

HIGHER THAN PRESENT GLOBAL MEAN SEA LEVEL RECORDED BY AN EARLY PLIOCENE INTERTIDAL UNIT IN PATAGONIA (ARGENTINA) - SUPPLEMENTARY INFORMATION -

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1 SUPPLEMENTARY NOTE 1: PALEO RELATIVE SEA LEVEL 2 INDICATORS IN PATAGONIA

marine/beach deposits were recognized from present-day coast-
line inland.

Holocene. Holocene sea level indicators at Camarones mark the maximum sea level transgression and a sequence of regressive beach ridges. Bini et al. (2018)²² reported precisely measured Holocene RSL proxies dated with ¹⁴C, indicating that, between ca. 5300 and 7000 cal. yr BP, RSL was 2 to 4 m above present sea level (elevations referred to the EGM2008 Geoid).

Marine Isotopic Stage 5e. The Last Interglacial is also preserved in the form of relic beach ridges in the Camarones area. These were investigated and dated by different authors throughout the years^{9,12,10,23} (Supplementary Table 1). A recent study by Pappalardo et al. (2015)⁹ provides more precise measurements, interpretations and additional dating of the MIS 5e beach ridge complex at Camarones. According to these authors⁹, the beach ridges at Camarones indicate a MIS 5e paleo RSL at 7.5 ± 2/-3.5m above present.

Marine Isotopic Stage 11. At one site south of Camarones town, articulated shells from (Sample Pa 35) was dated by Schellmann and Radtke (2000)¹² as MIS 9 or older. U-series mollusk ages by Pappalardo et al. (2015)⁹ confirm the attribution to MIS 11. We measured the deposits dated by these authors at 16.7 ± 0.4m above present sea level.

SUPPLEMENTARY NOTE 2: DETAILED DESCRIPTION OF Roadcut AND Caprock UNITS AT CAMARONES

The Roadcut section (Supplementary Figure 1) is characterized by the bedrock (*Formación Río Chico*) outcropping from the road level up to ca.12m above it. The topmost part of the bedrock is exposed for a maximum thickness of 1.2m in the western part of the outcrop and it is shaped as a flat, gently eastward (i.e. seaward) dipping platform. All the overlying units are separated from it by a sharp erosional unconformity. Less than 1 km south of the Roadcut, another outcrop shows the same geological context. We refer to this as the Caprock outcrop

The study of paleo shorelines in Patagonia dates back to Charles Darwin, who was the first to provide an account of the coastal stratigraphy in the region¹. Nearly a century later, the Italian geologist Feruglio reported the first full account of marine terraces along the Patagonian coast (Chubut and Santa Cruz Provinces)², that he grouped into six systems. The two uppermost systems were attributed to the late Pliocene–early Pleistocene³ based on biostratigraphic features and their high elevation (40–50 and 80–95 m asl). Several studies detailed the stratigraphy, elevation and age of Holocene^{4,5}, Pleistocene^{6,7,8,9,10,11,12} and Pliocene–to–Miocene^{13,14} marine and coastal deposits. The Tertiary marine sediments were assigned to Miocene and Pliocene periods mostly on the basis of biostratigraphy. Several authors worked to characterize the Marine Miocene of Patagonia^{15,16,17} and the Mio–Pliocene¹⁸. Concerning the Early Pliocene, a marine deposit in Northern Patagonia (Rio Negro Province) yielded a fission track age of 4.41 Ma¹⁹, but this age was later considered inconsistent with biostratigraphic characteristics of the deposits and thus rejected²⁰. Del Río et al. (2013)¹⁴ dated samples of mollusks from marine deposits in Central and Southern Patagonia, few hundreds kilometers south of our study area. The marine deposits of Cerro Laciár (300 km south of the area investigated in this study, 170–185m above MSL) yielded ages of 5.10 ± 0.21 Ma, and those of Cañadon Darwin (540 km south of the area investigated by this study, 65–75m above MSL) yielded ages of 5.15 ± 0.18 Ma. These two data points represent the first geochemically constrained evidence of a (Early) Pliocene transgression in the area.

In the coastal area around the Camarones town, the main lithostratigraphic units are a Jurassic volcanic complex (*Complejo Marifil*), and Upper Paleocene sedimentary rocks (*Formación Río Chico*)²¹. According to published geological maps²¹, the volcanic complex is composed by reddish rhyolites, leucorhyolites and ignimbrites, whereas the Río Chico formation is made of mudstones, sandstones and conglomerates, often volcanoclastic. Along the same coastal section, fossil beach ridges and

Supplementary Table 1: Ages of beach ridges associated to MIS 5e in the Camarones area.

Location	Author	Sample	Subsample	Age (ka)	Age uncertainty (ka)	Dating technique
Camarones North IV	Schellmann (1998) ²³	Pa 30	D2412A	117	21	ESR
			D2635	123	22	ESR
			K2412B	139	8	ESR
		Pa 47c	D2550	92	9	ESR
			D2549	99	12	ESR
Camarones North I	Schellmann (1998) ²³	Pa 47a	D2665	115	9	ESR
			D2547	117	13	ESR
			D2546	133	15	ESR
			D2545	137	18	ESR
			D2548	144	19	ESR
Camarones 12km South	Rostami et al., 2000 ¹⁰	3	3-0/1	117	5	U-Series
			3-0/2	115	9	U-Series
			3-0/2	110	8	ESR
			3-0/3	112	13	U-Series
			3-0/3	114	9	ESR
Various sites North and south of Camarones	Pappalardo et al., 2015 ⁹	WP64A(3)	N/A	121	0.9	U-Series
		WP65(1)	N/A	130	2.5	U-Series
		WP68(1)	N/A	131	1.1	U-Series
		WP70(B)	N/A	127	1.2	U-Series

