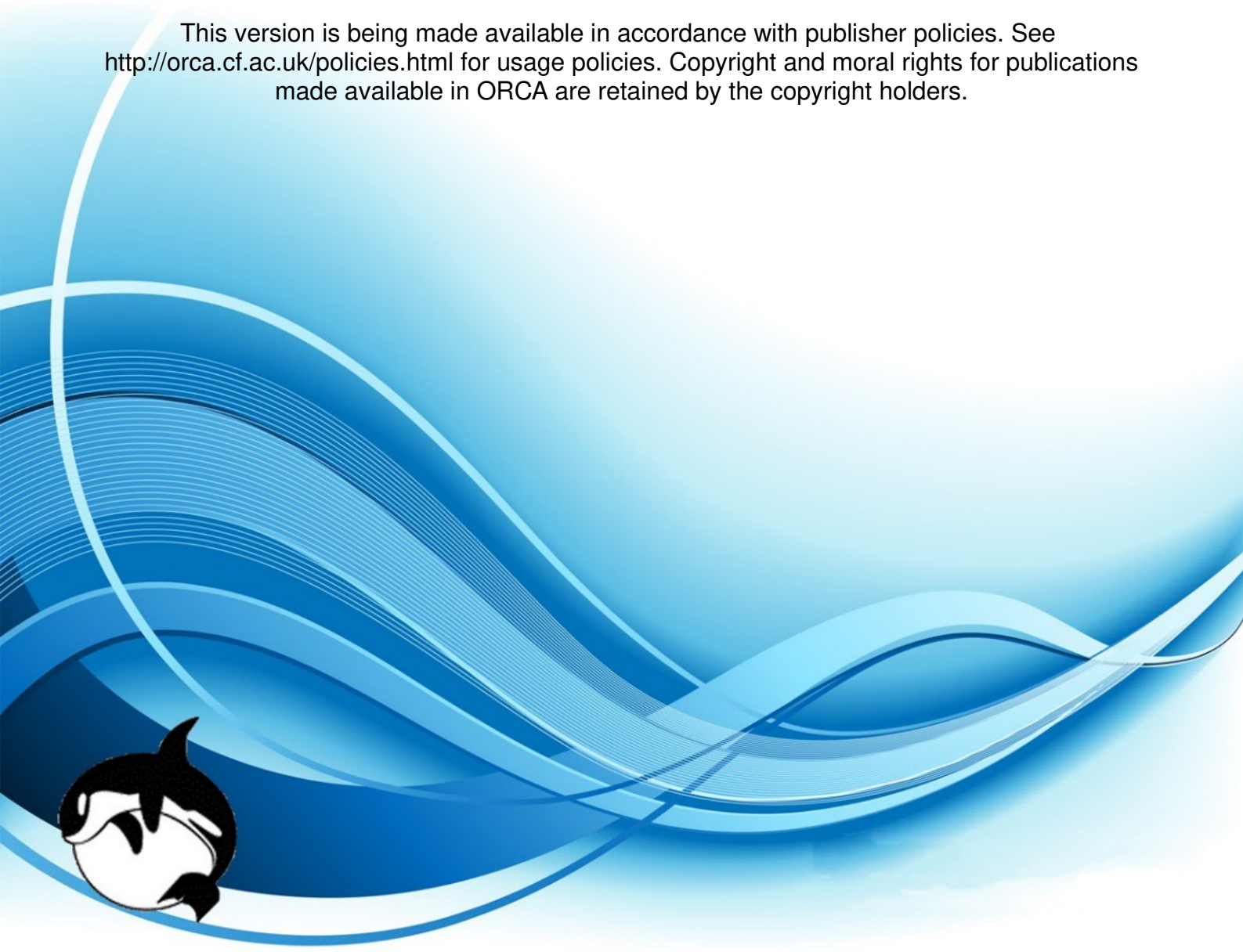

Table S1: Sedimentation rates used to restore the paleo-shorelines in this study. See Figure 1 for the location of points where sedimentation rates were calculated.

