Bao, R., Mcintyre, C., Zhao, M., Zhu, C., Kao, S.-J., and Eglinton, T. I. (2016) Widespread dispersal and aging of organic carbon in shallow marginal seas. *Geology*, 44(10), pp. 791-794. (doi:10.1130/G37948.1)

Widespread dispersal and aging of organic carbon in shallow marginal seas

Rui Bao[1], Cameron McIntyre[1,2], Meixun Zhao[3,4], Chun Zhu[5], Shuh-Ji Kao[6], and Timothy I. Eglinton[1]

[1]Geological Institute, ETH Zürich, Zurich 8092, Switzerland

[2]Laboratory for Ion Beam Physics, ETH Zürich, Zurich 8093, Switzerland

[3]Key Laboratory of Marine Chemistry Theory and Technology, Ministry of Education, Ocean University of China, Qingdao 266100, China

[4]Qingdao Collaborative Innovation Center of Marine Science and Technology, Qingdao 266100, China

[5]ExxonMobil Upstream Research Company, 22777 Springwoods Village Parkway, Spring, Texas 77389, USA

[6]State Key Laboratory of Marine Environmental Science, Xiamen University, Xiamen 361005, China

ABSTRACT

The occurrence of "pre-aged" organic carbon (OC) in continental margin surface sediments is a commonly observed phenomenon, yet the nature, sources, and causes of this aged OC remain largely undetermined for many continental shelf settings. Here, we present the results of an extensive survey of the abundance and radiocarbon content of OC in surface sediments from the northern Chinese marginal seas. Pre-aged OC is associated with both coarser (>63 μm) and finer (<63 μm) sedimentary components, with measurements on specific grain size fractions revealing that it is especially prevalent within the 20–63 μm fraction of inner shelf sediments. We suggest that organic matter associated with this “sortable silt” fraction is subject to protracted entrainment in resuspension-deposition loops during which it ages, is modified, and is laterally dispersed, most likely via entrainment within benthic nepheloid layers. This finding highlights the complex dynamics and pre-depositional history of organic matter accumulating in continental shelf sediments, with implications for our understanding of carbon cycling on continental shelves, development of regional carbon budgets, and interpretation of sedimentary records.

INTRODUCTION

As the major loci of organic carbon (OC) burial in the oceans and the confluence of terrestrial and marine realms, it is crucial to understand the processes that lead to the efflux of CO_2 and sequestration of OC on continental shelves in order to predict potential changes to this important and dynamic component of the carbon cycle. Physicochemical interactions between organic matter (OM) and the mineral matrix are typically invoked as the primary mode of stabilization and sequestration of OM in sediments (Kennedy and Wagner, 2011). Hydrodynamic processes play a critical role in the dispersal and distribution of mineral-associated OM on continental margins and in the deep sea (McCave and Hall, 2006; Inthorn et al., 2006). Protracted entrainment within resuspension-deposition loops and exposure to oxic conditions may, in turn, influence the properties of OC that accumulates in underlying sediments. Accordingly, the distribution, composition, reactivity, and age of OM preserved in continental margin sediments may be controlled to a significant degree by OM-mineral interactions, with important implications for regional and global carbon budgets (Burdige, 2005; Deng et al., 2006).

However, much remains to be understood concerning the spatial and temporal dimensions of OM-mineral interactions and associated transport processes, and their impacts on source, composition and amount of OM accumulating on continental margins and in the deep sea.

Radiocarbon (^{14}C) ages of OC residing in the surface mixed layer of shallow continental shelf sediments are, in many cases, older than expected if the OM had originated from modern-day biological production in the overlying water column or on the adjacent land mass (Tao et al., 2015). These less-than-modern ^{14}C ages (i.e., $\Delta^{14}C < 0$ ‰) imply that there is a contribution of OM from petrogenic source(s), and/or that there is a time offset between production and deposition of marine and/or terrestrially derived biospheric OM.