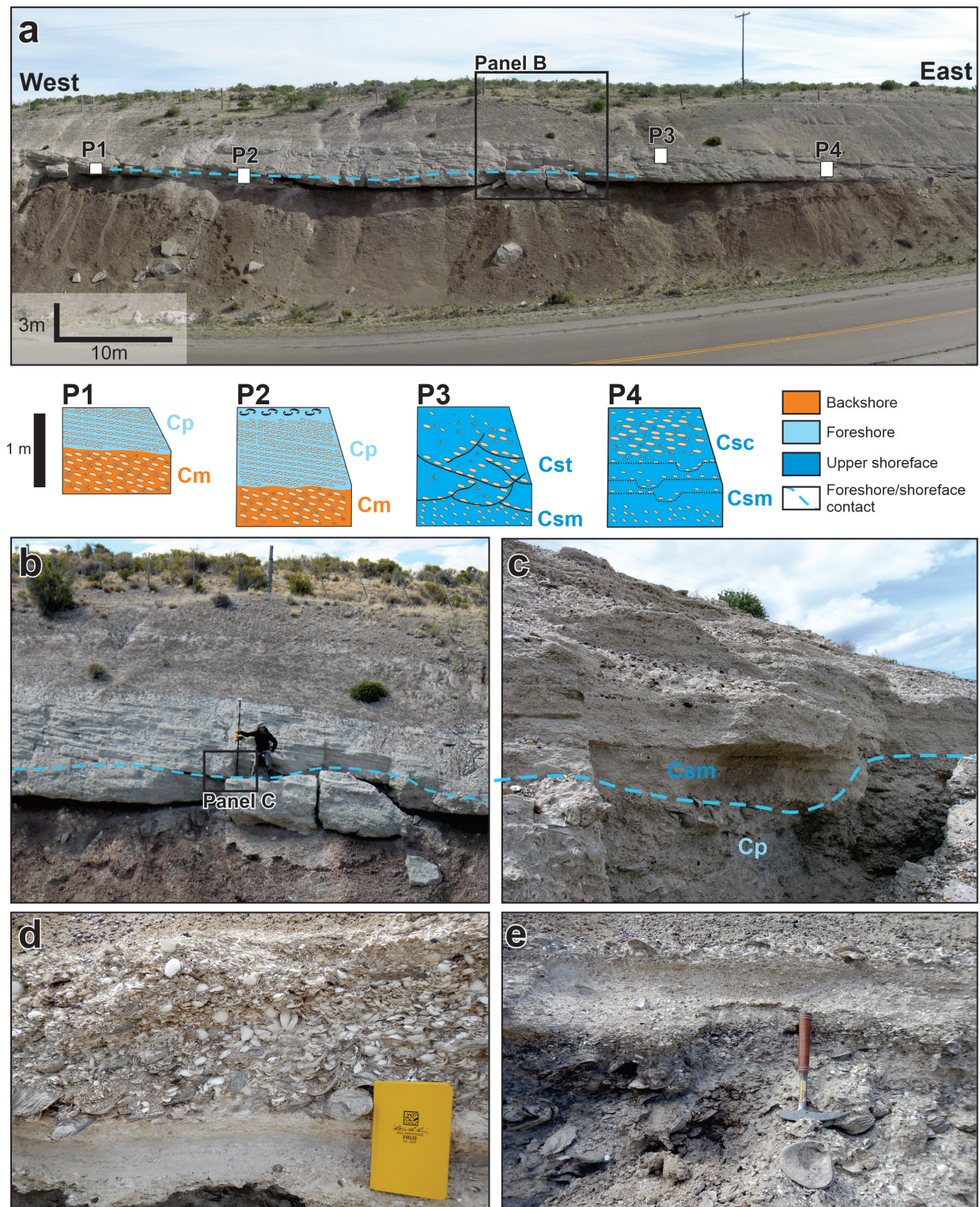
(Supplementary Figure 2). This rests on a relative topographic high of the bedrock, which at this location is represented by the volcanic rocks pertaining to the *Complejo Marifil*, capped by a thin sedimentary unit, as thick as 1m maximum, identical to the upper part of the Cp Unit observed in the *Roadcut* section. Each overlying unit is described separately hereafter.

Unit Cm. In the western part of the section on top of the bedrock rests a basal unit (Cm). This is represented by a massive, clast-supported conglomerate with coarse rounded pebbles of different rock types. Pebbles have an imbricated, seaward dipping bedding. Faunal content is absent.

Unit Cp. Eastward, a finer unit (Cp) overlaps the previous one and, towards the East, unconformably rests on the bedrock. Unit Cp is composed of well-cemented fine conglomerates with rounded pebbles, mostly unbroken shells and abundant sandy matrix, displaying a low-angle planar cross-stratification. The uppermost part of Cp contains a dense faunal assemblage in the form of a shellbed, with different shell types (Supplementary Table 2) mostly intact and sometimes with paired valves (articulated), but not in living position. Only the fragmentation of Pectinids is relevant, which is expected even with minimal transport as they have a fragile shell structure. The shells in Unit Cp are characterized by different stages of preservation, depending mostly on the shell type. Big oysters (*Crassostrea* sp.), up to 15 cm in size, are frequent, mostly oriented concordant with strata dip and strike. They underwent partial dissolution, especially of their outer part, which explains the high degree of cementation of this unit. The faunal assemblage of Unit Cp is analogous to that of the Pleistocene terraces towards the coast, with notable exceptions. The absence of *Tegula atra* (cold gastropod species), together with the occurrence of bivalves of warm/warm-temperate affinity (*C. patagonica*, *D. patagonica*, *F. vilardebona*, *M. cf. isabelleana*), is the main difference relative to the Pleistocene deposits. Cp has a maximum thickness of 1m in the western part of the outcrop (stratigraphic column B, Supplementary Figure 1B).

Unit Cs. East of this point, the Cp unit becomes progressively thinner, and is overlapped by a finer unit (Cs) of matrix-supported sandy conglomerates. The contact between Cp and Cs is planar and displays a lateral continuity up to the midpoint of the section, East of which Cs lays directly on the bedrock. The basal part of Cs is massive (Csm) with no sedimentary structures, whereas its uppermost part, separated from Csm by a gradational contact, displays trough cross-stratification (Cst) and, more eastward, longitudinal channels (Csc).

