Reynolds, L.C., Simms, A.R., Rockwell, T.K., Yokoyama, Y., Miyairi, Y., and Hangsterfer, A., 2021, Sedimentary response of a structural estuary to Holocene coseismic subsidence: GSA Bulletin, <https://doi.org/10.1130/B35827.1>.

Supplemental Material

Supplemental Materials 1. Supplemental figures S1, S2, S3, S4.

Figure S1. Geoprobe cores stratigraphy.

Figure S2. Vibracore transects based off Reynolds et al., 2018.

Figure S3. Stratigraphy of cores CM16 and CM43.

Figure S4. Carbon isotope values of modern sediments from Carpinteria Marsh.

Supplemental Materials 2.

Table S1. Core Information.

Table S2. All radiocarbon data

Supplemental Materials 3. Bacon and OxCal Scripts.

Supplemental Materials 4. Invertebrate depth references.

Geoprobe cores stratigraphy

CM43

CM16

Key

- Grey Sand Facies
- White Sand Facies
- Mud Facies
- Brown Sand Facies
- Parallel laminations
- *Cerithidea californica*
- Organic-rich mud
- Bivalve shell
- Shell fragment
- Mottling
- Burrow
- Organic fragment
- Rip up mud clasts
- Ripples
- Roots

1.7-1.9 Cal. 14C dates (ka)

Table S1. Core information. Location, elevation and depth data for all cores from Carpinteria Marsh.											
Original Core Number (Reynolds et al., 2018; Reynolds, 2018)	Core Number	Radiocarbon ages?	Age-depth model	Latitude	Longitude	Core Top Elevation (cm relative to NAVD88)	Elevation Error (cm)	Elevation method	Base of core depth BGS (cm)	GSF absent?	Base GSF "Contact" Depth (cm relative to ground surface)*
CS12-01	1			34.40	-119.53	135.35	2.80	Topcon			>175
CS12-02	2			34.40	-119.53	146.10	2.80	Topcon			>76
CS12-03	3	Y		34.40	-119.53	143.58	2.80	Topcon			>355
CS12-04	4			34.40	-119.53	73.40	2.80	Topcon	50	Y	
CS12-05	5			34.40	-119.53	132.25	2.80	Topcon	85	Y	
CS12-06	6			34.40	-119.53	136.93	2.80	Topcon	90	Y	
CS12-07	7			34.40	-119.53	137.05	2.80	Topcon	90	Y	
CS12-08	8			34.40	-119.53	134.38	2.80	Topcon	100	Y	
CS12-09	9			34.40	-119.53	141.03	2.80	Topcon	90	Y	
CS12-10	10			34.40	-119.53	176.60	2.80	Topcon			>191
CS12-11	11			34.40	-119.53	147.60	3.00	Topcon			>190
CS12-12	12			34.40	-119.53	148.00	3.00	Topcon			>290
CS12-13	13			34.40	-119.53	144.60	3.00	Topcon			>202
CS12-14	14			34.40	-119.54	140.70	3.00	Topcon			>205
CS12-15	15	Y	Y	34.40	-119.54	140.60	3.00	Topcon			393.00
CS12-16	16	Y		34.40	-119.54	158.87	15.00	Lidar	380	Y	
CS12-17	17			34.40	-119.54	160.70	15.00	Lidar	300	Y	
CS12-18	18			34.40	-119.54	178.34	15.00	Lidar			>115
CS12-19	19	Y	Y	34.40	-119.54	167.67	15.00	Lidar			361.00
CS12-20	20	Y	Y	34.40	-119.54	158.78	15.00	Lidar			367.00
CS12-21	21	Y	Y	34.40	-119.54	156.95	15.00	Lidar			394.00

