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The distribution of barium (Ba) concentrations in seawater resembles that of nutrients and Ba has been widely used as a proxy of paleoproductivity. However, the exact mechanisms controlling the nutrient-like

dissolved silicon isotopes are fractionated during diatom growth resulting in the heaviest isotopic compositions in the very surface waters. Combined with the decoupling of DBa concentrations and $\delta^{137}Ba_{DBa}$ from the concentrations of nitrate and phosphate this implies that the apparent nutrient-like fractionation of Ba isotopes in seawater is primarily induced by preferential adsorption of the lighter isotopes onto biogenic particles rather than by biological utilization. The subsurface $\delta^{137}Ba_{DBa}$ distribution is dominated by water mass mixing. The application of stable Ba isotopes as a proxy for nutrient cycling should therefore be considered with caution and both biological and physical processes need to be considered. Clearly, however, Ba isotopes show great potential as a new tracer for land–sea interactions and ocean mixing processes.

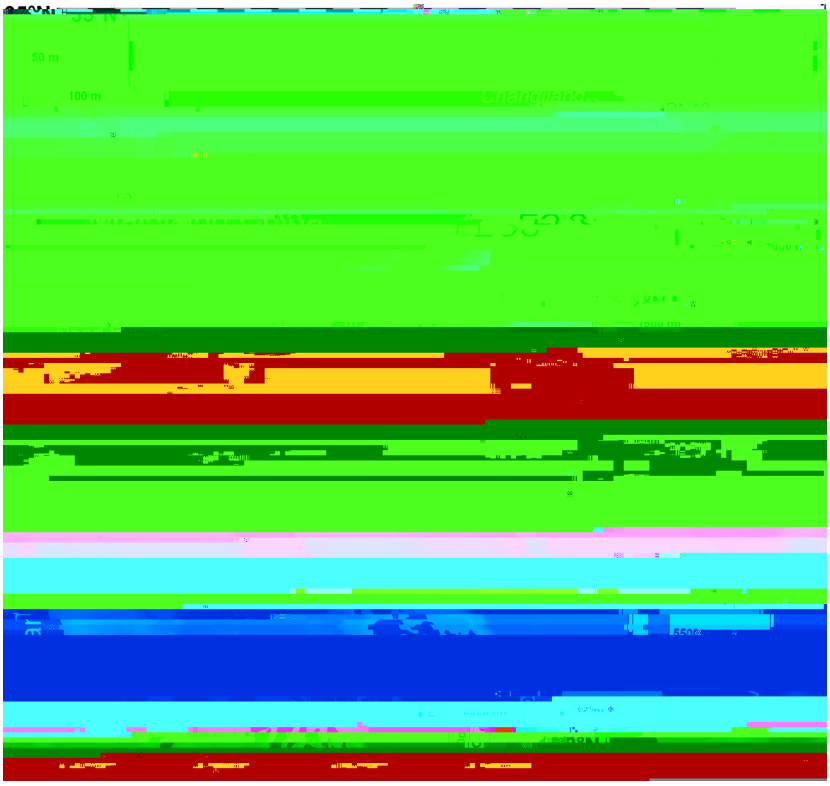


Fig. 1. Bathymetric

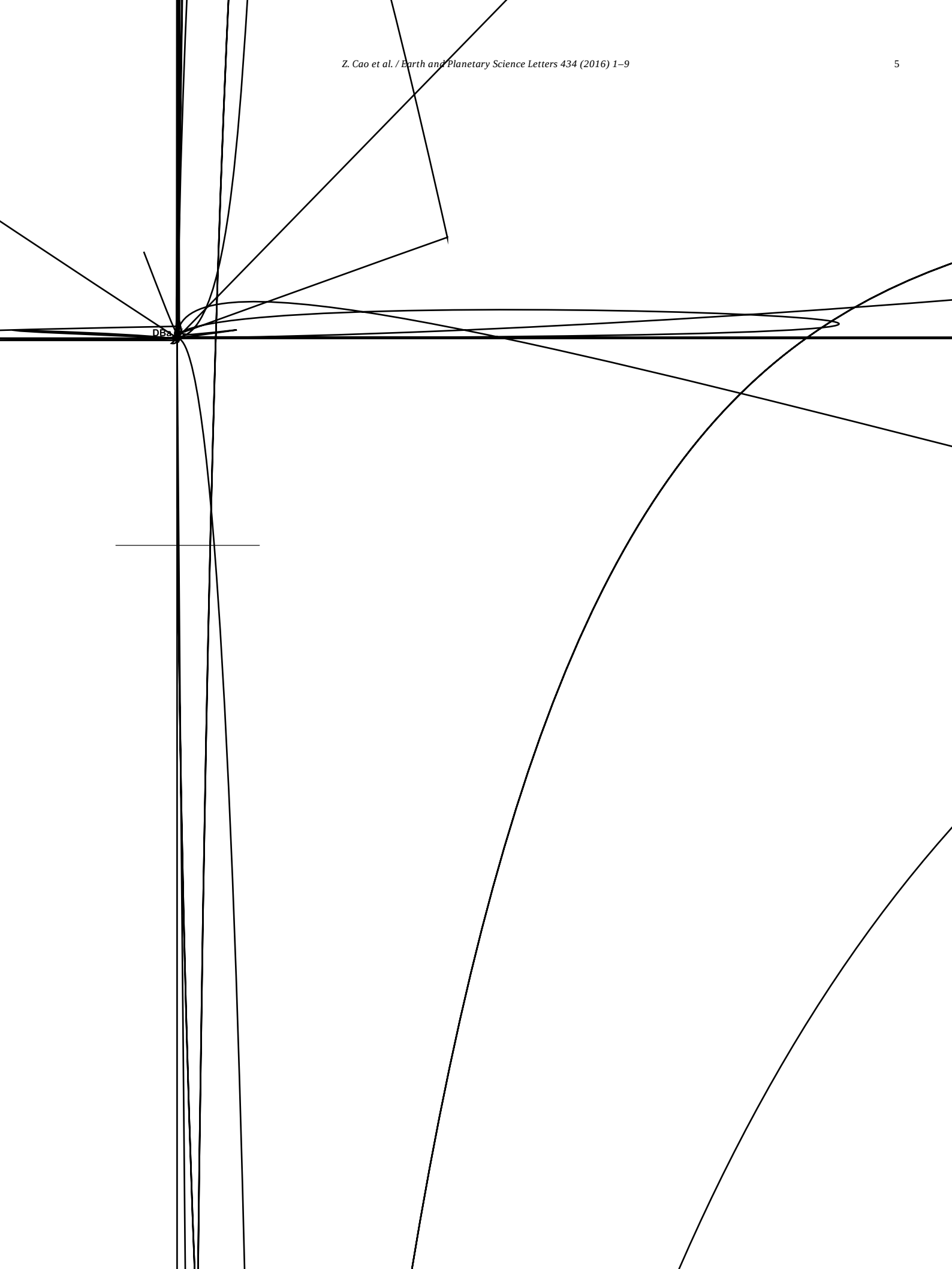
Table 1
Salinity, dissolved barium (DBa) concentration and their stable barium isotopic composition ($/^{137}Ba_{DBa}$) data collected in the East China Sea (ECS) in August 2009 and in the South China Sea (SCS) in January 2010.