Overall, this section represents the product of sedimentation due to a transgressive event on top of a marine platform carved in the volcanic bedrock. The sequence is fining (and thus deepening) upward. The similarities of the basal unit (Cm) with modern storm berms in the area suggest that it was formed in a backshore environment. We interpret Unit Cp as the product of sedimentation in a foreshore environment. The bedding of marine shells within this unit testifies that they have been reworked within the surf zone where sediments from upper offshore and shoreface are floated towards the beachface and from there are driven back by rip currents, producing an isorientation of single shells parallel to the current direction. The topmost Units (Csm, Cst and Csc) can be interpreted as mainly developed in middle to upper shoreface. The sedimentary structures within these units can be interpreted as the product of longitudinal currents caused by coastal drift.



Supplementary Figure 1: **a)** General view of the *Roadcut* section. Below the photo, four stratigraphic profiles (P1-P4) detailing the relationships between the main sedimentary facies. **Cm**: Conglomerate, massive; **Cp**: Conglomerate with low angle planar cross-stratification; **Csm**: Sandy conglomerate, massive; **Cst**: Sandy conglomerate with trough cross-stratification; **Csc**: Sandy conglomerate with longitudinal channels. **b)** Location where the elevation of unit **Cp** has been measured (the points listed in the main paper are located near the person standing on the outcrop). **c)** Detail of the contact between **Cp** (foreshore) and **Csm** (upper foreshore). **d)** and **e)** Details of the bivalve-rich horizon sampled for Sr isotopes dating.

Supplementary Table 2: Faunal assemblage in the marine deposits outcropping at the *Roadcut* section at Camarones. Most of the species recognized by Feruglio^{3;2} and assigned to the highest terrace system (that was tentatively dated to Pliocene) were detected in the Cp Unit of the *Roadcut* section (This work). Nomenclature of the taxa has been updated as some generic or specific names do not agree with those used by Feruglio. * indicates species with warm/warm-temperate affinity.

BIVALVIA	Feruglio ^{3;2}	This work
<i>Aulacomya atra</i> (Molina, 1782)	X	X
<i>Aequipecten tehuelchus</i> (d'Orbigny, 1842)	X	
<i>Zygochlamys patagonica</i> (King, 1832)	X	X
<i>Pectinidae</i> indet.		X
<i>Ostrea equestris</i> Say, 1834		X
<i>Ostrea puelchana</i> d'Orbigny, 1842	X	
<i>Ostrea tehuelcha</i> Feruglio	X	X
<i>Ostrea cf. tehuelcha</i> Feruglio		X
<i>Ostrea sp</i>		X
<i>Ostrea tehuelcha</i> d'Orbigny*		X
<i>Diplodonta patagonica</i> (d'Orbigny, 1842)*		X
<i>Felaniella vilardeboana</i> (d'Orbigny, 1846)*	X	
<i>Diplodonta sp</i>	X	
<i>Abra sp</i>		X
<i>Mactra cf. isabellena</i> d'Orbigny, 1846*	X	X
<i>Mactra cf. patagonica</i> d'Orbigny		X
<i>Eurhomalea exalbida</i> (Dilwyn, 1817)		
<i>Ameghinomya antiqua</i> (King, 1832)		X
<i>Pitar rostratus</i> (Philippi, 1844)	X	X
<i>Corbula patagonica</i> d'Orbigny 1845	X	X
GASTROPODA		
<i>Epitonium georgettinum</i> (Kiener, 1838)	X	X
<i>Trophon varians</i> (d'Orbigny, 1841)	X	X
<i>Trophon geversianus</i> (Pallas, 1774)	X	X
<i>Trophon laciniatus</i> (Martin)	X	X
<i>Adelomelon ancilla</i> (Lightfoot, 1786)	X	X
<i>Adelomelon ferussaci</i> (Donovan, 1824)		
<i>Adelomelon sp</i>		X
<i>Odontocymbiola magellanica</i> (Gmelin, 1791)	X	X
<i>Olivancillaria auricularia</i> (Lamarck, 1811)	X	X
<i>Olivancillaria cf. carcellesi</i> Klappenbach, 1965		
<i>Buccinanops deformis</i> (P.P. King, 1832)	X	X
<i>Buccinanops cochlidium</i> (Dilwyn, 1817)	X	
<i>Buccinanops sp</i>	X	X
<i>Siphonaria lessonii</i> Blainville, 1827		
<i>Volutidae</i> indet.	X	X

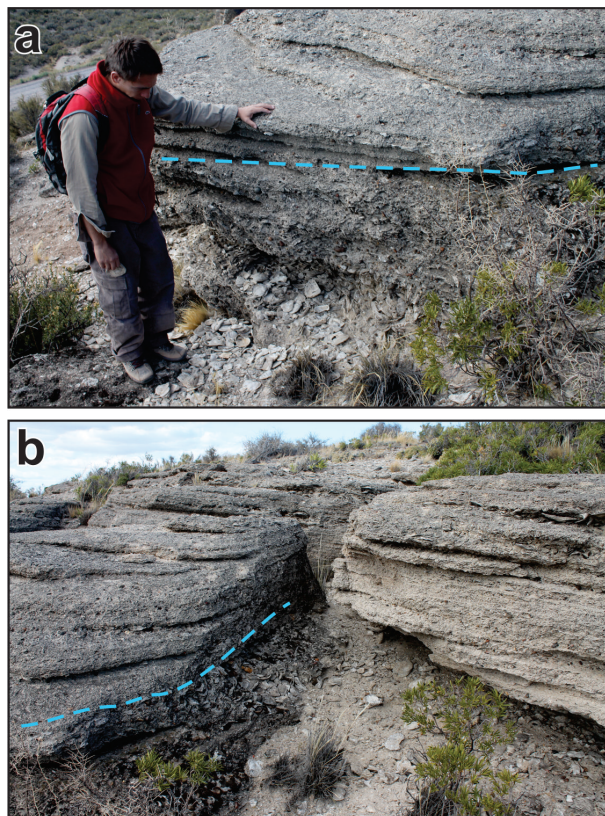
SUPPLEMENTARY NOTE 3: SIS AGE DETAILS.

Details on samples and SIS analyses performed are shown hereafter, in Supplementary Figures 3 to 7. Full SIS age results are reported in Supplementary Table 4.