CS12-22	22	Y		34.40	-119.54	148.47	15.00	Lidar			>390
CS12-23	23			34.40	-119.53	182.35	15.00	Lidar	117	Y	
CSV13-01	24			34.40	-119.54	161.86	15.00	Lidar			>263
CSV13-02	25	Y		34.40	-119.54	151.24	15.00	Lidar			>295
CSV13-03	26			34.40	-119.54	148.40	9.40	New Topcon			> 400
CSV13-04	27			34.40	-119.54	153.99	15.00	Lidar			>267
CSV13-05	28			34.40	-119.54	144.05	15.00	Lidar			>130
CSV13-06	29			34.40	-119.54	158.38	15.00	Lidar	100	Y	
CSMF14-01	30			34.40	-119.54	112.19	15.00	Lidar			>186
CSMF14-02	31	Y		34.40	-119.54	106.25	15.00	Lidar			>186
CSMF14-03	32			34.40	-119.54	123.95	15.00	Lidar			>195
CSV14-01	33			34.40	-119.54	119.20	15.00	Lidar			>187
CSV14-02	34			34.40	-119.54	157.31	15.00	Lidar			>240
CSV14-03	35			34.40	-119.54	151.01	15.00	Lidar	175	Y	
CSV14-04	36			34.40	-119.54	152.50	15.00	Lidar			>180
CSV14-05	37			34.40	-119.54	125.65	15.00	Lidar			>234
CSV14-06	38			34.40	-119.54	155.26	15.00	Lidar	273	Y	
CS15-01	39			34.40	-119.54	157.43	15.00	Lidar			>237
CS15-02	40			34.40	-119.54	31.30	9.40	Topcon			
CS15-03	41	Y	Y	34.40	-119.54	15.30	9.40	Topcon			285.00
CS16-01	42			34.40	-119.53	79.70	3.90	Topcon	236	Y	
CS16-02	43	Y		34.40	-119.53	75.70	3.90	Topcon			>371
CS17-01	44	Y	Y	34.40	-119.53	56.70	4.70	Topcon			375.00
CSGP13-01	45			34.40	-119.54	228.40	9.30	Topcon			
CSGP13-02	46	Y	*	34.40	-119.54	223.89	15.00	Lidar			552.00
CSGP13-03	47			34.40	-119.54	231.24	15.00	Lidar			
CSGP13-04	48			34.40	-119.53	242.53	15.00	Lidar			

[illegible]

TABLE S2. ALL RADIOCARBON DATA

Lab	Lab No.	Material description	Facies (following Reynolds et al., 2018)	Core number	Sample depth below ground surface (cm)	14C age	14C error	lower cal range BP	upper cal range BP	median cal age BP	Paleo MSL rel to PMSL	Paleo MSL error	depth of sample relative to "contact"	Removed from Bacon models?	Removed from OxCal model?	Other notes
YAUT	26704	articulated bivalve (<i>Leukoma staminea</i>)	GSF	3	282	1217	22	328	680	528	160.43	80.06				
UCIAMS	186408	plant fragment	GSF	15	224	130	20	11	268	107	105.40	80.06	169.00	Y	Y	Anomalously young age; likely contamination or a root
YAUT	26733	stems/roots and one piece charcoal mud break in GSF	MF-U/GSF	15	123	19	39	-6	255	80	126.40	74.07	270.00			CALIBOMB, approximate median age: 1695 to 1956, most probably 1867 to 1918
UCIAMS	115624	charcoal	MF-U	15	69	5170	20	5902	5990	5927	72.40	74.07	324.00	Y	Y	Removed, out of stratigraphic order within core; very small fragment likely reworked
UCIAMS	115623	charcoal and insect parts	MF-U	15	40	180	20	1	289	185	43.40	74.07	353.00			Suspect age, out of stratigraphic order within core; multiple types of sample combined
UCIAMS	186403	stem/roots/charcoal within mud lens in GSF	MF-U/GSF	15	123	130	20	11	268	107	126.40	74.07	270.00			Suspect age, possible root age
UCIAMS	186404	wood in MF at base of GSF	MF-L	15	399	1255	20	1087	1276	1224	402.40	74.07	-6.00			
UCIAMS	169345	plant stem	MF-U	16	117	1040	15	926	957	942	102.13	75.51				
UCIAMS	169346	single charcoal fragment	MF-U	16	151	1510	20	1347	1408	1379	136.13	75.51				
UCIAMS	169347	plant stem	MF-U	16	310	1850	15	1713	1821	1747	295.13	75.51				
UCIAMS	169348	<i>Cerithidea californica</i>	MF-U	16	322	2220	15	1250	2010	1612	307.13	75.51				
UCIAMS	169349	multiple charcoal pieces	MF-U	16	168	1405	15	1292	1345	1307	153.13	75.51				
UCIAMS	153252	charcoal	MF-L	19	370	2160	20	2057	2301	2148	346.33	75.51	-9.00			
UCIAMS	153268	charcoal	MF-L	19	384	2180	15	2120	2302	2252	360.33	75.51	-23.00			
UCIAMS	186405	plant fragment 15 cm above top of GSF in MF	MF-U	19	129	830	30	683	783	727	105.33	75.51	232.00			
UCIAMS	186406	stem, plants growing up from MF to WSF at base of WSF	MF-U/WSF	19	67	225	20	9	307	199	43.33	75.51	294.00			
UCIAMS	186401	plant fragment	GSF	20	225	1395	15	1288	1343	1302	88.22	81.40	142.00			Suspect age; mottling indicates bioturbation
YAUT	26706	articulated ridged bivalve (<i>Chione undulata</i>)	GSF	20	265	1481	26	559	938	754	128.22	81.40	102.00			
YAUT	26725	articulated ridged bivalve (<i>Chione undulata</i>)	GSF	20	270	1429	47	520	909	707	133.22	81.40	97.00			
UCIAMS	115625	charcoal	MF-U	20	59	255	20	154	422	300	44.22	75.51	308.00			
UCIAMS	115626	insect parts	MF-U	20	86	185	20	1	289	185	71.22	75.51	281.00			
UCIAMS	153253	plant part	MF-L	20	380	2970	110	2856	3388	3134	365.22	75.51	-13.00			
UCIAMS	186402	plant fragment	MF-L	20	373	2240	15	2156	2332	2220	358.22	75.51	-6.00			
UCIAMS	186407	plant fragment	MF-U	20	110	660	15	562	665	586	95.22	75.51	257.00			
UCIAMS	186289	<i>Cerithidea californica</i> in lower GSF just above MF contact; within a mud clast	GSF	21	388	1835	15	829	1549	1193	253.05	81.40	6.00			Suspect age, <i>Cerithidea</i> <i>californica</i> within mud clast: reworked
YAUT	26735	root in mud clast between GSF upper and lower	MF-U/GSF	21	272	510	50	481	642	535	259.05	75.51	122.00			Suspect age, possible root age
UCIAMS	153254	plant part	MF-L	21	400	1915	20	1743	1885	1829	387.05	75.51	-6.00			
YAUT	26705	articulated thin bivalve (<i>Macoma nasuta</i>)	GSF	22	163	1426	29	528	899	703	36.53	81.40				
YAUT	26737	wood, not burnt	MF-U	25	100	205	22	1	300	182	92.76	75.51				
UCIAMS	169363	oyster shell (<i>Ostrea</i> spp.)	GSF	31	90	1625	15	683	1094	888	5.75	81.40				

