

# Transitions in coral reef accretion rates linked to intrinsic ecological shifts on turbid-zone nearshore reefs

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## SUPPLEMENTARY INFORMATION

### *Radiocarbon processing and calibration methodology*

Prior to dating at the NERC Radiocarbon Facility samples selected for  $^{14}\text{C}$  dating were sectioned, surficial calcareous encrustation removed, subjected to ultrasonic agitation in distilled water to remove detrital particles and then oven dried (40 °C). Samples were sent to the NERC Radiocarbon Facility-East Kilbride where the outer 20% by weight of sample was removed using dilute HCl, rinsed in distilled water, dried, ground and converted to CO<sub>2</sub> via hydrolysis with 85% H<sub>3</sub>PO<sub>4</sub>. Sample CO<sub>2</sub> was cryogenically purified, collected and the volume measured. CO<sub>2</sub> was converted to graphite via Fe/Zn reduction (Sloata et al., 1987) and the  $^{14}\text{C}/^{13}\text{C}$  ratio measured at the SUERC AMS Laboratory using a NEC 5MV accelerator mass spectrometer (Freeman et al., 2007) and measured to 3‰ counting precision. Results were background corrected and normalised to  $\delta^{13}\text{C}_{\text{VPDB}}$ ‰ of -25 and are presented in the following Supplementary Table as: (i) conventional years Before Present (y BP) and (ii) calibrated years Before Present (calBP) where present is defined as 1950. Calibration was performed by converting the conventional dates to a calendar time-scale using the Calib 7.1 calibration program <http://calib.qub.ac.uk/calib/> (Stuiver and Reimer 1993) and the Marine13 calibration curve (Reimer et al. 2013). The conventionally employed Marine Reservoir Correction in Australian waters is  $450 \pm 35$  years (Gillespie, 1977). The ΔR value of  $+10 \pm 7$  used in Perry et al., 2012 (and references therein) was used to correct for local deviation from the Marine Reservoir Correction conventionally used for Australian waters.

Recalibration of previously reported radiocarbon results (y BP) (Palmer et al., 2010, Perry et al., 2012; 2013) was carried out using the Calib 7.1 calibration program (Stuiver and Reimer 1993) and the Marine13 calibration curve (Reimer et al., 2013) to conform with data reported here.

Process standard materials: A radiocarbon free (i.e., background) internal standard (Iceland Spar Calcite, Geo Supplies 49 Station Road, Chapeltown, Sheffield, S35 2XE) was processed contemporaneously with samples to quantify the addition of contamination during processing. All results (n=5) were within 2σ confidence limits of the NRCF-EK hydrolysis background of  $51,227 \pm 2,835$  y BP.

**Supplementary Table DR1.** Summary of radiocarbon dating information from core material recovered at Offshore Paluma Shoals A (OPSA: PC1, PC5, PC6, PC7 and PC8), Offshore Paluma Shoals B (OPSB: PC1, PC3, PC4, PC5 and PC6), Offshore Paluma Shoals C (OPSC: PC1, PC2 and PC3), Offshore Paluma Shoals D (OPSD: PC1, PC2 and PC3). Sample depths are relative to lowest astronomical tide (m LAT).

Sample code	Material	Lab Ref.	Elevation (m rel. to LAT)	<sup>14</sup> C age (y BP)	<sup>14</sup> C age error (y BP)	Calibrated age range (1 $\sigma$ )		Median probability age (cal. yBP)						
						Maximum	Minimum							
<b>OPSA</b>														
<i>Core OPSA-PC1</i>														
OPSA-PC1-25	<i>Acropora</i>	SUERC-52297	-1.0	299	35.7	Modern		Modern						
OPSA-PC1-80	<i>Turbinaria</i>	SUERC-52298	-1.7	468	37.7	0	99	72						
OPSA-PC1-170	<i>Platygyra</i>	SUERC-52301	-2.9	1159	37.7	659	726	697						
OPSA-PC1-202	<i>Turbinaria</i>	SUERC-52302	-3.3	1211	37.7	690	777	740						
<i>Core OPSA-PC5</i>														
OPSA-PC5-45	<i>Acropora</i>	SUERC-52291	-1.3	340	37.7	Modern		Modern						
OPSA-PC5-95	<i>Goniastrea</i>	SUERC-52292	-1.9	1051	37.7	565	580	613						
OPSA-PC5-140	<i>Montipora</i>	SUERC-52293	-2.5	1137	37.7	647	710	680						
OPSA-PC5-210	<i>Euphyllia</i>	SUERC-52294	-3.4	1186	37.7	674	750	718						
OPSA-PC5-260	<i>Lobophyllia</i>	SUERC-52295	-4.0	1384	37.7	882	966	921						
<i>Core OPSA-PC6</i>														
OPSA-PC6-42	<i>Acropora</i>	SUERC-51880	-1.3	0	0	Modern		Modern						
OPSA-PC6-102	<i>Acropora</i>	SUERC-51881	-2.0	1214	37.7	692	780	743						
OPSA-PC6-173	<i>Leptastrea</i>	SUERC-51882	-3.0	1145	37.7	652	716	686						
OPSA-PC6-203	<i>Galaxea</i>	SUERC-51885	-3.4	1190	35.7	677	752	720						
<i>Core OPSA-PC7</i>														

