

## Supplemental Information

### Materials and Methods

**Strontium Isotope Analysis.** Fossils were cleaned in ultrapure water, followed by brief cleaning with 0.02N HCl and rinsed with ultrapure water. They were totally dissolved in quartz-distilled 2.5M HCl and the solution was centrifuged. Strontium was separated using conventional cation-exchange columns and loaded, as a nitrate, on tantalum filaments with TaF<sub>5</sub> as an activator. Isotope measurements were carried out using a ThermoFinnigan Triton T1 thermal ionization mass spectrometer at the Institute Instrumentation Centre, Indian Institute of Technology, Roorkee. <sup>87</sup>Sr/<sup>86</sup>Sr ratios were normalized to <sup>86</sup>Sr/<sup>88</sup>Sr = 0.1194. During the period of data collection, the value of measured NIST 987 strontium standard was higher by 0.000012 of the value of 0.710248, and all measured <sup>87</sup>Sr/<sup>86</sup>Sr ratios of samples were adjusted to this value. Total procedural blank was <2 ng for Sr. The corrected mean isotopic ratios were converted to a best-fit age using the LOWESS fit to the marine Sr curve (20, 41) (Table DR1).

**Carbon Isotope Analysis.** Fifty grams of sediment from each sampled layer (0 to 60 m: 0.5 m interval; 60 to 100 m: 1 m interval) was powdered, transferred to disposable glass centrifuge tubes, and then treated with ~5 ml of 10% HCl (~1.0 M HCl) for 24 hrs (42). Samples were centrifuged, rinsed (5x DI water), and freeze-dried. Total carbon content (TC) and total inorganic carbon content (TIC) were determined coulometrically and the total organic carbon content (TOC) was calculated as the difference between these two values. For samples with TIC > 0.01 wt%, the preceding acid rinse was repeated. Measured TOC was used to determine appropriate sample size for δ<sup>13</sup>C analysis. Samples were analyzed by combustion on a Costech 4010 Elemental Analyzer linked to a ThermoFinnigan Delta<sup>plus</sup> XP continuous flow isotope ratio mass spectrometer at the University of Wyoming Stable Isotope Facility (UWSIF). Analytical precision was ±0.1‰ for δ<sup>13</sup>C. Total carbon content (wt%) and δ<sup>13</sup>C values for sediments from each level are reported in Table DR2.

**Table DR1.** Strontium isotopic data for analyzed fossil taxa from the Cambay Shale, Vastan Lignite Mine, district Surat, Gujarat

Forms	Sample	Taxa	$^{87}\text{Sr}/^{86}\text{Sr} \pm 2 \text{ s.e.}$	Age (Ma) (Best fit)*
Mollusca (Bivalves)	F12b	Mollusca indet.1	$0.707744 \pm 35$	54.10
	25a	Mollusca indet.2	$0.707746 \pm 40$	54.25
	25d	Mollusca indet.2	$0.707733 \pm 50$	53.90
	25s	Mollusca indet.3	$0.707744 \pm 53$	54.10
	K12	Mollusca indet.3	$0.707744 \pm 45$	54.10
Foraminifers	E12a	<i>Nummulites globulus</i>	$0.707739 \pm 90$	53.75
	F1	<i>Nummulites globulus</i>	$0.707741 \pm 84$	53.90
	D12	<i>Nummulites globulus</i>	$0.707743 \pm 89$	54.04
	N6	<i>Nummulites globulus</i>	$0.707787 \pm 40$	57.56
Fish otoliths	O1a	Ambassidae	$0.707730 \pm 80$	53.07
	O1b	Apogonidae	$0.707735 \pm 80$	53.46
	O3	Ambassidae	$0.707765 \pm 100$	55.56
	L12	Ambassidae	$0.707775 \pm 56$	56.34
Ostracoda	M12	<i>Alocopocythere</i> sp.	$0.707759 \pm 35$	55.15
	G12	<i>Neocyprideis</i> sp.	$0.707779 \pm 60$	56.68

\* Upper and lower confidence limits, including analytical error on ratios, are within  $\pm 2$  Ma of the best-fit age.