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YAUT	26736	plant part in GSF	GSF	41	233	1819	27	1624	1820	1719	239.70	80.56	52.00		Y	Suspect age, mottle indicates bioturbation; Out of stratigraphic order in OxCal compilation
UCIAMS	169360	limpet	GSF	41	273	4090	15	3543	4059	3789	279.70	80.56	12.00	Y	Y	Suspect age, out of stratigraphic order within core; mottling indicates bioturbation
UCIAMS	169361	plant stem	MF-L	41	287	2275	15	2181	2343	2321	415.70	74.60	-2.00			
UCIAMS	169362	plant parts	GSF	41	95	590	20	544	643	606	101.70	80.56	190.00			
UCIAMS	169341	<i>Cerithidea californica</i>	MF-U/BSF	43	121	1200	15	279	908	586	189.30	74.11				Suspect age, out of stratigraphic order within core; <i>Cerithidea</i> in sand bed, indicating reworking
UCIAMS	169339	plant stem	MF-U/BSF	43	85	885	15	732	897	769	153.30	74.11				
UCIAMS	169340	plant stem	MF-U/BSF	43	94	785	15	677	725	701	162.30	74.11				
UCIAMS	169342	multiple plant parts	MF-U/BSF	43	274	885	15	732	897	769	342.30	74.11				
UCIAMS	169343	partially burned stem	MF-U/BSF/GSF	43	275	835	15	688	773	730	221.30	80.10				
UCIAMS	169344	plant stem	GSF	43	281	1350	20	1179	1303	1288	227.30	80.10				
UCIAMS	186426	plant fragment	GSF	44	266	1560	15	1385	1516	1458	231.30	80.14	109.00	Y	Y	Removed, out of stratigraphic order within core; mottling indicates bioturbation
UCIAMS	186427	plant fragment	GSF	44	320	1445	15	1303	1354	1329	285.30	80.14	55.00	Y	Y	Removed, out of stratigraphic order within core; mottling indicates bioturbation
UCIAMS	186428	plant fragment	GSF	44	377	1590	15	1411	1521	1469	342.30	80.14	-2.00	Y	Y	Removed, out of stratigraphic order within core; mottling indicates bioturbation
UCIAMS	186424	woody charcoal in MF	MF-U	44	137	1465	30	1302	1388	1345	224.30	74.16	238.00	Y	Y	Removed, out of stratigraphic order within core; very small sample size
UCIAMS	186425	plant fragment	GSF	44	169	910	20	737	907	834	134.30	80.14	206.00			
UCIAMS	186429	plant fragment	MF-L	44	395	1200	15	1067	1176	1114	482.30	74.16	-20.00			
UCIAMS	129078	<i>Cerithidea californica</i>	MF-L/BSF	46	1130	5240	20	4924	5736	5360	1050.11	75.51	-578.00			Previously published in Simms et al. (2016)
UCIAMS	129079	<i>Cerithidea californica</i>	MF-L/BSF	46	1224	5730	25	5545	6273	5899	1144.11	75.51	-672.00			Previously published in Simms et al. (2016)
UCIAMS	129080	<i>Cerithidea californica</i>	MF-L/BSF	46	789	4020	20	3387	4256	3816	709.11	75.51	-237.00			Previously published in Simms et al. (2016)
UCIAMS	129081	<i>Cerithidea californica</i>	MF-L/BSF	46	904	4520	20	4000	4877	4472	824.11	75.51	-352.00			Previously published in Simms et al. (2016)
UCIAMS	151214	<i>Cerithidea californica</i>	MF-L	46	551	1865	20	873	1599	1225	471.11	75.51	0.00			sample at contact
YAUT	26708	<i>Cerithidea californica</i>	MF-L/BSF	46	755	4038	26	3407	4284	3839	675.11	75.51	-203.00			
YAUT	26709	<i>Cerithidea californica</i>	MF-L/BSF	46	959	4793	30	4400	5274	4821	879.11	75.51	-407.00			
YAUT	26711	<i>Cerithidea californica</i>	MF-L/BSF	46	1239	6047	38	5868	6632	6237	1159.11	75.51	-687.00			
YAUT	26712	<i>Cerithidea californica</i>	MF-L/BSF	46	745	3737	30	3025	3894	3462	665.11	75.51	-193.00			
YAUT	26713	<i>Cerithidea californica</i>	MF-L/BSF	46	750	3940	26	3297	4162	3714	670.11	75.51	-198.00			
YAUT	26716	<i>Cerithidea californica</i>	MF-L/BSF	46	907	4455	33	3941	4823	4386	827.11	75.51	-355.00			
YAUT	26717	<i>Cerithidea californica</i>	MF-L/BSF	46	959	4838	37	4434	5304	4882	879.11	75.51	-407.00			
YAUT	26718	<i>Cerithidea californica</i>	MF-L/BSF	46	1207	5866	28	5653	6399	6045	1127.11	75.51	-655.00			
YAUT	26719	<i>Cerithidea californica</i>	MF-L/BSF	46	1239	5929	34	5722	6482	6109	1159.11	75.51	-687.00			
YAUT	26722	<i>Cerithidea californica</i>	MF-L/BSF	46	882	4315	44	3733	4666	4202	802.11	75.51	-330.00			
UCIAMS	129084	charcoal	MF-L/BSF	46	1130	4645	20	5314	5461	5413	1050.11	75.51	-578.00			
UCIAMS	129085	charcoal	MF-L/BSF	46	1224	5295	20	5995	6184	6083	1144.11	75.51	-672.00			
UCIAMS	129086	charcoal	MF-L/BSF	46	789	3615	20	3848	3980	3923	709.11	75.51	-237.00			
UCIAMS	129087	charcoal	MF-L/BSF	46	904	3845	20	4152	4403	4252	824.11	75.51	-352.00			
UCIAMS	129088	charcoal	GSF	46	1369	5850	20	6569	6740	6671	1167.11	81.40	-817.00			
UCIAMS	129089	plant fragment	GSF	46	1363	5920	25	6667	6826	6738	1161.11	81.40	-811.00			
UCIAMS	151182	stem or wood part	MF-L	46	568	2730	20	2769	2863	2815	488.11	75.51	-16.00			

