

Supporting Information

Release of plutonium isotopes from the Fukushima Daiichi Nuclear Power Plant accident to the marine environment was negligible

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Table S1. Activities and inventories of radiocesium in the sediment samples.

Sample site	Depth (cm)	Bulk density (g cm ⁻³)	Ignition loss (%)	¹³⁴ Cs activity (mBq g ⁻¹) ^a	¹³⁷ Cs activity (mBq g ⁻¹) ^a	¹³⁴ Cs/ ¹³⁷ Cs activity ratio ^b	¹³⁴ Cs inventory (0-3 cm) (Bq m ⁻²) ^a	¹³⁷ Cs inventory (0-3 cm) (Bq m ⁻²) ^a	¹³⁴ Cs inventory (0-10 cm) (Bq m ⁻²) ^a	¹³⁷ Cs inventory (0-10 cm) (Bq m ⁻²) ^a	¹³⁴ Cs F ₀₋₃ ^c	¹³⁷ Cs F ₀₋₃ ^c
NP2	0-1	1.9	1.4	28.1±0.6	55.1±0.8	1.03±0.03	1540	3005	4908	9877	0.31	0.30
	1-2	1.8	1.6	20.1±0.5	39.6±0.6	1.07±0.03						
	2-3	1.8	1.5	17.2±0.7	32.8±0.9	1.07±0.05						
	3-4	1.8	1.2	17.0±0.5	32.9±0.5	1.05±0.03						
	4-5	1.7	1.8	20.6±0.7	41.5±0.9	1.01±0.04						
	5-6	1.7	1.5	23.1±0.5	45.3±0.6	1.03±0.03						
	6-7	1.7	2.2	24.5±0.8	48.9±1.0	1.01±0.04						
	7-8	1.7	1.9	24.5±0.5	48.8±0.7	1.01±0.03						
	8-9	1.6	2.2	22.8±0.8	52.5±1.1	0.87±0.04						
	9-10	1.6	2.1	23.7±0.5	48.9±0.7	0.98±0.03						
NP1	0-1	1.7	2.4	14.0±0.4	28.5±0.5	1.01±0.03	699	1472	1675	3589	0.42	0.41
	1-2	1.7	1.9	10.1±0.4	20.5±0.4	1.03±0.05						
	2-3	1.8	1.9	7.8±0.3	18.0±0.4	0.90±0.04						
	3-4	1.8	1.8	9.5±0.3	20.3±0.4	0.97±0.04						
	4-5	1.8	2.0	12.9±0.4	24.8±0.5	1.07±0.04						
	5-6	1.8	2.0	6.3±0.3	16.3±0.4	0.82±0.04						
	6-7	2.3	1.6	5.7±0.2	12.2±0.3	1.00±0.05						
	7-8	1.8	2.1	3.7±0.2	8.5±0.3	0.98±0.07						
	8-9	1.8	2.1	3.0±0.2	7.2±0.3	0.94±0.09						
AN6	0-1	1.7	2.9	16.3±1.1	34.9±1.0	0.95±0.07	906	1822	4679	9475	0.19	0.19
	1-2	1.7	2.5	13.7±0.5	27.3±0.6	1.03±0.04						
	2-3	1.7	2.3	10.9±0.6	20.0±0.8	1.13±0.08						
	3-4	1.7	2.6	23.1±0.9	50.7±1.1	0.92±0.04						
	4-5	1.7	3.0	52.8±1.2	101.3±1.5	1.04±0.03						
	5-6	1.7	2.6	28.2±0.9	59.1±1.1	0.96±0.04						
	6-7	1.7	2.7	16.9±0.7	33.8±0.9	1.02±0.05						
	7-8	1.7	2.6	17.1±0.5	34.7±0.6	1.00±0.03						
	8-9	1.7	2.8	17.1±0.7	34.1±0.9	1.02±0.05						
	9-10	1.8	2.0	11.9±0.4	25.3±0.5	0.97±0.04						
	10-11	1.7	2.2	13.8±0.7	27.3±0.8	1.04±0.06						
	11-12	1.8	2.0	20.7±0.5	42.2±0.7	0.99±0.03						
	12-13	1.8	2.2	8.2±0.5	17.1±0.6	1.01±0.07						
	13-14	1.7	2.2	12.2±0.4	25.4±0.5	0.98±0.04						
M01	0-1	1.9	2.8	11.1±0.9	24.9±1.0	0.92±0.08	401	877	743	1663	0.54	0.54
	1-2	1.8	2.0	5.0±0.4	12.7±0.5	0.85±0.08						
	2-3	1.8	2.0	5.7±0.5	10.0±2.6	1.24±0.37						
	3-4	1.8	1.8	4.5±0.4	11.0±0.5	0.89±0.09						
	4-5	1.8	1.7	6.7±0.6	14.1±0.7	1.02±0.11						
	5-6	1.8	1.8	3.4±0.2	8.5±0.3	0.89±0.07						
	6-7	1.8	1.9	4.2±0.5	8.3±1.9	1.14±0.32						
I02	0-1	1.0	9.5	78.4±2.3	154.9±2.8	1.01±0.04	4293	7996	11162	18867	0.39	0.42
	1-2	1.3	9.1	30.1±0.9	63.9±1.2	0.95±0.03						
	2-3	1.3	7.2	22.4±0.6	52.6±0.8	0.86±0.03						
	3-4	1.3	7.2	29.0±0.7	57.3±0.8	1.02±0.03						
	4-5	1.3	7.4	28.5±0.7	54.5±0.9	1.06±0.03						
	5-6	1.2	7.6	33.2±1.4	66.8±1.6	1.00±0.05						
	6-7	1.2	8.3	42.4±1.6	90.6±1.8	0.94±0.04						
	7-8	1.3	7.0	29.7±0.7	58.9±0.8	1.02±0.03						
	8-9	1.3	6.8	74.3±1.8	147.1±2.3	1.01±0.03						
	9-10	1.3	7.4	26.2±1.4	55.0±1.4	0.96±0.06						

