	55Mn ppm	60Ni ppb	86Sr ppm	138Ba ppm	238U ppm
Jcp-1a	0.4136	970	380344	0.6148	0.1182	7276	9.926	2.746
Jcp-1b	0.3998	970	380426	0.7006	-0.0332	7275	10.164	2.796
Jcp-1a	0.4087	955	378238	0.6247	0.1896	7226	9.722	2.768
Jcp-1a	0.4391	955	378921	0.6280	0.1432	7246	9.682	2.744
Jcp-1a	0.4066	960	380141	0.6207	0.2022	7248	9.722	2.740
Jcp-1a	0.4184	964	382147	0.6276	0.2512	7258	9.803	2.757
Jcp-1a	0.3786	969	381214	0.6659	-0.0079	7286	9.882	2.768
Jcp-1a	0.3735	965	380435	0.6334	0.1048	7244	9.892	2.758
Jcp-1a	0.3671	965	379530	0.6233	0.0571	7231	9.828	2.761
Jcp-1a	0.4278	969	378256	0.6300	-0.0260	7169	9.916	2.727
Standard deviation (1)	0.0238	5.95	1252	0.0263	0.1004	33.42	0.139	0.019
Average	0.4033	964	379965	0.6369	0.0999	7246	9.854	2.756
RSD	**5.89%**	**0.62%**	**0.33%**	**4.12%**	**100.45%**	**0.46%**	**1.42%**	**0.69%**

Standards two-monthly resolution and H_2O_2 treatment analytical run

	Sr/Ca	atomic Sr/Ca	Sr/Ca-SST C	Mg/Ca	atomic Mg/Ca	Mg/Ca-SST C	U/Ca	atomic U/Ca	U/Ca-SST C	Ba/Ca	atomic Ba/Ca
Jcp-1a	1.91E-02	8.75E-03	28.78	2.55E-03	4.21E-03	27.96	7.22E-06	1.22E-06	27.55	2.61E-05	7.62E-06
Jcp-1b	1.91E-02	8.75E-03	28.83	2.55E-03	4.20E-03	27.92	7.35E-06	1.24E-06	27.08	2.67E-05	7.80E-06
Jcp-1a	1.91E-02	8.74E-03	28.96	2.52E-03	4.16E-03	27.61	7.32E-06	1.23E-06	27.20	2.57E-05	7.50E-06
Jcp-1a	1.91E-02	8.75E-03	28.84	2.52E-03	4.15E-03	27.54	7.24E-06	1.22E-06	27.47	2.56E-05	7.46E-06
Jcp-1a	1.91E-02	8.72E-03	29.23	2.52E-03	4.16E-03	27.61	7.21E-06	1.21E-06	27.60	2.56E-05	7.46E-06
Jcp-1a	1.90E-02	8.69E-03	29.76	2.52E-03	4.16E-03	27.60	7.21E-06	1.21E-06	27.57	2.57E-05	7.49E-06
Jcp-1a	1.91E-02	8.74E-03	28.90	2.54E-03	4.19E-03	27.85	7.26E-06	1.22E-06	27.40	2.59E-05	7.57E-06
Jcp-1a	1.90E-02	8.71E-03	29.42	2.54E-03	4.18E-03	27.78	7.25E-06	1.22E-06	27.45	2.60E-05	7.59E-06
Jcp-1a	1.91E-02	8.72E-03	29.34	2.54E-03	4.19E-03	27.85	7.27E-06	1.22E-06	27.35	2.59E-05	7.56E-06
Jcp-1a	1.90E-02	8.67E-03	30.05	2.56E-03	4.22E-03	28.07	7.21E-06	1.21E-06	27.59	2.62E-05	7.65E-06
Standard deviation (1)	6.05E-05	2.77E-05	0.43	1.41E-05	2.32E-05	0.18	4.81E-08	8.09E-09	0.17	3.55E-07	1.04E-07
Average	1.91E-02	8.72E-03	29.21	2.54E-03	4.18E-03	27.78	7.25E-06	1.22E-06	27.43	2.59E-05	7.57E-06
RSD	**0.32%**	**0.32%**	**1.48%**	**0.55%**	**0.55%**	**0.65%**	**0.66%**	**0.66%**	**0.63%**	**1.37%**	**1.37%**

High precision Xi-interface data: MAG01D modern coral

Calendar years	7Li ppm	9Be ppb	45Sc ppb	49Ti ppb	71Ga ppb	85Rb ppb	89Y ppb	90Zr ppb	93Nb ppb	111Cd ppb	135Ba ppm	139La ppb	140Ce ppb
1814-1816	0.4495	0.6138	116.73	262.13	1.3399	15.65	183.31	-58.46	0.1410	3.435	2.111	75.37	26.00
1832-1834	0.4671	0.6330	119.89	255.60	1.0145	18.85	164.77	-58.99	0.1202	8.944	2.054	29.07	21.59
1850-1852	0.4472	0.4284	113.15	263.46	1.1396	28.16	152.31	-57.73	0.2774	5.660	2.541	30.56	18.02
1858-1860	0.4505	0.3716	109.07	250.23	1.5740	16.89	171.69	-58.17	0.1783	6.117	3.154	32.57	22.13
1864-1866	0.4651	0.3847	92.50	259.95	1.6438	19.35	179.52	-55.67	0.1365	5.911	3.728	34.15	23.29
1876-1878	0.4454	0.7958	116.63	241.97	0.8984	14.25	205.51	0.70	0.1972	5.786	4.266	47.39	29.44
1880-1882	0.4464	0.7277	113.94	253.09	1.5077	15.90	204.54	8.63	0.3356	9.398	4.271	49.83	34.06
1896-1898	0.4596	0.8389	114.54	248.13	0.9914	24.74	250.40	7.80	0.4324	15.832	5.426	65.95	39.51
1902-1904	0.4604	0.6814	102.83	251.07	0.9904	24.30	214.30	1.53	0.2897	5.538	5.224	55.07	37.40
1916-1918	0.4664	0.9760	103.90	227.09	0.6117	20.54	203.69	5.50	0.1179	4.225	3.986	55.90	34.61
1936-1938	0.4540	0.8258	110.13	337.45	0.9558	21.80	211.76	-2.81	0.3590	3.681	5.233	54.06	33.70
1952-1954	0.4719	0.9397	117.90	292.63	1.0018	26.99	241.34	-2.57	0.1231	5.544	3.572	61.57	35.69
1974-1976	0.4567	1.0279	111.53	284.16	1.1327	18.81	259.62	-5.55	0.1337	3.993	4.481	72.04	40.46
1982-1984	0.4904	0.7942	107.25	279.13	0.8831	27.15	260.26	0.71	0.3092	12.589	4.917	63.29	37.20

Calendar years	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	184W ppb	Y/Ho
1814-1816	7.077	29.10	7.096	1.819	1.592	10.198	11.223	2.802	9.183	1.660	12.072	2.163	11.054	65.43
1832-1834	5.606	23.56	5.448	1.428	1.347	8.265	9.548	2.487	8.082	1.454	11.206	2.010	10.003	66.26
1850-1852	5.179	21.39	5.397	1.372	1.236	7.555	8.451	2.188	7.397	1.240	9.506	1.691	25.603	69.60
1858-1860	6.072	25.95	6.558	1.694	1.482	9.245	10.504	2.558	8.112	1.490	10.525	1.866	27.481	67.12
1864-1866	6.508	27.54	6.614	1.717	1.568	9.609	10.575	2.733	8.897	1.668	13.136	2.230	21.348	65.67
1876-1878	8.545	35.30	8.414	2.234	1.854	12.135	13.091	3.219	10.571	1.855	13.610	2.386	15.684	63.85
1880-1882	9.022	37.89	8.903	2.295	1.952	12.813	13.061	3.222	10.194	1.872	13.321	2.389	21.096	63.47
1896-1898	11.259	46.67	10.905	2.799	2.342	15.036	16.586	3.985	12.857	2.183	16.127	2.751	38.745	62.84
1902-1904	9.847	40.45	9.626	2.502	2.029	13.178	13.649	3.408	11.054	1.947	14.347	2.555	22.191	62.88
1916-1918	10.052	41.62	9.675	2.336	2.010	13.102	13.613	3.236	10.371	1.724	12.754	2.259	11.366	62.95
1936-1938	9.787	39.82	9.470	2.580	2.003	13.067	14.122	3.435	10.667	1.788	12.898	2.297	21.078	61.64
1952-1954	11.435	46.45	10.651	2.727	2.311	15.003	15.830	3.803	12.518	2.114	14.794	2.598	11.744	63.46
1974-1976	12.796	52.25	11.593	3.079	2.454	16.375	17.110	4.182	13.428	2.252	15.763	2.838	13.696	62.08
1982-1984	11.153	46.80	11.077	2.886	2.470	16.038	17.128	4.264	13.290	2.209	16.334	2.864	30.035	61.04

Normalised REE and Y to mud from Queensland (MUQ) standard MAG01D modern coral

sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
MUQ	32510	71090	8460	32910		6880	1570	6360	990	5890	31850	1220	3370	510	3250	490
1814-1816	2.32E-03	3.66E-04	8.37E-04	8.84E-04		1.03E-03	1.16E-03	1.60E-03	1.61E-03	1.91E-03	5.76E-03	2.30E-03	2.72E-03	3.25E-03	3.71E-03	4.41E-03
1832-1834	8.94E-04	3.04E-04	6.63E-04	7.16E-04		7.92E-04	9.09E-04	1.30E-03	1.36E-03	1.62E-03	5.17E-03	2.04E-03	2.40E-03	2.85E-03	3.45E-03	4.10E-03
1850-1852	9.40E-04	2.54E-04	6.12E-04	6.50E-04		7.84E-04	8.74E-04	1.19E-03	1.25E-03	1.43E-03	4.78E-03	1.79E-03	2.20E-03	2.43E-03	2.92E-03	3.45E-03
1858-1860	1.00E-03	3.11E-04	7.18E-04	7.89E-04		9.53E-04	1.08E-03	1.45E-03	1.50E-03	1.78E-03	5.39E-03	2.10E-03	2.41E-03	2.92E-03	3.24E-03	3.81E-03
1864-1866	1.05E-03	3.28E-04	7.69E-04	8.37E-04		9.61E-04	1.09E-03	1.51E-03	1.58E-03	1.80E-03	5.64E-03	2.24E-03	2.64E-03	3.27E-03	4.04E-03	4.55E-03
1876-1878	1.46E-03	4.14E-04	1.01E-03	1.07E-03		1.22E-03	1.42E-03	1.91E-03	1.87E-03	2.22E-03	6.45E-03	2.64E-03	3.14E-03	3.64E-03	4.19E-03	4.87E-03
1880-1882	1.53E-03	4.79E-04	1.07E-03	1.15E-03		1.29E-03	1.46E-03	2.01E-03	1.97E-03	2.22E-03	6.42E-03	2.64E-03	3.02E-03	3.67E-03	4.10E-03	4.88E-03
1896-1898	2.03E-03	5.56E-04	1.33E-03	1.42E-03		1.58E-03	1.78E-03	2.36E-03	2.37E-03	2.82E-03	7.86E-03	3.27E-03	3.82E-03	4.28E-03	4.96E-03	5.62E-03
1902-1904	1.69E-03	5.26E-04	1.16E-03	1.23E-03		1.40E-03	1.59E-03	2.07E-03	2.05E-03	2.32E-03	6.73E-03	2.79E-03	3.28E-03	3.82E-03	4.41E-03	5.21E-03
1916-1918	1.72E-03	4.87E-04	1.19E-03	1.26E-03		1.41E-03	1.49E-03	2.06E-03	2.03E-03	2.31E-03	6.40E-03	2.65E-03	3.08E-03	3.38E-03	3.92E-03	4.61E-03
1936-1938	1.66E-03	4.74E-04	1.16E-03	1.21E-03		1.38E-03	1.64E-03	2.05E-03	2.02E-03	2.40E-03	6.65E-03	2.82E-03	3.17E-03	3.51E-03	3.97E-03	4.69E-03
1952-1954	1.89E-03	5.02E-04	1.35E-03	1.41E-03		1.55E-03	1.74E-03	2.36E-03	2.33E-03	2.69E-03	7.58E-03	3.12E-03	3.71E-03	4.14E-03	4.55E-03	5.30E-03
1974-1976	2.22E-03	5.69E-04	1.51E-03	1.59E-03		1.68E-03	1.96E-03	2.57E-03	2.48E-03	2.90E-03	8.15E-03	3.43E-03	3.98E-03	4.42E-03	4.85E-03	5.79E-03
1982-1984	1.95E-03	5.23E-04	1.32E-03	1.42E-03		1.61E-03	1.84E-03	2.52E-03	2.50E-03	2.91E-03	8.17E-03	3.50E-03	3.94E-03	4.33E-03	5.03E-03	5.84E-03

High precision Xi-interface data: NEL01D mid-Holocene coral

Year	7Li ppm	9Be ppb	45Sc ppb	49Ti ppb	71Ga ppb	85Rb ppb	89Y ppb	90Zr ppb	93Nb ppb	111Cd ppb	135Ba ppm	139La ppb	140Ce ppb
68-70	0.4659	2.008	121.11	274.01	1.115	16.228	258.21	6.444	0.3211	9.334	5.264	46.06	37.49
66-68	0.4687	2.350	130.04	277.84	1.217	15.669	227.67	8.939	0.2104	10.976	4.484	33.94	26.46
64-66	0.4697	1.931	103.24	260.28	1.198	16.272	214.72	-0.586	0.1935	9.957	4.031	35.90	25.41
62-64	0.5416	8.134	186.79	1977.06	22.918	301.489	477.47	235.00	6.6015	7.041	5.924	383.29	731.92
58-60	0.4684	2.589	107.50	290.53	1.976	20.915	266.25	7.922	0.2754	7.871	4.439	29.13	26.62
56-58	0.4520	2.918	104.90	291.12	1.436	14.871	260.54	7.727	0.3174	10.911	4.924	30.39	27.44
54-56	0.4658	1.654	108.78	292.75	13.095	15.867	190.16	-9.021	0.3390	11.273	4.207	26.69	22.53

Year	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	184W ppb	Y/Ho
68-70	9.100	37.768	9.093	2.174	2.203	12.812	16.281	4.176	14.288	2.543	19.384	3.374	13.239	61.83
66-68	6.586	27.776	6.935	1.872	1.864	10.669	13.805	3.567	12.281	2.260	16.789	3.046	11.069	63.83
64-66	6.704	29.077	6.975	1.806	1.710	9.888	12.246	3.254	11.090	2.038	15.774	2.843	16.403	65.99
62-64	84.364	313.481	63.295	12.041	9.930	64.222	60.573	12.813	35.953	5.505	35.972	5.566	35.700	37.26
58-60	5.617	23.776	6.282	1.782	2.254	11.926	18.213	4.857	15.407	2.627	18.991	3.206	10.282	54.82
56-58	6.052	26.287	6.843	1.884	2.237	11.965	17.021	4.585	15.156	2.645	18.383	3.074	6.248	56.83
54-56	5.095	21.219	5.173	1.288	1.414	8.105	10.773	2.910	10.045	1.807	13.423	2.374	17.295	65.35

Normalised REE and Y to mud from Queensland (MUQ) standard NEL01D mid-Holocene coral

sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
68-70	1.42E-03	5.27E-04	1.08E-03	1.15E-03		1.32E-03	1.38E-03	2.01E-03	2.23E-03	2.76E-03	8.11E-03	3.42E-03	4.24E-03	4.99E-03	5.96E-03	6.89E-03
66-68	1.04E-03	3.72E-04	7.78E-04	8.44E-04		1.01E-03	1.19E-03	1.68E-03	1.88E-03	2.34E-03	7.15E-03	2.92E-03	3.64E-03	4.43E-03	5.17E-03	6.22E-03
64-66	1.10E-03	3.57E-04	7.92E-04	8.84E-04		1.01E-03	1.15E-03	1.55E-03	1.73E-03	2.08E-03	6.74E-03	2.67E-03	3.29E-03	4.00E-03	4.85E-03	5.80E-03
62-64	1.18E-02	1.03E-02	9.97E-03	9.53E-03		9.20E-03	7.67E-03	1.01E-02	1.00E-02	1.03E-02	1.50E-02	1.05E-02	1.07E-02	1.08E-02	1.11E-02	1.14E-02
58-60	8.96E-04	3.74E-04	6.64E-04	7.22E-04		9.13E-04	1.14E-03	1.88E-03	2.28E-03	3.09E-03	8.36E-03	3.98E-03	4.57E-03	5.15E-03	5.84E-03	6.54E-03
56-58	9.35E-04	3.86E-04	7.15E-04	7.99E-04		9.95E-04	1.20E-03	1.88E-03	2.26E-03	2.89E-03	8.18E-03	3.76E-03	4.50E-03	5.19E-03	5.66E-03	6.27E-03
54-56	8.21E-04	3.17E-04	6.02E-04	6.45E-04		7.52E-04	8.20E-04	1.27E-03	1.43E-03	1.83E-03	5.97E-03	2.39E-03	2.98E-03	3.54E-03	4.13E-03	4.85E-03

High precision Xi-interface data: NEL21A modern coral 1968-1973

Calendar years	7Li ppm	Mn ppm	60Ni ppb-No oxide correction	66Zn ppb-no oxide correction (TiO)	89Y ppb	Ba ppm	139La ppb	140Ce ppb	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb
1968a	0.3908	0.5701	6207	16614	212.71	18.49	40.51	23.52	7.011	27.99	6.857	1.910	1.810	10.725	13.057
1968b	0.3901	0.4723	6012	12926	199.25	10.59	33.05	22.91	5.845	24.38	6.075	1.740	1.692	9.706	12.330
1968c	0.3614	0.3932	5576	6054	176.86	8.80	26.72	19.89	4.691	20.13	4.895	1.474	1.405	8.173	10.299
1968d	0.3948	0.3708	5939	8443	178.77	8.26	28.33	20.23	5.104	21.19	5.347	1.467	1.419	8.244	10.709
1969a	0.4004	0.3699	6105	24786	200.09	9.51	32.61	23.35	5.977	24.37	6.229	1.754	1.720	9.864	13.053
1969b	0.3952	0.3485	6327	17033	195.95	9.74	32.22	23.13	5.899	24.16	5.965	1.659	1.641	9.546	11.986
1969c	0.3835	0.3452	5862	68305	172.54	8.98	28.22	19.42	4.898	20.75	5.168	1.513	1.443	7.950	10.194
1969d	0.4049	0.4387	6206	40312	182.86	8.91	29.81	20.66	5.411	21.73	5.541	1.552	1.500	8.865	11.226
1969e	0.4185	0.5192	6428	66755	182.86	9.68	28.73	20.45	5.184	22.19	5.564	1.606	1.441	8.672	10.708
1969f	0.3976	0.5924	6292	48911	182.36	13.24	28.81	18.68	5.142	21.34	5.070	1.487	1.461	8.332	10.755
1970a	0.3969	0.4819	6476	48052	210.41	16.00	33.22	21.89	5.945	24.81	6.184	1.809	1.674	9.726	12.467
1970b	0.4149	0.5223	6517	22703	209.22	11.85	33.89	22.71	6.152	25.09	6.420	1.806	1.709	9.684	12.305
1970c	0.4119	0.5491	6354	67916	193.03	12.06	35.31	21.42	6.136	24.45	5.942	1.688	1.599	9.219	11.246
1970d	0.3956	0.5214	6096	17923	184.64	14.59	31.46	20.04	5.681	23.38	5.860	1.682	1.508	8.696	10.904
1971a	0.4287	0.3935	6018	17276	192.52	14.47	32.89	22.71	6.103	25.40	6.217	1.784	1.631	9.403	11.520
1971b	0.4478	0.9863	6302	34111	206.85	12.24	38.01	30.15	7.280	29.67	7.117	2.039	1.812	10.680	12.778
1971c	0.4310	0.6256	6105	52015	175.66	10.45	32.94	21.16	5.918	24.13	5.922	1.677	1.511	9.036	10.869
1971d	0.4110	1.3167	6205	38504	198.98	12.54	40.20	23.28	7.134	29.36	7.021	1.898	1.769	10.549	11.895
1972a	0.3887	1.1111	6387	50851	256.28	22.51	49.60	28.65	8.787	36.60	8.645	2.575	2.211	13.156	16.212
1972b	0.4281	0.4676	6380	29008	263.40	16.19	44.92	28.25	8.063	33.95	8.225	2.440	2.183	12.694	16.098
1972c	0.4094	0.6902	6339	48916	208.08	10.49	34.19	24.13	6.212	28.64	6.164	1.798	1.708	9.772	12.448
1973a	0.4088	0.7339	6416	47960	225.23	11.49	52.96	46.03	10.151	40.47	9.427	2.413	2.185	13.100	14.756

High precision Xi-interface data: NEL21A modern coral 1968-1973

Calendar years	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	208Pb ppb	232Th ppb	238U ppm	Y/Ho
1968a	3.507	11.087	1.796	12.376	2.128	68.192	0.2550	2.851	60.65
1968b	3.234	10.629	1.681	11.261	1.970	60.929	0.2622	3.111	61.61
1968c	2.878	9.329	1.550	11.240	1.945	62.960	0.5472	2.803	61.46
1968d	2.810	9.379	1.563	10.588	1.964	62.669	0.2602	3.206	63.61
1969a	3.338	10.593	1.694	11.887	2.014	81.542	0.2095	3.168	59.95
1969b	3.106	9.907	1.613	11.454	2.002	59.008	0.2818	3.104	63.10
1969c	2.685	8.663	1.385	10.119	1.704	55.097	0.4832	2.853	64.26
1969d	2.982	9.484	1.512	10.471	1.818	67.969	0.2151	3.015	61.32
1969e	2.893	9.195	1.498	10.350	1.752	88.949	0.2511	3.092	63.21
1969f	2.769	8.977	1.485	10.617	1.851	111.233	0.1698	2.775	65.86
1970a	3.311	10.570	1.754	12.384	2.211	125.336	0.2463	2.959	63.54
1970b	3.321	10.759	1.707	11.987	2.154	207.196	0.1894	3.076	62.99
1970c	3.015	9.671	1.597	11.184	1.950	102.513	0.1209	2.786	64.03
1970d	2.944	9.228	1.530	10.836	1.903	61.829	0.3792	2.622	62.73
1971a	3.047	9.740	1.618	11.360	2.036	85.728	0.7078	2.909	63.17
1971b	3.322	10.694	1.755	11.939	2.094	91.569	0.7907	3.203	62.27
1971c	2.806	8.951	1.374	9.584	1.612	67.515	0.5493	2.699	62.61
1971d	3.312	10.168	1.604	10.903	1.911	60.984	0.2125	2.627	60.07
1972a	4.282	13.789	2.197	15.329	2.665	82.114	0.2676	2.837	59.84
1972b	4.417	14.327	2.332	16.222	2.866	90.125	0.1492	3.387	59.63
1972c	3.346	11.232	1.783	11.944	2.005	122.820	0.2822	2.757	62.19
1973a	3.899	12.098	1.874	12.448	2.122	145.981	2.4045	2.781	57.76