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UCIAMS	151183	charcoal	MF-L/BSF	46	753	3305	20	3466	3567	3522	673.11	75.51	-201.00
UCIAMS	151184	plant fragment	MF-L/BSF	46	807	3785	25	4085	4244	4163	727.11	75.51	-255.00
UCIAMS	151185	charcoal	GSF/BSF	49	521	2035	25	1889	2052	1970	321.04	81.40	
UCIAMS	151186	seed	MF-L/BSF	49	654	3015	20	3083	3331	3209	576.04	75.51	
UCIAMS	151187	plant fragment	MF-L/BSF	49	687	3445	20	3637	3825	3703	609.04	75.51	
UCIAMS	151188	charcoal	MF-L/BSF	49	828	3960	100	4095	4811	4413	750.04	75.51	
UCIAMS	151189	charcoal	MF-L/BSF	49	1090	4560	60	4980	5457	5194	1012.04	75.51	
UCIAMS	151190	charcoal	MF-L/BSF	49	1256	5320	25	5999	6193	6085	1178.04	75.51	
UCIAMS	151191	charcoal	GSF	49	1407	5910	100	6488	6988	6736	1207.04	81.40	
UCIAMS	151192	charcoal	GSF	49	1460	5800	90	6398	6833	6600	1260.04	81.40	
UCIAMS	151215	<i>Cerithidea californica</i>	MF-L/BSF	49	928	4430	20	3920	4800	4353	850.04	75.51	
UCIAMS	153269	charcoal	MF-L/BSF	49	667	3000	20	3077	3324	3189	589.04	75.51	
UCIAMS	153236	plant fragment	MF-L/BSF	50	1239	5190	20	5910	5993	5944	1133.00	75.51	
UCIAMS	153248	plant fragment	MF-L/BSF	50	729	3240	20	3395	3483	3450	623.00	75.51	
UCIAMS	153249	charcoal	MF-L/BSF	50	1352	5385	25	6015	6282	6211	1246.00	75.51	
UCIAMS	153250	charcoal	MF-L/BSF	50	1239	5135	20	5759	5980	5908	1133.00	75.51	
UCIAMS	153251	charcoal	MF-L/BSF	50	667	3000	20	3077	3324	3189	561.00	75.51	
UCIAMS	151193	plant fragment	MF-U/BSF	51	363	845	20	690	785	742	257.00	75.51	
UCIAMS	151194	plant fragment	MF-L/BSF	51	663	3130	20	3257	3439	3360	557.00	75.51	
UCIAMS	151195	charcoal	MF-L/BSF	51	718	3325	30	3460	3635	3534	612.00	75.51	
UCIAMS	151196	charcoal-single piece, fragmented	MF-L/BSF	51	715	3210	20	3381	3456	3421	609.00	75.51	
UCIAMS	151197	plant fragment	MF-L/BSF	51	777	3365	45	3467	3811	3597	671.00	75.51	
UCIAMS	151198	plant fragment	MF-L/BSF	51	899	3765	25	3998	4235	4126	793.00	75.51	
UCIAMS	151199	plant fragment	MF-L/BSF	51	1079	4335	20	4849	4960	4883	973.00	75.51	
UCIAMS	151200	plant fragment	MF-L/BSF	51	1205	4595	25	5141	5445	5317	1099.00	75.51	
UCIAMS	151201	plant fragment	MF-L/BSF	51	1307	5235	20	5927	6165	5970	1201.00	75.51	