^aDecay corrected to the sampling date; ^bDecay corrected to 15 March 2011; ^cThe ratio of the inventory of the surface sediments (0-3 cm) to that of the 0-10 cm sediment core. Uncertainties represent 1σ error; ¹³⁴Cs and ¹³⁷Cs inventories (0-10 cm) of M01 are based on the data obtained from 0-7 cm.

Table S2. Analytical results of Pu isotopes in the marine sediments within the 30 km zone around the FDNPP site.

Location	Sample	²³⁹⁺²⁴⁰ Pu activity (mBq g ⁻¹)	²⁴⁰ Pu/ ²³⁹ Pu atom ratio	²⁴¹ Pu activity (mBq g ⁻¹) ^a	²⁴¹ Pu/ ²³⁹ Pu atom ratio ^a
NP2	0-1 cm	0.288±0.009	0.253±0.010	0.39±0.05	0.0016±0.0002
	1-2 cm	0.282±0.013	0.255±0.006	0.36±0.06	0.0015±0.0002
	2-3 cm	0.281±0.006	0.254±0.007	0.36±0.05	0.0015±0.0002
	3-4 cm	0.268±0.005	0.253±0.006	0.37±0.04	0.0016±0.0002
	4-5 cm	0.311±0.005	0.252±0.006	0.40±0.06	0.0015±0.0002
	5-6 cm	0.314±0.007	0.252±0.007	0.40±0.07	0.0015±0.0003
	6-7 cm	0.317±0.008	0.253±0.008	0.41±0.05	0.0015±0.0002
	7-8 cm	0.324±0.005	0.255±0.005	0.34±0.05	0.0012±0.0002
	8-9 cm	0.324±0.008	0.252±0.008	0.40±0.04	0.0014±0.0001
	9-10 cm	0.323±0.006	0.253±0.006	0.40±0.05	0.0014±0.0002
NP1	0-1 cm	0.264±0.005	0.251±0.006	0.31±0.07	0.0014±0.0003
	1-2 cm	0.254±0.006	0.250±0.008	0.32±0.05	0.0015±0.0002
	2-3 cm	0.272±0.008	0.250±0.009	0.32±0.08	0.0014±0.0003
AN6	0-1 cm	0.514±0.012	0.252±0.008	0.65±0.09	0.0015±0.0002
	1-2 cm	0.538±0.021	0.255±0.013		
	2-3 cm	0.523±0.014	0.252±0.009		
	3-4 cm	0.500±0.017	0.256±0.010		
	4-5 cm	0.528±0.022	0.252±0.013		
	5-6 cm	0.507±0.024	0.254±0.016		
	6-7 cm	0.510±0.019	0.253±0.011		
	7-8 cm	0.485±0.013	0.251±0.008		
	8-9 cm	0.512±0.024	0.252±0.014		
	9-10 cm	0.464±0.027	0.255±0.019		
	10-11 cm	0.465±0.017	0.254±0.011		
	11-12 cm	0.451±0.015	0.255±0.011		
	12-13 cm	0.462±0.015	0.255±0.011		
	13-14 cm	0.478±0.017	0.251±0.012		
M01	0-1 cm	0.337±0.012	0.248±0.011	0.43±0.04	0.0015±0.0001
	1-2 cm	0.357±0.023	0.235±0.018		
	2-3 cm	0.288±0.013	0.245±0.014		
	3-4 cm	0.269±0.010	0.250±0.012		
	4-5 cm	0.272±0.017	0.252±0.019		
	5-6 cm	0.255±0.015	0.258±0.018		
	6-7cm	0.275±0.017	0.253±0.019		
I02	0-2 cm	0.940±0.013	0.245±0.005	1.12±0.13	0.0014±0.0002
	2-3 cm	0.912±0.028	0.246±0.004	1.12±0.14	0.0014±0.0001
	3-4 cm	0.929±0.036	0.245±0.003	1.10±0.17	0.0014±0.0002
	4-5 cm	0.922±0.028	0.248±0.006	1.16±0.22	0.0015±0.0003
	5-6 cm	0.963±0.025	0.244±0.005	1.17±0.13	0.0014±0.0002
	6-7 cm	0.973±0.025	0.245±0.005	1.17±0.12	0.0014±0.0001
	7-8 cm	0.871±0.026	0.246±0.005	1.07±0.17	0.0014±0.0002
	8-9 cm	0.793±0.031	0.245±0.004	0.92±0.11	0.0013±0.0001
	9-10 cm	0.814±0.029	0.249±0.005	1.16±0.20	0.0016±0.0003