Here we present a comprehensive assessment of the ^{14}C content of OC in both bulk samples and specific grain size fractions of surface sediments from the northern Chinese marginal seas (CMS), including the Bohai Sea, Yellow Sea and East China Sea (Fig. 1A). The CMS is one of largest shallow marginal seas in the world where two major rivers—the Yellow River and the Yangtze River—discharge vast quantities of sediment (1.08 and 0.5 × 10^9 t/yr, respectively; Yang et al., 2003, and reference in there) into an extensive (~1000 km wide, ~3000 km long) shallow shelf sea where, seasonal currents and other hydrodynamic influence exert complex and dynamic controls on the sediment distribution (Chen, 2009) (Fig. 2B). An extensive suite of more than 300 new ^{14}C and ^{13}C measurements are combined with previously published data to yield a detailed picture of the spatial variability in OC characteristics for the CMS. When combined with sedimentological information, they shed new light on hydrodynamic controls on OC age and distribution in this extensive marginal sea system.

METHODS

Surface sediments (0–1, 0–2, or 0–5 cm) were collected from the CMS during different cruises (Table DR1 in the GSA Data Repository[1]). Particle size analysis was performed on bulk sediments after freeze-drying and removal of OM (350 °C for 12 h) using a Mastersizer 2000 (Malvern Instruments Ltd) laser-diffraction instrument (Geological Institute, ETH-Zürich). For carbon isotopic analyses on size fractions, wet sediment samples were separated into <20, 20–32, and 32–63 μm and coarser fractions using stainless steel mesh sieves in less than one hour (in order to minimize OM losses). Freeze-dried bulk sediment samples and corresponding grain size fractions were analyzed for OC content and stable carbon isotopic composition at ETH Zürich. Prior to analysis, inorganic carbon was removed from dried samples by fumigation with concentrated HCl (37%, 72 h) and drying over NaOH pellets (72 h) in a desiccator at 60 °C. Radiocarbon analysis was performed at the Laboratory of Ion Beam Physics, ETH Zürich.

RESULTS

Bulk OC ^{14}C contents ($\Delta^{14}C_{org}$) of surface sediments exhibit marked spatial variability (avg. −305‰ ± 102‰ (1σ), n = 320), with ^{14}C-enriched, i.e., relatively young, OC (−174‰ to −280 ‰) in the central Yellow Sea and on the outer shelf of the East China Sea, and older OC (−274‰ to −682 ‰) along the inner edge of the East China Sea, in front of the old and modern Yellow River delta and the Yangtze River delta, and adjacent to the Island of Taiwan (Fig. 1; Table DR1). Total organic carbon (TOC) contents of surface sediments vary from less than 0.01% to 2.14% (avg. 0.5% ± 0.3 (1σ), n = 240). Mean grain size of bulk sediments (Fig. 1C) varies from 6.2 µm to 452.8 µm (avg., 83.7 µm; n = 190).

A subset of 16 samples spanning the nearshore regimes of the CMS was chosen for separation and geochemical characterization of specific grain size fractions. The samples (black symbols in Fig. 2B) were selected from regions that are proximal to the mouths of the modern Yangtze and Yellow and old Yellow Rivers and also down-current from these major river systems. Marked age variability is evident among grain size fractions derived from the same surface sediment, with $\Delta^{14}C_{org}$ values ranging from −777‰ to −218‰ (n = 48) (Table DR2). We also measured $^{14}C_{org}$ of coarser fractions (63–125, 125–250, 250–500, >500 µm) in highly energetic regimes (at H20, H21, H23, P01) with a large range of values (−551‰ ± 148 ‰; n = 11). Stable carbon isotope compositions ($\delta^{13}C_{org}$ values) also exhibit marked variability among grain size fractions (−24.6‰ to −20.4 ‰, n = 48). OC contents of grain size fractions ranged from 0.07% to 1.22% (n = 48), with smaller size fractions generally characterized by higher TOC values.