Initial field selection criteria involved visual assessment based on shell thickness, coloration, and diagnostic features of preservation, including microborings, Fe and Mg staining, fragmentation of original layers, and irregularities in structure^{14;24;25} (Supplementary Figure 4). In the laboratory, samples were slabbed, polished and imaged using an optical microscope with CCD camera for further inspection. and an ASPEX Express scanning electron microscope (SEM). This preliminary screening method helps identify locations of alteration that can be correlated with the ⁸⁷Sr/⁸⁶Sr leach variations and establishes the overall integrity

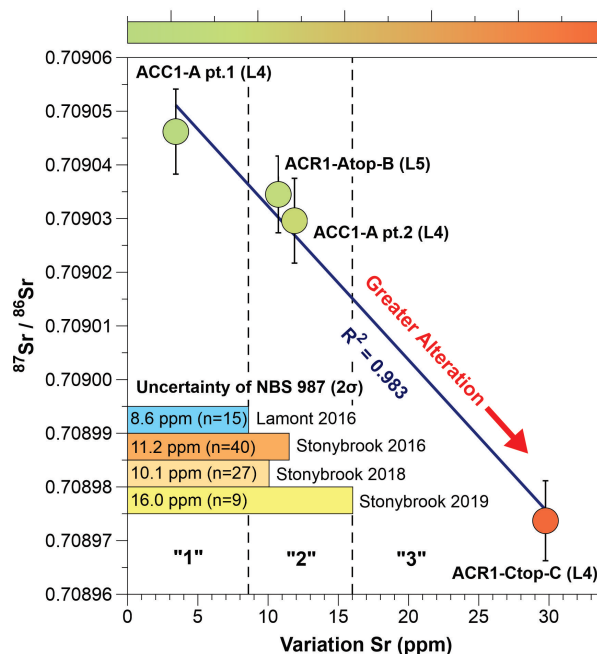
of preservation in each shell. A preservation scoring system was established as outlined in Hearty et al. (2020)²⁶, with optical and SEM images assigned scores from "1" (no visible alteration) to "3" (significant alteration observable) based on screening criteria above (Supplementary Table 3).

Shells were micro sampled in the best-preserved regions, primarily through physical micro-drilling using a handheld drill and the subsequent powder was homogenized by hand (except in the case ACC1-A pt.2, where the shell was carefully fragmented to sand-sized grains and the Sr split was picked under a microscope). Minor and trace elements were measured for three samples on a Thermo iCap Q quadrupole ICP-MS at LDEO. Samples were prepared and analyzed following methods similar to Yu et al²⁷. Briefly, ca.250 µg of powder was diluted to 75 ppm



Supplementary Figure 2: **a)** and **b)** Contact between the unit Cp (lower) and Cs (higher) at the Caprock site.

along with the full dissolution splits (Supplementary Table 4 and Supplementary Figure 5). Sr was isolated and dried down using typical separation techniques with Eichon exchange resin. Following separation, 1% of Sr was removed and measured on a mass spectrometer to determine concentration. A drop of 0.05 N Phosphoric acid was added and between 150-375 ng of Sr (for each measurement) was loaded onto degassed Rhenium filaments using tantalum chloride loader.



Supplementary Figure 3: Variation of $^{87}\text{Sr}/^{86}\text{Sr}$ within a leach set (as ppm) vs. the inner leach $^{87}\text{Sr}/^{86}\text{Sr}$ of that shell. Sr leach variation scores are shown by dashed black line; these scores are based on the range of ppm error from seasonal long-term averages of the standard NBS 987. Green circles have low variation within leach sets (usually better preservation) and display younger SIS ages than shell ACR1-Ctop-C (red point) with high variation. This sample is excluded from the average shoreline SIS age based on high Sr variation and other screening criteria (Supplementary Table 3). Long-term uncertainty of standard NBS987 for each year/lab plotted on lower left as ppm variation.