Notes: Radiocarbon ages were calibrated using CALIB 8.2 (Stuiver et al., 2021), which uses the IntCal20 (Reimer et al., 2020) and Marine20 (Heaton et al., 2020) calibration curves. The delta R values used are 120 ± 78 for bivalve and oyster shells; 34 ± 160 for *Cerithidea* following Holmquist et al., and re-calculated using the Marine20 Reservoir Database (<http://calib.org/marine/>). Elevation error for core top elevations measured with lidar is assigned 0.15 m (average difference from differential GPS measurement from Sadro et al., 2015). Samples which were removed for analysis are noted in Notes column. Facies include Mud Facies (MF), Grey Sand Facies (GSF), and White Sand Facies (WSF), following Reynolds et al. (2018).

Supplemental Materials III. Bacon and Oxcal Scripts

Bacon R Script and output

Load needed libraries.

library(tidyverse)

library(rbacon)

Run Bacon age-depth model, given a csv file of radiocarbon ages and depths within each core. The hiatus is set to the depth below ground surface (cm) of the contact in each core. Because of the lithological change at the contact, we assumed the sedimentation rates above and below the contact were independent. For all age-depth models, a gamma distribution representing a mean accumulation rate of 0.4 cm/yr was used as the prior value for the sediments above the contact. This value is the average sedimentation rate previously calculated from Pb210, Cs137, and pollen/pollution horizons (Reynolds et al., 2018) for the upper 1-2 m of sediment in Carpinteria Marsh. The prior value used for the accumulation rate of sediments below the contact was 0.2 cm/yr, which is the sedimentation rate we calculated from a linear regression between all calibrated ages and depths below NAVD88 values below the contact ($[\text{depth relative to NAVD88 (cm)}] = 0.2 \text{ cm/yr} * [\text{cal yr BP}] + 149 \text{ cm}$, $R^2 = 0.93$).