DISCUSSION

Hydrodynamic processes are considered to exert strong influence on the type, amount, and dispersal of OC accumulating in sediments of the CMS (DeMaster et al., 1985). The marked heterogeneity in $\Delta^{14}C_{org}$ values of surface sediments does not, however, exhibit a straightforward relationship with grain size (Figs. 1B, 1C and 2A). Hydrodynamic particle sorting would result in decreasing $\Delta^{14}C_{org}$ values with increasing grain size, and indeed, $\Delta^{14}C_{org}$ values are negatively correlated with mean grain size for offshore sediments (Fig. 2A, yellow and magenta, >20 m water depth, $r^2 = 0.53$). This relationship may reflect various factors: diminished preservation of fresh OM on coarser particles due to lower mineral surface area protection (Aller, 1998), sluggish transport of larger particles (Huettel et a., 2014), sediment winnowing processes (Hedges et al., 1999), enhanced OM remineralization as a consequence of greater permeability of coarser sediments (Huettel et al., 2014), or export of sedimentary rock-derived petrogenic OC eroded from Taiwan island via episodic storm events (Hilton et al., 2008). Overall, greater proportions of refractory OM from old carbon sources and protracted lateral transport may account for the greater proportion of pre-aged OC in coarser fractions in deeper waters.

In sharp contrast to this above trend, samples dominated by finer-grained sediments (mean grain size, <63 μm; Figure 2A, green and magenta symbols) do not exhibit any correlation between grain size and $\Delta^{14}C_{org}$ ($r^2 = 0.1$), and include a population of samples characterized by significantly pre-aged OC (Fig. 2A, green, $\Delta^{14}C_{org}$ values <–250‰) with OC contents of up to 1.14%. The latter observations may be partly explained by fluvial supply of terrestrial materials containing fossil (^{14}C dead) or pre-aged biospheric OC to the marginal seas (Tao et al., 2015). “Plumes” of aged OC emanate from these point sources, dispersed by prevailing seasonal current systems in the region (Fig. 1B). However, this cannot be the sole cause of this distribution pattern. For instance, suspended OM from the Yangtze River mouth is characterized by higher $\Delta^{14}C_{org}$ values ($\Delta^{14}C_{org}$: −103‰ to −129‰, Wang et al., 2012) relative to those of adjacent inner shelf sediments. Similarly, the average reported $\Delta^{14}C_{org}$ value of Yellow River particulate OM collected across all seasons is −417‰ ± 17 ‰ (Tao et al., 2015), while in the corresponding deltaic area, we found that $\Delta^{14}C_{org}$ values of 20–32 μm fraction are lower (−604‰ at B45). The contrast in OC ages between shallow (inner) and deeper (outer) shelves may reflect the influence of hydrodynamic processes where differential particle transport and inherent $\Delta^{14}C_{org}$ variations among grain size fractions impart changes in bulk sediment characteristics.

Finer-grained sediments characterized by older OC (Fig. 2A green) derived mostly from shallow inner shelf and subaqueous delta environments that are prone to wind- and tidally-driven sediment resuspension processes (Wang et al., 2011, Yang et al., 2011) (Fig. 2B). Local and regional currents mobilize, entrain and redistribute sediments (Chen, 2009), satellite images (Fig. DR1) clearly showing trajectories of large-scale sediment dispersal. In winter, Yangtze-derived fine-grained sediments are carried southward in the bottom layers by an intensified Chinese Coastal Current, transporting materials parallel to the coastline, forming the muddy regimes (Liu et al., 2007; Yang et al., 2011). These seasonal currents induce sediment sorting, and ^{14}C analyses of OC residing in different grain size fractions were undertaken on representative samples (n = 16) from shallow regions (<50 m) in an effort to understand hydrodynamic controls on the scatter exhibited in mean grain and $\Delta^{14}C_{org}$ values in finer-grained sediments (<63 μm; Figure 2B, green). For several locations (n = 12), it is evident that the 20–32 μm fraction exhibits lower $\Delta^{14}C_{org}$ than corresponding smaller (<20 μm) and larger (>32 μm) fractions (Fig. 3B, *t*-test, $p < 0.05$). For example, at a Yellow River pro-delta location (station: B45), the $\Delta^{14}C_{org}$ values of this fraction are ~255‰ and 220‰ lower (~4000 ^{14}C yr older) than those of <20 μm and 32–63 μm fractions, respectively (Table DR2). In some highly energetic regimes local conditions may mobilize of coarser materials. For example, in the Yangtze River prodelta (P01) and the region ~200 km northward (e.g., H20, H21, H23) where wave and tidal action promotes vigorous sediment resuspension