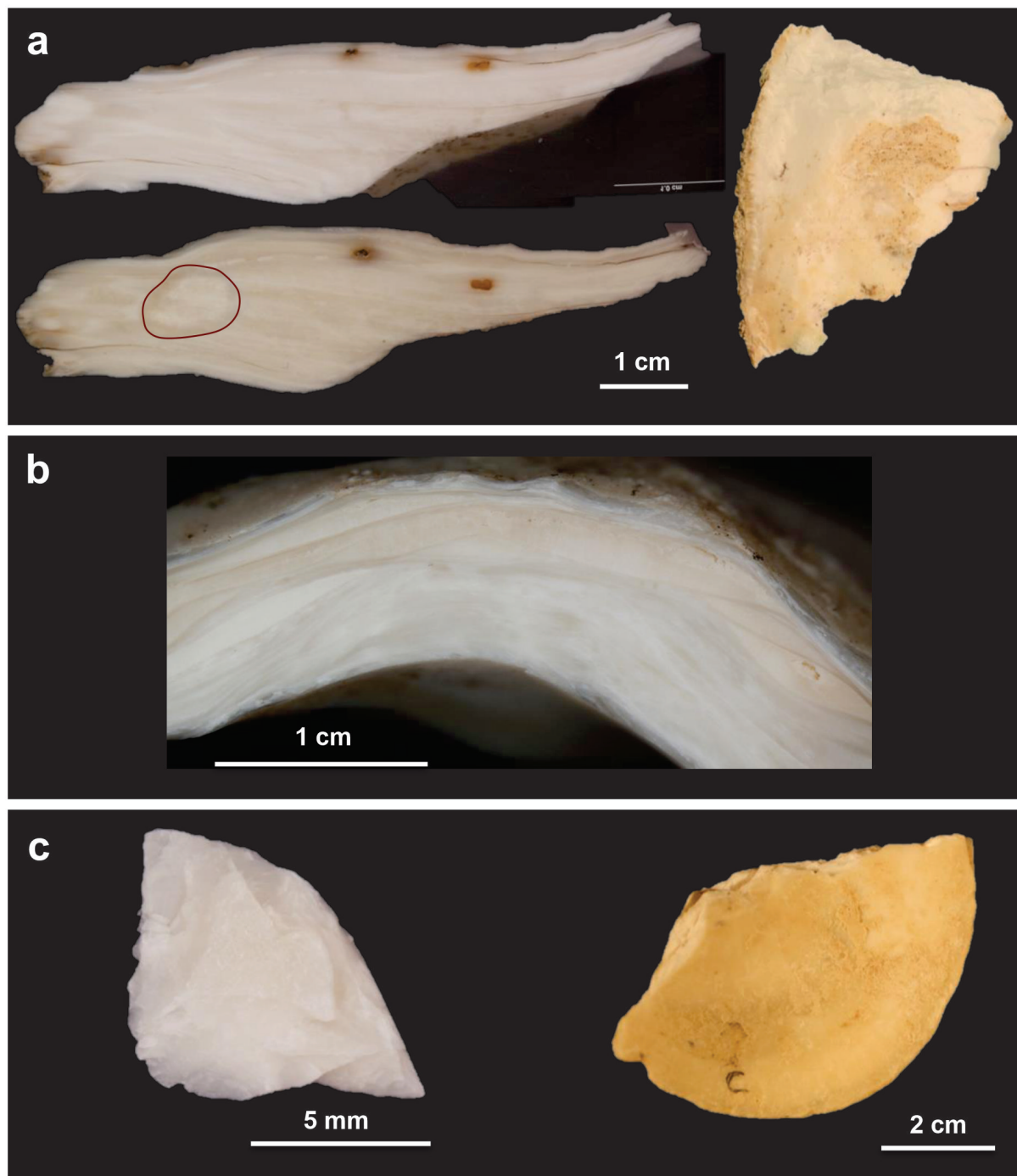
$^{87}\text{Sr}/^{86}\text{Sr}$ ratios were measured on either an IsotopX Phoenix62 Thermal Ionization Mass Spectrometer (TIMS) at Stonybrook University, or a Finnigan Triton Plus TIMS at Lamont-Doherty Earth Observatory (LDEO). Measurements at Stonybrook were conducted in a very similar manner to Gothmann et al²⁹, with a dynamic routine measuring masses 84, 85, 86, 87, and 88 over 160 cycles for each sample. Filaments were slowly ramped up to 2.8 - 3.2 A and a temperature of ca. 1400 degrees Celsius, to achieve a beam intensity between 3-5 V on mass 88. TIMS measurements at LDEO were carried out using a static routine for 200-400 cycles with similar parameters to Stonybrook. The Sr isotope external standard NBS SRM 987 long-term instrument accuracy at the two labs was computed every season and ranged between 8.6 - 16 ppm (2σ) (Supplementary Figure 3). At Stonybrook: NBS 987 = 0.710245 ± 0.000008 (2σ ; 2016, n = 40); 0.709241 ± 0.000007 (2σ ; 2018, n = 27), and

Ca (to negate matrix effects), and run alongside calibration standards covering the range of elements concentrations. The results were normalized to the in-house reference standards QC-Calcite and planktonic standard V03, the latter of which has long-term ($n = 86$) 2σ errors of: Sr/Ca = 1.4%, Mg/Ca = 1.3%, U/Ca = 3.0%, Ba/Ca = 1.8%, Mn/Ca = 1.2%, Al/Ca = 15.8%, Fe/Ca = 2.1% and Na/Ca = 1.3%. A Holocene bivalve (*Tridactna gigas* standard JCT-1) was run alongside the samples for comparison. An elemental scoring system was established for Mg, Mn, and Fe (Supplementary Table 3), elements thought to be indicative of diagenesis^{28;29;26}. Scores ranged from "1" (unaltered) to "3" (altered) based on comparison to a set of Holocene corals and bivalves (for a better overview of screening methods, see Sandstrom et al. (2020)³⁰). Sample splits were taken for Sr isotope analysis (ca. 50 mg for leach fraction, and ca. 10 mg for full dissolution).