Cruise	Station	Depth[a] (m)	Salinity[a]	DBa (nmol kg^{-1})	$/^{137}Ba_{DBa}$ (‰)	2SD[b] (‰)	n[c]
ECS	PN10	1.3	25.89	175.8	0.45	0.07	3
August 2009	31.0°N 123.0°E	1.3	duplicate		0.47	0.11	4
		4.5	27.17	161.5	0.42	0.07	4
		14.9	32.22	70.0	0.54	0.09	2
		14.9	duplicate		0.45	0.12	3
		25.1	34.00	51.2			
		35.5	34.11	50.0			
		46.9	34.13	50.7	0.66	0.09	3
		46.9	duplicate		0.59	0.09	4
	PN04	2.0	33.74	40.6	0.98	0.08	2
	29.0°N 126.0°E	24.4	33.83	40.4	0.87	0.13	3
		49.4	33.85	38.9			
		73.8	34.10	38.5			
		99.8	34.50	39.7			
		117.7	34.50	39.2	0.90	0.03	2
	DH13	3.2	33.73	36.6	0.89	0.04	2
	29.0°N 127.3°E	3.2	duplicate		0.76	0.08	3
		25.1	33.82	35.7	0.93	0.08	3
		49.6	33.99	37.2			
		73.8	34.18	39.8			
		98.6	34.39	39.8	0.99	0.11	2
		123.7	34.61	40.8	0.81	0.09	3
		123.7	duplicate		0.74	0.10	4
		148.6	34.49	44.4			
		198.5	34.45	45.7	0.62	0.07	3
		297.3	34.37	52.0			
		553.7	34.33	72.9	0.45	0.04	3
		553.7	duplicate		0.56	0.03	3
SCS	KK1	5.2	33.88	40.2	0.90	0.10	3
January 2010	18.3°N 115.7°E	19.6	33.88	38.4	1.03	0.12	3
		50.1	34.10	41.4	0.91	0.07	3
		50.1	duplicate		1.04	0.04	2
		79.8	34.49	40.4			
		98.3	34.57	40.6	0.86	0.05	3
		98.3	duplicate		0.86	0.17	2
		149.9	34.59	45.6			
		198.5	34.53	49.2	0.88	0.06	3
		198.5	duplicate		0.77	0.15	3
		301.0	34.44	55.9			
		499.2	34.41	75.5	0.67	0.05	3
		499.2	duplicate		0.60	0.16	3
		798.3	34.48	98.8	0.56	0.09	4
		1000.9	34.53	112.7	0.57	0.08	3
		1000.9	duplicate		0.52	0.09	3
		1500.5	34.59	133.8	0.54	0.12	3
		2499.1	34.61	136.6	0.51	0.06	3
		3644.6	34.61	134.9	0.58	0.02	3
		3644.6	duplicate		0.54	0.11	3

[a] Depth and salinity data collected in the ECS are from Cao et al. (2015).
[b] SD is the standard deviation estimated from the double spike bracketing measurements of a single sample solution.
[c] n is the number of double spike bracketing measurements of a single sample solution.

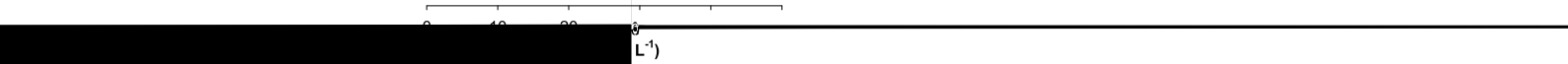
Table 2
Excess particulate barium (Ba_{xs}) concentration and their stable barium isotopic composition ($/^{137}Ba_{Baxs}$) data collected in the upper 150 m of

Table 3
Dissolved barium (DBa) concentration and their


DBa

a stable value of $+0.5‰$ (Figs. 2b and 2c) suggesting homogenization by the strong vertical mixing in the interior of the South China Sea.

Note that both DBa concentrations and $/^{137}Ba_{DBa}$ signatures are essentially constant in the upper 100 m at values of ∼40 nmol kg^{-1} and $\sim +0.9‰$ (Figs. 2a and 2c) despite a surface mixed layer above 25 and 60 m,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1/DBa (k