Uncertainties represent 1σ error; ^aDecay corrected to 15 March 2011.

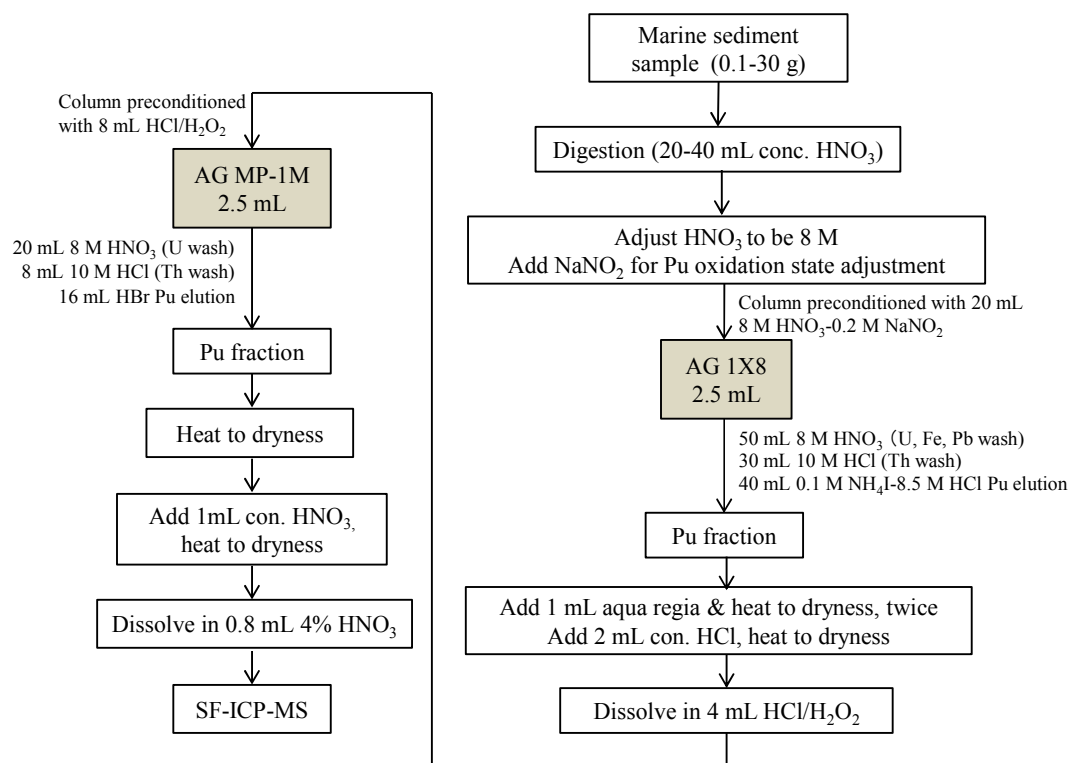


Fig. S1. Analytical procedure for the determination of Pu isotopes in marine sediments.