Normalised REE and Y to mud from Queensland (MUQ) standard NEL21A modern coral 1968-1973

sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
MUQ	32510	71090	8460	32910		6880	1570	6360	990	5890	31850	1220	3370	510	3250	490
1968a	1.25E-03	3.31E-04	8.29E-04	8.50E-04		9.97E-04	1.22E-03	1.69E-03	1.83E-03	2.22E-03	6.68E-03	2.87E-03	3.29E-03	3.52E-03	3.81E-03	4.34E-03
1968b	1.02E-03	3.22E-04	6.91E-04	7.41E-04		8.83E-04	1.11E-03	1.53E-03	1.71E-03	2.09E-03	6.26E-03	2.65E-03	3.15E-03	3.30E-03	3.47E-03	4.02E-03
1968c	8.22E-04	2.80E-04	5.55E-04	6.12E-04		7.11E-04	9.39E-04	1.29E-03	1.42E-03	1.75E-03	5.55E-03	2.36E-03	2.77E-03	3.04E-03	3.46E-03	3.97E-03
1968d	8.72E-04	2.85E-04	6.03E-04	6.44E-04		7.77E-04	9.34E-04	1.30E-03	1.43E-03	1.82E-03	5.61E-03	2.30E-03	2.78E-03	3.07E-03	3.26E-03	4.01E-03
1969a	1.00E-03	3.28E-04	7.06E-04	7.40E-04		9.05E-04	1.12E-03	1.55E-03	1.74E-03	2.22E-03	6.28E-03	2.74E-03	3.14E-03	3.32E-03	3.66E-03	4.11E-03
1969b	9.91E-04	3.25E-04	6.97E-04	7.34E-04		8.67E-04	1.06E-03	1.50E-03	1.66E-03	2.03E-03	6.15E-03	2.55E-03	2.94E-03	3.16E-03	3.52E-03	4.09E-03
1969c	8.68E-04	2.73E-04	5.79E-04	6.31E-04		7.51E-04	9.64E-04	1.25E-03	1.46E-03	1.73E-03	5.42E-03	2.20E-03	2.57E-03	2.71E-03	3.11E-03	3.48E-03
1969d	9.17E-04	2.91E-04	6.40E-04	6.60E-04		8.05E-04	9.88E-04	1.39E-03	1.52E-03	1.91E-03	5.74E-03	2.44E-03	2.81E-03	2.97E-03	3.22E-03	3.71E-03
1969e	8.84E-04	2.88E-04	6.13E-04	6.74E-04		8.09E-04	1.02E-03	1.36E-03	1.46E-03	1.82E-03	5.74E-03	2.37E-03	2.73E-03	2.94E-03	3.18E-03	3.58E-03
1969f	8.86E-04	2.63E-04	6.08E-04	6.49E-04		7.37E-04	9.47E-04	1.31E-03	1.48E-03	1.83E-03	5.73E-03	2.27E-03	2.66E-03	2.91E-03	3.27E-03	3.78E-03
1970a	1.02E-03	3.08E-04	7.03E-04	7.54E-04		8.99E-04	1.15E-03	1.53E-03	1.69E-03	2.12E-03	6.61E-03	2.71E-03	3.14E-03	3.44E-03	3.81E-03	4.51E-03
1970b	1.04E-03	3.19E-04	7.27E-04	7.62E-04		9.33E-04	1.15E-03	1.52E-03	1.73E-03	2.09E-03	6.57E-03	2.72E-03	3.19E-03	3.35E-03	3.69E-03	4.40E-03
1970c	1.09E-03	3.01E-04	7.25E-04	7.43E-04		8.64E-04	1.08E-03	1.45E-03	1.62E-03	1.91E-03	6.06E-03	2.47E-03	2.87E-03	3.13E-03	3.44E-03	3.98E-03
1970d	9.68E-04	2.82E-04	6.71E-04	7.10E-04		8.52E-04	1.07E-03	1.37E-03	1.52E-03	1.85E-03	5.80E-03	2.41E-03	2.74E-03	3.00E-03	3.33E-03	3.88E-03
1971a	1.01E-03	3.19E-04	7.21E-04	7.72E-04		9.04E-04	1.14E-03	1.48E-03	1.65E-03	1.96E-03	6.04E-03	2.50E-03	2.89E-03	3.17E-03	3.50E-03	4.16E-03
1971b	1.17E-03	4.24E-04	8.61E-04	9.02E-04		1.03E-03	1.30E-03	1.68E-03	1.83E-03	2.17E-03	6.49E-03	2.72E-03	3.17E-03	3.44E-03	3.67E-03	4.27E-03
1971c	1.01E-03	2.98E-04	7.00E-04	7.33E-04		8.61E-04	1.07E-03	1.42E-03	1.53E-03	1.85E-03	5.52E-03	2.30E-03	2.66E-03	2.69E-03	2.95E-03	3.29E-03
1971d	1.24E-03	3.27E-04	8.43E-04	8.92E-04		1.02E-03	1.21E-03	1.66E-03	1.79E-03	2.02E-03	6.25E-03	2.72E-03	3.02E-03	3.15E-03	3.35E-03	3.90E-03
1972a	1.53E-03	4.03E-04	1.04E-03	1.11E-03		1.26E-03	1.64E-03	2.07E-03	2.23E-03	2.75E-03	8.05E-03	3.51E-03	4.09E-03	4.31E-03	4.72E-03	5.44E-03
1972b	1.38E-03	3.97E-04	9.53E-04	1.03E-03		1.20E-03	1.55E-03	2.00E-03	2.21E-03	2.73E-03	8.27E-03	3.62E-03	4.25E-03	4.57E-03	4.99E-03	5.85E-03
1972c	1.05E-03	3.39E-04	7.34E-04	8.70E-04		8.96E-04	1.15E-03	1.54E-03	1.72E-03	2.11E-03	6.53E-03	2.74E-03	3.33E-03	3.50E-03	3.67E-03	4.09E-03
1973a	1.63E-03	6.48E-04	1.20E-03	1.23E-03		1.37E-03	1.54E-03	2.06E-03	2.21E-03	2.51E-03	7.07E-03	3.20E-03	3.59E-03	3.68E-03	3.83E-03	4.33E-03

High precision Xi-interface data: luminescent lines 1974 and 1991- NEL21A; 1831 and 1870- MAG01D

Calendar years	7Li ppm	Mn ppm	60Ni ppb- No oxide correction	66Zn ppb- no oxide correction (TiO)	89Y ppb	Ba ppm	139La ppb	140Ce ppb	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb
1974 FB	0.6137	10.4466	6256	41904	566.66	21.69	612.30	1271.03	152.927	567.48	109.580	21.149	13.903	95.351	75.272
1991 FB	0.4271	0.5830	6848	28647	273.15	23.62	57.34	36.75	10.620	43.88	10.095	2.935	2.400	14.838	17.365
1831 FB	0.4205	0.8201	6492	9313	160.09	2.91	31.05	23.18	6.161	25.72	6.303	1.507	1.376	8.431	9.906
1870 FB	0.4112	5.6274	6565	14881	210.45	4.90	48.07	28.44	8.730	36.89	8.412	2.040	1.888	11.968	12.899

Calendar years	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	208Pb ppb	232Th ppb	238U ppm	Y/Ho
1974 FB	15.504	41.974	6.083	38.374	5.965	300.574	55.8151	3.149	36.55
1991 FB	4.428	14.476	2.413	16.597	2.954	68.166	0.7673	2.904	61.68
1831 FB	2.444	8.127	1.464	11.217	2.007	91.108	1.3662	2.519	65.52
1870 FB	3.340	10.977	1.919	14.263	2.612	79.145	1.2266	2.638	63.01

Normalised REE and Y to mud from Queensland (MUQ) standard: coral luminescent lines

sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
1974 FB	1.88E-02	1.79E-02	1.81E-02	1.72E-02		1.59E-02	1.35E-02	1.50E-02	1.40E-02	1.28E-02	1.78E-02	1.27E-02	1.25E-02	1.19E-02	1.18E-02	1.22E-02
1991 FB	1.76E-03	5.17E-04	1.26E-03	1.33E-03		1.47E-03	1.87E-03	2.33E-03	2.42E-03	2.95E-03	8.58E-03	3.63E-03	4.30E-03	4.73E-03	5.11E-03	6.03E-03
1831 FB	9.55E-04	3.26E-04	7.28E-04	7.82E-04		9.16E-04	9.60E-04	1.33E-03	1.39E-03	1.68E-03	5.03E-03	2.00E-03	2.41E-03	2.87E-03	3.45E-03	4.10E-03
1870 FB	1.48E-03	4.00E-04	1.03E-03	1.12E-03		1.22E-03	1.30E-03	1.88E-03	1.91E-03	2.19E-03	6.61E-03	2.74E-03	3.26E-03	3.76E-03	4.39E-03	5.33E-03

High precision Xi-interface data: NEL01D mid-Holocene coral growth hiatus

	7Li ppm	Mn ppm	60Ni ppb-No oxide correction	66Zn ppb-no oxide correction (TiO)	89Y ppb	Ba ppm	139La ppb	140Ce ppb	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb
NEL01Da	0.4434	1.1378	6274	4694	292.69	5.30	42.56	53.17	9.738	38.43	8.556	2.045	2.491	13.413	19.995
NEL01Db	0.4719	1.4112	6253	12351	330.61	6.40	106.22	187.38	25.631	97.36	19.840	4.121	3.852	22.260	27.219
NEL01Dc	0.5151	0.8124	6622	20086	312.27	4.83	36.60	43.47	7.993	31.71	7.774	2.012	2.695	13.519	21.474
NEL01Dd	0.4906	1.6701	6430	10553	292.96	4.59	71.71	108.38	16.762	62.91	13.070	2.936	3.385	18.191	23.767
NEL01De	0.4630	47.8029	6230	20267	432.00	4.71	136.01	273.79	33.969	131.94	30.802	7.073	7.149	41.269	47.527
NEL01Df	0.5167	2.7477	6200	12513	512.56	5.46	563.51	1135.59	120.563	453.52	96.078	19.082	14.371	99.149	78.121
NEL01Dg	0.9241	65.5698	5392	9131	1169.82	5.38	2280.58	4645.97	564.078	2054.30	369.722	62.773	42.329	290.831	222.778

	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	208Pb ppb	232Th ppb	238U ppm	Y/Ho
NEL01Da	5.497	18.064	3.085	20.985	3.629	56.219	5.4492	2.985	53.24
NEL01Db	6.943	22.141	3.617	24.836	4.122	93.603	28.1972	2.976	47.61
NEL01Dc	5.874	19.256	3.120	21.593	3.656	48.004	3.7638	3.233	53.16
NEL01Dd	6.100	19.213	3.120	20.629	3.396	65.532	10.5000	2.786	48.03
NEL01De	11.048	32.538	4.894	31.115	4.828	62.486	24.2377	2.805	39.10
NEL01Df	15.515	41.428	5.912	36.836	5.563	129.615	71.6730	3.083	33.04
NEL01Dg	42.278	112.177	15.933	95.641	13.495	799.470	676.9733	2.780	27.67

Normalised REE and Y to mud from Queensland (MUQ) standard NEL01D growth hiatus

sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
NEL01Da	1.31E-03	7.48E-04	1.15E-03	1.17E-03		1.24E-03	1.30E-03	2.11E-03	2.52E-03	3.39E-03	9.19E-03	4.51E-03	5.36E-03	6.05E-03	6.46E-03	7.41E-03
NEL01Db	3.27E-03	2.64E-03	3.03E-03	2.96E-03		2.88E-03	2.62E-03	3.50E-03	3.89E-03	4.62E-03	1.04E-02	5.69E-03	6.57E-03	7.09E-03	7.64E-03	8.41E-03
NEL01Dc	1.13E-03	6.11E-04	9.45E-04	9.64E-04		1.13E-03	1.28E-03	2.13E-03	2.72E-03	3.65E-03	9.80E-03	4.82E-03	5.71E-03	6.12E-03	6.64E-03	7.46E-03
NEL01Dd	2.21E-03	1.52E-03	1.98E-03	1.91E-03		1.90E-03	1.87E-03	2.86E-03	3.42E-03	4.04E-03	9.20E-03	5.00E-03	5.70E-03	6.12E-03	6.35E-03	6.93E-03
NEL01De	4.18E-03	3.85E-03	4.02E-03	4.01E-03		4.48E-03	4.50E-03	6.49E-03	7.22E-03	8.07E-03	1.36E-02	9.06E-03	9.66E-03	9.60E-03	9.57E-03	9.85E-03
NEL01Df	1.73E-02	1.60E-02	1.43E-02	1.38E-02		1.40E-02	1.22E-02	1.56E-02	1.45E-02	1.33E-02	1.61E-02	1.27E-02	1.23E-02	1.16E-02	1.13E-02	1.14E-02
NEL01Dg	7.02E-02	6.54E-02	6.67E-02	6.24E-02		5.37E-02	4.00E-02	4.57E-02	4.28E-02	3.78E-02	3.67E-02	3.47E-02	3.33E-02	3.12E-02	2.94E-02	2.75E-02

High precision Xi-interface data: NEL21A modern coral 2000-2003

Calendar years	7Li ppm	Mn ppm	60Ni ppb	89Y ppb	Ba ppm	139La ppb	140Ce ppb	141Pr ppb	146Nd ppb	149Sm ppb	151Eu ppb	159Tb ppb	160Gd ppb	161Dy ppb
2000a	0.3466	0.5521	5329	213.85	14.486	44.39	28.38	8.003	33.86	7.967	2.114	1.946	11.670	13.871
2000b	0.3957	0.7488	5779	253.82	14.572	51.56	34.00	9.255	39.87	9.747	2.559	2.392	14.242	16.598
2000c	0.3893	0.6147	5458	246.74	11.403	49.23	33.25	8.982	38.25	9.098	2.397	2.314	13.746	16.126
2000d	0.3766	0.4870	5479	238.27	10.169	47.39	33.30	8.881	35.39	8.419	2.357	2.146	12.874	15.205
2000e	0.4089	0.4573	5737	238.80	9.904	45.65	31.69	8.255	34.30	8.333	2.250	2.151	12.560	15.669
2000f	0.3844	0.4400	5814	213.83	10.717	39.62	28.07	7.100	29.61	7.269	1.991	1.857	11.192	13.344
2000g	0.3768	0.9426	6603	208.84	11.037	38.47	27.26	6.953	29.12	7.247	1.855	1.801	10.831	13.174
2000h	0.3736	0.7698	5884	206.70	12.389	39.31	31.34	7.422	30.76	7.362	2.111	1.833	10.835	13.258
2000i	0.3887	0.5123	6259	220.80	13.112	39.38	27.18	7.205	29.21	7.471	2.052	1.889	11.129	13.609
2000j	0.3667	0.5569	5750	199.84	11.081	34.93	24.17	6.419	26.64	6.739	1.906	1.765	9.993	12.214
2001a	0.4098	0.3857	6296	217.98	10.713	37.18	25.90	6.807	28.87	7.174	2.023	1.876	11.027	13.246
2001b	0.3886	0.3765	5526	197.06	9.768	35.75	24.46	6.529	26.92	6.771	1.909	1.740	10.225	13.172
2001c	0.4205	0.4457	6084	201.16	8.793	36.41	24.97	6.511	27.74	6.925	1.932	1.736	10.394	12.589
2001d	0.3933	0.6013	5920	179.40	8.266	33.62	21.38	5.984	24.51	5.970	1.687	1.585	9.193	11.199
2001e	0.3933	0.6583	5920	183.45	9.315	36.35	23.86	6.640	27.61	6.689	1.812	1.603	9.740	11.315
2001f	0.3851	0.7198	5956	198.09	10.899	39.08	25.34	6.898	28.54	6.906	1.912	1.683	10.275	12.119
2002a	0.3816	1.1675	5870	193.46	12.686	34.92	22.68	6.230	25.75	6.416	1.741	1.585	9.557	12.105
2002b	0.4126	0.4389	5840	204.80	10.977	33.28	23.05	6.069	25.30	6.529	1.842	1.686	9.796	12.085
2002c	0.4498	0.4042	6008	211.69	10.268	34.64	25.17	6.397	26.54	6.719	1.822	1.747	10.358	12.847
2002d	0.4138	0.3765	5810	190.58	8.779	31.18	22.84	5.595	23.35	6.047	1.621	1.567	8.905	11.584
2002e	0.4209	0.4714	6308	197.30	9.056	32.43	22.35	5.752	23.74	6.031	1.643	1.613	9.236	11.575
2003a	0.3989	0.4706	5811	176.63	9.733	29.77	20.26	5.161	21.22	5.129	1.505	1.428	8.258	10.088
2003b	0.4170	0.4270	5901	186.59	11.524	31.28	21.85	5.567	22.68	5.713	1.614	1.593	8.779	11.572
2003c	0.3974	0.8912	5493	190.27	10.491	35.48	32.20	6.641	27.36	6.562	1.983	1.757	9.922	12.491
2003d	0.4218	0.4361	5861	192.51	10.243	33.51	24.75	6.119	24.82	6.388	1.707	1.592	9.236	11.445
2003e	0.4359	0.4250	6069	190.24	9.611	32.61	24.24	5.962	25.00	6.374	1.706	1.578	9.322	11.617
2003f	0.4017	0.5026	5983	183.03	9.367	31.78	24.43	5.979	24.86	6.255	1.770	1.519	9.047	10.906

High precision Xi-interface data: NEL21A modern coral 2000-2003

Calendar years	165Ho ppb	166Er ppb	169Tm ppb	172Yb ppb	175Lu ppb	208Pb ppb	232Th ppb	238U ppm	Y/Ho
2000a	3.448	11.267	1.842	13.310	2.308	76.45	0.3417	2.499	62.02
2000b	4.219	13.478	2.237	15.386	2.693	51.16	1.0954	3.008	60.16
2000c	4.237	13.513	2.195	15.147	2.588	46.14	0.4636	3.121	58.23
2000d	4.012	12.851	2.050	14.445	2.421	83.01	0.7168	3.105	59.40
2000e	3.891	12.468	2.027	13.948	2.326	62.72	0.4980	3.116	61.37
2000f	3.428	11.001	1.746	11.992	2.068	63.99	0.4854	2.745	62.37
2000g	3.441	10.831	1.724	12.242	2.063	52.75	0.5865	2.626	60.68
2000h	3.307	10.847	1.709	11.941	1.945	45.44	0.6199	2.577	62.50
2000i	3.455	11.159	1.789	12.434	2.180	48.57	0.3268	2.795	63.90
2000j	3.211	10.228	1.689	11.440	1.974	58.68	0.2929	2.787	62.24
2001a	3.510	10.894	1.820	12.459	2.056	56.31	0.3310	3.180	62.10
2001b	3.343	10.387	1.732	11.528	1.964	43.89	0.2941	3.048	58.94
2001c	3.211	10.496	1.631	11.182	1.950	44.62	0.5393	3.102	62.65
2001d	2.832	9.117	1.399	9.122	1.623	65.51	0.3561	2.708	63.34
2001e	2.918	9.175	1.459	9.702	1.724	42.40	0.5052	2.569	62.86
2001f	3.108	10.048	1.618	11.188	1.947	59.93	0.5100	2.587	63.74
2002a	3.048	9.433	1.622	11.396	1.961	52.40	0.4012	2.589	63.46
2002b	3.237	10.334	1.695	12.312	2.119	68.85	0.2511	2.965	63.26
2002c	3.347	11.170	1.789	12.534	2.212	710.72	0.3548	3.275	63.25
2002d	3.017	9.832	1.604	10.910	1.913	61.64	0.4203	3.050	63.16
2002e	3.042	9.848	1.590	11.112	1.857	115.98	0.3550	2.917	64.87
2003a	2.712	8.774	1.434	9.987	1.729	205.69	0.3038	2.652	65.12
2003b	2.992	9.409	1.579	10.695	1.792	58.87	0.2917	2.847	62.36
2003c	3.209	10.357	1.651	11.526	2.015	265.29	1.5049	2.789	59.30
2003d	3.016	9.920	1.577	10.727	1.830	105.87	0.5245	3.055	63.83
2003e	3.016	9.436	1.457	10.352	1.805	116.09	0.3912	3.052	63.08
2003f	2.847	8.910	1.412	9.656	1.702	275.74	0.5543	2.830	64.30

Normalised REE and Y to mud from Queensland (MUQ) standard NEL21A modern coral 2000-2003

sample/MUQ	La	Pr	Nd	Pm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
MUQ	32510	8460	32910		1570	6360	990	5890	31850	1220	3370	510	3250	490
2000a	1.37E-03	9.46E-04	1.03E-03		1.35E-03	1.83E-03	1.97E-03	2.36E-03	6.71E-03	2.83E-03	3.34E-03	3.61E-03	4.10E-03	4.71E-03
2000b	1.59E-03	1.09E-03	1.21E-03		1.63E-03	2.24E-03	2.42E-03	2.82E-03	7.97E-03	3.46E-03	4.00E-03	4.39E-03	4.73E-03	5.50E-03
2000c	1.51E-03	1.06E-03	1.16E-03		1.53E-03	2.16E-03	2.34E-03	2.74E-03	7.75E-03	3.47E-03	4.01E-03	4.30E-03	4.66E-03	5.28E-03
2000d	1.46E-03	1.05E-03	1.08E-03		1.50E-03	2.02E-03	2.17E-03	2.58E-03	7.48E-03	3.29E-03	3.81E-03	4.02E-03	4.44E-03	4.94E-03
2000e	1.40E-03	9.76E-04	1.04E-03		1.43E-03	1.97E-03	2.17E-03	2.66E-03	7.50E-03	3.19E-03	3.70E-03	3.97E-03	4.29E-03	4.75E-03
2000f	1.22E-03	8.39E-04	9.00E-04		1.27E-03	1.76E-03	1.88E-03	2.27E-03	6.71E-03	2.81E-03	3.26E-03	3.42E-03	3.69E-03	4.22E-03
2000g	1.18E-03	8.22E-04	8.85E-04		1.18E-03	1.70E-03	1.82E-03	2.24E-03	6.56E-03	2.82E-03	3.21E-03	3.38E-03	3.77E-03	4.21E-03
2000h	1.21E-03	8.77E-04	9.35E-04		1.34E-03	1.70E-03	1.85E-03	2.25E-03	6.49E-03	2.71E-03	3.22E-03	3.35E-03	3.67E-03	3.97E-03
2000i	1.21E-03	8.52E-04	8.87E-04		1.31E-03	1.75E-03	1.91E-03	2.31E-03	6.93E-03	2.83E-03	3.31E-03	3.51E-03	3.83E-03	4.45E-03
2000j	1.07E-03	7.59E-04	8.09E-04		1.21E-03	1.57E-03	1.78E-03	2.07E-03	6.27E-03	2.63E-03	3.03E-03	3.31E-03	3.52E-03	4.03E-03
2001a	1.14E-03	8.05E-04	8.77E-04		1.29E-03	1.73E-03	1.89E-03	2.25E-03	6.84E-03	2.88E-03	3.23E-03	3.57E-03	3.83E-03	4.20E-03
2001b	1.10E-03	7.72E-04	8.18E-04		1.22E-03	1.61E-03	1.76E-03	2.24E-03	6.19E-03	2.74E-03	3.08E-03	3.40E-03	3.55E-03	4.01E-03
2001c	1.12E-03	7.70E-04	8.43E-04		1.23E-03	1.63E-03	1.75E-03	2.14E-03	6.32E-03	2.63E-03	3.11E-03	3.20E-03	3.44E-03	3.98E-03
2001d	1.03E-03	7.07E-04	7.45E-04		1.07E-03	1.45E-03	1.60E-03	1.90E-03	5.63E-03	2.32E-03	2.71E-03	2.74E-03	2.81E-03	3.31E-03
2001e	1.12E-03	7.85E-04	8.39E-04		1.15E-03	1.53E-03	1.62E-03	1.92E-03	5.76E-03	2.39E-03	2.72E-03	2.86E-03	2.99E-03	3.52E-03
2001f	1.20E-03	8.15E-04	8.67E-04		1.22E-03	1.62E-03	1.70E-03	2.06E-03	6.22E-03	2.55E-03	2.98E-03	3.17E-03	3.44E-03	3.97E-03
2002a	1.07E-03	7.36E-04	7.82E-04		1.11E-03	1.50E-03	1.60E-03	2.06E-03	6.07E-03	2.50E-03	2.80E-03	3.18E-03	3.51E-03	4.00E-03
2002b	1.02E-03	7.17E-04	7.69E-04		1.17E-03	1.54E-03	1.70E-03	2.05E-03	6.43E-03	2.65E-03	3.07E-03	3.32E-03	3.79E-03	4.32E-03
2002c	1.07E-03	7.56E-04	8.06E-04		1.16E-03	1.63E-03	1.77E-03	2.18E-03	6.65E-03	2.74E-03	3.31E-03	3.51E-03	3.86E-03	4.51E-03
2002d	9.59E-04	6.61E-04	7.10E-04		1.03E-03	1.40E-03	1.58E-03	1.97E-03	5.98E-03	2.47E-03	2.92E-03	3.14E-03	3.36E-03	3.90E-03
2002e	9.97E-04	6.80E-04	7.21E-04		1.05E-03	1.45E-03	1.63E-03	1.97E-03	6.19E-03	2.49E-03	2.92E-03	3.12E-03	3.42E-03	3.79E-03
2003a	9.16E-04	6.10E-04	6.45E-04		9.59E-04	1.30E-03	1.44E-03	1.71E-03	5.55E-03	2.22E-03	2.60E-03	2.81E-03	3.07E-03	3.53E-03
2003b	9.62E-04	6.58E-04	6.89E-04		1.03E-03	1.38E-03	1.61E-03	1.96E-03	5.86E-03	2.45E-03	2.79E-03	3.10E-03	3.29E-03	3.66E-03
2003c	1.09E-03	7.85E-04	8.31E-04		1.26E-03	1.56E-03	1.77E-03	2.12E-03	5.97E-03	2.63E-03	3.07E-03	3.24E-03	3.55E-03	4.11E-03
2003d	1.03E-03	7.23E-04	7.54E-04		1.09E-03	1.45E-03	1.61E-03	1.94E-03	6.04E-03	2.47E-03	2.94E-03	3.09E-03	3.30E-03	3.74E-03
2003e	1.00E-03	7.05E-04	7.60E-04		1.09E-03	1.47E-03	1.59E-03	1.97E-03	5.97E-03	2.47E-03	2.80E-03	2.86E-03	3.19E-03	3.68E-03
2003f	9.77E-04	7.07E-04	7.55E-04		1.13E-03	1.42E-03	1.53E-03	1.85E-03	5.75E-03	2.33E-03	2.64E-03	2.77E-03	2.97E-03	3.47E-03