**Table DR2.** Lignite and DOC TC, TIC, TOC and  $\delta^{13}\text{C}$  values for sediments from Vastan

Sample	Lithology	Level (m)	TC (wt%)	TIC (wt%)	TOC (wt%)	No. of Runs	$\delta^{13}\text{C}_{\text{org}}$	sd
L1	lignite	0	60.4	0.02	60.38	1	-28.45	
L2	lignite	0.5	59.71	0.03	59.68	1	-27.26	
L3	lignite	1	57.9	0.02	57.88	2	-27.70	0.01
L4	lignite	1.5	59.2	0.01	59.19	2	-27.10	
L5	lignite	2	58.95	0.03	58.92	1	-27.83	
B1	lignite	3	69.2897			1	-28.80	
B2	lignite	3.5	65.6432			1	-28.30	
B3	lignite	4	62.0117			1	-27.67	
B4	lignite	4.5	58.9413			1	-27.54	
B5	lignite	5	63.7025			1	-27.75	
B6	lignite	5.5	62.9904			1	-27.89	
B7	lignite	6	58.7457			1	-28.04	
B8	shell carbonate	6.5	4.8124			1	-27.69	
B9	shale	7	1.3261			1	-27.95	
B10	shale	7.5	1.59	0.04	1.55	2	-28.15	0.02
B11	shale	8	1.9168			1	-27.64	
B12	shale	8.5	1.2196			1	-27.94	
B13	shale	9	1.2789			1	-27.66	
B14	shale	9.5	3.3196			1	-27.72	
B15	shale	10	5.5178			1	-27.54	
B16	shale	10.5	2.1364			1	-28.19	
B17	shale	11	6.8197			1	-27.74	
B18	shale	11.5	8.9842			1	-27.92	
B19	shale	12	30.095			1	-27.96	
B20	shale	12.5	6.965			1	-26.77	
B21	lignite	13	58.5268			1	-28.33	
B22	lignite	13.5	61.6334			1	-27.71	
B23	shale	14	16.568			1	-27.81	
B24	lignite	14.5	62.7938			1	-27.32	
B25	shale	15.5	1.798			1	-27.03	
B26	lignite	16.5	50.9761			1	-27.59	
B27	shale	17.5	1.4585			1	-27.34	
B28	shale	18.5	0.94	0.05	0.89	2	-27.64	0.13
B29	shale	19.5	1.7628			1	-27.59	
B30	shale	20.5	1.5388			1	-26.46	
B31	lignite	21.5	63.1844			1	-26.83	
B32	shale	22.5	0.6394			1	-26.31	
B33	shell carbonate	23.5	8.32	7.69	0.63	3	-26.69	0.02
B34	shale	24.5	0.8272			1	-26.68	
S1	shell carbonate	25.5	2.42	2.26	0.16	3	-27.60	0.81
S2	shale	26.5	0.79	0.08	0.71	2	-27.72	1.20
S4	shale	27.5	2.99	0.03	2.96	2	-26.35	0.01
S6	shale	28.5	1.18	0.02	1.16	3	-27.04	0.56
S7	shale	29.5	3.13	0.3	2.83	1	-26.80	0.40
B35	shale	30.5	1.7891			3	-27.57	0.87
S8	shale	30.5	3.8	0.17	3.63	1	-26.68	0.49
S9	shale	31.5	1.99	0	1.99	1	-24.71	0.68
B36	shale	32				2	-24.89	0.45
B37	shale	32.5	13.1	0.06	13.04	4	-25.92	0.30
B38	shale	33.5	1.04	0.35	0.68	3	-26.86	0.94
B39	shale	34.5	1.3569			1	-26.90	0.69

B40	lignite	35.5	52.1					-27.31	0.13
B41	shell carbonate	36.5	5.99	5.69	0.3		4	-28.30	0.19
B42	shell carbonate	37.5	1.8				4	-27.80	0.30
B43	shell carbonate	38.5	2.84	2.47	0.37		5	-28.00	1.00
B44	shell carbonate	39.5	2.94	2.57	0.38		4	-30.55	0.21
B45	shell carbonate	40.5	3.4	2.99	0.41		5	-30.45	0.07
B46	shale	41.5	0.8961				1	-30.90	
B47	shale	42.5	13.1217				3	-28.08	0.16
B48	lignite	43.5	82.7				3	-27.16	0.17
B49	shale	44.5	3.5	0.05	3.45		4	-27.01	0.28
B50	lignite	45.5	64.5324				3	-28.36	0.16
B51	shale	46.5	2.8905				3	-27.47	0.42
B52	shell carbonate	47.5	3.62	3.09	0.53		1	-25.66	
G1	shale	49.5	4.91	0.02	4.89		3	-26.85	0.21
G2	shale	50.5	3.61	0.18	3.43		3	-26.05	0.07
B53	shale	51.5	4.6288				1	-26.58	
G3	shale	52.5	1.53	0.01	1.52		1	-25.86	
G4	shale	53.5	1.17	0.06	1.11		1	-25.91	
B54	shale	55.5	2.4396				1	-27.25	
G5	shale	56.5	2.39	0.02	2.37		1	-26.69	
G6	shale	57.5	2.83	0.02	2.81		1	-27.20	
G7	shale	58.5	2.75	0.01	2.74		2	-27.45	0.54
B55	shale	59.5	2.699				1	-27.33	
G8	shale	61.5	3.02	0	3.02		1	-26.84	
G9	shale	62.5	1.85	0.01	1.84		1	-26.59	
G10	shale	63	1.81	0	1.81		1	-26.70	
B56	shell carbonate	63.5	6.54	6.08	0.46		2	-27.14	
B57	shale	68.5	2.8645				1	-27.70	
B58	shale	72.5	0.4443				1	-25.78	
B59	shale	78	0.1463				1	-26.19	
B60	shale	83	0.2299				1	-25.80	
B61	shale	87	0.101				1	-27.04	
B62	shale	92	0.1421				1	-25.24	
B63	shale	97	0.08	0.04	0.04		1	-26.82	