(Wang et al., 2011), $\Delta^{14}C_{org}$ values of coarser fractions (e.g., 32–63 μm) are lower than corresponding 20–32 μm fractions (Fig. DR2b). The theoretical relationship between critical shear stress and grain size of spherical quartz implies that particle sizes centered around 20 μm have the greatest potential to be eroded and remobilized when compared with the more cohesive clay fractions and the coarser silt and sand fractions (Thomsen and Gust, 2000; McCave and Hall, 2006; Fig. 3A). This corresponds to the "sortable silt" fraction (10–63 μm) as defined by McCave and Hall (2006). For practical purposes (i.e., sieve mesh sizes), we adopt a slightly narrower range (20–63 μm) here. The relatively ^{14}C-depleted values of OM associated with this "sortable silt" fraction in subaqueous delta and inner shelf sediments of the CMS are consistent with the influence of particle resuspension processes. Systematic ^{14}C relationships between the sortable silt and other grain size fractions are evident in 12 samples (t-test, $p < 0.05$), but they do not hold across the entire suite of samples investigated ($p > 0.05$). This is likely due to the wide diversity of depositional environments in which other factors such as particle density and shape, and flow viscosity, and particle interactions (e.g., aggregation) may play a role (Thomsen and Gust, 2000).

As remobilized particles enter the bottom boundary layer (BBL), they may contribute to the formation of benthic nepheloid layers (BNLs) that can persist for extended periods of time and result in translocation of entrained particles over considerable distances prior to eventual sedimentation and burial. In the Yellow River delta and in the adjacent Bohai Sea, winter storm waves and tidal currents induce enhanced sediment resuspension (up to 100 mg/l in the BBL; Yang et al., 2011). Enhanced BBL sediment transport on the East China Sea inner shelf has also been indicated from modeling studies (Bian et al., 2013) and observations (Li et al., 2013). The BBL is characterized by significant physical, chemical and biological gradients that promote oxic degradation and transformation of labile OM (Keil et al., 2004; Thomsen and Gust, 2000). While it is not known if BBL processes preferentially act upon materials residing in the sortable silt fraction, residual OM within this fraction is likely to become more refractory and increase in ^{14}C age as a consequence of its protracted residence in the BNL and participation in repeated sediment resuspension-deposition cycles (Aller, 1998; Aller and Blair, 2004). Notably, the pattern of $\delta^{13}C_{org}$ values among grain size fractions echoes that of $\Delta^{14}C_{org}$, with relatively low values for the 20–32 μm fraction (Fig. 3C; p <0.01). This suggests that during resuspension and lateral transport the sortable silt fraction loses OC (Fig. 3D) and retains a greater proportion of ^{13}C-depleted OC due to preferential mobilization of terrestrial material, selective loss of marine OC relative to terrestrial OC, or enhanced degradation of ^{13}C-enriched marine OM (e.g., hydrolysable amino acids, carbohydrates) relative to more refractory ^{13}C-depleted marine OM components (Hwang and Druffel, 2003). Prevailing and seasonally oscillating coastal currents transport and disperse entrained sediment both northward and southward in the CMS (Chen, 2009), with attendant degradation processes promoting attenuation, aging and ^{13}C-depletion of associated OM. In offshore and deeper water settings, relatively high $\Delta^{14}C_{org}$ values suggest translocation of sediments to distal regions of the CMS by other processes (e.g., near-surface transport; Milliman et al., 1985; Chen, 2009) or direct supply from overlying waters. With respect to the latter, the muddy area southwest of Cheju Island, may reflect vertical settling and accumulation of marine OM, as supported by observations of higher chlorophyll-*a* concentrations in surface waters (Fu, et al., 2015) and higher $\delta^{13}C$ values of underlying sediments (data not shown).