Appendix 11: Oxygen and carbon isotopes- raw data

NEL01D mid-Holocene coral

Year	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
5-10	-1.1	-4.3	26.5	24.84	24.30	-0.0968
10-15	-1	-4.2	26.6	24.28	23.26	-0.1836
15-20	-1.5	-4.5	26.3	25.96	24.97	-0.1772
20-15	-1	-4.4	26.4	25.40	25.32	-0.0132
25-30	-0.5	-4.2	26.6	24.28	24.52	0.0438
30-35	-0.8	-4.2	26.5	24.28	23.82	-0.0820
35-40	-0.5	-4.2	26.6	24.28	23.78	-0.0908
40-45	-1	-4.7	26.1	27.07	24.55	-0.4537
45-50	-0.9	-4.5	26.2	25.96	23.56	-0.4318
50-55	-1.2	-4.9	26.1	28.19	22.14	-0.8480
55-60	-1.4	-4.7	26.2	27.07	25.00	-0.5586
60-65	-1.7	-4.5	26.3	25.96	24.00	-0.3526
65-70	-1.4	-4.5	26.5	25.96	24.12	-0.3303
70-75	-1.8	-4.7	26.1	27.07	24.04	-0.5458
75-80	-1.6	-4.8	26	27.63	24.83	-0.5039
80-85	-0.9	-4.4	26.3	25.40	24.48	-0.1651
85-90	-1.2	-4.3	26.5	24.84	25.29	0.0812
90-95	-1.1	-4.5	26	25.96	24.50	-0.2620
95-100	-1.4	-4.5	26.5	25.96	25.01	-0.1697
100-105	-1.1	-3.7	27.1	21.49	24.20	0.4882
105-110	-0.6	-4.2	26.5	24.28	24.04	-0.0428
110-115	-0.7	-3.9	27	22.60	26.03	0.6170
115-120	-0.7	-3.9	26.9	22.60	25.19	0.4659
120-125	-0.3	-3.8	26.8	22.04	25.07	0.5443
125-130	-0.6	-4.4	26.4	25.40	24.85	-0.0979

Nel03D mid-Holocene coral

Year	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
5-10	-2.4	-4.8	26	27.63	24.70	-0.5275
10-15	-2.3	-4.5	26.3	25.96	24.28	-0.3020
15-20	-2.2	-4.6	26.2	26.51	24.52	-0.3594
20-25	-2.1	-4.6	26.1	26.51	25.32	-0.2143
25-30	-2.1	-4.7	26.1	27.07	26.14	-0.1687
30-35	-2	-4.8	25.9	27.63	26.50	-0.2033
35-40	-1.7	-4.4	26.4	25.40	24.45	-0.1701
40-45	-2.3	-4.8	26	27.63	26.84	-0.1433
45-50	-2	-4.4	26.3	25.40	25.72	0.0589
50-55	-2	-4.6	26.2	26.51	26.24	-0.0494
55-60	-1.9	-4.7	26.1	27.07	25.32	-0.3147
60-65	-1.9	-4.6	26.2	26.51	25.61	-0.1623
65-70	-2.1	-4.5	26.2	25.96	24.99	-0.1730

MAG01D modern coral 1810-1985

Calendar Year	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
1810-1815	-1.5	-4.4	26.4	25.40	23.01	-0.4303
1815-1820	-0.6	-4.4	26.4	25.40	23.21	-0.3942
1820-1825	-1.1	-4.5	26.3	25.96	24.09	-0.3365
1825-1830	-1.3	-4.7	26.1	27.07	25.00	-0.3724
1830-1835	-1.2	-4.5	26.3	25.96	25.59	-0.0665
1835-1840	-1.2	-4.4	26.4	25.40	25.32	-0.0144
1840-1845	-1	-4.3	26.5	24.84	25.44	0.1082
1845-1850	-0.7	-4.3	26.5	24.84	24.38	-0.0829
1850-1855	-0.6	-4	26.8	23.16	24.37	0.2167
1855-1860	-1.2	-4.4	26.4	25.40	25.15	-0.0445
1860-1865	-1.7	-4.6	26.2	26.51	26.65	0.0251
1865-1870	-1.8	-4.2	26.6	24.28	25.80	0.2740
1870-1875	-1.5	-4.3	26.5	24.84	25.44	0.1092
1875-1880	-1.4	-4.2	26.6	24.28	26.08	0.3237
1880-1885	-1.6	-4.2	26.6	24.28	25.27	0.1789
1885-1890	-1.3	-4.6	26.2	26.51	24.76	-0.3149
1890-1895	-1.6	-4.7	26.1	27.07	24.91	-0.3898
1895-1900	-1.6	-4.7	26.1	27.07	24.27	-0.5046
1900-1905	-1.2	-4.5	26.2	25.96	25.27	-0.1226
1905-1910	-2.1	-4.8	26	27.63	25.39	-0.4036
1910-1915	-1.9	-4.7	26.1	27.07	24.92	-0.3876
1915-1920	-1.1	-4.5	26.3	25.96	24.80	-0.2076
1920-1925	-1.3	-4.7	26.1	27.07	25.47	-0.2883
1925-1930	-1.2	-4.8	26	27.63	25.42	-0.3974
1930-1935	-1.2	-4.6	26.2	26.51	25.07	-0.2598
1935-1940	-1.4	-4.4	22.6	25.40	25.80	0.0720
1940-1945	-1.3	-4.1	26.8	23.72	24.18	0.0822
1945-1950	-1.2	-4.4	23.2	25.40	25.80	0.0729
1950-1955	-1.1	-4.5	23	25.96	25.81	-0.0257
1955-1960	-1.3	-4.3	26.4	24.84	24.43	-0.0743
1960-1965	-0.9	-4.2	26.6	24.28	25.25	0.1745
1965-1970	-1.1	-4.5	26.2	25.96	25.49	-0.0838
1970-1975	-1.6	-4.7	26	27.07	24.47	-0.4687
1975-1980	-1.4	-4.9	26	28.19	25.30	-0.5194
1980-1985	-1.5	-4.6	26.2	26.51	25.44	-0.1940

MAG01D modern coral two-monthly resolution

Calendar year	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
1980A	-2.7	-5	25.8	28.75	28.48	-0.0489
1980B	-2.6	-4.7	26.1	27.07	27.22	0.0260
1980C	-1.9	-4.1	26.7	23.72	24.45	0.1315
1980D	-1	-3.8	27	22.04	23.75	0.3077
1980E	-1.2	-4.6	26.1	26.51	26.56	0.0086
1980F	-1.6	-4.8	26	27.63	26.90	-0.1313
1981A	-2.3	-5.8	24.9	33.22	28.50	-0.8500
1981B	-2.8	-5.4	25.3	30.98	28.89	-0.3776
1981C	-2.2	-4.7	26.1	27.07	25.55	-0.2737
1981D	-1.9	-3.8	27	22.04	24.00	0.3521
1981E	-2.2	-3.8	27	22.04	25.50	0.6212
1981F	-1.9	-4.2	26.6	24.28	25.31	0.1861
1982A	-1	-4.5	26.3	25.96	26.89	0.1675
1982B	-1.4	-4.3	26.5	24.84	28.72	0.6981
1982C	-3.5	-4.3	26.5	24.84	27.78	0.5289
1982D	-1.5	-3.1	27.7	18.13	24.76	1.1925
1982E	-0.8	-3.8	27	22.04	22.96	0.1640
1982F	-0.4	-4.2	26.6	24.28	24.75	0.0847
1983A	-1.4	-5.4	25.4	30.98	26.87	-0.7406
1983B	-1.3	-4.7	26.1	27.07	28.28	0.2179
1983C	-1.2	-4.6	26.2	26.51	28.31	0.3233
1983D	-1.6	-4.8	26	27.63	27.34	-0.0530
1983E	-2.2	-3.7	27.1	21.49	25.27	0.6809
1983F	-3.7	-4	26.8	23.16	26.21	0.5477
1984A	-1.7	-4.4	26.4	25.40	27.64	0.4030
1984B	-1.7	-4.6	26.2	26.51	27.02	0.0904
1984C	-1.6	-5	25.8	28.75	27.46	-0.2311
1984D	-1.8	-5	25.8	28.75	28.32	-0.0764
1984E	-1.6	-4.8	26	27.63	27.05	-0.1042
1984F	-1.8	-3.8	27	22.04	24.23	0.3940

NEL03D mid-Holocene coral two-monthly resolution

Year	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
1a	-1.7	-5.3	25.4	30.42	28.05	-0.4272
1b	-1.4	-4.8	25.9	27.63	27.69	0.0107
1c	-1.4	-4.9	25.9	28.19	27.10	-0.1970
1d	-1.4	-5	25.8	28.75	27.43	-0.2367
1e	-2.1	-6.2	24.6	35.45	27.33	-1.4623
1f	-2.4	-5.4	25.3	30.98	28.30	-0.4826
2a	-3.4	-6.1	24.6	34.89	27.39	-1.3501
2b	-2	-4.6	26.2	26.51	24.66	-0.3340
2c	-2.3	-4	26.8	23.16	24.39	0.2202
2d	-2.5	-5.1	25.7	29.31	28.04	-0.2288
2e	-2.1	-5.5	25.3	31.54	27.73	-0.6867
2f	-2.6	-5.3	25.5	30.42	27.27	-0.5681
3a	-2	-3.9	26.9	22.60	24.60	0.3601
3b	-1.6	-4.3	26.5	24.84	26.43	0.2867
3c	-1.7	-5	25.8	28.75	27.13	-0.2911
3d	-1.8	-5.4	25.3	30.98	28.04	-0.5291
3e	-2.2	-5	25.8	28.75	26.86	-0.3397
3f	-2.7	-4.4	26.4	25.40	23.35	-0.3679
4a	-2.1	-4.4	26.4	25.40	22.95	-0.4400
4b	-1.6	-4.7	26.1	27.07	27.87	0.1432
4c	-1.4	-4.9	25.9	28.19	26.34	-0.3338
4d	-2.1	-4.6	26.2	26.51	26.30	-0.0394
4e	-2.1	-4	26.8	23.16	24.37	0.2165
4f	-1.5	-3.8	27	22.04	23.53	0.2680
5a	-1.6	-4.2	26.6	24.28	26.04	0.3172
5b	-1.9	-5	25.8	28.75	28.43	-0.0572
5c	-1.9	-4.8	25.9	27.63	28.78	0.2071
5d	-2.2	-5.2	25.6	29.87	28.94	-0.1666
5e	-2.8	-5	25.8	28.75	29.08	0.0595
5f	-3.1	-5.2	25.5	29.87	28.93	-0.1679

Standards

	$\delta^{13}C$ (PDB)	$\delta^{18}O$ PDB	$\delta^{18}O$ SMOW	$\delta^{18}O$-SST°C	Sr/Ca-SST °C	$\Delta^{18}O$
Pandora	-1.6	-4.7	26.1	27.07	25.69	-0.2494
Pandora	-1.9	-4.9	25.9	28.19	25.35	-0.5107
Pandora	-1.6	-4.6	26.2	26.51	25.94	-0.1037
Pandora	-1.7	-4.8	22.1	27.63	25.88	-0.3144
Pandora	-1.6	-4.7	25.7	27.07	26.21	-0.1550
Pandora	-1.8	-4.8	26	27.63	25.70	-0.3472
Pandora	-1.9	-4.7	25.7	27.07	25.41	-0.2986
Pandora	-1.7	-4.7	25.8	27.07	26.50	-0.1024
Pandora	-1.5	-4.9	25.9	28.19	26.11	-0.3746
Pandora	-1.6	-4.7	26.1	27.07	25.94	-0.2044
Standard deviation (1)	0.137032	0.0971825	1.2240643	0.5429192	0.3529282	0.1295841
Average	-1.69	-4.75	25.55	27.351955	25.87393	-0.2660446
RSD	**-8.11%**	**-2.05%**	**4.79%**	**1.98%**	**1.36%**	**-48.71%**

Appendix 12: A potential coral proxy of turbidity/An evaluation of the effect of the 1970s dredging on the fringing reefs of Magnetic Island. Turbidity data Nelly Bay.

A-12.1. A potential turbidity coral proxy for the GBR

A-12.1.1. Overview and background

Elevated seawater turbidity levels are known to have detrimental effects on coral reefs. Elevated turbidity significantly reduces the light available to corals and results in decreased coral photosynthesis/calcification, lowered coral cover/diversity and a considerable drop in coral recruitment/settlement numbers (Fabricius, 2005). It may also retard the development of juvenile coral growth and survival (see review in Fabricius, 2005).

One of the most complex and contentious issues in the scientific literature on water quality on the GBR is the question of whether turbidity levels on inshore coral reefs have increased since European settlement. Some inshore reefs of the GBR are considered to be situated in naturally turbid systems and to have developed when a hard substrate has become available (e.g. Larcombe and Woolfe, 1999b; Smithers and Larcombe, 2003). Turbidity levels in the waters of the inshore GBR are controlled dominantly by the resuspension of sediment from wind-generated wave stress (e.g. Larcombe et al., 1995a). Wind speed and direction is, therefore, the major control of turbidity/suspended sediment levels on inshore coral reefs. It is thought that these parameters have been relatively constant for the last 5-6,000 years (Larcombe et al., 1995a).

However, it is argued that the substantial increase in the sediments and nutrients exported from river catchments to the GBR (e.g. models by Moss et al., 1992; Prosser et al., 2001; Furnas, 2003) since the arrival of Europeans, have not only allowed more sediments to be deposited in the embayments, but have also provided more favorable conditions for phytoplankton production, which can also influence turbidity levels (Fabricius and De'ath, 2001a). Increased phytoplankton production is known to encourage particles to flocculate and settle out as a sticky "marine snow" which could severely damage coral reefs (Wolanski and Spagnol, 2000; Fabricius and Wolanski, 2000). Sediment accumulation in the embayments of north Queensland may allow more sediment to be reworked and resuspended under moderate to heavy sea conditions (e.g. McCulloch et al., 2003;

McCulloch, 2003). However, fine-grained sediment exported from the Burdekin River is not deposited near inshore reefs northwards of the delta, but is transferred to the inshore coastal fringes in mangrove and creek systems (Orpin et al., 2004). The extremely low sediment accumulation rates that have been calculated for Cleveland Bay (~ 0.25 mm/year) are further evidence that this embayment acts more as a sediment transport system, rather than as a sediment trap (Carter et al., 1993). Nonetheless, the increased load of fine sediments, colloids and nutrients supplied from the rivers and creeks may have resulted in elevated turbidity levels at some coral reefs. It is important to assess this threat to the inshore coral communities of the GBR.

Inshore coral reefs of the GBR may have already experienced higher levels of turbidity since European settlement. Deteriorating seawater visibility (as high as a 50% reduction) has been documented for inshore reefs of the Cairns region (Low Isles; Wolanski and Spagnol, 2000) and these increased turbidity levels may have played a major role in reducing the species diversity of the inshore coral reefs of the GBR (Fabricius and De'ath, 2001a). This increase in turbidity has had a particularly large effect on the soft coral and crustose coralline algae communities, which are believed to have become severely depleted at inshore coral reefs since European settlement (Fabricius and De'ath, 2001a;b). The depletion of these communities has allowed the more "turbidity tolerant" species to dominate the inshore GBR (Fabricius and De'ath, 2001a).

The successful development and application of a coral turbidity proxy would prove invaluable to assess the threat of turbidity to the health of the inshore GBR. As previously discussed, the Y/Ho ratio has displayed considerable promise as a sedimentation proxy and could also be an indicator of turbidity (see sections 8.2.5 and 8.3). Declining coral Y/Ho ratios appear to document the deterioration of water quality conditions which preceded the mortality of the mid-Holocene corals (Fig 8.2c; 8.4a-b). The shift in the coral Y/Ho ratio also precedes the rise in coral Th concentrations which suggests that the mid-Holocene corals did not experience sedimentation until the final 2-4 years of growth (Fig 8.4a). In addition, the coral Y/Ho ratios do not appear to be significantly affected by large flood events unless sediments are incorporated in the coral (e.g. 1974 flood; Fig 8.5b).

Therefore, the only other conceivable control on the coral Y/Ho ratio appears to be suspended sediment and colloidal particles, which are the main contributors to turbidity levels at inshore coral reefs.

Turbidity monitoring on coral reefs has been limited as instruments were restricted to the amount of time that they could be deployed due to cleaning problems and battery power. The physical measurement of turbidity levels on coral reefs would also have been biased towards favorable sea state conditions as it would be difficult and dangerous to conduct fieldwork in rough weather conditions. Fortunately, the development of the nephelometer has allowed seawater turbidity to be measured for relatively long and continuous periods of time (e.g. Ridd and Larcombe, 1994). Environmental monitoring during the construction of the Nelly Bay Harbour permitted a long, continuous turbidity dataset spanning the years 2000-2002. A coral from Nelly Bay was cored in 2004 (NEL21) by AIMS and sampled at sub-annual resolution to investigate a possible correlation between turbidity and the Y/Ho ratio.

A-12.1.2. Chronology of coral record

In order to correlate the coral record with the real-time turbidity dataset, U, Ba and Th were measured in the coral as well as Y and Ho. The coral U concentrations provide a reliable estimate of SST while elevated Ba levels are correlated to flood events. Coral Th concentrations were used to investigate the possibility of sediments trapped in the coral skeleton.

The Y/Ho ratios displayed three clear deviations in the 2000-2003 coral record where values fall below 60 (Fig A-12.1a). These samples include 2000c (58.23), 2001b (58.94) and 2003c (59.3). The relative timing of these fluctuations was investigated from the coral U and Ba concentrations as proxies of SST and Burdekin River discharge, respectively.

The peak and trough U concentrations in the 2000-2003 coral record were matched with the peak of winter and summer, respectively (Fig A-12.1a; note inverted U scale). The lowest U concentration was correlated with the highest monthly SST, which occurs in January,

while the highest coral U concentration was interpreted to correlate with July (Fig A-12.1b). By applying this chronology, the major Y/Ho deviations are estimated to have occurred during April-May 2000, August-September 2001 and April-May 2003.

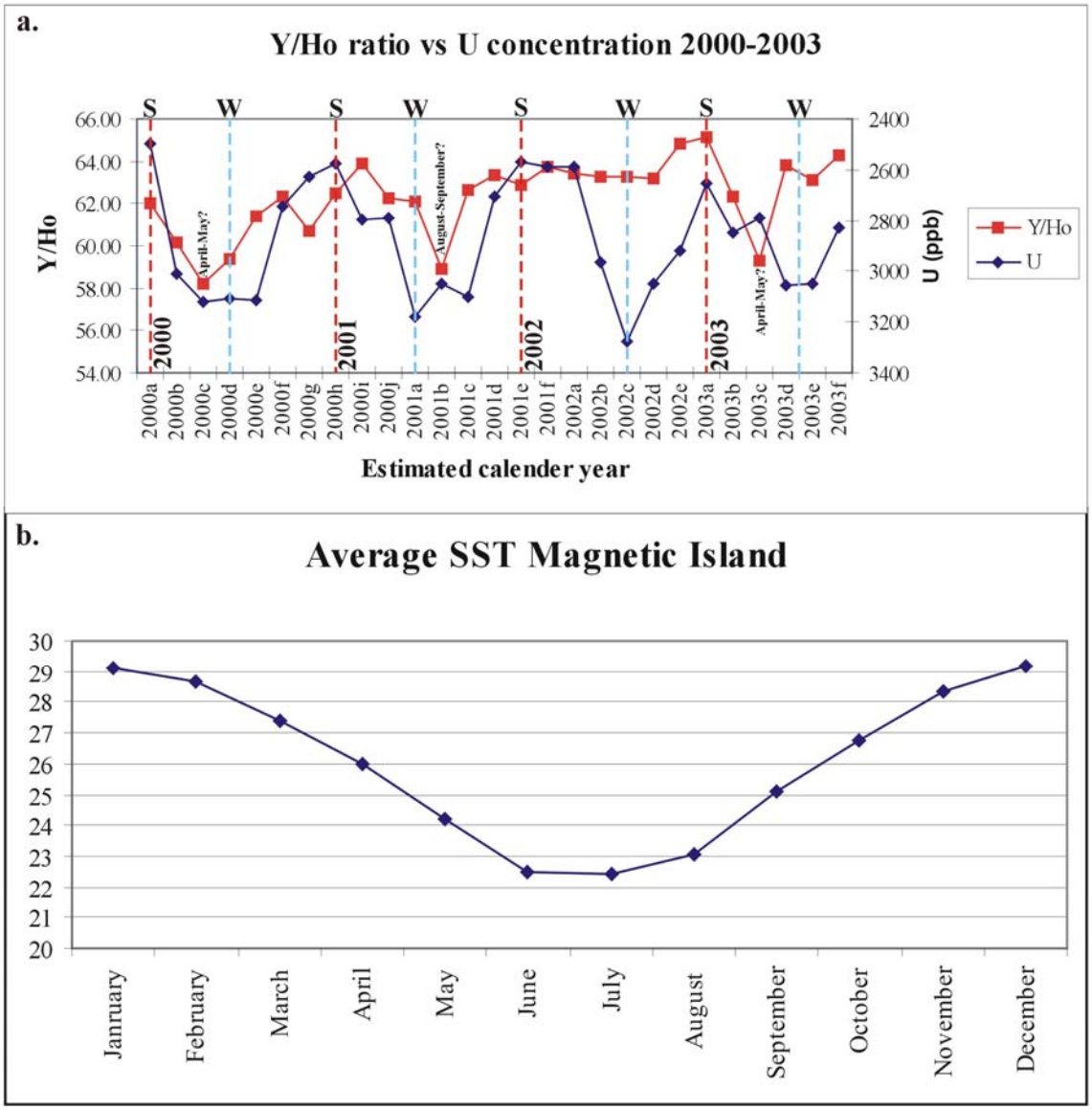

Figure A-12.1 a-b. In order to investigate the timing of the major Y/Ho deviations in the 2000-2003 coral record (a), coral U concentrations were used as a SST proxy to estimate the peak of summer (S) and winter (W). On Magnetic Island the highest and lowest SSTs occur in January and July, respectively (b). The major deviations in the coral Y/Ho ratio were estimated to have occurred in April-May 2000, August-September 2001 and April-May 2003 (a).

In order to verify the Y/Ho chronology produced from the coral U concentrations, the Ba concentration was analysed to investigate peak river discharge. Previous studies have demonstrated that the peak coral Ba concentration coincides with peak river discharge (e.g. McCulloch et al., 2003). Therefore, the peak Ba concentrations in the 2000-2003 coral record were matched to the Burdekin River discharge records (A-12.2a). The peak Burdekin discharge occurred in February 2000, January, 2001, February 2002 and February 2003 (Fig A-12.2b). The major Y/Ho deviations were estimated to have occurred in March-April 2000, July-August 2001 and March-April 2003. These estimates closely coincided with the U-SST approximations.