Sedimentation rate	Ages	Locations	Longitude / E	Latitude / N	References
14.0 cm/ka	Quaternary-Pliocene	Well LF14	116°16’16”	21°34’58”	Ref.[1]
100.0 cm/ka	Holocene	Offshore northeast Hainan Island	109°25’18”	20°14’59”	Ref.[2]
39 cm/ka	Quaternary	Taiwan Strait	116°33’00”	22°55’15”	Ref.[3]
113 cm/ka	Quaternary	Offshore Xiamen	118°35’00”	24°07’00”	Ref.[4]
11.3 cm/ka	Quaternary	Zhongsha Island	115°28’18”	18°08’00”	Ref.[5]
46.9 cm/ka	Quaternary	GMGS05	117°24’09”	20°48’45”	Ref.[6]
36.9 cm/ka		GMGS07	117°17’34”	21°03’29”	
56.6 cm/ka		GMGS08	117°23’44”	21°01’31”	
73.3 cm/ka		GMGS09	117°18’08”	21°07’30”	
51.3 cm/ka		GMGS16	117°45’45”	21°06’49”	
Thickness map	Quaternary	Qiongdongnan Basin	--	--	Ref.[7]
139 cm/ka	Quaternary	Yinggehai Basin	108°07’57”	17°56’21”	Ref.[8]
115 cm/ka	Quaternary	Qiongdongnan Basin	110°46’40”	17°07’17”	
Thickness map	Quaternary	Yinggehai Basin	--	--	Ref.[9]
Thickness map	Quaternary	Pearl River Mouth Basin	--	--	Ref.[10]
Thickness map	Quaternary	Pearl River Mouth Basin	--	--	Ref.[11]
490 cm/ka	Quaternary	Qinzhou Bay (Site A146)	108°40’30”	21°32’07”	Ref.[12]
530 cm/ka	Quaternary	Qinzhou Bay (Site A122)	108°37’10”	21°28’45”	
350 cm/ka	Quaternary	Qinzhou Bay (Site A97)	108°34’03”	21°25’37”	
230 cm/ka	Quaternary	Qinzhou Bay (Site A54)	108°22’27”	21°25’37”	
240 cm/ka	Quaternary	Qinzhou Bay (Site B84)	108°31’24”	21°21’00”	
100 cm/ka	Quaternary	West Qiongzhou Strait (Site B553)	109°25’18”	20°15’00”	
490 cm/ka	Quaternary	West Qiongzhou Strait (Site B765)	109°49’24”	20°18’08”	
530 cm/ka	Quaternary	Offshore northwest	108°58’21”	20°08’44”	

		Hainan Island (Site 310)			
500 cm/ka	Quaternary	Offshore northwest Hainan Island (Site 255)	108°52’19”	20°05’49”	
530 cm/ka	Quaternary	Offshore south Weizhou Island (Site B349)	109°01’29”	20°48’15”	
300 cm/ka	Quaternary	Offshore south Weizhou Island (Site B397)	109°07’28”	20°35’56”	
440 cm/ka	Quaternary	Offshore south Weizhou Island (Site B294)	108°55’13”	20°38’51”	
340 cm/ka	Quaternary	Central Beibu Bay (Site C31)	108°19’19”	20°54’01”	
200 cm/ka	Quaternary	Central Beibu Bay (Site B123)	108°37’23”	20°29’57”	
165 cm/ka	Quaternary	ZK2 (northwestern slope of the SCS)	110°40’41”	17°15’54”	Ref.[13]
2.4 cm/ka	Quaternary-Pliocene	IODP U1505	115°51’32”	18°55’03”	Ref.[14]
2.3 cm/Ka	Quaternary	NS90-103 (Western Slope of the SCS）	110°23’55”	11°11’32”	Ref.[15]
13.3 cm/ka	Quaternary	Baiyun Sag	114°59’28”	19°54’10”	Ref.[16]
17.1 cm/ka	Quaternary	Site 191 (Northern slope of the SCS)	116°13’13”	19°02’57”	Ref.[17]
25.1 cm/ka	Quaternary	973-4 (Taixinan Basin)	118°49’05”	21°54’19”	Ref.[18]
14.8 cm/ka	Quaternary	Well A (Western slope of the Dongsha Massif)	115°34’26”	20°32’28”	Ref.[19]
12.9 cm/ka	Quaternary	Well B (Western slope of the Dongsha Massif)	115°44’46”	20°48’40”	
49 cm/ka	Quaternary	ODP 1144	117°25’08”	20°03’11”	Ref.[20]
9.2 cm/ka	Quaternary	ODP 1145	117°37’52”	19°35’02”	
6.9 cm/ka		ODP 1148	116°33’56”	18°50’10”	
12 cm/ka	Quaternary	ODP 1146	116°16’22”	19°27’24”	Ref.[21]
4.1 cm/ka	Quaternary	ODP 1147	116°33’17”	18°50’07”	
38 cm/ka	Quaternary	Well DLW3101	115°21’18”	20°09’54”	Ref.[22]