Overall, our investigation reveals that marked spatial heterogeneity exists in ^{14}C ages of bulk OC and in grain size fractions from surface sediments of the CMS. This heterogeneity reflects both modern and relict material, and sedimentological influences on OC content and composition. Enrichment of aged OC in the sortable silt fraction of inner shelf sediments is attributed to cyclic resuspension-deposition processes occurring within the BBL. These results shed new light on processes that control the fate and composition of OM delivered to and produced in continental shelf seas, and have implications for carbon cycling and burial in other shallow marginal sea systems (e.g., Dauwe and Middelburg, 1998). With respect to the latter, aging and chemical transformations of OC on shallow and wide continental shelves will confound assessments of OC burial based on simple isotopic mixing models. Assignment of end-members based on $\Delta^{14}C$ or $\delta^{13}C$ values of bulk OC and/or specific molecular tracers of source carbon pools may fail to account for these processes during transport, leading to potential errors in source apportionment, and in corresponding budgets for OM burial. These processes may also lead to aliasing in organic geochemical proxies in sedimentary records. Moreover, since the degree of transport-associated aging likely varies with sea level stand due to changing time- and length-scales of sediment resuspension and redistribution, the magnitude of temporal and spatial offsets between proxy signals associated with different sedimentary phases may also vary. Such processes occurring in continental shelf seas also likely influence the nature of sedimentary OM that is ultimately exported to and buried in sediments accumulating in adjacent ocean basins.

Indeed, sediment and OC redistribution is by no means restricted to shallow marginal seas (McCave and Hall, 2006; Inthorn et al., 2006).

OM-mineral interactions play a key role on continental shelves, influencing OM reactivity and hydrodynamic properties. Protracted sediment entrainment in cyclic resuspension-deposition loops enhances remineralization of OC, prompting these systems to serve as sources for carbon to the atmosphere, while the refractory OC that escapes remineralization is likely to serve as a long-term carbon sink. Overall, the net influence of sediment redistribution processes over continental margins on the carbon cycle, and on continental margin and deep ocean sedimentary archives remains poorly understood, as does the manner in which it may vary under changing ocean and climate conditions.

ACKNOWLEDGMENTS

This work was supported by SNF “CAPS-LOCK” project 200021_140850 (Eglinton), by the National Natural Science Foundation of China (grants 41520104009 and 41521064 to Zhao) and by “111” project (B13030). We thank the reviewers for comments on the manuscript.

REFERENCES CITED

Aller, R.C., 1998, Mobile deltaic and continental shelf muds as suboxic, fluidized bed reactors: Marine Chemistry, v. 61, p. 143–155, doi:10.1016/S0304-4203(98)00024-3.

Aller, R.C., and Blair, N.E., 2004, Early diagenetic remineralization of sedimentary organic C in the Gulf of Papua deltaic complex (Papua New Guinea): net loss of terrestrial C and diagenetic fractionation of C isotopes: Geochimica et Cosmochimica Acta, v. 68, p. 1815–1825, doi:10.1016/j.gca.2003.10.028.