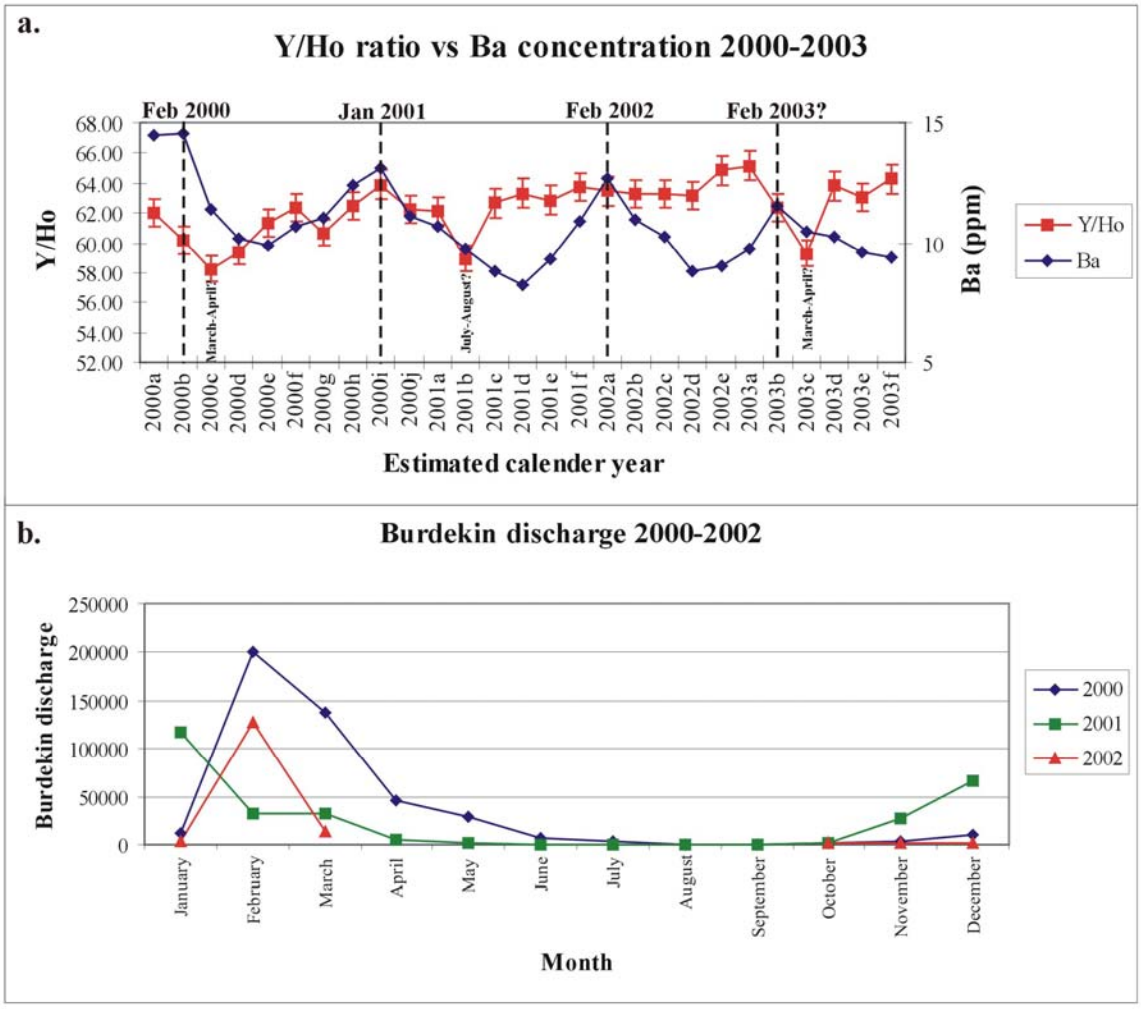

Figure A-12.2 a-b. The Ba concentrations in the 2000-2003 coral record (a) were matched to peak Burdekin River discharge (b) in order to provide an independent estimate for the timing of the Y/Ho deviations. The Y/Ho deviations occurred in March-April 2000, July-August 2001 and March-April 2003. This record closely matches the U-SST produced estimate (Fig A-12.1a).

A-12.1.3. Comparison of the coral Y/Ho ratio with the instrumental turbidity dataset

The nephelometers measured suspended sediment concentrations (SSC) at 10 min intervals in April-May 2000 and from November 2000 to December 2002 at 4 sites in Nelly and Geoffrey Bays (Fig 4.18). This data was processed and averaged to monthly intervals to correlate with the coral record (Fig A-12.3). Interestingly, the first major Y/Ho deviation, estimated to have occurred in March-May 2000, coincided with significantly elevated turbidity concentrations in April 2000. The average turbidity for April 2000 exceeded 60 mg/L at 3 sampling sites. This event is thought to occur once every ten years (P. Ridd personal communication, 2005). The coral Th concentrations remained at baseline values in the corresponding sample (2003c) which suggests that no sedimentation was associated with this event and that the coral Y/Ho ratio is probably responding only to turbidity fluctuations (Fig A-12.4). However, the second Y/Ho deviation, estimated to have occurred during July-September 2001, does not appear to coincide with any increase in measured turbidity over this timeframe. Unfortunately, a monthly sampling resolution is not adequate to assess most turbidity fluctuations because, in most cases, turbidity varies greatly between days and weeks. The turbidity data from the 4 sites also displayed significant variability, which indicates that turbidity is also highly variable within the one small embayment (see Table A-12.1; A-12.2). No turbidity data was available and so no correlation with the third Y/Ho deviation, estimated to have occurred in March-May 2003, could be made. However, there is evidence that sedimentation has influenced this Y/Ho fluctuation as the Th concentration is elevated in the corresponding sample (Fig A-12.4).

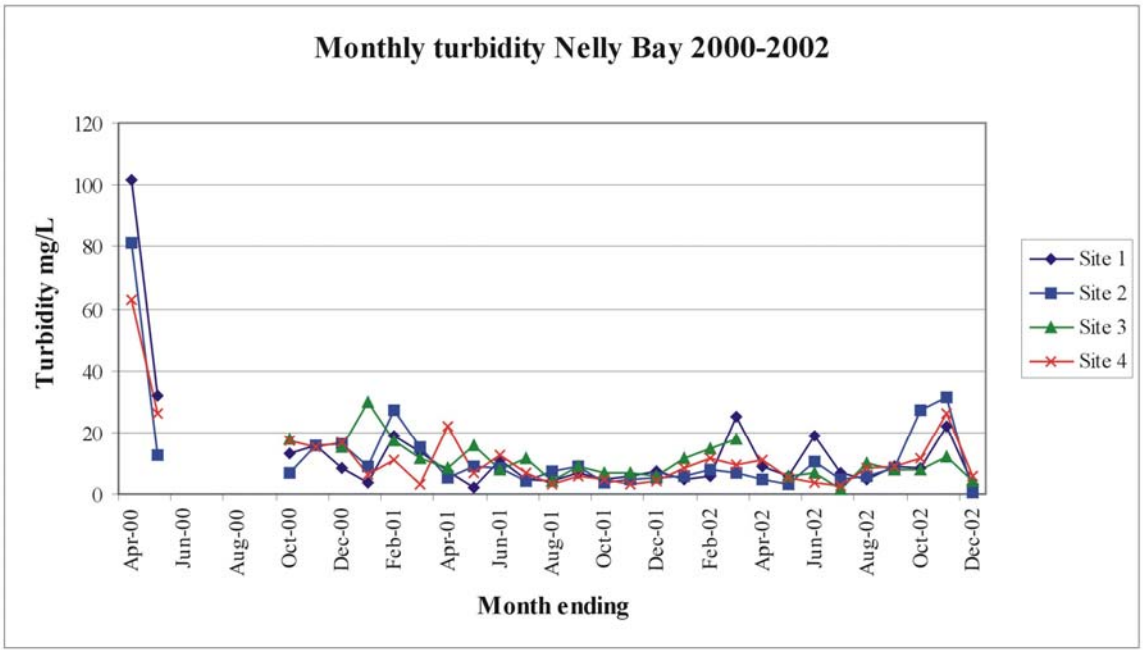

Figure A-12.3. Average monthly seawater turbidity from April 2000-December 2002 at 4 sites in Nelly Bay (see Fig 4.18). A significant one-in-ten year rough weather event occurred in April 2000 and coincided with significantly elevated turbidity concentrations. With the exception of this "event" average turbidity concentrations in Nelly Bay are relatively low in the remaining record rarely exceeding 20 mg/L.

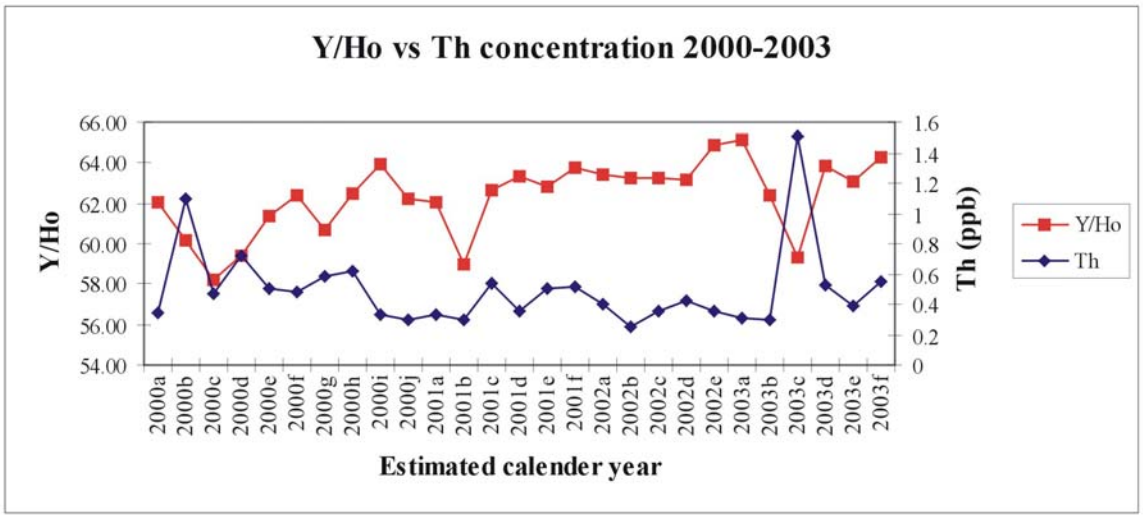

Figure A-12.4. Coral Th concentrations were used to investigate the effect of sedimentation on the Y/Ho ratio. The first and second major deviations in the Y/Ho ratio did not coincide with elevated Th which suggests that these deviations may be related to turbidity. However, the third Y/Ho deviation in 2003 coincided with relatively elevated Th concentrations. This finding indicates that the Y/Ho ratio has been influenced by sediment trapped in the coral lattice for the 2003c sample.

A-12.1.4. Summary

The coral Y/Ho ratio displays considerable promise as an indicator for turbidity. However, a higher resolution (minimum weekly resolution) study is required to investigate the correlation between the nephelometer data and the coral Y/Ho ratio. A reliable coral proxy of turbidity would be invaluable to investigate and quantify any change on the GBR since European settlement. This study has demonstrated that the coral Y/Ho ratio is an excellent proxy to assess sedimentation; however, its reliability as a turbidity proxy is unsubstantiated.

A-12.2. The impact of dredging on the GBR

A-12.2.1. Overview: The 1970s dredging event

Some researchers have argued that the dumping of spoil following the dredging of Townsville's shipping channel during the early 1970s was linked to the degradation of Magnetic Island's fringing coral reefs (Brown, 1972). However, the views of long-term residents of Magnetic Island are varied and the impact of the channel dredging program during this time remains controversial (see Appendix 1). Studies of turbidity levels in Magnetic Island during the 1994 capital dredging program found no apparent increase in turbidity (Larcombe and Ridd, 1994). This section will examine Th concentrations and the Y/Ho ratio in a Nelly Bay coral from 1968 to 1973 to examine any major changes in water quality during the early 1970s dredging.

A-12.2.2. Coral Th concentrations and the Y/Ho ratio

Four samples in the 1968-1973 Y/Ho record have ratios below 60, including the 1969a (59.95), 1972a (59.84), 1972b (59.63) and 1973a (57.76) samples (Fig A-12.5). However, only one of these samples appears to have been influenced by sedimentation (1973a; Th concentration= 2.40 ppb). The 1972a, 1972b and 1973a samples contain relatively high Ba

concentrations and the relatively low coral Y/Ho ratios in these samples may be linked to turbid flood plumes or rough weather events (Figs 8.5b; 8.13). Elevated turbidity and sedimentation to the coral reefs of Nelly Bay may have occurred before this time (~1971; Brown, 1972). Therefore, it appears there has been no apparent change in water quality recorded by this coral when the dredge spoil was dumped in the vicinity of Magnetic Island.

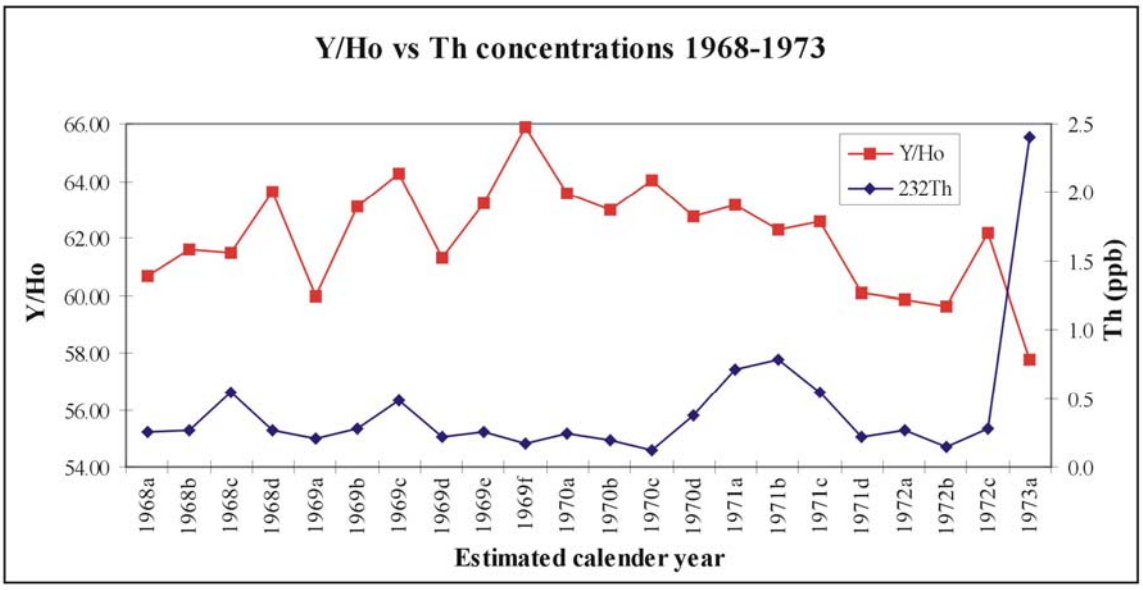

Figure A-12.5. The Y/Ho ratios and the Th concentration in the 1968-1973 coral record do display some significant variations. However, the major deviations occur in 1972 and 1973 which come after the dredging period reported by Brown (1972) and are thought to be related to turbid flood plumes following extended dry periods.

A-12.2.3. Turbidity and sedimentation modelling

To investigate further the possible impacts of dredging, the sedimentation component was subtracted from the coral Y/Ho ratios using the Th concentration. A power regression was fitted to the Y/Ho vs Th plot using the precision ICP-MS data which produced an r^2 value of 0.85 (Fig A-12.6a). These samples included the "sedimentation influenced" mid-Holocene corals to provide the widest possible spread of data. An equation was then produced to predict the Y/Ho ratio using the coral Th concentration (Fig A-12.6a). The measured coral Y/Ho ratio was then subtracted from the corresponding predicted "sedimentation-influenced" Y/Ho values (Y/Ho*). Values that are strongly positive are

considered to be influenced by turbidity, whereas strongly negative Y/Ho* values may be indicative of sedimentation.

To test this model, the 2000-2003 coral record was investigated (Fig A-12.6b). Only 2 of the samples (2000c and 2001b) displayed Y/Ho* values greater than 2, which corresponded to the major Y/Ho fluctuations identified in figure A-12.4. One sample contained a Y/Ho* value less than -4 (2003c) which is related to the elevated Th concentrations in this sample. Therefore, samples containing Y/Ho* values that exceed 2 may be affected by turbidity while samples with values less than -4 may be influenced by sedimentation.

This model was applied to the 1968-1973 coral record with surprising results (Fig A-12.6c). Six samples from 1968-1971 coral record contained Y/Ho* values greater than 2 and may suggest that turbidity has been elevated over this timeframe. In addition, the 1971a and 1971b samples contain values less than -4, which may indicate increased sedimentation. The timing of this deviation also coincided with the documented sedimentation of the Nelly Bay reef by Brown (1972). The 1968-1973 Y/Ho* values displayed greater variability compared to the 2000-2003 record (Fig A-12.6b-c). However, it is conceded that this model is still in the developing stages and further refinement is required to produce better results. Therefore, the impact of the 1970s dredging program to the fringing reefs of Magnetic Island is still unresolved.

The Y/Ho* values were also examined in the analysis of the coral luminescent lines or "flood bands" (Fig A-12.6d). This record displays a high degree of variability with the majority of samples in the "turbidity influenced" or the "sedimentation influenced" zones. Interestingly, both the 1831 and 1870 flood bands appear to be influenced by sedimentation while floods after prolonged dry periods appear to produce relatively high turbid Y/Ho* values. However, the 1974 flood, which was affected by sedimentation, contains a Y/Ho* value of + 2.98 (Fig A-12.6d). Therefore, more data is required to further develop and refine this model.

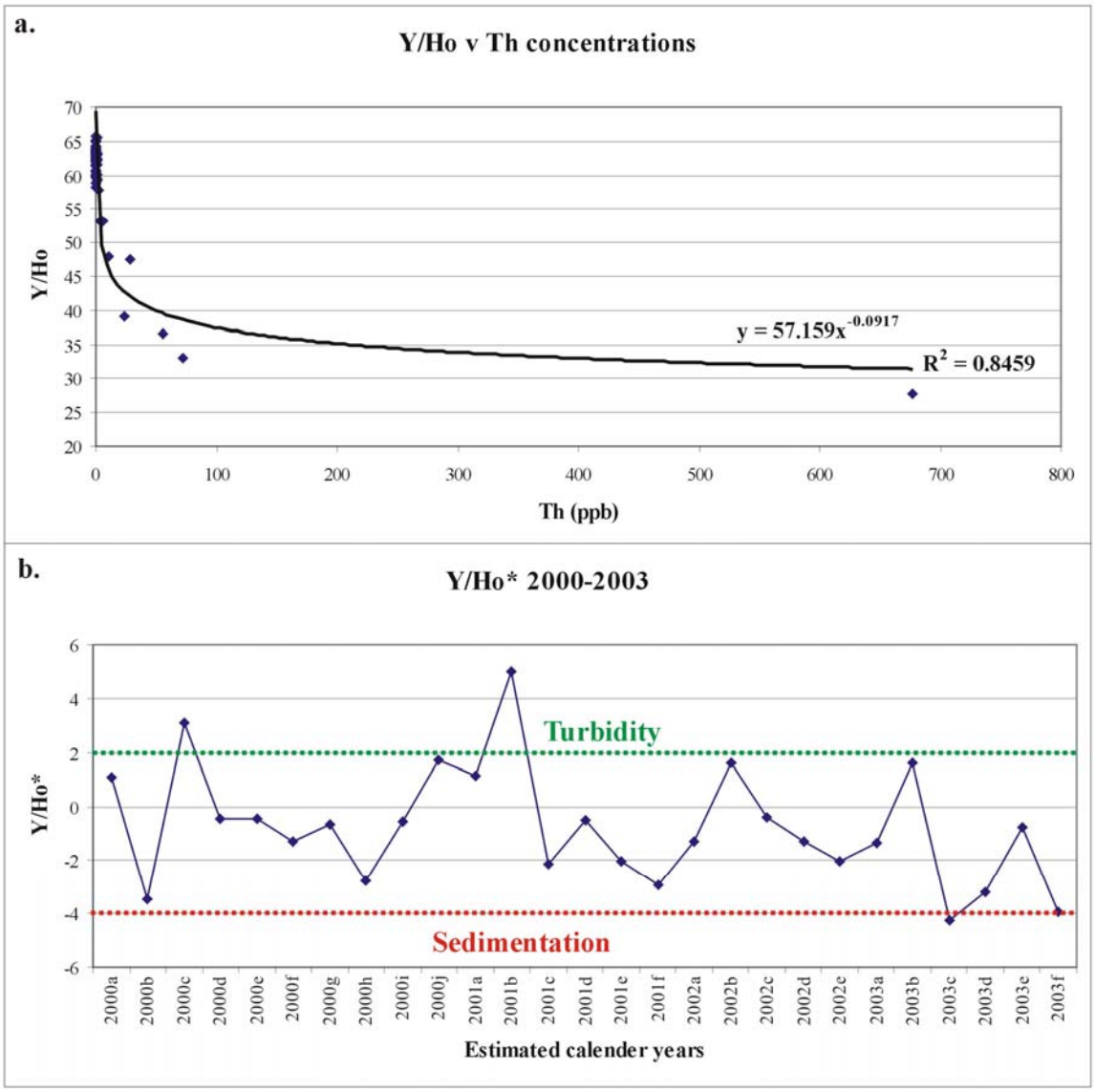

Figure A-12.6 a-b. A power regression analysis was performed on the coral Y/Ho ratio vs the Th concentration (a). The equation of this regression was used to subtract the sedimentation component off the coral Y/Ho ratio to produce a record of turbidity (Y/Ho*). The 2000-2003 record was used to examine this model (b). Y/Ho* values exceeding 2 are considered to be "turbidity influenced" while values lower than -4 are considered to be "sedimentation influenced".

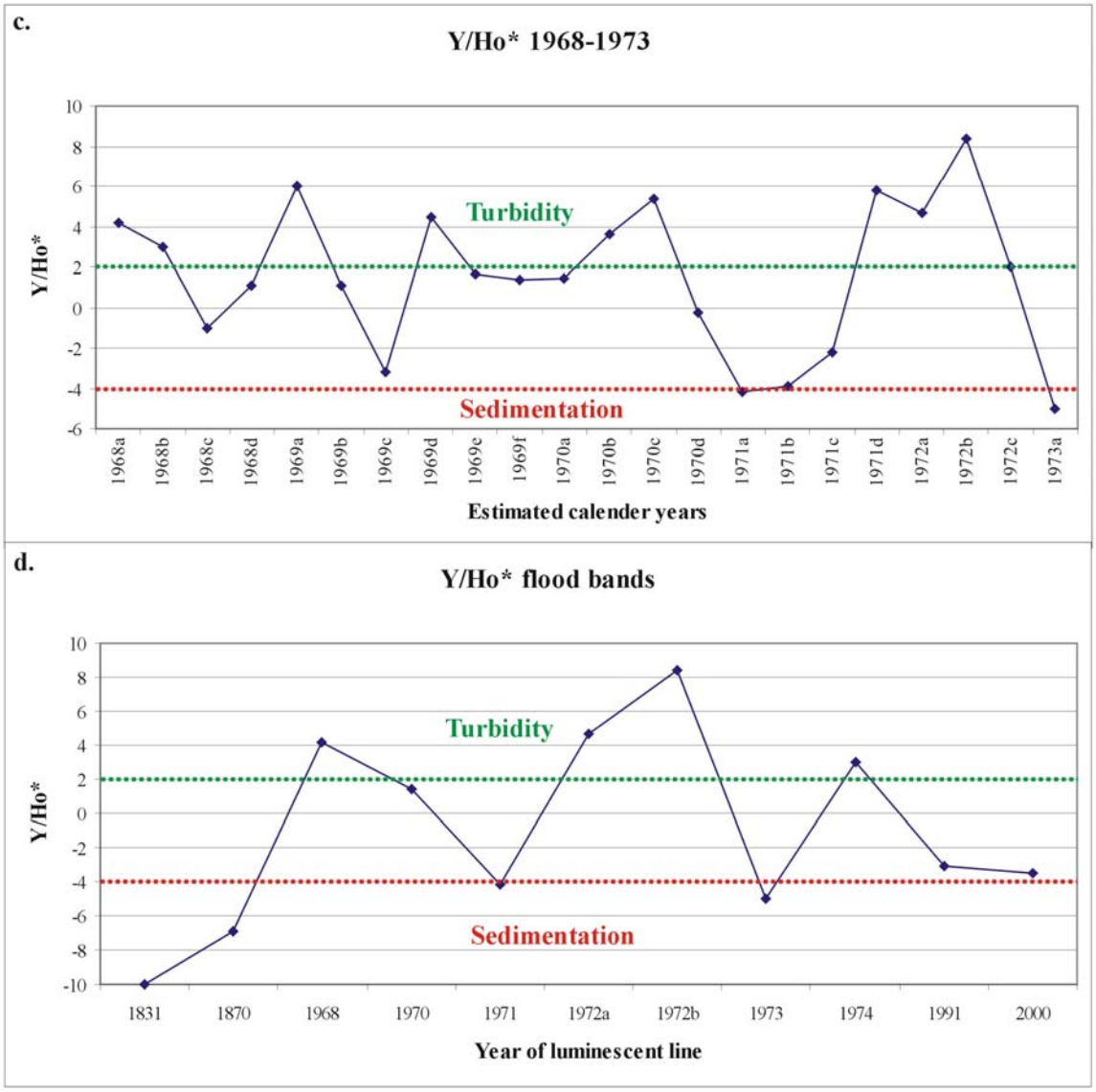

Figure A-12.6c-d. The Y/Ho* was then plotted for the 1968-1973 coral record (c) and also for the coral flood bands (d). Interestingly, both records displayed higher Y/Ho* fluctuations compared to the 2000-2003 record (b). In addition, the "turbidity influenced" coral samples in the 1968-1971 period coincides with the documented turbid waters described by Brown (1972) in this period. However, the 1974 flood, which has been demonstrated to have been influenced by sedimentation, resides in the "turbidity influenced" zone (d). Therefore, this model still requires further development.

A12.2.4. Summary

The coral Y/Ho ratio and Th concentrations in the 1968-1973 record did not display any significant deviations during the dredging between 1968-1971. Major variations in the Y/Ho ratio occurred in 1972 and may be related to turbid flood plumes following periods of relatively dry conditions. However, when the sedimentation component is subtracted from the Y/Ho ratio using the Th concentrations, the Y/Ho* values display considerable variability in the 1968-1971 dredging period. The Y/Ho* model requires further development before it can be employed confidently as a proxy to investigate seawater turbidity levels and sedimentation to coral reefs.