		(Northern slope of the Baiyun Sag-Canyon zone)			
40-85 cm/ka	Quaternary	Core 17940 (Southeast Dongsha Massif)	117°23’00”	20°07’00”	Ref.[23]
2 cm/ka	Quaternary-Pliocene	W2	115°35’39”	19°24’55”	Ref.[24]
9.8 cm/ka	Quaternary-Pliocene	LW31-1-1	115°36’02”	19°46’33”	
50 cm/ka	Quaternary	LS22-1-1	110°45’44”	17°39’03”	
42 m/ka	Quaternary	LS33-1-1	110°42’39”	17°25’21”	
120 cm/ka	Quaternary	C19 (eastern Xisha Trough)	111°09’38”	16°53’53”	Ref.[25]
48.2 m/Ma	Quaternary	SH1	115°16’03”	19°46’02”	Ref.[26]
72.6 m/Ma	Quaternary	SH2	115°14’23”	19°46’28”	
60.8 m/Ma	Quaternary	SH5	115°20’42”	19°44’54”	
76.8 m/Ma	Quaternary	SH7	115°14’12”	19°48’51”	
17.5 cm/ka	Quaternary	MD05-2904	116°15’09”	19°27’19”	Ref.[27]
9.6 cm/ka	Quaternary	N-31	112°30’20”	17°42’32”	Ref.[28]
3.1-7.4 cm/ka	Quaternary	Upper slope of the Baiyun Sag	118°38’45”	22°07’51”	Ref.[29]
49 cm/ka	Quaternary	South of the Dongsha Massif	117°25’08”	20°03’11”	Ref.[30]
2.58-10.40 cm/ka	Quaternary	Deep water of the SCS	117°57’21”	16°52’57”	Ref.[31]
8.3 cm/da	Quaternary	XK1	111°44’06”	16°24’42”	Ref.[32]
25 cm/ka	Quaternary	PC338	110°24’00”	16°42’00”	Ref.[33]
Thickness map	Quaternary	Offshore Hainan	-	-	Ref.[34]
77.8 cm/ka	Quaternary	Xisha Massif	117°46’16”	16°36’49”	Ref.[35]
25.6 cm/ka	Quaternary	Northern shelf of the SCS	114°25’26”	21°56’42”	Ref.[36]

Table S2: Parameters used in the NHWAVE model.

Landslide density (kg/m^3)	1750
Cartesian grids resolution (m)	1100
Effective kinematic viscosity of the slide (m^2/s)	0.1
Bottom friction coefficient	0.0025
Total time of modelling (s)	7200 (0~2nd hours)