Bian, C.W., Jiang, W.S., Greatbatch, R.J., and Ding, H., 2013, The suspended sediment concentration distribution in the Bohai Sea, Yellow Sea and East China Sea: Journal of Ocean University of China, v. 12, p. 345–354, doi:10.1007/s11802-013-1916-3.

Burdige, D.J., 2005, Burial of terrestrial organic matter in marine sediments: A re-assessment: Global Biogeochemical Cycles, v. 19, p. 1–7, doi:10.1029/2004GB002368.

Chen, C.-T.A., 2009, Chemical and physical fronts in the Bohai, Yellow and East China seas: Journal of Marine Systems, v. 78, p. 394–410, doi:10.1016/j.jmarsys.2008.11.016.

Dauwe, B., and Middelburg, J.J., 1998, Amino acids and hexosamines as indicators of organic matter degradation state in North Sea sediments: Limnology and Oceanography, v. 43, p. 782–798, doi:10.4319/lo.1998.43.5.0782.

DeMaster, D.J., McKee, B.A., Nittrouer, C.A., Jiangchu, Q., and Guodong, C., 1985, Rates of sediment accumulation and particle reworking based on radiochemical measurements from continental shelf deposits in the East China Sea: Continental Shelf Research, v. 4, p. 143–158, doi:10.1016/0278-4343(85)90026-3.

Deng, B., Zhang, J., and Wu, Y., 2006, Recent sediment accumulation and carbon burial in the East China Sea: Global Biogeochemical Cycles, v. 20, p. 1–12, doi:10.1029/2005GB002559.

Fu, D.Y., Huang, Z.J., Zhang, Y.Z., Pan, D.L., Ding, Y.Z., Liu, D.Z., Zhang, Y., Mao, Z.H., and Chen, J.F., 2015, Factors affecting spring bloom in the South of Cheju Island in the East China Sea: Acta Oceanologica Sinica, v. 34, p. 51–58, doi:10.1007/s13131-015-0633-8.

Hedges, J.I., Hu, F.S., Devol, A.H., Hartnett, H.E., Tsamakis, E., and Keil, R.G., 1999, Sedimentary organic matter preservation: A test for selective degradation under oxic conditions: American Journal of Science, v. 299, p. 529–555, doi:10.2475/ajs.299.7-9.529.

Hilton, R.G., Galy, A., Hovius, N., Chen, M.C., Horing, M.J., and Chen, H., 2008, Tropical-cyclone-driven erosion of the terrestrial biosphere from mountains: Nature Geoscience, v. 1, p. 759–762, doi:10.1038/ngeo333.

Huettel, M., Berg, P., and Kostka, J.E., 2014, Benthic Exchange and Biogeochemical Cycling in Permeable Sediments: Annual Review of Marine Science, v. 6, p. 23–51, doi:10.1146/annurev-marine-051413-012706.

Hwang, J., and Druffel, E.R., 2003, Lipid-like material as the source of the uncharacterized organic carbon in the ocean?: Science, v. 299, p. 881–884, doi:10.1126/science.1078508.

Inthorn, M., Wagner, T., Scheeder, G., and Zabel, M., 2006, Lateral transport controls distribution, quality and burial of organic matter along continental slopes in high-productivity areas: Geology, v. 34, p. 205–208, doi:10.1130/G22153.1.

Keil, R.G., Dickens, A.F., Arnarson, T., Nunn, B.L., and Devol, A.H., 2004, What is the oxygen exposure time of laterally transported organic matter along the Washington margin?: Marine Chemistry, v. 92, p. 157–165, doi:10.1016/j.marchem.2004.06.024.

Kennedy, M.J., and Wagner, T., 2011, Clay mineral continental amplifier for marine carbon sequestration in a greenhouse ocean: Proceedings of the National Academy of Sciences of the United States of America, v. 108, p. 9776–9781, doi:10.1073/pnas.1018670108.