Weekly nephelometer data Nelly Bay (mg/L)

Date week ending	site 1	site 2	site 3	site 4	St. Dev. turbidity all sites	Average turbidity all sites	RSD
16/04/2000	68.55	30.29		49.29	19.13	49.38	**38.74%**
23/04/2000	8.13	4.07		3.04	2.69	5.08	**52.97%**
30/04/2000	228.90	209.01		136.47	48.65	191.46	**25.41%**
8/05/2000	16.15	9.25		9.05	4.04	11.49	**35.18%**
16/05/2000	46.57	15.03		16.92	17.69	26.17	**67.57%**
24/05/2000	33.11	13.70		53.25	19.78	33.35	**59.29%**
31/10/2000	13.34	7.04	17.77	17.18	4.93	13.83	**35.67%**
8/11/2000	6.96	9.40		6.96	1.41	7.77	**18.11%**
16/11/2000	20.81	10.37		13.82	5.32	15.00	**35.45%**
23/11/2000		18.06		6.66	8.06	12.36	**65.19%**
30/11/2000	19.05	24.30		33.07	7.08	25.47	**27.81%**
8/12/2000	15.41	31.98	24.73	26.23	6.87	24.59	**27.94%**
16/12/2000	4.60	9.76		11.23	3.48	8.53	**40.78%**
24/12/2000		16.60		20.45	2.72	18.53	**14.71%**
31/12/2000	5.26	5.68	6.01	9.44	1.92	6.60	**29.05%**
8/01/2001	7.92	22.53	19.93	12.85	6.66	15.81	**42.15%**
16/01/2001	1.10	2.44	2.58	2.56	0.72	2.17	**33.04%**
24//01/2001	2.41	4.59	8.81	3.03	2.89	4.71	**61.26%**
31/01/2001	3.79	5.78	88.62		48.41	32.73	**147.92%**
7/02/2001	11.21			11.21	0.00	11.21	**0.00%**
14/02/2001	19.95	30.05	12.08		9.01	20.69	**43.54%**
21/02/2001	32.42	42.29	32.69		5.62	35.80	**15.71%**
28/02/2001	11.49	10.17	7.10		2.25	9.58	**23.51%**
8/03/2001	4.58	8.15	13.48		4.48	8.74	**51.27%**
16/03/2001	28.80	43.11	18.37	5.59	15.90	23.97	**66.35%**
24/03/2001	11.44	4.27	5.37	0.71	4.46	5.44	**81.98%**
31/03/2001	10.70	6.10	9.90	3.62	3.32	7.58	**43.74%**
8/04/2001	15.59	8.59	11.83	9.77	3.07	11.44	**26.84%**
16/04/2001	9.17	4.27	8.35	17.38	5.49	9.79	**56.11%**
23/04/2001	2.91	1.85	4.75	38.12	17.51	11.91	**147.11%**
30/04/2001	2.14	6.09	9.48		3.67	5.90	**62.28%**
8/05/2001	0.94	1.18	6.88	4.82	2.89	3.46	**83.73%**
16/05/2001	1.16	4.39		5.61	2.30	3.72	**61.87%**
24/05/2001	2.67	6.89	4.75	6.27	1.88	5.14	**36.56%**
31/05/2001	2.65	24.14	34.91	10.90	14.26	18.15	**78.54%**
8/06/2001	27.92	16.07	12.86	24.79	7.10	20.41	**34.81%**
16/06/2001	3.61	7.03	3.04	16.25	6.10	7.48	**81.61%**
23/06/2001	6.69	5.60	5.79	6.61	0.56	6.18	**9.05%**

Weekly nephelometer data Nelly Bay (mg/L)

Date week ending	site 1	site 2	site 3	site 4	St. Dev. turbidity all sites	Average turbidity all sites	RSD
30/06/2001	4.79	4.10	9.47	2.48	3.00	5.21	**57.58%**
8/07/2001	4.20	3.89	8.80	6.76	2.32	5.91	**39.15%**
16/07/2001	4.37	4.18		7.98	2.14	5.51	**38.90%**
24/07/2001	4.37	4.74	13.16	6.23	4.10	7.12	**57.62%**
31/07/2001	5.29	3.45	12.48	5.63	3.96	6.71	**59.02%**
8/08/2001	4.61	3.23	4.99	2.99	0.99	3.96	**25.08%**
16/08/2001	5.15	5.71	6.22	2.70	1.56	4.94	**31.58%**
24/08/2001	3.45	9.78	3.17	2.18	3.47	4.65	**74.61%**
31/08/2001	3.41	10.17	2.50	4.31	3.46	5.10	**67.93%**
8/09/2001	3.84	6.76	2.69	4.18	1.72	4.37	**39.33%**
16/09/2001	5.25	2.50	2.52	6.44	1.99	4.18	**47.55%**
23/09/2001	11.09	13.71	14.24	7.88	2.91	11.73	**24.81%**
30/09/2001	6.17	12.72	16.51	4.76	5.54	10.04	**55.14%**
8/10/2001	6.49	2.72	5.61	1.68	2.29	4.13	**55.46%**
16/10/2001	6.48	1.20	6.27	5.19	2.46	4.78	**51.35%**
24/10/2001	4.77	8.90	8.38	10.72	2.49	8.19	**30.44%**
31/10/2001	1.98	2.15	6.19	2.09	2.06	3.10	**66.47%**
8/11/2001	3.54	2.69	6.15	3.58	1.50	3.99	**37.53%**
16/11/2001	5.59	5.93	6.99	1.47	2.42	4.99	**48.54%**
23/11/2001	11.06	4.83	6.57	4.43	3.04	6.72	**45.18%**
30/11/2001	3.40	5.35	7.44	3.30	1.95	4.87	**40.05%**
8/12/2001	7.19	6.35	7.42	1.55	2.76	5.63	**48.97%**
16/12/2001	2.99	9.04	10.94	2.57	4.24	6.39	**66.34%**
24/12/2001	13.42	4.17	4.03	6.23	4.42	6.96	**63.52%**
31/12/2001	6.02	0.78	0.33	7.20	3.54	3.58	**98.68%**
8/01/2002	5.92	5.92	2.12	7.24	2.21	5.30	**41.73%**
16/01/2002	5.86	5.86	11.63	7.27	2.73	7.65	**35.69%**
24//01/2002	5.18	6.27	24.23	8.96	8.86	11.16	**79.38%**
31/01/2002	0.89	4.08	9.02	9.72	4.19	5.93	**70.74%**
7/02/2002	3.87	7.87	13.02	3.87	4.34	7.16	**60.66%**
14/02/2002	6.17	5.56	19.98	19.42	8.00	12.78	**62.56%**
21/02/2002	6.77	13.23	21.97	15.19	6.26	14.29	**43.80%**
28/02/2002	6.18	3.74	3.04	7.92	2.25	5.22	**43.06%**
8/03/2002	24.53	11.54	35.76	10.67	11.92	20.63	**57.78%**
16/03/2002	66.90	9.10	19.09	10.50	27.36	26.40	**103.64%**
24/03/2002	4.91	3.21	13.20	9.91	4.59	7.81	**58.73%**
31/03/2002	5.14	2.44	3.68	6.39	1.72	4.41	**38.90%**
8/04/2002	7.84	6.70		11.91	2.74	8.82	**31.11%**

Weekly nephelometer data Nelly Bay (mg/L)

Date week ending	site 1	site 2	site 3	site 4	St. Dev. turbidity all sites	Average turbidity all sites	RSD
16/04/2002	9.75	8.46		10.48	1.02	9.56	**10.70%**
23/04/2002		2.48				2.48	**0.00%**
30/04/2002		1.55				1.55	**0.00%**
8/05/2002		6.74		13.72	4.94	10.23	**48.30%**
16/05/2002	5.11	2.24	5.77	2.80	1.72	3.98	**43.22%**
24/05/2002	3.36	2.08	5.51	2.37	1.55	3.33	**46.62%**
31/05/2002	8.41	2.50	6.62	2.44	3.00	4.99	**60.12%**
8/06/2002	16.70	24.08	7.22	2.00	9.83	12.50	**78.65%**
16/06/2002	18.30	4.27	7.43	2.87	6.99	8.21	**85.08%**
23/06/2002	33.61	7.57	8.22	3.85	13.67	13.31	**102.66%**
30/06/2002	7.44	6.67	3.45	6.75	1.78	6.08	**29.34%**
8/07/2002	8.11	5.32	1.52	2.40	3.00	4.34	**69.05%**
16/07/2002	7.61	4.61	1.55	1.74	2.85	3.88	**73.63%**
24/07/2002	8.58	6.06	1.88	2.58	3.13	4.77	**65.51%**
31/07/2002	2.25	2.95		3.03	0.43	2.75	**15.74%**
8/08/2002	1.77	2.89		2.22	0.56	2.30	**24.48%**
16/08/2002	7.98	7.46	11.84	19.23	5.43	11.63	**46.70%**
24/08/2002	5.45	7.17	7.96	5.03	1.39	6.40	**21.76%**
31/08/2002	4.70	5.60	10.11	6.37	2.38	6.69	**35.52%**
8/09/2002	4.18	6.64	6.74	8.96	1.96	6.63	**29.49%**
16/09/2002	15.39	16.38	18.29		1.48	16.69	**8.84%**
23/09/2002	8.41	4.53	1.93	8.81	3.29	5.92	**55.55%**
30/09/2002	7.80	5.20	5.26	9.52	2.10	6.94	**30.24%**
8/10/2002	8.47	5.07	10.28	12.58	3.17	9.10	**34.84%**
16/10/2002	7.61	2.53	3.08	5.91	2.40	4.78	**50.10%**
24/10/2002	8.79	8.27	6.07	7.45	1.18	7.65	**15.48%**
31/10/2002	9.48	92.13	12.12	20.65	39.31	33.59	**117.02%**
8/11/2002	11.81	62.20	10.12	20.67	24.44	26.20	**93.29%**
16/11/2002	41.71		8.47	22.70	16.68	24.29	**68.65%**
23/11/2002	20.34		21.79	30.08	5.26	24.07	**21.84%**
30/11/2002	14.23	1.09	8.61	31.91	13.12	13.96	**93.96%**
8/12/2002	3.32	0.88	3.20	4.12	1.40	2.88	**48.50%**
16/12/2002	3.43	0.36	4.95	7.23	2.88	3.99	**72.09%**

Monthly nephelometer data Nelly Bay (mg/L)

Date	Site 1	Site 2	Site 3	Site 4	St. dev	Average all sites	RSD
Apr-00	101.86	81.12		62.93	19.48	81.97	**23.76%**
May-00	31.94	12.66		26.41	9.93	23.67	**41.94%**
Oct-00	13.34	7.04	17.77	17.18	4.93	13.83	**35.67%**
Nov-00	15.60	15.53		15.13	0.26	15.42	**1.67%**
Dec-00	8.43	16.00	15.37	16.84	3.87	14.16	**27.33%**
Jan-01	3.80	8.84	29.99	6.15	12.04	12.19	**98.74%**
Feb-01	18.77	27.50	17.29	11.21	6.72	18.69	**35.98%**
Mar-01	13.88	15.41	11.78	3.31	5.40	11.09	**48.67%**
Apr-01	7.45	5.20	8.60	21.76	7.47	10.75	**69.48%**
May-01	1.86	9.15	15.51	6.90	5.66	8.35	**67.80%**
Jun-01	10.75	8.20	7.79	12.53	2.23	9.82	**22.76%**
Jul-01	4.56	4.07	11.48	6.65	3.39	6.69	**50.62%**
Aug-01	4.15	7.22	4.22	3.05	1.79	4.66	**38.45%**
Sep-01	6.59	8.92	8.99	5.82	1.62	7.58	**21.40%**
Oct-01	4.93	3.74	6.61	4.92	1.18	5.05	**23.38%**
Nov-01	5.90	4.70	6.79	3.20	1.56	5.14	**30.23%**
Dec-01	7.40	5.08	5.68	4.39	1.29	5.64	**22.86%**
Jan-02	4.46	5.53	11.75	8.30	3.26	7.51	**43.35%**
Feb-02	5.74	7.60	14.50	11.60	3.94	9.86	**39.98%**
Mar-02	25.37	6.57	17.93	9.37	8.54	14.81	**57.65%**
Apr-02	8.79	4.80		11.20	3.23	8.26	**39.12%**
May-02	5.62	3.39	5.97	5.33	1.16	5.08	**22.74%**
Jun-02	19.01	10.64	6.58	3.87	6.61	10.03	**65.90%**
Jul-02	6.64	4.74	1.65	2.44	2.26	3.87	**58.59%**
Aug-02	4.98	5.78	9.97	8.21	2.28	7.23	**31.58%**
Sep-02	8.94	8.19	8.06	9.10	0.53	8.57	**6.13%**
Oct-02	8.59	27.00	7.89	11.65	8.96	13.78	**65.04%**
Nov-02	22.02	31.64	12.25	26.34	8.21	23.06	**35.62%**
Dec-02	3.38	0.62	4.07	5.67	2.11	3.44	**61.39%**

Appendix 13: Results C-14 and U-Th dating

The Australian National University

Research School of Earth Sciences

Radiocarbon Dating Laboratory

Radiocarbon Dating Laboratory
Research School of Earth Sciences
The Australian National University
CANBERRA 0200, AUSTRALIA

Report on Radiocarbon Age Determination for ANU- 11580 G

Submitter	M.K. Gagan
Submitter's Code	Nel07
Site & Location	.
Sample Material	Coral
Physical Pretreatment	
Chemical Pretreatment	

$d^{14}C$	-478.0 ± 4.8	‰
$\delta^{13}C$	0.0 ± 2.0	‰ estimated
$D^{14}C$	-504.1 ± 5.0	‰
AGE	**5630 ± 90 BP**	

Comments

31/10/01

- In your publications you must always quote Laboratory Code, Sample Number and Conventional Age BP ± error or % Modern ± error if given.
- Ages are reported as Conventional Years BP or % Modern (Stuiver and Polach, 1977, Radiocarbon 19, 353-363).
- Recommended oceanic reservoir correction for Australia is -450 ± 35 (Gillespie and Polach, 1979, in Berger and Suess (eds), Radiocarbon Dating, UCLA Press, 404-421). If a correction is applicable you must quote Laboratory Code, Sample Number and both the Conventional Age BP and the Reservoir Corrected Age BP*.

John Chappell - ANU

The Australian National University

Research School of Earth Sciences

Radiocarbon Dating Laboratory

Radiocarbon Dating Laboratory
Research School of Earth Sciences
The Australian National University
CANBERRA 0200, AUSTRALIA

Report on Radiocarbon Age Determination for ANU- 11581 G

Submitter M.K. Gagan

Submitter's Code Nel08

Site & Location ,

Sample Material Coral

Physical Pretreatment

Chemical Pretreatment

$d^{14}C$	-476.9 ± 4.8	‰
$\delta^{13}C$	0.0 ± 2.0	‰ estimated
$D^{14}C$	-503.0 ± 5.0	‰
AGE	**5620 ± 90 BP**	

Comments

31/10/01

- In your publications you must always quote Laboratory Code, Sample Number and Conventional Age BP ± error or % Modern ± error if given.
- Ages are reported as Conventional Years BP or % Modern (Stuiver and Polach, 1977, Radiocarbon 19, 353-363).
- Recommended oceanic reservoir correction for Australia is -450 ± 35 (Gillespie and Polach, 1979, in Berger and Suess (eds), Radiocarbon Dating, UCLA Press, 404-421). If a correction is applicable you must quote Laboratory Code, Sample Number and both the Conventional Age BP and the Reservoir Corrected Age BP*.

Australian Government

ansto
Nuclear-based science benefiting all Australians

REPORT ON AMS ANALYSIS

Mr. Stephen Lewis
School of Earth Sciences
James Cook University
Townsville, QLD 4811

15. July 2005

ANSTO code	Submitter ID	$\delta(^{13}C)$	percent Modern Carbon		Conventional ^{14}C age	
		per mil	pMC	1σ error	yrs BP	1σ error
OZH561	Shell 2	0.2	87.90	0.43	1040	40
OZH562	Shell 3	1.5	47.78	0.31	5930	60
OZH563	Shell 4a	-4.8	58.73	0.45	4280	70
OZH564	Coral 4b	-2.1	49.35	0.32	5670	60
OZH565	Shell 5	0.7	47.71	0.37	5940	70
OZH566	Coral 6	-4.0	49.56	0.65	5640	110
OZH567	Coral 7	-0.1	48.12	0.33	5880	60
OZH568	Coral 8	-1.6	82.62	0.37	1530	40
OZH569	Shell 9	0.8	116.37	0.55	Modern	
OZH570	Coral 10	-0.7	63.64	0.36	3630	50
OZH571	Coral 11	-3.6	61.06	0.38	3960	50
OZH572	Shell 13	1.5	75.54	0.46	2250	50
OZH573	Shell 14	-4.6	73.69	0.42	2450	50
OZH574	Coral 15	-4.0	48.18	0.31	5870	50
OZH575	Coral 16	-2.2	48.94	0.32	5740	60
OZH576	Oyster shell 17	0.7	51.25	0.30	5370	50
OZH577	Oyster shell 18	-0.5	51.09	0.34	5400	60
OZH578	Oyster shell 19	2.4	65.87	0.33	3350	40
OZH579	Oyster bed shell 20	-0.4	56.13	0.35	4640	50
OZH580	Oyster shell 21	1.9	58.74	0.33	4270	50

Note:

1. The $\delta^{13}C$ values quoted above relate solely to the graphite derived from the fraction that was used for the radiocarbon measurement. It is sometimes the case that the $\delta^{13}C$ of this fraction is not the same as that of the bulk material.
2. The ages quoted are radiocarbon ages, not calendar ages.
3. The ages have been rounded according to M. Stuiver and A. Polach (1977).
4. Please use the ANSTO Code number in publications. The AMS facility should be referenced as Fink *et al.* (2004).

References:

D. Fink, M. Hotchkis, Q. Hua, G. Jacobsen, A. M. Smith, U. Zoppi, D. Child, C. Mifsud, H. van der Gaast, A. Williams and M. Williams (2004) The ANTARES AMS facility at ANSTO, NIM B 223-224, 109-115.

M. Stuiver and A. Polach (1977) Reporting of ^{14}C data, *Radiocarbon* 19, 355-363

AUSTRALIAN NUCLEAR SCIENCE AND TECHNOLOGY ORGANISATION

Dr Ugo Zoppi, ANSTO – Institute for Nuclear Geophysiology, PMB 1, Menai NSW 2233 (AUSTRALIA)
Tel: +61-2-9717-3043; Fax: +61-2-9717-3257; e-mail: ugo@ansto.gov.au
http://www.ansto.gov.au/nugeo/ams/index.html

Sample Name	Coral	Location	U (ppm)	± (2σ)	^{232}Th (ppb)	(^{230}Th/ ^{232}Th)	(^{234}U/ ^{238}U)	± (2σ)	(^{230}Th/^{238}U)	± (2σ)	Uncorr. ^{230}Th Age (ka)	± (2σ)	corr. ^{230}Th Age (ka)	± (2σ)	corr. Initial (^{234}U/ ^{238}U)	± (2σ)
NEL01D02	NEL01D	bottom	2.9759	0.0054	1.491	380.32	1.1497	0.0021	0.06280	0.00038	**6.102**	0.039	**6.089**	0.040	1.1523	0.0021
NEL02D02	NEL01D	top	3.1393	0.0044	5.011	114.41	1.1516	0.0023	0.06018	0.00020	**5.831**	0.023	**5.790**	0.031	1.1542	0.0023
NEL03D02	NEL03D	top	2.8665	0.0040	15.366	36.02	1.1472	0.0021	0.06364	0.00056	**6.200**	0.057	**6.062**	0.089	1.1500	0.0021
NEL04D02	NEL03D	bottom	2.8556	0.0057	3.168	174.44	1.1485	0.0021	0.06379	0.00031	**6.207**	0.033	**6.179**	0.036	1.1512	0.0021

Note for Graham and Stephen:

1. Ages are calculated using Isoplot Excel Version.

2. Detrital U-Th correction applied assuming detrital component Th/U = 3.8±1.9 (average crustal value), and 238U, 234U, 232Th and 230Th are in secular equilibrium. This correction is similar to that adopted by Ken Ludwig and Larry Edwards.

3. NEL03D02 has a slightly larger error. This is because the sample load fell off the filament during measurment (not an uncommon thing to happen). But the age is pretty acceptable, far better than 14C age.

Cheers
Jian-xin Zhao 13/9/03

Appendix 14: Sediment geochemistry data.

Sediment samples

Sample	Li ppm	Be ppm	Sc ppm	V ppm	Cr ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Ga ppm	Rb ppm	Sr ppm
Belyando*	34.41	2.280	16.600	88.60	65.41	9.590	22.500	22.070	63.08	23.450	123.00	86.18
Burdekin*	31.19	2.740	19.890	118.00	65.60	20.610	34.110	60.390	91.60	23.760	133.00	127.00
MUQ*	28.24	1.920	16.490	120.00	64.50	22.390	31.570	32.360	73.47	19.120	79.51	142.00
Burdekin Dam-01	39.04	3.163	21.263	127.51	105.30	21.671	59.258	43.185	97.94	27.213	142.87	89.15
Burdekin Dam-02	39.13	3.262	20.884	124.83	104.34	20.909	59.119	42.728	99.12	27.034	141.82	88.85
Ross River-01	29.25	2.567	14.980	97.07	28.59	13.798	16.223	18.486	80.61	21.872	135.45	83.22
Ross River-03	29.73	2.603	16.029	105.09	37.94	15.237	21.017	21.540	85.49	22.732	135.00	79.95
Gustav Creek	17.14	3.423	7.966	38.82	44.77	6.198	7.778	17.382	116.27	19.404	156.86	120.02
Shipping Channel	45.63	2.124	14.808	86.34	63.09	13.476	29.684	21.001	73.95	17.987	100.92	201.18
ICP-2a	47.60	1.570	10.743	90.95	50.17	10.857	27.131	18.730	57.75	13.352	77.12	1817.64
Nelly Bay grab	47.96	2.145	14.975	84.67	62.51	14.689	31.540	22.869	80.58	18.628	105.16	512.72
ICP-13a	27.83	3.681	6.958	28.78	15.36	3.300	8.693	7.660	43.40	18.960	143.76	500.19
ICP-13b	27.91	1.437	7.824	44.39	32.33	7.993	18.107	17.672	48.57	11.049	76.91	2208.79
ICP-13c	45.57	1.688	11.213	77.29	50.61	11.237	24.269	19.759	57.65	14.555	87.37	1525.13
ICP-13d	41.69	1.490	9.797	79.74	44.31	10.370	26.532	19.823	53.29	12.680	77.39	2064.58
ICP13-e	30.72	1.501	7.761	54.92	31.23	9.335	24.440	16.749	49.44	10.416	72.21	2708.92
Nelly Bay average	40.69	1.546	9.894	73.09	44.35	10.114	24.010	18.996	54.32	12.909	79.70	1904.04

* Kamber et al. (2005)

Sediment samples

Sample	Y ppm	Zr ppm	Nb ppm	Sn ppm	Cs ppm	Ba ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
Belyando*	33.580	179.000	16.700	4.860	9.770	509.00	41.720	86.47	9.720	35.71	7.180	1.4700
Burdekin*	33.290	175.000	18.620	5.120	8.460	475.00	45.040	100.50	10.340	37.50	7.240	1.4600
MUQ*	31.850	199.000	15.330	2.770	5.380	396.00	32.510	71.09	8.460	32.91	6.880	1.5700
Burdekin Dam-01	31.174	121.275	19.721	5.617	10.105	467.96	44.497	88.23	10.463	38.84	7.748	1.6253
Burdekin Dam-02	30.850	121.550	19.846	5.605	9.961	457.76	43.647	87.36	10.348	38.43	7.633	1.6065
Ross River-01	29.106	107.278	14.653	3.997	9.033	478.65	43.967	93.75	10.183	36.88	7.104	1.4019
Ross River-03	29.901	108.576	14.414	4.049	9.176	463.27	43.433	92.37	10.054	37.04	7.091	1.4223
Gustav Creek	37.995	428.327	39.656	5.395	3.825	600.38	61.174	130.04	14.025	49.21	8.756	1.5538
Shipping Channel	19.725	93.532	11.336	3.504	6.556	221.58	29.107	59.89	7.029	26.46	5.330	1.1175
ICP-2a	18.745	70.691	8.934	2.614	4.970	156.85	24.907	49.16	5.933	22.16	4.451	0.8847
Nelly Bay grab	22.217	111.170	12.511	3.716	6.626	231.81	31.334	63.59	7.566	28.39	5.663	1.1453
ICP-13a	56.595	194.302	26.354	4.411	3.263	485.99	95.764	147.42	17.145	61.80	10.748	1.8912
ICP-13b	17.697	86.039	9.948	2.141	3.365	217.93	22.257	45.02	5.228	19.34	3.797	0.8157
ICP-13c	20.443	95.353	10.872	2.795	4.891	195.02	25.666	50.96	6.162	22.87	4.534	0.9354
ICP-13d	18.717	93.318	12.676	2.500	4.331	174.65	23.795	46.38	5.602	20.96	4.145	0.8664
ICP13-e	19.977	155.080	24.751	2.688	3.141	193.87	24.631	47.96	5.773	21.22	4.084	0.8144
Nelly Bay average	18.901	86.350	10.608	2.513	4.389	186.11	24.156	47.88	5.731	21.33	4.232	0.8755