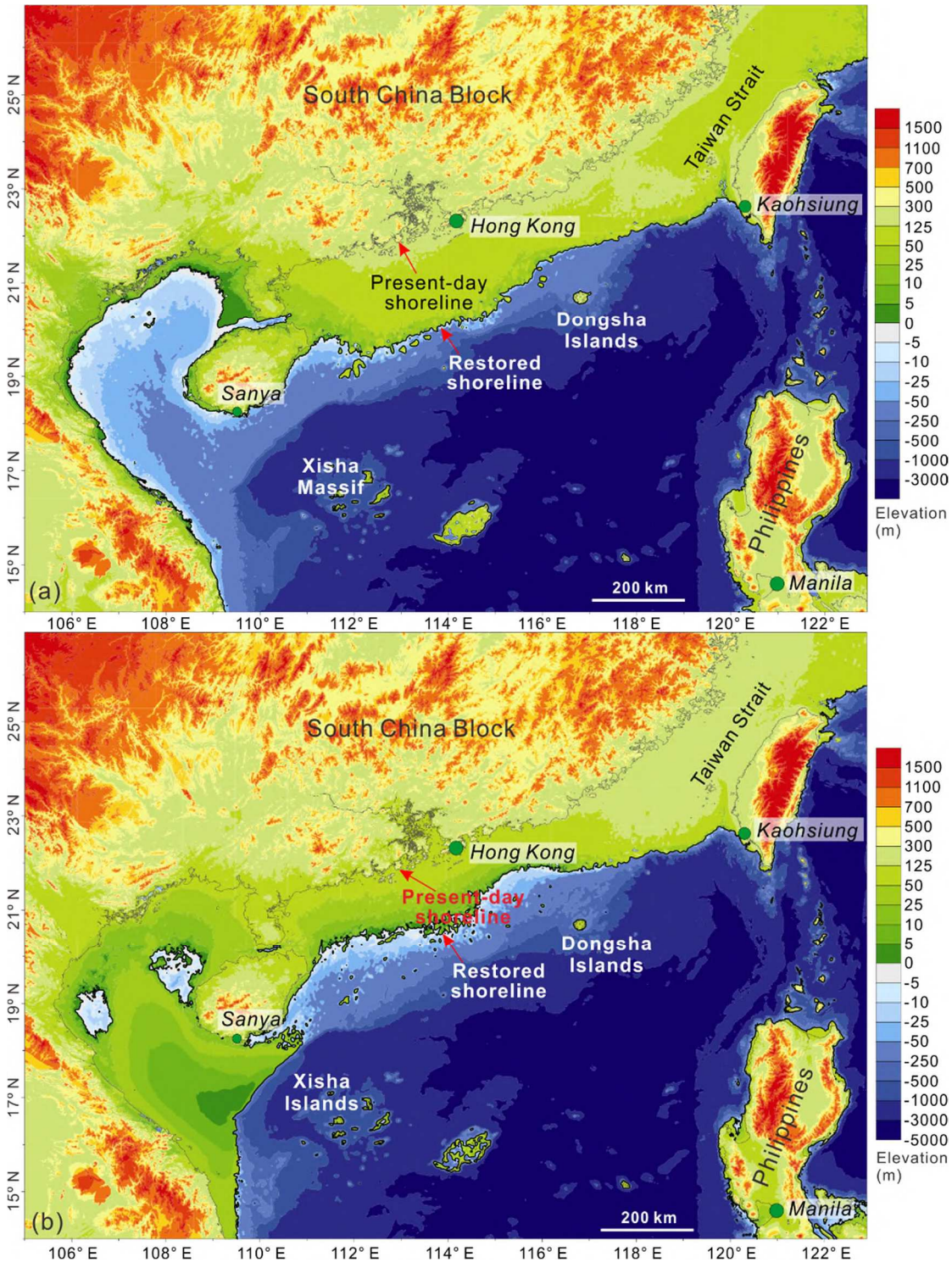

Figure S1: (a) Restoration of the paleo-shoreline at 0.54 Ma considering solely the effect of relative sea-level change. The continental shelf of the northern South China Sea is more sensitive to relative sea-level change than its northwest sector near the Yinggehai Basin; (b) Restoration of the paleo-shoreline at 0.54 Ma considering solely sediment supply as the main controlling factor. The Yinggehai Basin is more sensitive to sedimentary dynamics than the remainder of the northern South China Sea. See Figure 4 for the restoration of the paleo-shoreline at 0.54 Ma considering both the effect of relative sea-level changes and sediment supply.

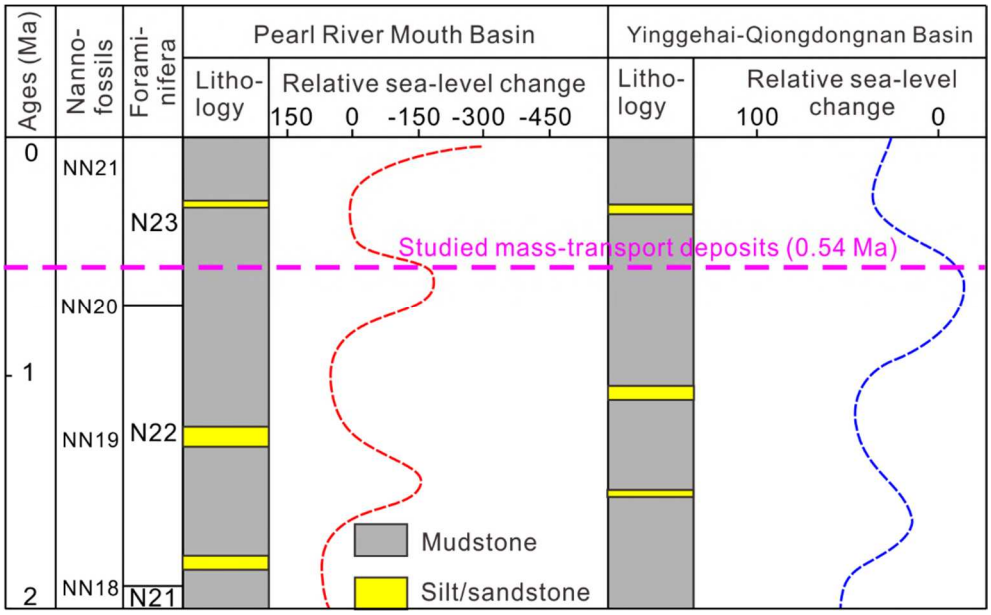

Figure S2: Relative sea-level change curves for the Pearl River Mouth[37] and Yinggehai and Qiongdongnan basins[38,39]. The studied mass-transport deposit (0.54 Ma) is labeled with a pink dashed line. Lithologocal data for the Pearl River Mouth and Qiongdongnan basins are based on Ref.[39] and Ref.[40].

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