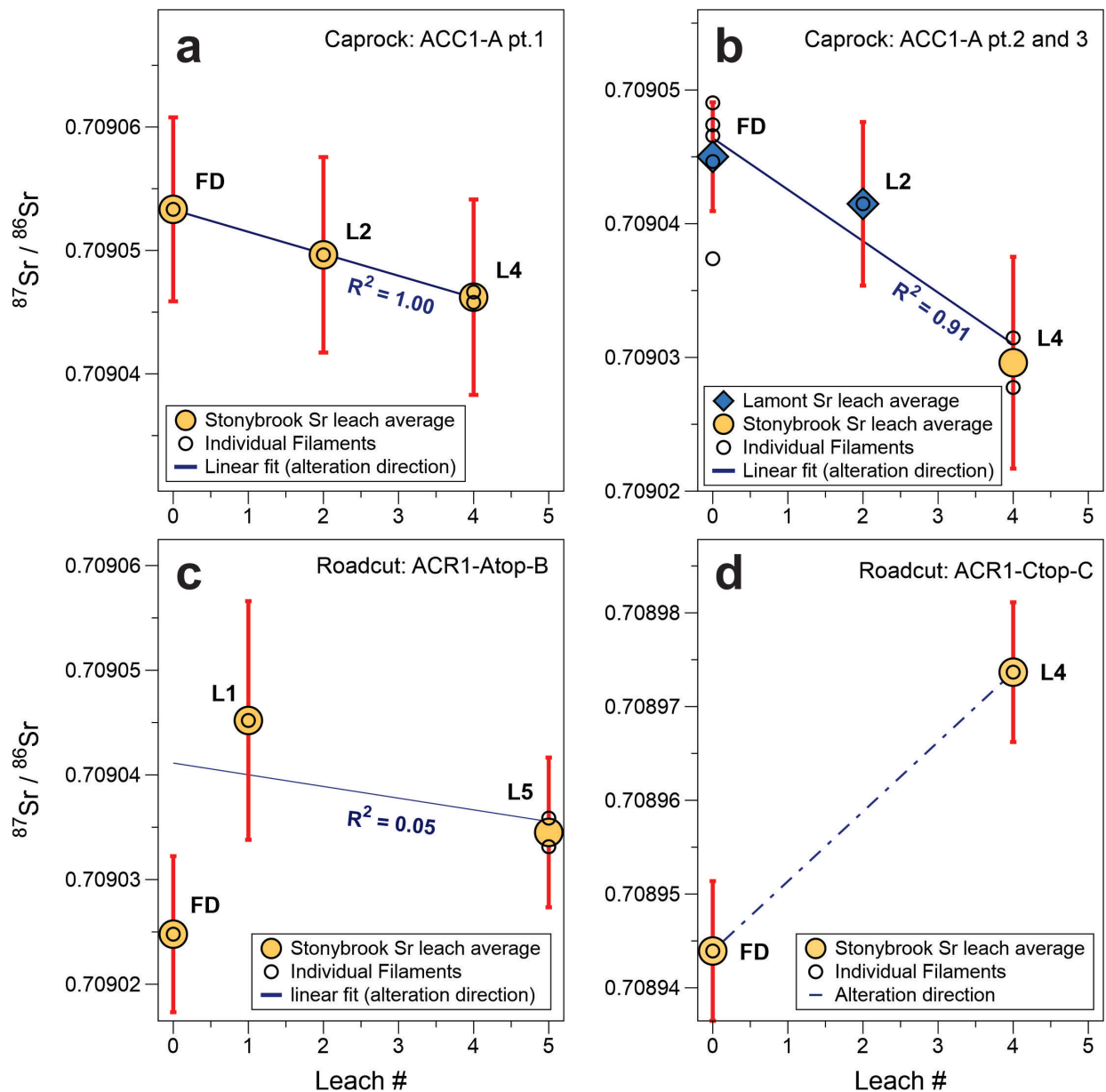
Leaching procedures are modified from Bailey et al³¹ (see Hearty et al., 2020²⁶), and involve weak (ca. 0.1M) Acetic acid leaches on the powdered/fragmented shell, designed to preferentially dissolve the more loosely bound secondary $^{87}\text{Sr}/^{86}\text{Sr}$ material before attacking the primary Sr. Typically, four to five leaches were performed per sample, each dissolving ca. 8-12 mg of carbonate (representing 16-25% of the total sample by weight). An additional split (10mg) for each sample was also fully dissolved, as an indication of the average bulk $^{87}\text{Sr}/^{86}\text{Sr}$. Typically, this resulted in 1400-4200 ng of Sr per leach. Only the initial (L1) and inner leaches (defined here as the dissolved 50-80% portions of each sample [i.e. L4 and L5]) were measured,

0.710244 ± 0.000011 (2σ; 2019, n = 9) and at LDEO: NBS 987
= 0.710238 ± 0.000006 (2σ; 2016, n = 15). Sr isotopes were all
corrected for mass fractionation based on an $^{86}\text{Sr}/^{88}\text{Sr}$ ratio of
0.1194 and normalized to the accepted NBS 987 standard value
= 0.709248. Sr isotope stratigraphy ages were calculated using
the LOWESS version 5 curve from McArthur et al.²⁸.

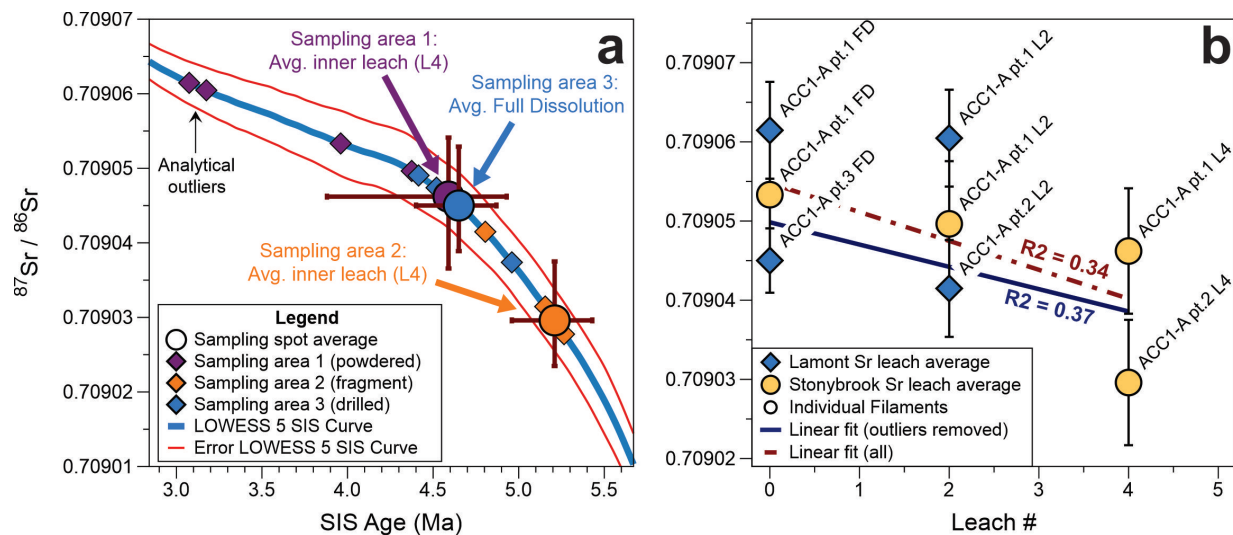
Sr isotope variations were calculated as ppm within leach sets (as
the total range of $^{87}\text{Sr}/^{86}\text{Sr}$ values within a leach set, multiplied
by a million to read as ppm) for each sample (Supplementary
Table 3). A scoring system from "1" to "3" was established based
on long-term uncertainties of NBS 987, where samples with Sr
isotope variations < 8.6 ppm = 1, between 8.6-16 ppm = 2, and >
16 ppm = 3 (see Supplementary Figure 3, Supplementary Table
3 and Sandstrom et al., 2020³⁰).