In each of the following sections, the R code to run the Bacon model is shown, along with its output age-depth model. Bacon.Age.d gives the modelled age at the depth indicated (the contact depth below ground surface in that core). A histogram of the modelled values is plotted below, along with the mean and standard deviation of these values.

Additional comments are included within the Core CM15 code/output section—these comments apply to the other core models as well.

Core CM15

Bacon(core = "CM15", hiatus.depths = 393, acc.mean = c(2.5, 4)) # Calibrates given radiocarbon ages and calculates an age-depth model for the sediment core. The hiatus depth is the depth of the contact in this core; the acc.mean values are the prior values used for accretion rates above and below the contact, respectively.

CM15 <- Bacon.Age.d(393) # Calculates the age of the depth indicated.

CM15 <- as_tibble(CM15) # Changes the output model ages to a tibble for easier plotting.

ggplot(CM15, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM15") # Plots the modelled ages of the contact as a histogram. By default, Bacon saves a subsample of all MCMC-derived estimated ages for a certain depth. For example, the histogram below represents ~ 1800 estimates.

`mean(CM15$value)` # Mean value of the histogram shown above—indicates the mean modelled age value for the contact.

output = 861

`sd(CM15$value)` # One standard deviation of the modelled age values for the contact.

output = 102

Core CM20

```
Bacon(core = "CM20", hiatus.depths = 367, acc.mean = c(2.5, 4))
```

```
CM20 <- Bacon.Age.d(367)
```

```
CM20 <- as_tibble(CM20)
```

```
ggplot(CM20, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM20")
```

```
mean(CM20$value)
```

```
# output: 1169
```

```
sd(CM20$value)
```

```
# output : 75
```

Core CM21

```
Bacon(core = "CM21", hiatus.depths = 394, acc.mean = c(2.5, 4))
```

```
CM21 <- Bacon.Age.d(394)
```

```
CM21 <- as_tibble(CM21)
```

```
ggplot(CM21, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM21")
```

```
mean(CM21$value)
```

```
# output : 881
```

```
sd(CM21$value)
```

```
# output: 78
```

Core CM44

```
Bacon(core = "CM44 ", hiatus.depths = 374, acc.mean = c(2.5, 4))
```

```
CM44 <- Bacon.Age.d(374)
```

```
CM44 <- as_tibble(CM44)
```

```
ggplot(CM44, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM44")
```

```
mean(CM44$value)
```

```
# output : 1156
```

```
sd(CM44$value)
```

```
# output : 49
```


Core CM19

```
Bacon(core = "CM19", hiatus.depths = 361, acc.mean = c(2.5, 4))
```

```
CM19 <- Bacon.Age.d(361)
```

```
CM19 <- as_tibble(CM19)
```

```
ggplot(CM19, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM19")
```

```
mean(CM19$value)
```

```
# output : 1261
```

```
sd(CM19$value)
```

```
# output : 116
```

Core CM41

```
Bacon(core = "CM41", hiatus.depths = 280, acc.mean = c(2.5, 4))
```

```
CM41 <- Bacon.Age.d(280)
```

```
CM41 <- as_tibble(CM41)
```

```
ggplot(CM41, aes(value)) + geom_histogram() + labs(x = "Age of CSS", title = "CM41")
```

```
mean(CM41$value)
```

```
# output : 1111
```

```
sd(CM41$value)
```

```
# output : 72
```

// OxCal script

// Delta_R values updated for Marine20. All samples are ordered by age within their phase. Each phase is defined by its depth above or below the contact (given as a range in cm, i.e., the first Phase listed represents samples 817 to 600 cm below the contact), as well as its facies (in parentheses, where MFL= mud facies lower; MFU = mud facies upper; and GSF = grey sand facies). For clarity, we have ordered the ages in each phase chronologically (i.e., not by depth), but the model does not consider ages within a phase to be sequential. However, using the “Sequence” function, the phases themselves are constrained to be in chronological sequence, i.e., the 817-600 phase is older than the 600-400 phase. In the script below, the phases are listed from the base of the section (oldest) to the top of the section (youngest). The radiocarbon ages (R_Date) are input as radiocarbon years BP and error and calibrated in the program. The name of each R_Date indicates the type of material and its depth relative to the contact, i.e., PF811 = plant fragment from 811 cm below the contact. For ages below the contact (listed first in the script), the depth should be read as “cm below the contact”, while for ages above the contact (listed further down in the script), the depth given should be read as “cm above the contact”. PF = plant fragment; Sh = shell; Ch = charcoal; Wd = wood. Additional details about the radiocarbon ages and reservoir values are provided in Table 2 and in the main text.