* Kamber et al. (2005)

Sediment samples

Sample	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	Hf ppm	Ta ppm	W ppm	Tl ppm
Belyando*	6.440	1.0400	6.210	1.3000	3.6500	0.5600	3.600	0.5300	5.140	1.370	2.570	0.6900
Burdekin*	6.430	1.0200	6.030	1.2600	3.5400	0.5500	3.560	0.5400	5.050	1.540	2.720	0.6800
MUQ*	6.360	0.9900	5.890	1.2200	3.3700	0.5100	3.250	0.4900	5.320	1.120	1.600	0.4200
Burdekin Dam-01	6.834	1.0370	5.912	1.1991	3.2983	0.4930	3.098	0.4580	3.486	1.528	2.250	0.7630
Burdekin Dam-02	6.736	1.0272	5.840	1.1751	3.2388	0.4853	3.042	0.4560	3.495	1.545	2.233	0.7600
Ross River-01	6.046	0.9392	5.401	1.1075	3.1356	0.4742	3.090	0.4650	3.339	1.168	2.084	0.7438
Ross River-03	6.185	0.9461	5.512	1.1347	3.2000	0.4824	3.138	0.4679	3.371	1.152	2.081	0.7242
Gustav Creek	6.978	1.0860	6.537	1.4081	4.2652	0.7217	5.103	0.8235	15.874	3.230	2.255	0.7309
Shipping Channel	4.554	0.6875	3.927	0.7920	2.1921	0.3340	2.146	0.3142	2.705	0.871	1.398	0.4917
ICP-2a	3.945	0.5891	3.417	0.6917	1.9124	0.2852	1.808	0.2677	2.124	0.701	0.975	0.4383
Nelly Bay grab	4.938	0.7407	4.318	0.8715	2.4226	0.3707	2.395	0.3582	3.384	0.973	1.476	0.5121
ICP-13a	10.646	1.5902	9.354	1.9509	5.3645	0.8003	5.073	0.7498	7.130	2.224	2.383	0.6712
ICP-13b	3.416	0.5265	3.153	0.6542	1.8370	0.2849	1.827	0.2760	2.710	0.778	1.472	0.3864
ICP-13c	4.102	0.6205	3.667	0.7557	2.1264	0.3238	2.087	0.3109	2.955	0.831	1.472	0.4790
ICP-13d	3.692	0.5592	3.335	0.6846	1.9196	0.2922	1.866	0.2802	3.215	0.984	0.994	0.4334
ICP13-e	3.599	0.5599	3.390	0.7186	2.0984	0.3294	2.256	0.3556	5.372	1.968	1.029	0.4239
Nelly Bay average	3.789	0.5738	3.393	0.6965	1.9488	0.2965	1.897	0.2837	2.751	0.824	1.228	0.4343

* Kamber et al. (2005)

Sediment samples

Sample	Pb ppm	Th ppm	U ppm	75As(noArCl correction) ppm	Mo ppm	Cd ppm	Sb ppm
Belyando*	25.310	18.940	3.280				
Burdekin*	31.650	18.540	3.130				
MUQ*	20.440	11.130	2.830				
Burdekin Dam-01	27.418	16.785	3.708	11.834	0.7574	0.0826	1.1692
Burdekin Dam-02	27.214	16.553	3.681	10.736	0.7368	0.0786	1.1638
Ross River-01	29.437	20.603	4.639	4.007	0.9088	0.0880	0.5615
Ross River-03	28.808	20.256	4.754	3.497	0.9711	0.0908	0.5541
Gustav Creek	36.583	31.523	7.077	1.557	2.5261	0.2444	0.3039
Shipping Channel	21.593	11.853	2.131	20.032	0.8084	0.0455	0.5423
ICP-2a	14.816	9.459	20.863	27.131	8.6656	0.1365	1.5213
Nelly Bay grab	23.156	13.149	2.659	16.166	0.9176	0.0504	0.5530
ICP-13a	18.584	23.688	6.830	14.205	3.2782	0.0834	0.4499
ICP-13b	12.851	11.058	5.516	11.082	1.4765	0.0561	0.4995
ICP-13c	15.922	12.596	13.809	17.072	3.5307	0.0992	0.9447
ICP-13d	14.031	8.688	26.584	22.625	4.6023	0.1186	1.7444
ICP13-e	12.355	15.331	7.318	12.346	1.0777	0.1134	0.6806
Nelly Bay average	14.405	10.450	16.693	19.478	4.5688	0.1026	1.1775

* Kamber et al. (2005)

Normalised REE and Y to mud from Queensland (MUQ*) standard- sediment samples

Sediment sample/MUQ	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Y	Ho	Er	Tm	Yb	Lu
MUQ*	32.51	71.09	8.46	32.91		6.88	1.57	6.36	0.99	5.89	31.85	1.22	3.37	0.51	3.25	0.49
Belyando*	1.2833	1.2163	1.1489	1.0851		1.0436	0.9363	1.0126	1.0505	1.0543	1.0543	1.0656	1.0831	1.0980	1.1077	1.0816
Burdekin*	1.3854	1.4137	1.2222	1.1395		1.0523	0.9299	1.0110	1.0303	1.0238	1.0452	1.0328	1.0504	1.0784	1.0954	1.1020
Burdekin Dam-01	1.3687	1.2412	1.2368	1.1803		1.1262	1.0352	1.0745	1.0475	1.0038	0.9788	0.9829	0.9787	0.9666	0.9531	0.9348
Burdekin Dam-02	1.3426	1.2288	1.2232	1.1679		1.1095	1.0233	1.0592	1.0376	0.9915	0.9686	0.9632	0.9611	0.9515	0.9359	0.9306
Ross River-01	1.3524	1.3187	1.2037	1.1206		1.0325	0.8929	0.9506	0.9487	0.9170	0.9138	0.9078	0.9304	0.9299	0.9507	0.9490
Ross River-03	1.3360	1.2994	1.1884	1.1256		1.0307	0.9059	0.9724	0.9556	0.9359	0.9388	0.9301	0.9495	0.9459	0.9657	0.9550
Gustav Creek	1.8817	1.8292	1.6578	1.4953		1.2727	0.9897	1.0971	1.0970	1.1098	1.1929	1.1542	1.2656	1.4151	1.5700	1.6807
Shipping Channel	0.8953	0.8424	0.8308	0.8040		0.7747	0.7118	0.7161	0.6944	0.6668	0.6193	0.6491	0.6505	0.6549	0.6603	0.6413
ICP-2a	0.7661	0.6915	0.7013	0.6733		0.6470	0.5635	0.6202	0.5950	0.5801	0.5885	0.5670	0.5675	0.5592	0.5562	0.5463
Nelly Bay grab	0.9638	0.8945	0.8943	0.8626		0.8231	0.7295	0.7765	0.7482	0.7331	0.6976	0.7144	0.7189	0.7269	0.7370	0.7311
ICP-13a	2.9457	2.0738	2.0266	1.8779		1.5622	1.2046	1.6738	1.6063	1.5881	1.7769	1.5991	1.5919	1.5692	1.5609	1.5301
ICP-13b	0.6846	0.6332	0.6180	0.5876		0.5519	0.5195	0.5372	0.5318	0.5353	0.5556	0.5362	0.5451	0.5587	0.5623	0.5633
ICP-13c	0.7895	0.7168	0.7284	0.6949		0.6591	0.5958	0.6450	0.6268	0.6226	0.6419	0.6194	0.6310	0.6349	0.6420	0.6346
ICP-13d	0.7319	0.6524	0.6622	0.6369		0.6025	0.5518	0.5805	0.5649	0.5663	0.5877	0.5612	0.5696	0.5729	0.5741	0.5718
ICP13-e	0.7576	0.6746	0.6824	0.6448		0.5936	0.5187	0.5659	0.5656	0.5756	0.6272	0.5890	0.6227	0.6459	0.6941	0.7257
Nelly Bay average	0.7430	0.6735	0.6775	0.6482		0.6151	0.5577	0.5957	0.5796	0.5761	0.5934	0.5709	0.5783	0.5814	0.5836	0.5790
Ross River average	1.3442	1.3090	1.1960	1.1231		1.0316	0.8994	0.9615	0.9521	0.9265	0.9263	0.9189	0.9400	0.9379	0.9582	0.9520
Burdekin Dam average	1.3556	1.2350	1.2300	1.1741		1.1179	1.0293	1.0668	1.0425	0.9977	0.9737	0.9731	0.9699	0.9590	0.9445	0.9327

* Kamber et al. (2005)

Appendix 15: Heavy metal concentrations in the Magnetic Island corals

A-15.1. Heavy metals

A-15.1.1. Overview

Heavy metal contamination on the inshore GBR is a concern of some researchers who have discovered elevated levels of heavy metals near marine harbours and ports (e.g. Haynes and Johnson, 2000). However, monitoring programs have found that heavy metal concentrations in corals, sediments, mangroves and soft tissue organisms are commonly negligible on the GBR (see review in Haynes and Johnson, 2000). The corals from Magnetic Island provide an ideal opportunity to assess heavy metal contamination from mining in Burdekin River catchment and from the Port of Townsville. The Port of Townsville is a major exporter of heavy metals including Cu, Ni, Zn and Pb. Previous studies have discovered elevated concentrations of these metals in sediments surrounding the reefs of Magnetic Island, particularly after episodes of channel dredging (Reichelt and Jones, 1994). Elevated concentrations of heavy metals were also found in sediments from the intertidal and near-shore zones of Cleveland Bay (Doherty et al., 2000). Levels of Zn in oysters from Ross Creek (which accommodates the Townsville Port) were significantly higher than the levels in oysters from Magnetic Island (Jones et al., 2000). This study has focused on concentrations of Ni, Zn and Pb in corals.

A-15.1.2. The concentration of heavy metals in corals (previous studies)

Concentrations of Ni, Zn and Pb in coral skeletons vary greatly from site to site but the variability may reflect the analytical pre-treatment procedure, inter-species/coral variation or the surrounding environmental conditions (Reichelt-Brushett and McOrist, 2003). Previous studies have discovered that coral zooxanthellae play a significant role in accumulating heavy metals and may regulate the incorporation of heavy metals into the coral skeleton (Reichelt-Brushett and McOrist, 2003). The coral tissue layer also contained elevated heavy metal concentrations compared to the coral skeleton (Reichelt-Brushett and McOrist, 2003). This finding places considerable doubt on the reliability of heavy metal records from corals (Reichelt-Brushett and McOrist, 2003; Esslemont et al., 2000). Heavy

metals are also discriminated against when substituting into the coral skeleton. However, elements such as Mn and Pb have still demonstrated promise in the reconstructions of long-term environmental coral records (Shen and Boyle, 1987; Lea at al., 1989; Fallon et al., 2002; This study see section 8.5).

A-15.1.3. Ni, Zn and Pb concentrations in the Magnetic Island corals

The Pb concentrations (Fig A-15.1 a-b) in the 1968-1973 and 2000-2003 coral records displayed some significant fluctuations. There were elevated Pb concentrations in early 1970 (peak value of 207.20 ppb) which coincided with a period of intense channel dredging in Cleveland Bay. However, coral Pb concentrations also significantly increased during 2002 peaking at 710.72 ppb and with 3 additional values in excess of 200 ppb.

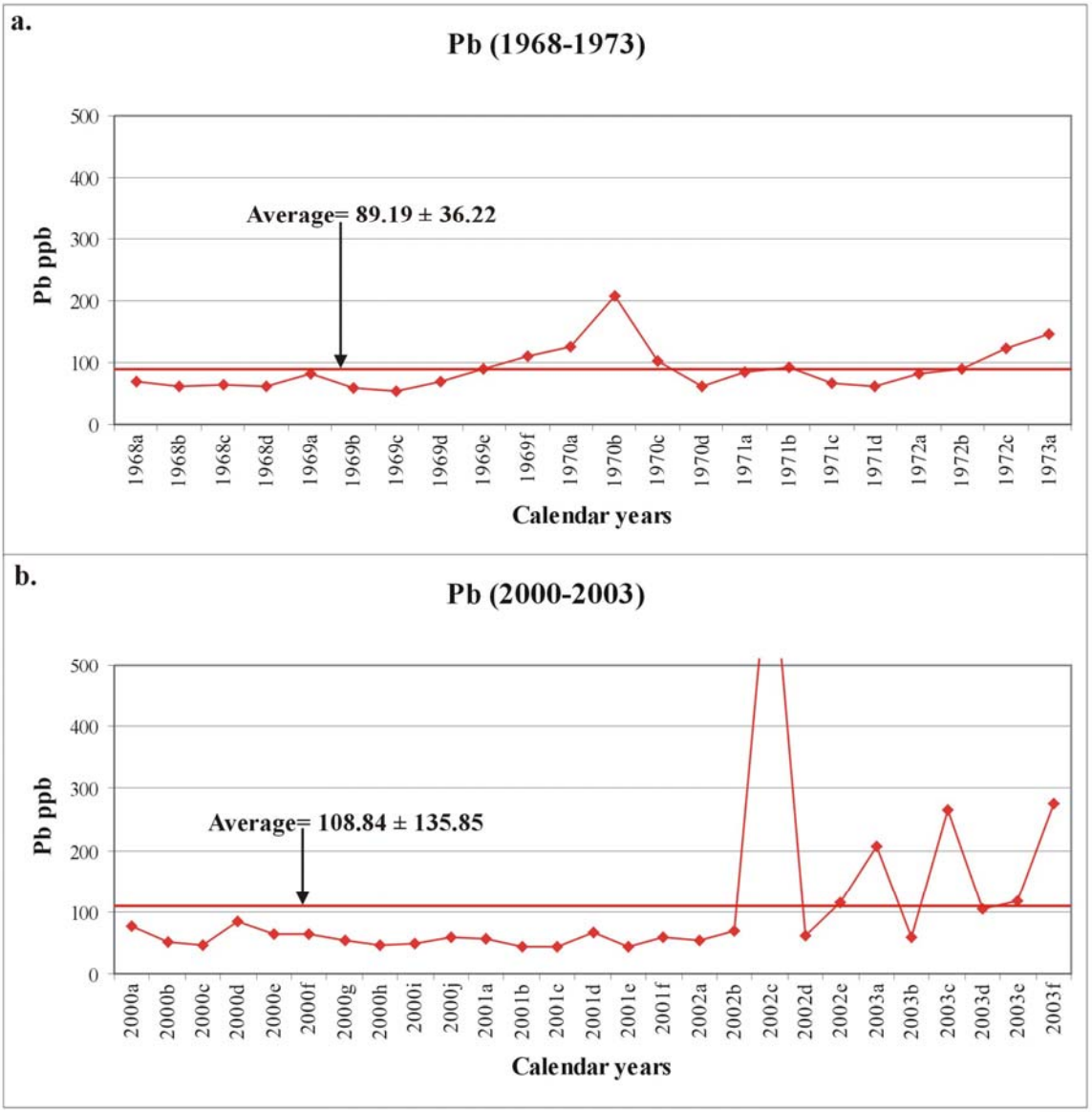

Figure A-15.1 (a-b). Pb concentrations for 1968-1973 (a) and 2000-2003 (b). While the average Pb concentrations were virtually identical for both records, Pb displays some considerable deviations with concentrations as high as 710 ppb in 2002 (b). Elevated coral Pb also occurred in 1970 and coincided with a period of intense dredging of the shipping channel (a). However, elevated Pb also occurred in the 2000-2003 record and it is unclear if elevated coral Pb concentrations were related to channel dredging.

The post 1850 average concentrations of Ni, Zn and Pb in the modern coral records were indistinguishable from the average pre-1850 and mid-Holocene values (Figs A-15.2a-15.4a). The average Ni and Pb concentrations in the modern and mid-Holocene corals were comparable or even lower than previous studies, while Zn levels were in the upper range limits (see Table 1 in Reichelt-Brushett and McOrist, 2003).

Nickel concentrations in the coral skeletons were typically less than 0.5 ppb and were orders of magnitude below levels reported in the literature (Fig A-15.2). Interspecies variations may influence the accumulation of this metal into corals and so may explain the relatively elevated Ni concentrations reported by Esslemont (2000) and Reichelt-Brushett and McOrist (2003) in other corals from Magnetic Island (Table 8.2). An unusual Ni "spike" of 2.13 ppb occurred in the modern 1970-1972 sample (Fig A-15.2a) and could be related to the development of the Greenvale Ni mine (located in the northern section of the Burdekin River catchment) that opened in 1972 (Fig 4.17). This area experienced heavy rains from Cyclones Althea and Bronwyn during early 1972. However, repeat analysis of this sample is required to confirm the validity of this concentration.

A large Zn spike occurs in the 1850-1852 sample in the modern coral record (Fig A-15.3a). This value is unusual and may be a product of analytical error because there was no European settlement in the region at this time. Sample contamination is another possibility as Pb also showed anomalous values for this sample (Fig A-15.4a). Average coral Zn concentrations were in the upper limits compared with previous studies and were also significantly elevated compared to other coral species analysed from Magnetic Island (Table A-15.1; Esslemont, 2000; Reichelt-Brushett and McOrist, 2003). These studies investigated *Goniastrea*, *Pocillopora* and *Acropora* genera that may have different partitioning mechanisms which regulate the incorporation of heavy metals in the coral skeleton compared to *Porites* (Esslemont, 2000; Reichelt-Brushett and McOrist, 2003). In addition, the coral pre-treatment procedure also differs in this study and may have also influenced the measurement of heavy metal concentrations in the corals.

The coral Pb concentrations in this study were slightly elevated compared to previous results from Magnetic Island (Table A-15.1). However, Esslemont (2000) found significantly higher Pb levels in a coral growing close to Townsville Harbour (Table A-15.1; Esslemont, 2000). Coral Pb concentrations in this study were also lower than for other corals around the world (see Table 1 in Reichelt-Brushett and McOrist, 2003). Highly polluted areas can contain coral Pb concentrations in excess of 1000 ppb (Hanna and Muir, 1990; Runnalls and Coleman, 2003). Like Zn, however, the Pb concentrations in

corals may vary with genera and therefore it is difficult to compare these results with confidence.

There were four notable exceptions in the modern Magnetic Island coral records of this study where Pb concentrations exceeded 400 ppb. These included the 1984-1986 sample (Fig A-15.4a), the 1966-1968 sample (A-15.4a), the 2002c sample (Fig A-15.1b) and the 1974 flood sample (Fig A-15.5). The 1984-1986 sample was probably contaminated during the coring process. The 1850-1852 sample coincided with elevated Zn concentrations and may be a product of sample contamination or analytical error (Fig A-15.3a-15.4a). The 1966-1968 and 2002c samples could also be related to analytical error and a repeat is required to verify these excessive concentrations (1227.14 and 710.72 ppb respectively; Fig A-15.4a; A-15.1b). If these high concentrations are genuine, there are numerous sources of Pb that could explain these "spikes". A local Pb source, such as paint or fuel spills, is the most probable cause. Environmental fallout following the 1968 sugar fire disaster in the Port of Townsville could be another reason for the elevated Pb levels in the 1966-1968 sample, although the sub-annual resolution coral record from Nelly Bay (Fig A-15.1s) displays no elevated Pb concentrations during 1968. The slight increase in baseline Pb concentrations after the 1890s was probably the result of a region-wide increase in industrial activity (Fig A-15.4a). Lead concentrations in the coral luminescent lines (flood bands) were commonly at low levels, which the exception of the 1974 flood (Fig A-15.5). Sediment trapped within the coral lattice would explain this elevated Pb concentration.

The Ni, Zn and Pb concentrations in the mid-Holocene corals were commonly at low levels, with the exception of some major "spikes" that coincide with sediment trapped within the coral skeleton (Figs A-15.2b-c-15.4b-c).

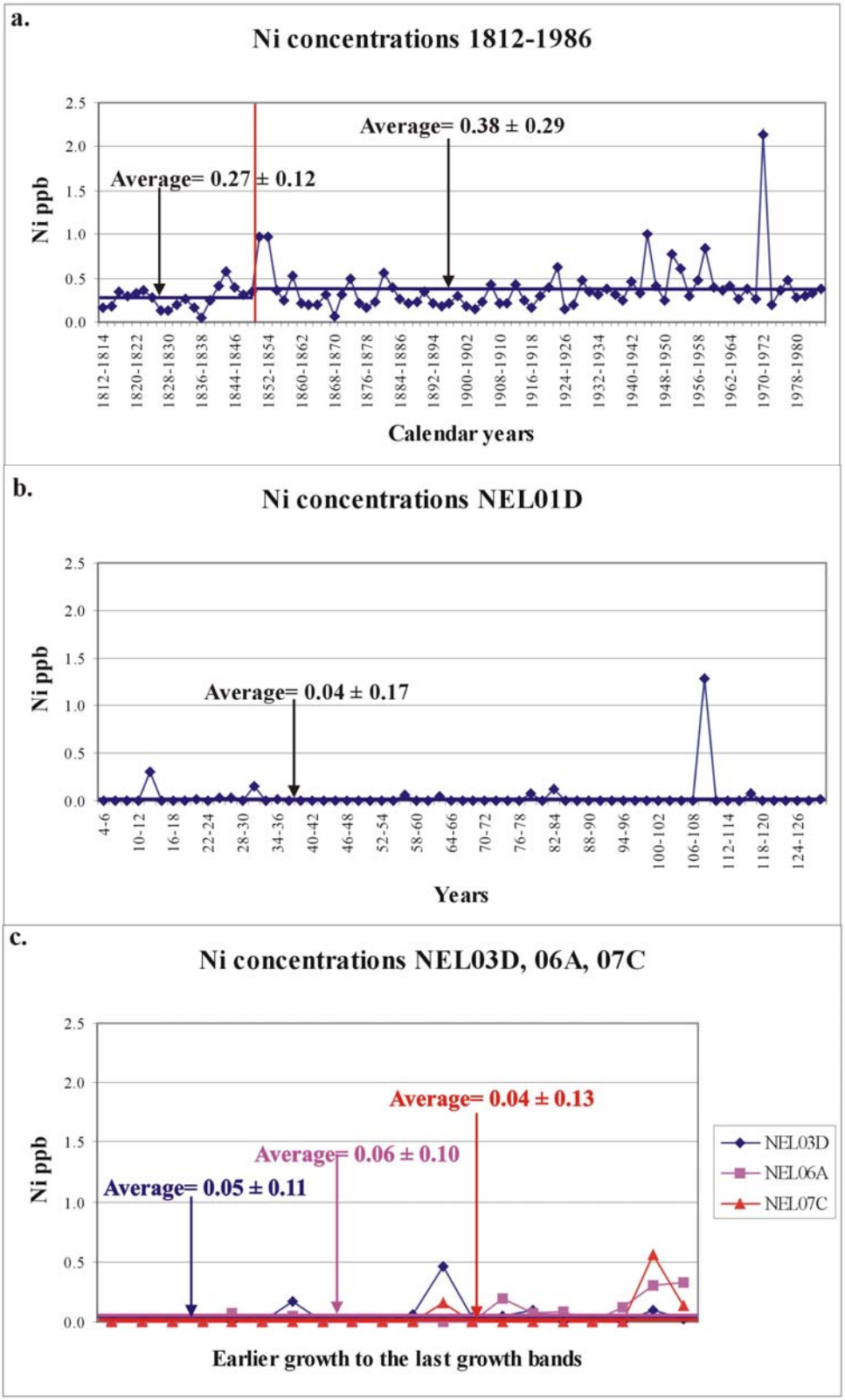

Figure A-15.2 (a-c). Ni concentrations for the modern (a) and mid-Holocene coral heads (b-c). It was unclear how reliable these records are taking into account the poor analytical precision for Ni. However the data suggest that there was very little Ni incorporated within the corals and no significant change after 1850.