OPSA-PC7-35	<i>Acropora</i>	SUERC-52285	-1.3	376	35.7	Modern		Modern
OPSA-PC7-95	<i>Goniastrea</i>	SUERC-52286	-2.1	1261	37.7	738	847	796
OPSA-PC7-130	<i>Montipora</i>	SUERC-52287	-2.6	1165	37.7	662	730	701
OPSA-PC7-205	<i>Platygyra</i>	SUERC-52288	-3.6	1207	37.7	688	773	736
<i>Core OPSA-PC8</i>								
OPSA-PC8-35	<i>Montipora</i>	SUERC-51876	-1.2	0	0	Modern		Modern
OPSA-PC8-100	<i>Montipora</i>	SUERC-51877	-2.1	686	37.7	277	369	328
OPSA-PC8-140	<i>Turbinaria</i>	SUERC-51878	-2.7	1327	37.7	815	910	859
OPSA-PC8-190	<i>Montipora</i>	SUERC-51879	-3.4	1222	38.6	695	789	752
<b>OPSB</b>								
<i>Core OPSB-PC1</i>								
OPSB-PC1-36	<i>Acropora</i>	SUERC-52308	-1.0	386	35.7	Modern		Modern
OPSB-PC1-84	<i>Acropora</i>	SUERC-52311	-1.7	1524	37.7	1011	1128	1069
OPSB-PC1-130	<i>Acropora</i>	SUERC-52312	-2.3	2409	37.7	1979	2092	2031
OPSB-PC1-214	<i>Acropora</i>	SUERC-52313	-3.4	1975	35.7	1471	1577	1521
<i>Core OPSB-PC3</i>								
OPSB-PC3-50	<i>Montipora</i>	SUERC-52303	-0.8	513	37.7	Modern	4	126
OPSB-PC3-80	<i>Porites</i>	SUERC-52304	-1.2	1557	35.7	1058	1159	1107
OPSB-PC3-150	<i>Acropora</i>	SUERC-52305	-2.2	2261	37.7	1809	1908	1857
OPSB-PC3-197	<i>Montipora</i>	SUERC-52306	-2.9	1857	35.7	1330	1435	1388
<i>Core OPSB-PC4</i>								
OPSB-PC4-41	<i>Montipora</i>	SUERC-52314	-1.0	512	37.7	Modern	5	125
OPSB-PC4-95	<i>Acropora</i>	SUERC-52315	-1.8	1501	35.7	975	1085	1039

OPSB-PC4-								
154	<i>Goniastrea</i>	SUERC-52316	-2.6	2468	37.7	2033	2158	2106
OPSB-PC4-								
182	<i>Acropora</i>	SUERC-52317	-3.0	2448	37.7	2019	2133	2078
<i>Core OPSB-PC5</i>								
OPSB-PC5-30	<i>Acropora</i>	SUERC-52325	-1.1	0	0	Modern		Modern
OPSB-PC5-								
143	<i>Acropora</i>	SUERC-52326	-2.6	1815	37.7	1297	1379	1345
OPSB-PC5-								
200	<i>Porites</i>	SUERC-52327	-3.3	1843	35.7	1314	1410	1372
OPSB-PC5-								
225	<i>Duncanopsammia</i>	SUERC-52328	-3.7	2445	35.7	2017	2127	2074
<i>Core OPSB-PC6</i>								
OPSB-PC6-35	<i>Acropora</i>	SUERC-52321	-0.8	0	0	Modern		Modern
OPSB-PC6-70	<i>Acropora</i>	SUERC-52322	-1.2	1678	35.7	1192	1198	1232
OPSB-PC6-								
127	<i>Acropora</i>	SUERC-52323	-2.0	1887	35.7	1372	1478	1424
OPSB-PC6-								
200	<i>Hydnophora</i>	SUERC-52324	-3.0	1973	37.7	1465	1577	1518
<b>OPSC</b>								
<i>Core OPSC-PC1</i>								
OPSC-PC1-5	<i>Montipora</i>	SUERC-59749	-0.5	0	0	Modern		Modern
OPSC-PC1-40	<i>Hydnophora</i>	SUERC-59750	-1.0	790	36	387	475	424
OPSC-PC1-98	<i>Montipora</i>	SUERC-59751	-1.8	1248	36	723	826	779
OPSC-PC1-								
140	<i>Porites</i>	SUERC-59752	-2.4	1299	38	789	886	833
OPSC-PC1-								
182	<i>Montipora</i>	SUERC-59753	-3.0	1286	36	778	877	822
OPSC-PC1-								
221	<i>Turbinaria</i>	SUERC-59754	-3.6	1508	38	985	1100	1047
OPSC-PC1-								
268	<i>Galaxea</i>	SUERC-59756	-4.2	1645	38	1167	1250	1202
<i>Core OPSC-PC2</i>								