Li, Y.H., Qiao, L., Wang, A., Zhang, Y., Fang, J.Y., and Chen, J., 2013, Seasonal variation of water column structure and sediment transport in a mud depo-center off the Zhejiang-Fujian coast in China: Ocean Dynamics, v. 63, p. 679–690, doi:10.1007/s10236-013-0620-6.

Liu, J.P., Xu, K.H., Li, A.C., Milliman, J.D., Velozzi, D.M., Xiao, S.B., and Yang, Z.S., 2007, Flux and fate of Yangtze River sediment delivered to the East China Sea: Geomorphology, v. 85, p. 208–224, doi:10.1016/j.geomorph.2006.03.023.

McCave, I., and Hall, I., 2006, Size sorting in marine muds: Processes, pitfalls, and prospects for paleoflow-speed proxies: Geochemistry Geophysics Geosystems, v. 7, p. 1–37, doi:10.1029/2006GC001284.

Milliman, J., Beardsley, R.C., Yang, Z.S., and Limeburner, R., 1985, Modern Huanghe-derived muds on the outer shelf of the East China Sea: Identification and potential transport mechanisms: Continental Shelf Research, v. 4, p. 175–188, doi:10.1016/0278-4343(85)90028-7.

Qiao, S.Q., Yang, Z.S., Liu, J.P., Sun, X.X., Xiang, R., Shi, X.F., Fan, D.J., and Saito, Y., 2011, Records of late-Holocene East Asian winter monsoon in the East China Sea: Key grain-size component of quartz versus bulk sediments: Quaternary International, v. 230, p. 106–114, doi:10.1016/j.quaint.2010.01.020.

Tao, S., Eglinton, T.I., Montluçon, D.B., McIntyre, C., and Zhao, M., 2015, Pre-aged soil organic carbon as a major component of the Yellow River suspended load: Regional significance and global relevance: Earth and Planetary Science Letters, v. 414, p. 77–86, doi:10.1016/j.epsl.2015.01.004.

Thomsen, L., and Gust, G., 2000, Sediment erosion thresholds and characteristics of resuspended aggregates on the western European continental margin: Deep-sea Research. Part I, Oceanographic Research Papers, v. 47, p. 1881–1897, doi:10.1016/S0967-0637(00)00003-0.

Wang, X.C., Ma, H., Li, R., Song, Z., and Wu, J., 2012, Seasonal fluxes and source variation of organic carbon transported by two major Chinese Rivers: The Yellow River and Changjiang (Yangtze) River: Global Biogeochemical Cycles, v. 26, p. 1–10, doi:10.1029/2011GB004130.

Wang, X.H., Qiao, F.L., Lu, J., and Gong, F., 2011, The turbidity maxima of the northern Jiangsu shoal-water in the Yellow Sea, China: Estuarine, Coastal and Shelf Science, v. 93, p. 202–211, doi:10.1016/j.ecss.2010.10.020.

Yang, S.Y., Jung, H.S., Lim, D.I., and Li, C.X., 2003, A review on the provenance discrimination of sediments in the Yellow Sea: Earth-Science Reviews, v. 63, p. 93–120, doi:10.1016/S0012-8252(03)00033-3.

Yang, Z.S., Ji, Y.J., Bi, N.S., Lei, K., and Wang, H.J., 2011, Sediment transport off the Huanghe (Yellow River) delta and in the adjacent Bohai Sea in winter and seasonal comparison: Estuarine, Coastal and Shelf Science, v. 93, p. 173–181, doi:10.1016/j.ecss.2010.06.005.