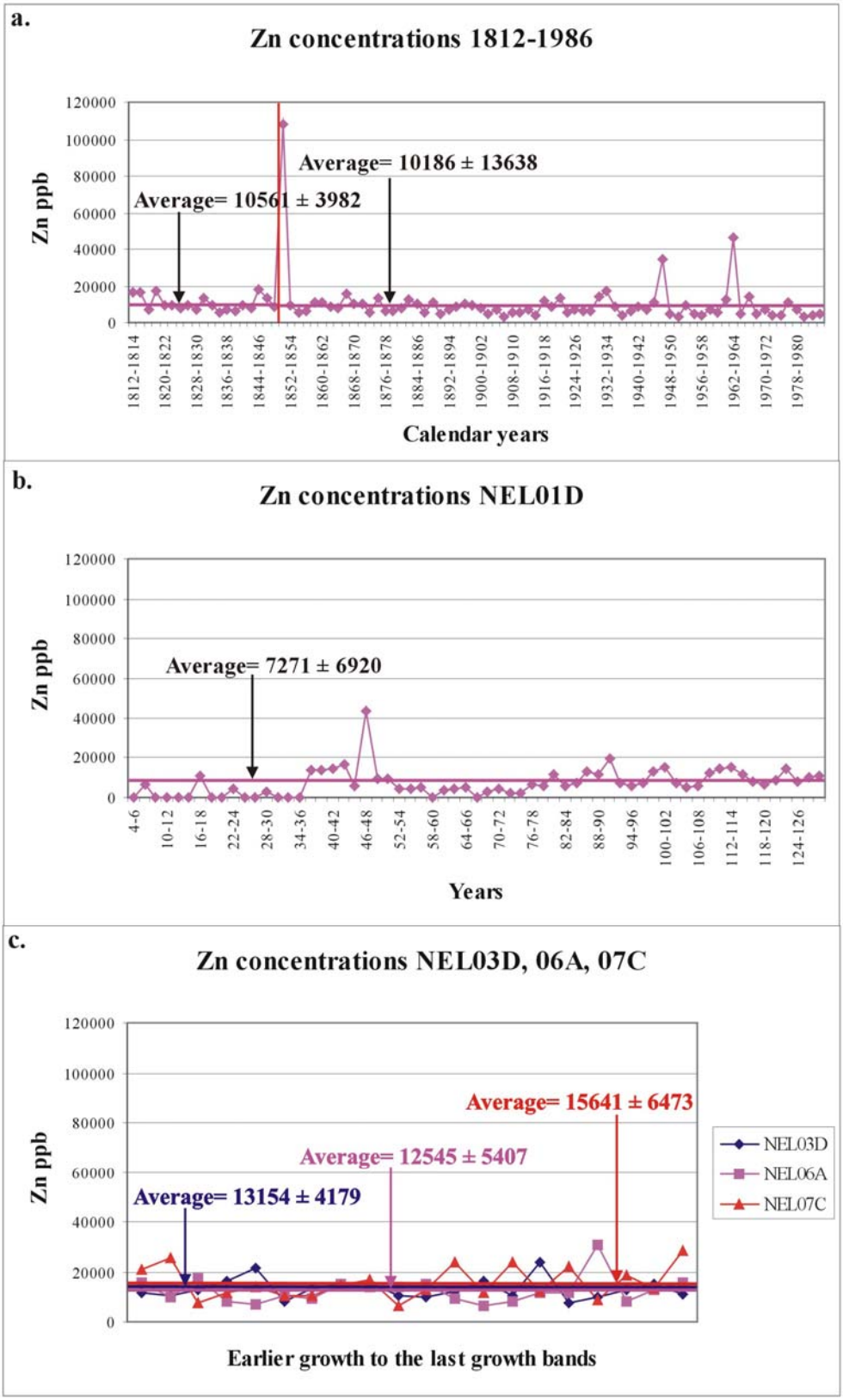

Figure A-15.3 (a-c). Zn concentrations for the modern (a) and mid-Holocene coral heads (a-c). Similarly to Ni, the reliability of these results is unclear. It appears there was little change in Zn concentrations between the modern and mid-Holocene corals

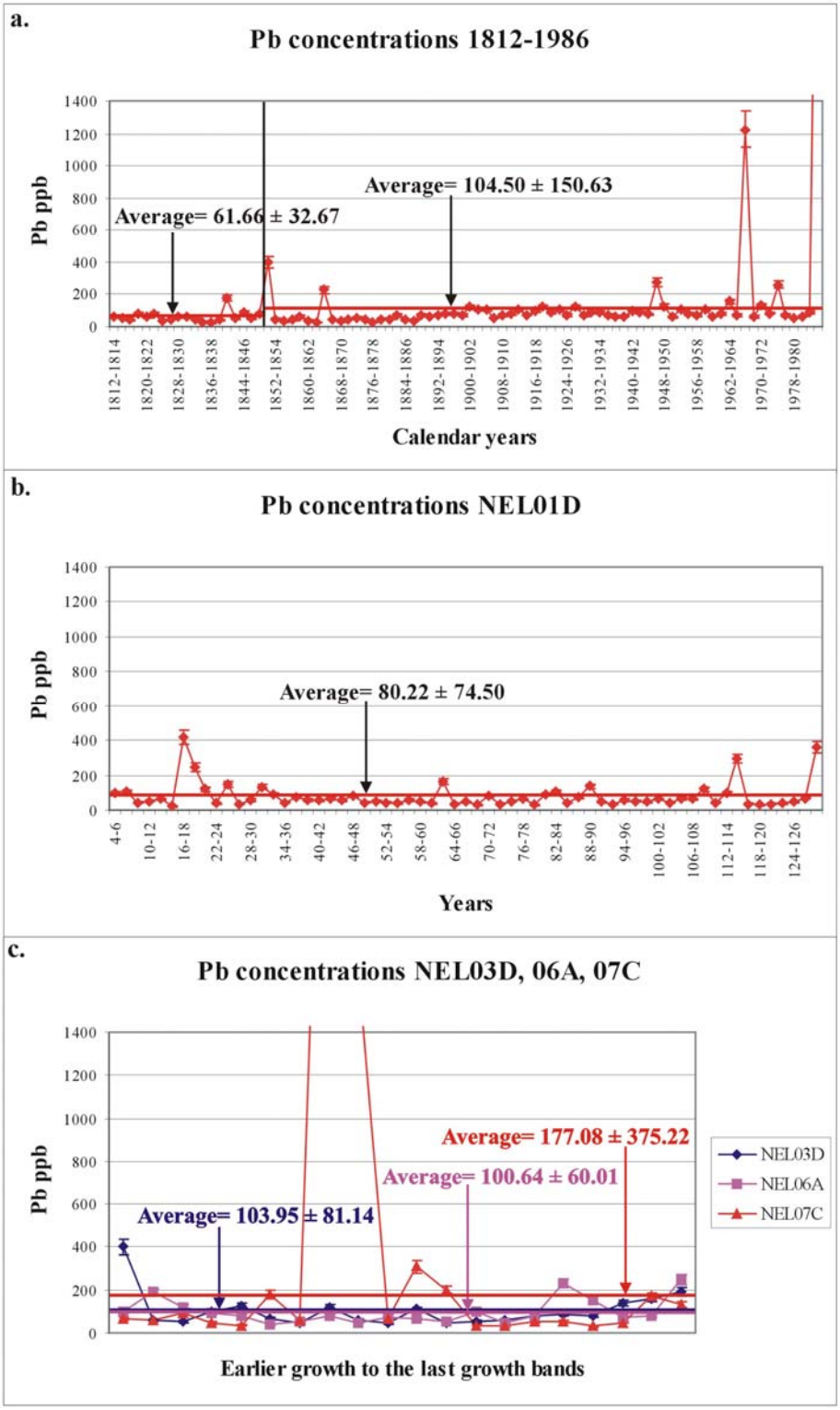

Figure A-15.4 (a-c). Pb concentrations for the modern (a) and mid-Holocene coral heads (b-c). The 1984-1986 Pb spike in the modern record (a) may be the result of contamination during the coring process, however the elevated Pb in the 1966-1968 sample was considered to be genuine. Overall, there are similar average Pb concentrations in the modern and mid-Holocene corals with no major deviations in Pb towards the final growth bands in the mid-Holocene corals (c). A minor increase in coral Pb concentrations may have occurred after the 1890s (a).

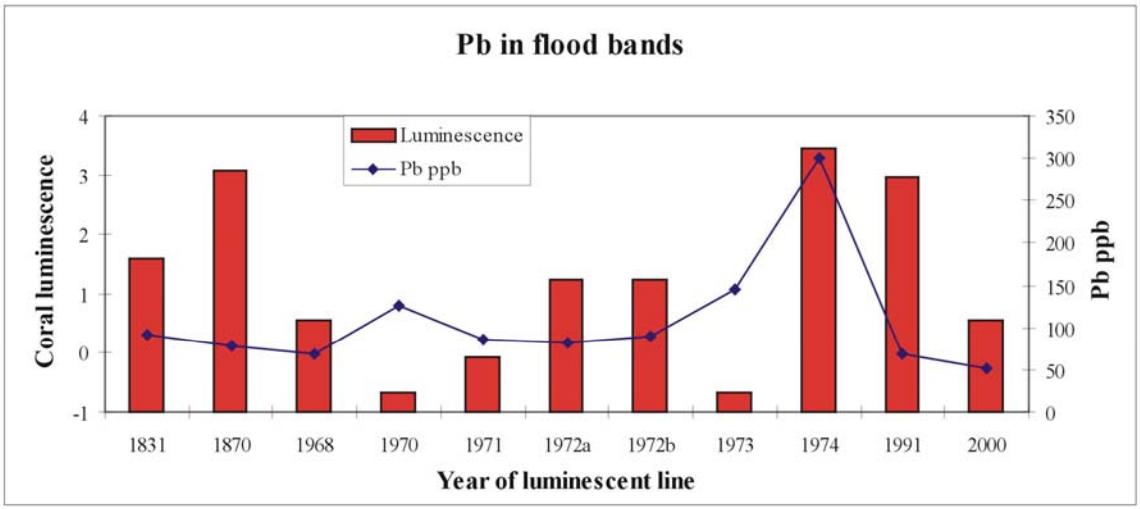

Figure A-15.5. The Pb concentrations in flood bands remained at baseline levels consistent with the other Pb records. The exception is the elevated Pb concentrations in the 1974 flood which is probably from a sediment influence.

Table A-15.1. Summary of heavy metals in corals from Magnetic Island

Coral species	Ni (ppb)	Zn (ppb)	Pb (ppb)
*Acropora**	3111	1425	49.73
*Pocillopora**	587	2419	39.37
*Acropora***	1100	1800	40.00
*Acropora***	700	500	50.00
Porites NEL01D	0.04	7271	80.22
Porites NEL03D	0.05	13154	103.95
Porites NEL06A	0.06	12545	100.64
Porites NEL07C	0.04	15641	177.08
Porites pre-1850	0.27	10561	61.66
Porites post-1850	0.38	10186	104.50
Porites 1968-1972	N/A	N/A	89.19
Porites 2000-2003	N/A	N/A	108.84
Goniastrea* Harbour	1878	29225	1699

* from Esslemont (2000); ** from Reichelt-Brushett and McOrist (2003).

A-15.1.4. Summary

Nickel, Zn and Pb concentrations in the corals from Magnetic Island are at normal background levels and have not increased significantly since European settlement. The Port of Townsville does not appear to have had any influence on the heavy metal concentrations in the Magnetic Island corals. The elevated "spikes" identified in this study need to be re-sampled and reanalysed to assess their validity. Future studies need to focus on the partitioning and incorporation of various heavy metals in corals. An understanding of these processes would greatly aid the sample preparation and analytical methods required to produce reliable long-term coral heavy metal records. The analysis of Cd and Hg in the long modern Magnetic Island coral record would be valuable in investigation of any historical contamination from mining activity in the Charters Towers district. These elements are also considered a threat to the water quality of the GBR and elevated concentrations have been reported in sediments and biota in the region (see Hayes and Michalek-Wagner, 2000).

Appendix 16: Carbon isotopes.

A-16.1. Carbon isotopes

Carbon isotopes are fractionated into corals by both kinetic and metabolic effects (McConnaughey, 1989). They have been proposed as proxies of light/sunshine/photosynthesis (McConnaughey, 1989; Suzuki et al., 2000; Reynaud-Vaganay et al., 2001), cloud cover (Quinn et al., 1993; Wellington and Dunbar, 1995), ENSO (Boiseau et al., 1998) and annual spawning (Gagan et al., 1994; et al., 1996).

Coral $\delta^{13}C$ levels appear to be correlated to light intensity. Therefore, C isotopes may provide an assessment of how light levels and possibly turbidity affect the water quality of coral reefs.

The two-monthly resolution $\delta^{13}C$ record displayed seasonal trends, with relatively negative values during the summer months and relatively positive values in winter (Fig A-16.1 a-b). However, major negative excursions of approximately 1.5‰ in the 1980-1984 record do not appear to be temperature or flood-related. The massive flood in the mid-Holocene record could account for the large depletion in coral $\delta^{13}C$. Another negative excursion towards the end of the high resolution record also cannot be attributed to freshwater influx (Fig A-16.1b).

The majority of $\delta^{13}C$ values in the modern 1810-1985 record (Fig A-16.2) were consistently within -0.5‰ and -2.0‰. The modern record averaged -1.31 ± 0.33‰ which was comparable to the average of -1.04 ± 0.40 ‰ in the mid-Holocene NEL01D coral (Fig A-16.3a). However, the NEL03D mid-Holocene coral contained more negative $\delta^{13}C$ values averaging -2.08 ± 0.19 (Fig A-16.3b).

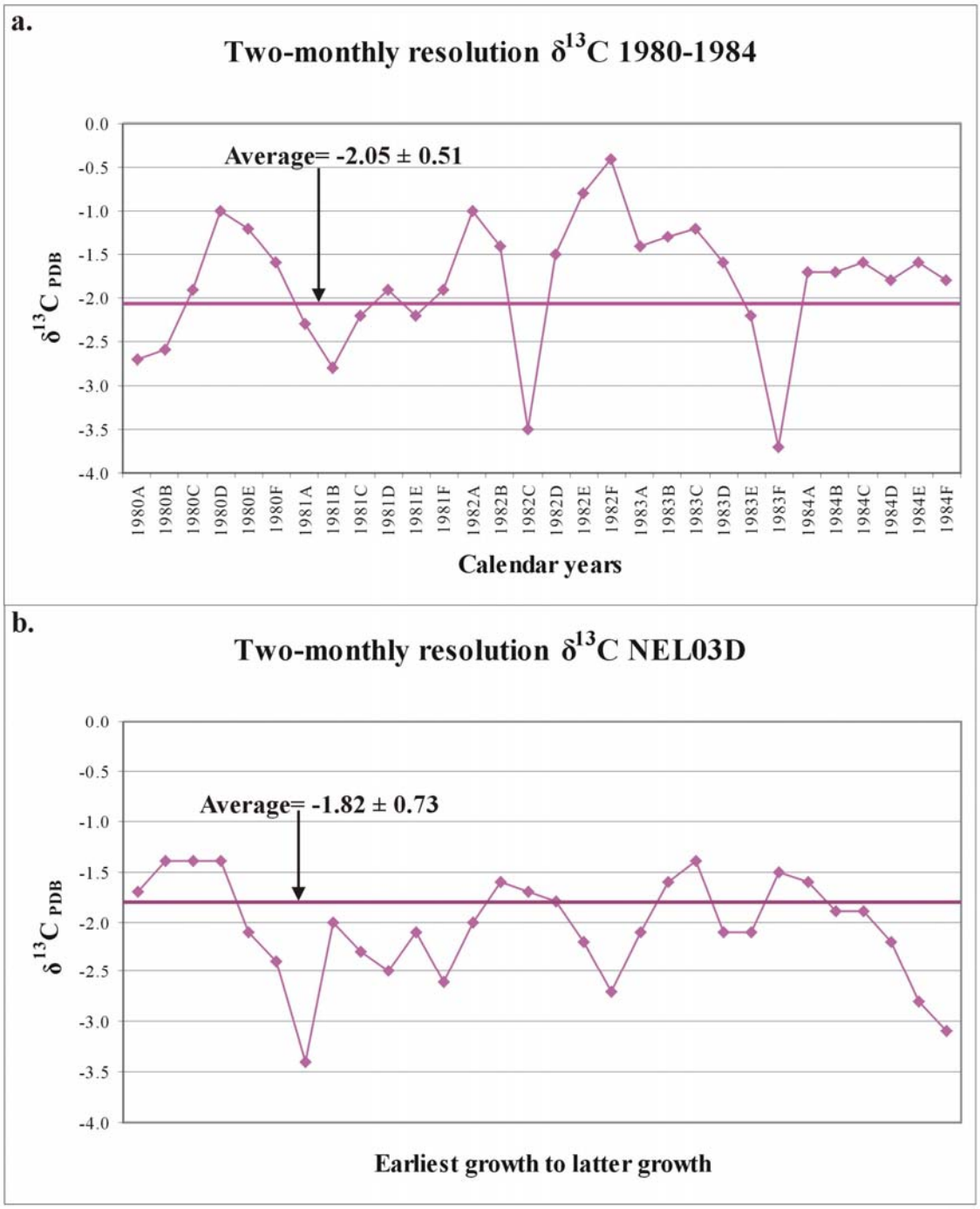

Figure A-16.1 (a-b). Two-monthly resolution $\delta^{13}C$ record for the modern (a) and mid-Holocene (b) corals. The $\delta^{13}C$ values displayed seasonal trends; however, major negative deviations in $\delta^{13}C$ were not correlated to peak SST or flood events.

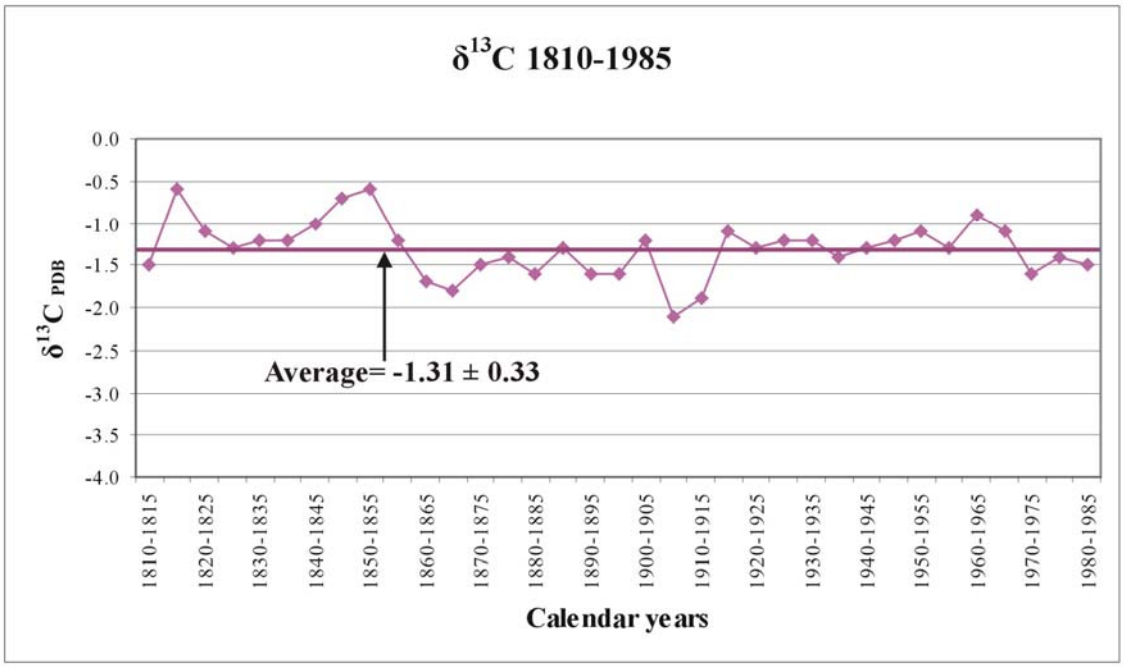

Figure A-16.2. $\delta^{13}C$ record for the 1810-1985 period. The majority of $\delta^{13}C$ values were between -0.5‰ and -2.0‰.

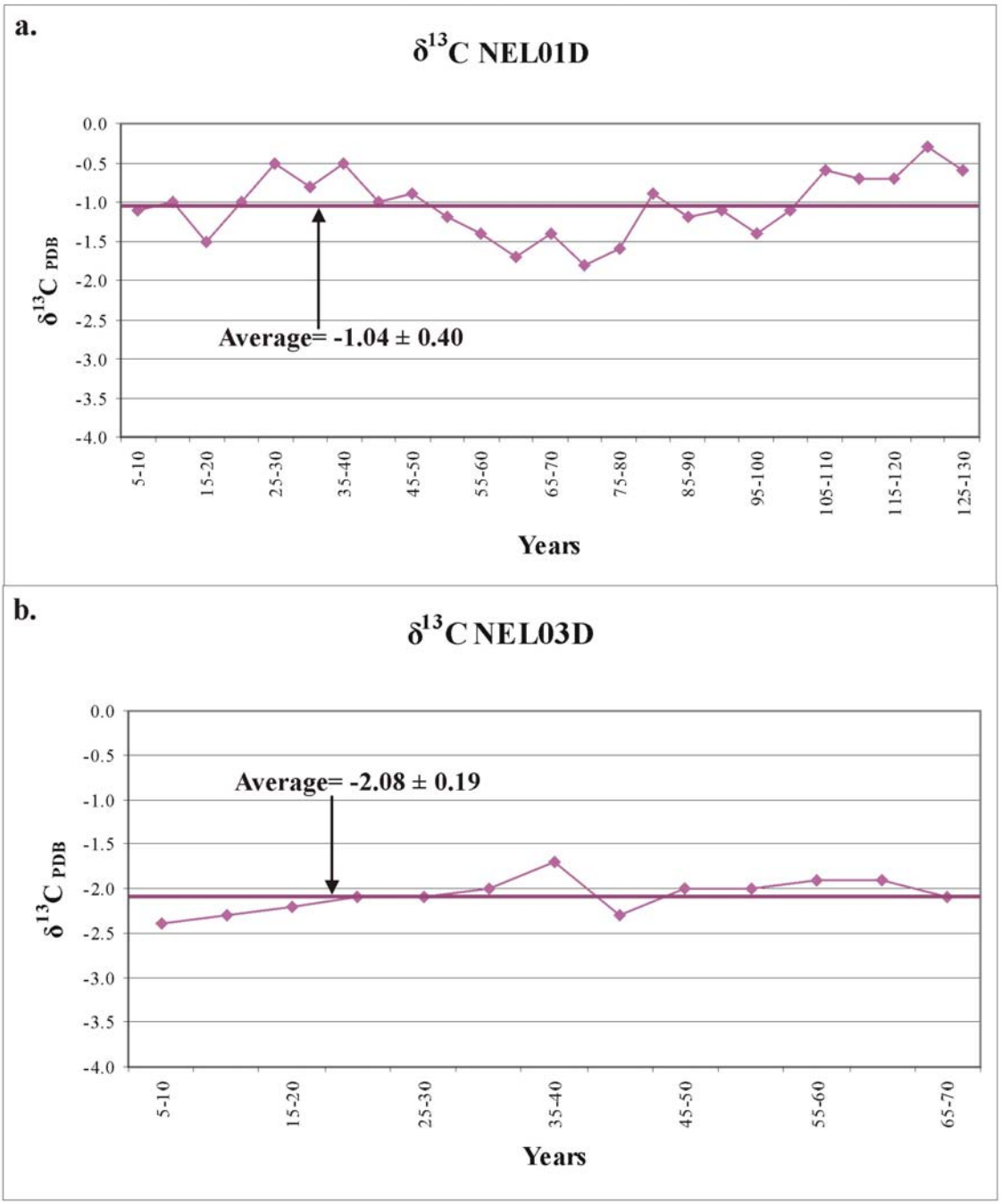

Figure A-16.3 (a-b). $\delta^{13}C$ record for the mid-Holocene coral heads. The NEL01D coral slice (a) had an average and range similar to the modern 1810-1985 record while NEL03D (b) contained more negative $\delta^{13}C$ values.

Appendix 17: GBRMPA Permits

-- 3 DEC 2002

GREAT BARRIER REEF
MARINE PARK AUTHORITY

Mr Stephen Lewis
Department of Earth Sciences
James Cook University
TOWNSVILLE QLD 4811

File No.: 17.442.64
Reg° No.: G3749.1

Dear Mr Lewis,

I refer to your application, dated 18 July 2002, for permission to conduct a research program in the Marine Parks.

Enclosed is the permit G02/3749.1 to cover your program. For your convenience, this permit grants the necessary authorities for your operation under both Commonwealth and State Marine Park legislation.

Please ensure you read and understand the conditions of this permission before undertaking fieldwork. If you require assistance with the interpretation of any condition of this permission, please do not hesitate to contact the Authority.

Permits are granted for a specified period and an application to continue your permit should be made prior to the expiry date. If during the period of this permit you propose to change the permitted operation you must apply in writing to this office.

Your attention is drawn to the notice of review rights enclosed; this notice is relevant to the Commonwealth permission only.

Day-to-day management of the Marine Parks is undertaken by the Queensland Parks and Wildlife Service. If you require any further information or assistance please contact the Service at one of the regional offices at the addresses below or the Great Barrier Reef Marine Park Authority.