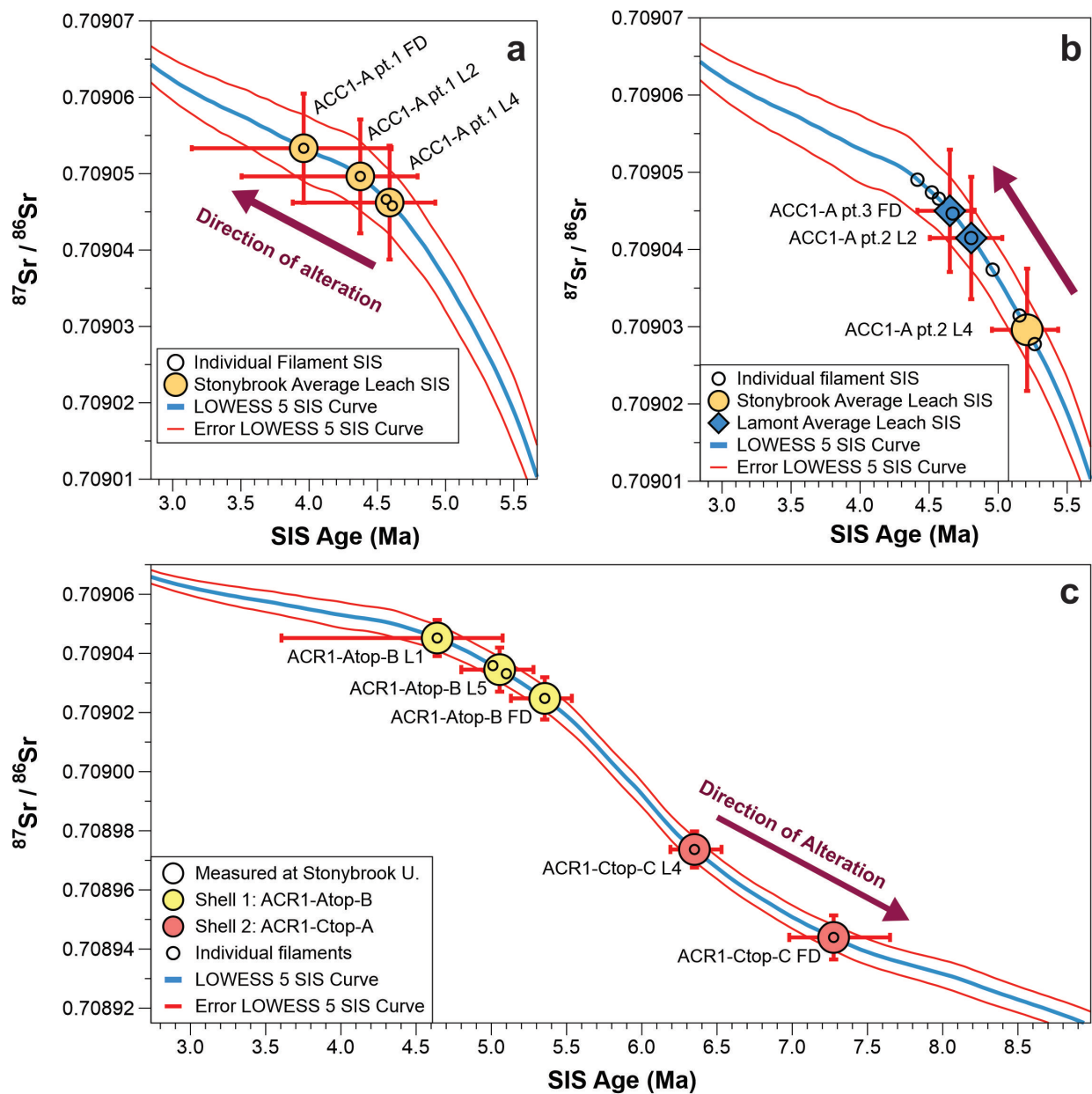
Supplementary Figure 4: Sample images. **a)** Oyster shell ACC1-A, showing slabbed x-section (top left), part 3 drill location (bottom left), and original shell fragment (right). **b)** Sample ACR1-Atop-B slabbed x-section. **c)** Shell ACR1-Ctop-C showing fragment used in Sr isotope dating (left) and partial shell collected from the field (right).



Supplementary Figure 5: Sr isotope leach set data for individual sample areas. Red error bars represent 2σ external uncertainty of NBS987 (except for full dissolution ACC1-A pt.3 FD, which is 2σ standard error of the mean). Linear regression lines (blue) indicate direction of alteration, with altering fluids causing the *Caprock* oyster (**a** and **b**) to appear slightly younger (more radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$), and the *Roadcut* samples (**c** and **d**) to appear older (alteration fluid with low $^{87}\text{Sr}/^{86}\text{Sr}$). **a** and **b**) Leach set data for sample ACC1-A parts 1 and 2 showing less radioactive $^{87}\text{Sr}/^{86}\text{Sr}$ (increased SIS age) with better preservation (L4). **c**) The inner leach lies between the initial leach and full dissolution, overlapping both within uncertainty. The leach set suggests alteration fluids cause ages to appear younger, while the full dissolution indicates the opposite. However, based upon the excellent preservation index score, the inner leach (L5) most likely reflects the original Sr isotopic ratio. **d**) The trend of significantly increasing $^{87}\text{Sr}/^{86}\text{Sr}$ of the inner leach compared to the full dissolution indicates post-depositional alteration in this sample.



Supplementary Figure 6: **a)** Oyster shell ACC1-A (*Caprock*) detailed Sr isotopes and SIS age assignments from three different sampling locations. **b)** Leach Sr values and different TIMS machines (yellow = stonybrook, blue = Lamont). Sample splits ACC-1A pt.1 FD and L2 measured at LDEO appear to be outliers for reasons unknown [possibly turret related? as this was the first turret run?]. Repeated measurements on these same splits at SBU yielded more reliable $^{87}\text{Sr}/^{86}\text{Sr}$ values that more closely align with other measurements from different sections of this shell, both at SBU and LDEO. Linear regression was computed for all leach averages (red) and also excluding the two outliers (blue) with similar results. There is a slight trend toward less radiogenic values for the better preserved inner leach measurements.