Plot()

{

Sequence("Carpinteria Marsh")

{

Boundary("Base of Section");

Phase("817-600 (MFL)")

{

R_Date("PF811", 5920, 25);

R_Date("Ch817", 5850, 20);

R_Date("Ch672", 5295, 20);

Curve("Marine20", "marine20.14c");

Delta_R("LocalMarine", 34, 160);

R_Date("Sh687", 6047, 38);

R_Date("Sh687.2", 5929, 34);

R_Date("Sh672", 5730, 25);

```

R_Date("Sh655", 5866, 28);
};
Phase("600-400 (MFL)")
{
R_Date("Ch578", 4645, 20);
Curve("Marine20","marine20.14c");
Delta_R("LocalMarine",34,160);
R_Date("Sh578", 5240, 20);
R_Date("Sh407.1", 4793, 30);
R_Date("Sh407.2", 4838, 37);
};
Phase("400-200 (MFL)")
{
Curve("Marine20","marine20.14c");
Delta_R("LocalMarine",34,160);
R_Date("Sh352.1", 4520, 20);
R_Date("Sh355", 4455, 33);
Curve("IntCal20","intcal20.14c");
R_Date("Ch352", 3845, 20);
Curve("Marine20","marine20.14c");
Delta_R("LocalMarine",34,160);
R_Date("Sh330", 4315, 44);
R_Date("Sh237", 4020, 20);
Curve("IntCal20","intcal20.14c");
R_Date("PF255", 3785, 25);
R_Date("Ch237", 3615, 20);
R_Date("Ch201", 3305, 20);
};

```

```

Phase("200-contact (MFL)")
{
  Curve("Marine20","marine20.14c");
  Delta_R("LocalMarine",34,160);
  R_Date("Sh203", 4038, 26);
  R_Date("Sh198", 3940, 26);
  R_Date("Sh193", 3737, 30);
  Curve("IntCal20","intcal20.14c");
  R_Date("PF13", 2970, 110);
  R_Date("PF16", 2730, 20);
  R_Date("PF6", 2240, 15);
  R_Date("PF2", 2275, 15);
  R_Date("Ch23", 2180, 15);
  R_Date("Ch9", 2160, 20);
  R_Date("PF6a", 1915, 20);
  Curve("Marine20","marine20.14c");
  Delta_R("LocalMarine",34,160);
  R_Date("Sh0", 1865, 20);
  Curve("IntCal20","intcal20.14c");
  R_Date("Wd6", 1255, 20);
  R_Date("PF20", 1200, 15);
};
Date("Contact");
Phase("contact-270 (GSF)")
{
  Curve("Marine20","marine20.14c");
  Delta_R("LocalMarine",34,160);
  R_Date("Sh6", 1835, 15);

```

```

Curve("IntCal20","intcal20.14c");
R_Date("PF142", 1395, 15);
Curve("Marine20","marine20.14c");
Delta_R("LocalMarine",120,78);
R_Date("Sh97", 1429, 47);
R_Date("Sh102", 1481, 26);
Curve("IntCal20","intcal20.14c");
R_Date("PF206", 910, 20);
R_Date("PF190", 590, 20);
R_Date("PF122", 510, 50);
};
Phase("232- ground surface (MFU)")
{
Curve("IntCal20","intcal20.14c");
R_Date("PF232", 830, 30);
R_Date("PF257", 660, 15);
R_Date("PF294", 225, 20);
R_Date("PF308", 255, 20);
R_Date("PF281", 185, 20);
R_Date("Ch353", 180, 20);
R_Date("PF270", 130, 20);
Curve("Bomb13NH2","Bomb13NH2.14c");
R_Date("PF270", 19, 39);
};
Boundary("Ground Surface");
};
};

```


Supplemental Materials IV. Species depth ranges and citations

Tagelus californianus (California jackknife clam)

(Emmett et al., 1991)

common near MLW

found on sand, mud, muddy sand flats near low tide in bays, sloughs, estuaries

+0.2 to -0.5 m MTL (after Wolotira et al., 1989)

not found above MSL in SD Bay (Merino 1981)

(Macdonald, 1969)

tidal creeks, usual <MLHW

Leukoma (formally Protothaca) staminea (Pacific littleneck clam)

(Chew and Ma, 1987)

-1 to +1.3 m MLLW

slightly higher elevation than butter clams (Nickerson 1977)