2 - 68 Flinders Street | Townsville | + 61 7 4750 0700 Telephone | info@gbrmpa.gov.au
PO Box 1379 | Queensland 4810 | + 61 7 4772 6093 Facsimile | www.gbrmpa.gov.au

let's keep it great

You can reach the permits section of GBRMPA after regular office hours on (07) 4750 0728. When you leave a message please include your name, contact preference (either phone, fax or letter), your enquiry including your permit or registration number if possible, and the most convenient time for us to reach you.

Yours sincerely,

Margie Atkinson
Assessor – Research Permits
Environmental Management Systems

Permits Coordinator -Townsville
Queensland Parks and Wildlife Service
PO Box 5391
TOWNSVILLE QLD 4810

Marine Parks

Permit

Great Barrier Reef Marine Park Regulations (Commonwealth)
Marine Parks Regulations 1990 (Queensland)

This/these permission/s remain/s in force,
unless sooner surrendered or revoked, for the period:

03-DEC-2002 to 31-DEC-2005

Permit No: G02/3749.1

Permission/s is/are granted to

Permittee: Mr Stephen LEWIS

Address: Department of Earth Sciences
James Cook University
TOWNSVILLE QLD 4811

for use of and entry to zones in the following Great Barrier Reef Marine Park Sections/Queensland Marine Parks as established by the Commonwealth *Great Barrier Reef Marine Park Act 1975* and Queensland *Marine Parks Act 1982* ('the Marine Park') :

CENTRAL SECTION
TOWNSVILLE/WHITSUNDAY MARINE PARK

in accordance with the details as stated in Part A, and subject to conditions stated in Part B on the reverse side.

date 28/11/02 — Delegate of the Great Barrier Reef Marine Park Authority

date 3/12/02 — Delegate of the Executive Director, Queensland Parks and Wildlife Service

Part A:
The purpose/s of use and entry may only be undertaken in the zone/s and location/s described below.
Zone/s and location/s to which the permission/s applies:

GENERAL USE 'A' ZONE, MARINE NATIONAL PARK 'A' ZONE and MARINE NATIONAL PARK 'B' ZONE - waters adjacent to Magnetic Island.
GENERAL USE 'A' ZONE - Cleveland Bay and Halifax Bay.

Purpose/s of use and entry authorised by permission/s:

Conduct of a research program - Holocene sedimentology of north Queensland coastal and continental inshore environments.

G02/3749.1 - Page 1 of 4

Part B:
Conditions of permission/s:

WARNING

This permission(s) extends to all employees of the Permittee, or other persons, who are acting on behalf of, or at the direction of, the Permittee for the purposes specified in this permit.

This permission(s) is not intended to extinguish any native title.

DEFINITIONS AND INTERPRETATION

A law shall be taken to be a law in force in the State of Queensland notwithstanding that it applies to only part of the State.

STANDARD CONDITIONS

---

1) All activities must be undertaken in accordance with the provisions of the laws in force from time to time in the State of Queensland.

2) The permittee must ensure that when operations are conducted in the Marine Park under this permit, the permit or a certified copy of the permit is held at the site or sites of operation and on vessels during transit to and from that site or sites.

3) The Permittee must inform staff and participants in the program of any restrictions applying under relevant zoning plans, Marine Park regulations and this permit.

RESEARCH PROGRAM CONDITIONS

---

4) From each of the three (3) locations (waters adjacent to Magnetic Island, Halifax Bay and Cleveland Bay) the Permittee must not collect more than the following:
   (a) 700 sediment samples (each no more than 500 gms);
   (b) 15 vibracores (each 5 cm X 500 cm);
   (c) 20 pieces of dead, washed up (fossil) coral; and
   (d) 20 fossil shell samples (each no more than 500 gms).

5) The Permittee must ensure that vibracores, fossil coral and fossil shell collections are only taken from General Use 'A' zones.

6) This permission allows:
   (a) Use of land and marine based echo sounding equipment to map sub-benthic profiles of fossil reefs; and
   (b) Collection by: hand, hand-held equipment, small sediment grabs, small vibracorer, marine echo sounding equipment and geophone equipment.

G02/3749.1 - Page 2 of 4

FM 175 11/99

7) The Permittee must ensure that vibracore samples are spaced as widely as possible and taken with due care so that minimal damage is done to the surrounding environment.

8) The Permittee must undertake any collection away from recognised tourist areas or where research projects are ongoing.

9) The Permittee must ensure that any equipment used in this project is clearly labelled with the Permittee's name and the permit number (G02/3749.1).

10) The Permittee must record on each visit on which collection takes place the information specified in the specimen record form a copy of which is at Attachment A to this permit. The collection form must at all times be kept with this permit and returned to the Great Barrier Reef Marine Park Authority (GBRMPA) on expiry of the permit.

12) The Permittee must ensure that all vessels used in connection with the activities permitted herein including any private or chartered vessel, are clearly marked "Research Vessel" while being used for those activities.

13) The Permittee must lodge any new species collected as part of this research in an appropriate curated collection within Australia, including all holotypes and at least half the number of paratypes of new species.

14) The Permittee must:
    (a) Forward an annual report to the GBRMPA including:
        (i) a detailed list of locations visited for collecting (incorporating a map);
        (ii) details of samples collected;
    (b) On expiry of the permit, forward to the GBRMPA:
        (i) a summary of projects and researchers who have operated under this permission;
        (ii) references of any publications derived from activities allowed under this permission; and
    (c) Remove all equipment and material used in connection with this research in the Marine Park, prior to the expiry of this permit.

G02/3749.1 - Page 3 of 4

ATTACHMENT A

Specimen Collection Form

(To be completed for each visit on which collection is made)

Marine Parks Permit: **G02/3749.1**

Permittee: Mr Stephen Lewis
James Cook University

Please Note:

- This specimen record form is to be completed after visit on which collection takes place.
- This collection form must be kept with the permit at all times and be returned to the Great Barrier Reef Marine Park Authority on expiry of the permit.

Date	Location/Reef	Specimen	Common Name	Number	Fate
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken
					Returned Taken

G02/3749.1 Page 4 of 4

Appendix 18: Archive samples

Archive JCU Number	Sample description	Sample details
73101	Thin section	SL1 (JCU-83) Pandora Reef coral
73102	Thin section	Coral block of Pandora Reef coral
73103	Thin section	NEL06A "N6B" mid-Holocene coral top of slice
73104	Thin section	NEL01D "N1C" mid-Holocene coral top of slice
73105	Thin section	NEL03D "N3A" mid-Holocene coral bottom of slice
73106	Thin section	NEL01D "N1A" mid-Holocene coral bottom of slice
73107	Thin section	MAG01D "M1B" Geoffrey Bay coral middle of slice
73108	Thin section	MAG01D "M1C" Geoffrey Bay coral top of slice
73109	Thin section	NEL07C "N7B" mid-Holocene coral top of slice
73110	Thin section	MAG01D "M1A" Geoffrey Bay coral bottom of slice
73111	Thin section	NEL01D "N1B" mid-Holocene coral middle of slice
73112	Thin section	NEL07C "N7A" mid-Holocene coral bottom of slice
73113	Thin section	NEL03D "N3B" mid-Holocene coral top of slice
73114	Thin section	NEL06A "N6A" mid-Holocene coral top of slice (thicker cut- includes block)
73115	Thin section	NEL07C "N7A" mid-Holocene coral bottom of slice (thicker cut- includes block)
73116	Thin section	NEL03D "N3A" mid-Holocene coral bottom of slice (thicker cut- includes block)
73117	Thin section	NEL07C "N7B" mid-Holocene coral top of slice (thicker cut- includes block)
73118	Thin section	NEL01D "N1C" mid-Holocene coral top of slice (thicker cut- includes block)
73119	Thin section	MAG01D "M1C" Geoffrey Bay coral top of slice (thicker cut- includes block)
73120	Thin section	NEL01D "N1B" mid-Holocene coral middle of slice (thicker cut- includes block)
73121	Thin section	NEL01D "N1A" mid-Holocene coral bottom of slice (thicker cut- includes block)

Archive JCU Number	Sample description	Sample details		
73122	Thin section	MAG01D "M1A" Geoffrey Bay coral bottom of slice (thicker cut- includes block)		
73123	Thin section	MAG01D "M1B" Geoffrey Bay coral middle of slice (thicker cut- includes block)		
73124	Thin section	NEL03D "N3B" mid-Holocene coral top of slice (thicker cut- includes block)		
73125	Thin section	NEL06A "N6B" mid-Holocene coral top of slice (thicker cut- includes block)		
73126	Coral core slice	MAG01D Geoffrey Bay coral (1812-1986)- labelled 1-9 (from oldest to youngest)		
73127	Coral core slice	NEL01D mid-Holocene coral- labelled from oldest to youngest		
73128	Coral core slice	NEL07C mid-Holocene coral- labelled from oldest to youngest		
73129	Coral core slice	Pandora coral (chips from this coral were homogenised for a standard)		
73130	Coral core slice	NEL03D mid-Holocene coral- labelled from oldest to youngest		
73131	Coral core slice	NEL06A mid-Holocene coral- labelled 1-4 (from oldest to youngest)		
73132	Coral core slice	NEL09C modern Nelly Bay coral		
73133	Coral powder samples analysed at the AQUIRE laboratory			
73133	Vial	1	MAG01	1984-1986
73133	Vial	2	MAG01	1982-1984
73133	Vial	3	MAG01	1980-1982
73133	Vial	4	MAG01	1978-1980
73133	Vial	5	MAG01	1976-1978
73133	Vial	6	MAG01	1974-1976
73133	Vial	7	MAG01	1972-1974
73133	Vial	8	MAG01	1970-1972
73133	Vial	9	MAG01	1968-1970

Archive JCU Number	Sample description	Sample details		
73133	Vial	10	MAG01	1966-1968
73133	Vial	11	MAG01	1964-1966
73133	Vial	12	MAG01	1962-1964
73133	Vial	13	MAG01	1960-1962
73133	Vial	14	MAG01	1960-1962
73133	Vial	15	MAG01	1958-1960
73133	Vial	16	MAG01	1956-1958
73133	Vial	17	MAG01	1954-1956
73133	Vial	18	MAG01	1952-1954
73133	Vial	19	MAG01	1950-1952
73133	Vial	20	MAG01	1948-1950
73133	Vial	21	MAG01	1946-1948
73133	Vial	22	MAG01	1944-1946
73133	Vial	23	MAG01	1942-1944
73133	Vial	24	MAG01	1940-1942
73133	Vial	25	MAG01	1938-1940
73133	Vial	26	MAG01	1936-1938
73133	Vial	27	MAG01	1934-1936
73133	Vial	28	MAG01	1932-1934
73133	Vial	29	MAG01	1930-1932
73133	Vial	30	MAG01	1928-1930

Archive JCU Number	Sample description	Sample details		
73133	Vial	31	MAG01	1926-1928
73133	Vial	32	MAG01	1924-1926
73133	Vial	33	MAG01	1922-1924
73133	Vial	34	MAG01	1920-1922
73133	Vial	35	MAG01	1918-1920
73133	Vial	36	MAG01	1916-1918
73133	Vial	37	MAG01	1914-1916
73133	Vial	38	MAG01	1912-1914
73133	Vial	39	MAG01	1910-1912
73133	Vial	40	MAG01	1908-1910
73133	Vial	41	MAG01	1906-1908
73133	Vial	42	MAG01	1904-1906
73133	Vial	43	MAG01	1902-1904
73133	Vial	44	MAG01	1900-1902
73133	Vial	45	MAG01	1898-1900
73133	Vial	46	MAG01	1896-1898
73133	Vial	47	MAG01	1894-1896
73133	Vial	48	MAG01	1892-1894
73133	Vial	49	MAG01	1890-1892
73133	Vial	50	MAG01	1888-1890
73133	Vial	51	MAG01	1886-1888

Archive JCU Number	Sample description	Sample details		
73133	Vial	52	MAG01	1884-1886
73133	Vial	53	MAG01	1882-1884
73133	Vial	54	MAG01	1880-1882
73133	Vial	55	MAG01	1878-1880
73133	Vial	56	MAG01	1876-1878
73133	Vial	57	MAG01	1874-1876
73133	Vial	58	MAG01	1872-1874
73133	Vial	59	MAG01	1870-1872
73133	Vial	60	MAG01	1868-1870
73133	Vial	61	MAG01	1866-1868
73133	Vial	62	MAG01	1864-1866
73133	Vial	63	MAG01	1862-1864
73133	Vial	64	MAG01	1860-1862
73133	Vial	65	MAG01	1858-1860
73133	Vial	66	MAG01	1856-1858
73133	Vial	67	MAG01	1854-1856
73133	Vial	68	MAG01	1852-1854
73133	Vial	69	MAG01	1850-1852
73133	Vial	70	MAG01	1848-1850
73133	Vial	71	MAG01	1846-1848
73133	Vial	72	MAG01	1844-1846

Archive JCU Number	Sample description	Sample details		
73133	Vial	73	MAG01	1842-1844
73133	Vial	74	MAG01	1840-1842
73133	Vial	75	MAG01	1838-1840
73133	Vial	76	MAG01	1836-1838
73133	Vial	77	MAG01	1834-1836
73133	Vial	78	MAG01	1832-1834
73133	Vial	79	MAG01	1830-1832
73133	Vial	80	MAG01	1828-1830
73133	Vial	81	MAG01	1826-1828
73133	Vial	82	MAG01	1824-1826
73133	Vial	83	MAG01	1822-1824
73133	Vial	84	MAG01	1820-1822
73133	Vial	85	MAG01	1818-1820
73133	Vial	86	MAG01	1816-1818
73133	Vial	87	MAG01	1814-1816
73133	Vial	88	MAG01	1812-1814
73133	Vial	89	NEL01D	128-130
73133	Vial	90	NEL01D	126-128
73133	Vial	91	NEL01D	124-126
73133	Vial	92	NEL01D	122-124
73133	Vial	93	NEL01D	120-122

Archive JCU Number	Sample description	Sample details		
73133	Vial	94	NEL01D	118-120
73133	Vial	95	NEL01D	116-118
73133	Vial	96	NEL01D	114-116
73133	Vial	97	NEL01D	112-114
73133	Vial	98	NEL01D	110-112
73133	Vial	99	NEL01D	108-110
73133	Vial	100	NEL01D	106-108
73133	Vial	101	NEL01D	104-106
73133	Vial	102	NEL01D	102-104
73133	Vial	103	NEL01D	100-102
73133	Vial	104	NEL01D	98-100
73133	Vial	105	NEL01D	96-98
73133	Vial	106	NEL01D	94-96
73133	Vial	107	NEL01D	92-94
73133	Vial	108	NEL01D	90-92
73133	Vial	109	NEL01D	88-90
73133	Vial	110	NEL01D	86-88
73133	Vial	111	NEL01D	84-86
73133	Vial	112	NEL01D	82-84
73133	Vial	113	NEL01D	80-82
73133	Vial	114	NEL01D	78-80

Archive JCU Number	Sample description	Sample details		
73133	Vial	115	NEL01D	76-78
73133	Vial	116	NEL01D	74-76
73133	Vial	117	NEL01D	72-74
73133	Vial	118	NEL01D	70-72
73133	Vial	119	NEL01D	68-70
73133	Vial	120	NEL01D	66-68
73133	Vial	121	NEL01D	64-66
73133	Vial	122	NEL01D	62-64
73133	Vial	123	NEL01D	60-62
73133	Vial	124	NEL01D	58-60
73133	Vial	125	NEL01D	56-58
73133	Vial	126	NEL01D	54-56
73133	Vial	127	NEL01D	52-54
73133	Vial	128	NEL01D	50-52
73133	Vial	129	NEL01D	48-50
73133	Vial	130	NEL01D	46-48
73133	Vial	131	NEL01D	44-46
73133	Vial	132	NEL01D	42-44
73133	Vial	133	NEL01D	40-42
73133	Vial	134	NEL01D	38-40
73133	Vial	135	NEL01D	36-38

Archive JCU Number	Sample description	Sample details		
73133	Vial	136	NEL01D	34-36
73133	Vial	137	NEL01D	32-34
73133	Vial	138	NEL01D	30-32
73133	Vial	139	NEL01D	28-30
73133	Vial	140	NEL01D	26-28
73133	Vial	141	NEL01D	24-26
73133	Vial	142	NEL01D	22-24
73133	Vial	143	NEL01D	20-22
73133	Vial	144	NEL01D	18-20
73133	Vial	145	NEL01D	16-18
73133	Vial	146	NEL01D	14-16
73133	Vial	147	NEL01D	12-14
73133	Vial	148	NEL01D	10-12
73133	Vial	149	NEL01D	8-10
73133	Vial	150	NEL01D	6-8
73133	Vial	151	NEL01D	4-6
73133	Vial	152	NEL03D	Top of slice
73133	Vial	153	NEL03D	
73133	Vial	154	NEL03D	
73133	Vial	155	NEL03D	
73133	Vial	156	NEL03D	

Archive JCU Number	Sample description	Sample details		
73133	Vial	157	NEL03D	
73133	Vial	158	NEL03D	
73133	Vial	159	NEL03D	
73133	Vial	160	NEL03D	
73133	Vial	161	NEL03D	bottom of top slice
73133	Vial	162	NEL03D	top of bottom slice
73133	Vial	163	NEL03D	
73133	Vial	164	NEL03D	
73133	Vial	165	NEL03D	
73133	Vial	166	NEL03D	
73133	Vial	167	NEL03D	
73133	Vial	168	NEL03D	
73133	Vial	169	NEL03D	
73133	Vial	170	NEL03D	
73133	Vial	171	NEL03D	bottom of bottom slice
73133	Vial	172	NEL06A	Top of slice
73133	Vial	173	NEL06A	
73133	Vial	174	NEL06A	
73133	Vial	175	NEL06A	
73133	Vial	176	NEL06A	
73133	Vial	177	NEL06A	

Archive JCU Number	Sample description	Sample details		
73133	Vial	178	NEL06A	
73133	Vial	179	NEL06A	
73133	Vial	180	NEL06A	
73133	Vial	181	NEL06A	bottom of top slice
73133	Vial	182	NEL06A	top of bottom slice
73133	Vial	183	NEL06A	
73133	Vial	184	NEL06A	
73133	Vial	185	NEL06A	
73133	Vial	186	NEL06A	
73133	Vial	187	NEL06A	
73133	Vial	188	NEL06A	
73133	Vial	189	NEL06A	
73133	Vial	190	NEL06A	
73133	Vial	191	NEL06A	bottom of bottom slice
73133	Vial	192	NEL07C	Top of slice
73133	Vial	193	NEL07C	
73133	Vial	194	NEL07C	
73133	Vial	195	NEL07C	
73133	Vial	196	NEL07C	
73133	Vial	197	NEL07C	
73133	Vial	198	NEL07C	

Archive JCU Number	Sample description	Sample details		
73133	Vial	199	NEL07C	
73133	Vial	200	NEL07C	
73133	Vial	201	NEL07C	bottom of top slice
73133	Vial	202	NEL07C	top of bottom slice
73133	Vial	203	NEL07C	
73133	Vial	204	NEL07C	
73133	Vial	205	NEL07C	
73133	Vial	206	NEL07C	
73133	Vial	207	NEL07C	
73133	Vial	208	NEL07C	
73133	Vial	209	NEL07C	
73133	Vial	210	NEL07C	
73133	Vial	211	NEL07C	bottom of bottom slice
73133	Vial	212	MAG01	1984-1986
73133	Vial	213	MAG01	1982-1984
73133	Vial	214	MAG01	1980-1982
73133	Vial	215	MAG01	1978-1980
73133	Vial	216	MAG01	1976-1978
73133	Vial	217	MAG01	1974-1976
73133	Vial	218	MAG01	1972-1974
73133	Vial	219	MAG01	1970-1972

Archive JCU Number	Sample description	Sample details		
73133	Vial	220	MAG01	1968-1970
73133	Vial	221	MAG01	1966-1968
73133	Vial	222	MAG01	1964-1966
73133	Vial	223	MAG01	1962-1964
73133	Vial	224	MAG01	1960-1962
73133	Vial	225	MAG01	1960-1962
73133	Vial	226	MAG01	1958-1960
73133	Vial	227	NEL03D	Two monthly resolution
73133	Vial	228	NEL03D	Two monthly resolution
73133	Vial	229	NEL03D	Two monthly resolution
73133	Vial	230	NEL03D	Two monthly resolution
73133	Vial	231	NEL03D	Two monthly resolution
73133	Vial	232	NEL03D	Two monthly resolution
73133	Vial	233	NEL03D	Two monthly resolution
73133	Vial	234	NEL03D	Two monthly resolution
73133	Vial	235	NEL03D	Two monthly resolution
73133	Vial	236	NEL03D	Two monthly resolution
73133	Vial	237	NEL03D	Two monthly resolution
73133	Vial	238	NEL03D	Two monthly resolution
73133	Vial	239	NEL03D	Two monthly resolution
73133	Vial	240	NEL03D	Two monthly resolution

Archive JCU Number	Sample description	Sample details		
73133	Vial	241	NEL03D	Two monthly resolution
73133	Vial	242	NEL03D	Two monthly resolution
73133	Vial	243	NEL03D	Two monthly resolution
73133	Vial	244	NEL03D	Two monthly resolution
73133	Vial	245	NEL03D	Two monthly resolution
73133	Vial	246	NEL03D	Two monthly resolution
73133	Vial	247	NEL03D	Two monthly resolution
73133	Vial	248	NEL03D	Two monthly resolution
73133	Vial	249	NEL03D	Two monthly resolution
73133	Vial	250	NEL03D	Two monthly resolution
73133	Vial	251	NEL03D	Two monthly resolution
73133	Vial	252	NEL03D	Two monthly resolution
73133	Vial	253	NEL03D	Two monthly resolution
73133	Vial	254	NEL03D	Two monthly resolution
73133	Vial	255	NEL03D	Two monthly resolution
73133	Vial	256	NEL03D	Two monthly resolution
73133	Vial	257	MAG01	1980A
73133	Vial	258	MAG01	1980B
73133	Vial	259	MAG01	1980C
73133	Vial	260	MAG01	1980D
73133	Vial	261	MAG01	1980E

Archive JCU Number	Sample description	Sample details		
73133	Vial	262	MAG01	1980F
73133	Vial	263	MAG01	1981A
73133	Vial	264	MAG01	1981B
73133	Vial	265	MAG01	1981C
73133	Vial	266	MAG01	1981D
73133	Vial	267	MAG01	1981E
73133	Vial	268	MAG01	1981F
73133	Vial	269	MAG01	1982A
73133	Vial	270	MAG01	1982B
73133	Vial	271	MAG01	1982C
73133	Vial	272	MAG01	1982D
73133	Vial	273	MAG01	1982E
73133	Vial	274	MAG01	1982F
73133	Vial	275	MAG01	1983A
73133	Vial	276	MAG01	1983B
73133	Vial	277	MAG01	1983C
73133	Vial	278	MAG01	1983D
73133	Vial	279	MAG01	1983E
73133	Vial	280	MAG01	1983F
73133	Vial	281	MAG01	1984A
73133	Vial	282	MAG01	1984B

Archive JCU Number	Sample description	Sample details	
73133	Vial	283	MAG01 1984C
73133	Vial	284	MAG01 1984D
73133	Vial	285	MAG01 1984E
73133	Vial	286	MAG01 1984F
73133	Vial	347	MAG01 1972-1974
73134	Sediment	BD01	Burdekin dam
73135	Sediment	BD02	Burdekin dam
73136	Sediment	RR1	Ross River dam
73137	Sediment	RR3	Ross River dam
73138	Sediment	GC1	Gustav Creek
73139	Sediment	SC01	Shipping Channel Cleveland Bay (adjacent to tail of Magnetic Island near tripod)
73140	Sediment	NB5c	Nelly Bay reef fore slope grab sample
73141	Sediment core	NEL-1	Nelly Bay Harbour section
73142	Sediment core	NEL-2	Nelly Bay Harbour section
73143	Sediment core	NEL-3	Nelly Bay Harbour section
73144	Sediment core	NEL-4	Nelly Bay Harbour section
73145	Sediment core	NEL-6	Nelly Bay X-base section
73146	Sediment core	NEL-7	Nelly Bay middle section
73147	Sediment core	NEL-8	Nelly Bay middle section
73148	Sediment core	NEL-9	Nelly Bay middle section
73149	Sediment core	NEL-10	Nelly Bay middle section

Archive JCU Number	Sample description	Sample details	
73150	Sediment core	NEL-11	Nelly Bay middle section
73151	Sediment core	NEL-12	Nelly Bay middle section
73152	Sediment core	NEL-13	Nelly Bay Harbour section
73153	Sediment core	NEL-14	Nelly Bay X-base section
73154	Sediment core	CO-1	Cockle Bay sediment core (not used)