Supplementary Figure 7: Same data as Supplementary Figure 5. Sr isotope leach set data for individual sample areas, plotted against Lowess5 SIS curve. Red error bars represent 2σ external uncertainty of NBS987 (except for full dissolution ACC1-A pt.3 FD, which is 2σ standard error of the mean). Purple arrows indicate direction of alteration, with altering fluids causing the *Caprock* oyster (panels a and b) to appear younger (more radioactive $^{87}\text{Sr}/^{86}\text{Sr}$), and the *Roadcut* samples (panel c) to appear older (in the case of ACR1-Ctop-C), and possibly younger in the case of ACR1-Atop-A, but no distinct trend can be assigned.

Supplementary Table 3: Elemental and diagenetic screening results of oyster samples. BDL = below detection limit. n.a. = not measured. ^a JCt-1 is the Holocene Tridactna standard³². ^b Samples used in elemental score average. ^c Full dissolution used for variation calculation, as L1 was not measured. ^d Scoring criteria outlined in Sandstrom et al. (2020)³⁰. ^e See Supp. methods and Hearty et al. (2020)²⁶. ^f Leach variation scores: "1" = <8.6ppm; "2" = 8.6 to 16 ppm; "3" = >16 ppm. ^g Samples with preservation index scores $\geq$ "2" are considered altered and excluded.

Sample code	ACC1-A pt.1	ACR1-Atop-B	ACR1-Ctop-C	JCt-1 ^a
SESAR IGSN ID	IEMRS006J	IEMRS006L	IEMRS006P	N/A
Description	Caprock - Oyster	Roadcut - Oyster	Roadcut - Oyster	Holocene Tridactna
Na/Ca (mmol/mol)	8.1	9.5	11.7	19.9
Mg/Ca (mmol/mol) ^b	2.9	3.3	4.9	1.2
Al/Ca (μ mol/mol)	4.6	BDL	20.4	17.2
Mn/Ca (μ mol/mol) ^b	78.8	16.2	1484.7	2.6
Fe/Ca (μ mol/mol) ^b	1.7	BDL	144.5	BDL
Sr/Ca (mmol/mol)	0.58	0.85	1.50	1.84
Ba/Ca (μ mol/mol)	2.2	2.2	5.9	1.6
U/Ca (nmol/mol)	89.2	107.5	155.2	33.3
number of splits	1	2	1	3
⁸⁷ Sr/ ⁸⁶ Sr leach variation (ppm)	11.88	10.73	29.75 ^c	n.a.
Elemental score (1-3) ^d	1.67	1.67	2.33	1.00
SEM score (1-3) ^e	2	n.d.	2	n.a.
Optical score (1-3) ^e	2	1	2	1
⁸⁷ Sr/ ⁸⁷ Sr variation score (1-3) ^f	2	2	3	n.a.
Preservation Index Score^g (average of all scores: 1-3)	1.92	1.56	2.33	1.00

Supplementary Table 4: $^{87}\text{Sr}/^{86}\text{Sr}$ results and Sr isotope stratigraphy ages for Caprock and Roadcut outcrops. ^a Inner leach Sr isotope values for sample; ^b Sample leaches excluded based on analytical or diagenetic criteria; ^c Sample excluded from shoreline age based on significant diagenesis (see Table S3); ^d Uncertainty based on $2\sigma\text{SEM}$; ^e Sample variation is calculated as the difference between the initial leach [or full dissolution] and last leach, multiplied by one million (ppm); ^f Average of inner leaches on samples that passed screening criteria: ACC1-A pts. 1 and 2, and ACR1-Atop-B; ^g Uncertainty based on combined analytical [$2\sigma\text{SEM}$] and SIS curve [LOWESS 5] errors.

Sample Name	TIMS Lab	Leach ID	Nb. filaments	$^{87}\text{Sr}/^{86}\text{Sr}$ (measured)	$^{87}\text{Sr}/^{86}\text{Sr}$ (normalized to NBS97)	2σ external uncertainty	Mean SIS Age (Ma)	Maximum SIS Age (Ma)	Minimum SIS Age (Ma)	Uncorrected SIS Age (Ma)
Average $^{87}\text{Sr}/^{86}\text{Sr}$ by Leach										
Caprock										
ACC1-A pt.1 FD	SBU	FD	1	0.7090465	0.7090533	0.0000075	3.960	4.605	3.140	4.58
ACC1-A pt.1 L2	SBU	L2	1	0.7090462	0.7090496	0.0000079	4.375	4.795	3.505	4.59
ACC1-A pt.1 L4 ^a	SBU	L4	2	0.7090427	0.7090462	0.0000079	4.590	4.925	3.880	4.76
ACC1-A pt.1 FD ^b	LDEO	FD	1	0.7090509	0.7090615	0.0000061	3.075	3.745	2.635	4.27
ACC1-A pt.1 L2 ^b	LDEO	L2	1	0.7090499	0.7090605	0.0000061	3.175	3.855	2.695	4.36
ACC1-A pt.2 L2	LDEO	L2	1	0.7090309	0.7090415	0.0000061	4.805	5.030	4.505	5.17
ACC1-A pt.2 L4 ^a	SBU	L4	2	0.7090261	0.7090296	0.0000079	5.210	5.435	4.955	5.32
ACC1-A pt.3 FD	LDEO	FD	5	0.7090345	0.7090344	0.0000041 ^d	4.650	4.415	4.830	5.055
Roadcut										
ACR1-Atop-B FD	SBU	FD	1	0.7090180	0.7090248	0.0000075	5.355	5.535	5.130	5.52
ACR1-Atop-B L1	SBU	L1	1	0.7090409	0.7090452	0.0000114	4.640	5.075	3.605	4.83
ACR1-Atop-B L5 ^a	SBU	L5	2	0.7090279	0.7090345	0.0000072	5.055	5.280	4.800	5.27
ACR1-Ctop-C FD	SBU	FD	1	0.7089371	0.7089439	0.0000075	7.275	7.650	6.980	7.62
ACR1-Ctop-C L4 ^{a,c}	SBU	L4	1	0.7089668	0.7089737	0.0000075	6.350	6.530	6.190	6.52
Average Shoreline SIS Age										
Average of screened inner leaches ^f	SBU	L4, L5	6	0.7090322	0.7090368	0.0000064 ^d	4.98	5.225 ^g	4.685 ^g	5.13

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