OPSC-PC2-26	<i>Montipora</i>	SUERC-59759	-1.1	0	0	Modern	Modern
OPSC-PC2-103	<i>Montipora</i>	SUERC-59760	-2.1	715	38	301	395
OPSC-PC2-170	<i>Euphyllia</i>	SUERC-59761	-3.0	925	36	491	545
OPSC-PC2-227	<i>Turbinaria</i>	SUERC-59762	-3.7	1153	38	656	721
OPSC-PC2-271	<i>Turbinaria</i>	SUERC-59763	-4.3	1531	36	1030	1141
<i>Core OPSC-PC3</i>							
OPSC-PC3-52	<i>Montipora</i>	SUERC-59764	-0.8	0	0	Modern	Modern
OPSC-PC3-166	<i>Goniopora</i>	SUERC-59766	-2.4	1104	38	625	686
OPSC-PC3-176	<i>Bivalve</i>	SUERC-59769	-2.5	1121	36	638	695
OPSC-PC3-190	<i>Hydnophora</i>	SUERC-59770	-2.7	1333	38	821	914
OPSC-PC3-222	<i>Pachyseris</i>	SUERC-59771	-3.0	1557	36	1058	1159
<b>OPSD</b>							
<i>Core OPSD-PC1</i>							
OPSD-PC1-3	<i>Montipora</i>	SUERC-59772	-0.1	0	0	Modern	Modern
OPSD-PC1-65	<i>Goniopora</i>	SUERC-60084	-0.9	1003	36	544	616
OPSD-PC1-123	<i>Turbinaria</i>	SUERC-60085	-1.8	1295	38	785	884
OPSD-PC1-194	<i>Acropora</i>	SUERC-60087	-2.8	1726	38	1235	1304
OPSD-PC1-240	<i>Montipora</i>	SUERC-60088	-3.5	1827	38	1304	1392
<i>Core OPSD-PC2</i>							
OPSD-PC2-31	<i>Acropora</i>	SUERC-60089	-1.3	0	0	Modern	Modern
OPSD-PC2-72	<i>Montipora</i>	SUERC-60090	-1.8	997	38	539	613
OPSD-PC2-150	<i>Euphyllia</i>	SUERC-60093	-2.8	2139	38	1665	1785

OPSD-PC2-								
183	<i>Euphyllia</i>	SUERC-60094	-3.2	2207	38	1741	1849	1794
OPSD-PC2-								
241	<i>Turbinaria</i>	SUERC-60095	-4.0	2256	38	1803	1903	1851
<i>Core OPSD-PC3</i>								
OPSD-PC3-21	<i>Montipora</i>	SUERC-60097	-1.1	0	0	Modern	Modern	
OPSD-PC3-99	<i>Galaxea</i>	SUERC-60099	-2.3	2066	38	1573	1681	1626
OPSD-PC3-								
157	<i>Leptoseris</i>	SUERC-60100	-3.2	2358	38	1911	2024	1968
OPSD-PC3-								
167	Bivalve	SUERC-60103	-3.3	2421	38	1991	2102	2046

**Supplementary Table DR2.** Mean ( $\pm$ s.d.) relative abundance of coral cover and dominant coral genera across the reefs that form the Paluma Shoals Reef Complex (OPS: Offshore Paluma Shoals, OPSA/B/C/D: Offshore Paluma Shoals A, B, C, D) from Morgan et al., (2016). Classifications of ecological community types at Paluma Shoals North and South can be found in Palmer et al., (2010).

Benthic cover (%)	OPS	OPSA	OPSB	OPSC	OPSD
Elevation (m LAT)	0	-0.4	-0.4	-0.6	-0.6
Live coral	18.3 (26)	22.7 (31)	43.9 (37)	64.4 (30)	54.0 (36)
<i>Acropora</i> spp.	10.4 (28)	30.1 (41)	32.1 (38)	10.4 (21)	25.6 (33)
<i>Montipora</i> spp.	3.9 (18)	7.6 (23)	1.2 (10)	6.2 (18)	21.4 (30)
<i>Turbinaria</i> spp.	71.3 (42)	37.7 (43)	62.7 (40)	81.3 (28)	31.4 (31)
<i>Porites</i> spp.	2.9 (15)	17.0 (36)	2.6 (14)	0.8 (6)	15.7 (36)
Other	10.7 (28)	5.9 (22)	1.0 (7)	1.4 (8)	5.9 (20)

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