-0.9 to +1.2 m, up to 18 m depth (Washington state)

lower 3/4s intertidal to subtidal (British Colombia)

~ 0 m tidal level (Alaska)

(Dethier, 2006)

low to mid intertidal

concentrated at MLLW

(Emmett et al., 1991)

coarse, sandy-rocky muds of bays, sloughs, estuaries

intertidal to 37 m depth

normally -1 to 1.3 m MLLW (after Chew and Ma 1987)

most abundant in the low intertidal to 0.4 m MLLW

(Hiebert et al., 2015)

coarse sand, gravel with mud, seldom clean sand

below half tide to lowest tide line (Puget Sound), also subtidally
lower intertidal

(Macdonald, 1969)

tidal creeks, usually < MLHW

(Crooks, 2001)

subtidal and tidal creeks (Mission Bay, San Diego)

(Warme, 1971)

most abundant in the subtidal zone, but occurs in decreasing numbers with elevation in the lower half of the barren zone where there is submergence twice daily (<MLW) (Mugu Lagoon)

Macoma nasuta (Bent-nosed clam)

(Hiebert et al., 2015)

bays and offshore, small lagoons, eelgrass beds

most common in bays at low tide in California

(Macdonald, 1969)

tidal creeks, usually < MLHW

(Crooks, 2001)

tidal creeks (Mission Bay)

(Warme, 1971)

most abundant in the subtidal zone, but occurs in decreasing numbers with elevation in the lower half of the barren zone where there is submergence twice daily (<MLW) (Mugu Lagoon)

***Cryptomya californica* (California softshell)**

(Hiebert et al., 2015)

bays, sand and sandy mud

upper to mid intertidal to 20 feet below MSL

(Macdonald, 1969)

tidal creeks, usually < MLHW

(Crooks et al., 2001)

subtidal and creeks (Mission Bay, San Diego)

***Chione undulata* (wavy cockle)**

(MacDonald, 1969)

tidal creeks, usually < MLHW

(Crooks et al., 2001)

subtidal and creeks (Mission Bay, San Diego)

(Warne, 1971)

most abundant in the subtidal zone, but occurs in decreasing numbers with elevation in the lower half of the barren zone where there is submergence twice daily (<MLW) (Mugu Lagoon)

***Leptopecten latiauratus* (Kelp scallop)**

(Morton, 1994)

just below low tide to 229 m (Grau, 1959)

Ostrea lurida (US West coast Olympia Oyster)

(Tronske et al., 2018)

max density at +0.2 m MLLW (~ MLW in Newport and San Diego Bays)

subtidal to 1 m relative to MLLW (~ MSL)

(Trimble et al., 2009)

survive best at subtidal elevations (<MLLW) (Willapa Bay, WA)

(Dethier, 2006 (Couch et al., 1989))

0-10 m depth

low intertidal and subtidal

primarily subtidal

Ostrea gigas (Pacific oyster)

(Tronske et al., 2018)

max density +0.4 m MLLW (~MLW in Newport and San Diego Bays)

range: +0.2 to 1.2 m MLLW (~ MLW to MSL)

(Emmett et al., 1991)

bays and estuaries in lower intertidal areas to depths of 7 m < MLLW

Saxidomus nuttalli

(Hiebert et al., 2015)

bays and estuaries

Cerithidea californica (California hornsnail)

(Sousa, 1983)

1.2 to 2.1 m above MLLW

Salicornia marshes and high intertidal mudflats and creeks

(MacDonald, 1969)

marsh surface and tidal creeks

usually between MLHW and MHHW

Marsh platforms

(MacDonald, 1969)

~MLHW to MHHW: low marsh

MHHW to EHW: high marsh

(Thorne et al., 2018)

MHHW +/- 0.5 m

Mugu Lagoon: -0.47 to 0.39 m to MHHW (~ MSL to > MHHW)

(Steven et al., 2007)

most marsh 1.4 to 2 m elevation

Salicornia ~ MLW to > MHHW

Tidal creeks

(MacDonald, 1969)

dissect marsh surface

usually < MLHW

(Onuf, 1987)

Mugu lagoon: up to 1 m deeper than marsh surface

subtidal in lower reaches; smaller creeks are intertidal

(Zedler et al., 1999)

lacking in high marsh (1.1-1.27 m above reference datum), abundant in plain (0.9-1.2 m MLLW)
(Baja)

(Sadro et al., 2007)

tidal channels range from 0.9 m deep to -0.5 m near mouth (MSL to subtidal)

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