FIGURE CAPTIONS

Figure 1. Geographical variations in bulk properties of surface sediments in the Chinese marginal seas (CMS). A: Total organic carbon (TOC) (%). B:) $\Delta^{14}C_{org}$ (‰). C: Mean grain size (µm). Black dots represent sample locations. Areas of fine-grained sediment

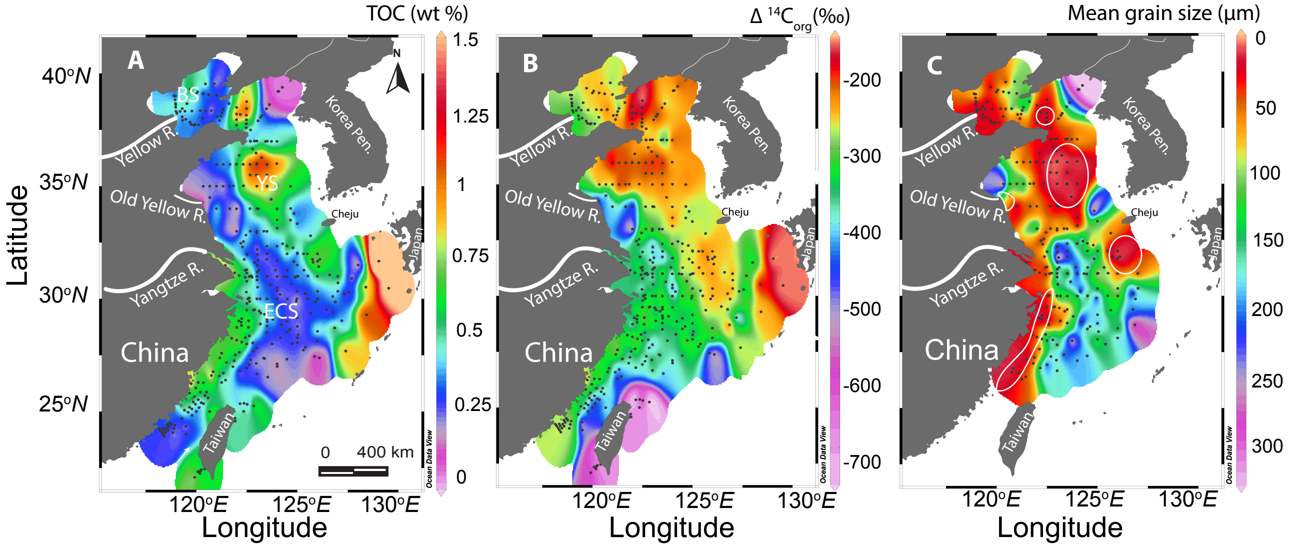
accumulation (red-colored regions in C) match well with those delineated by Qiao et al. (2011).

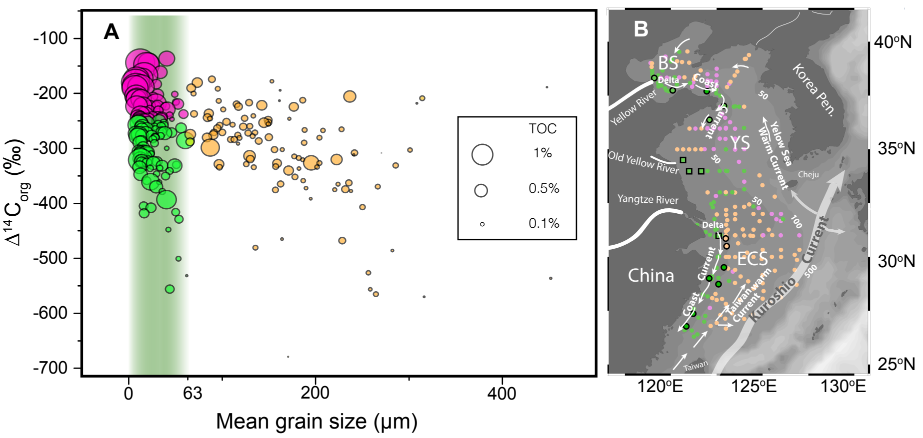
Figure 2. Sedimentological control on bulk total organic carbon (TOC) (%) and $\Delta^{14}C_{org}$ (‰) in surface sediments from the Chinese marginal seas (CMS). A: Relationship between $\Delta^{14}C_{org}$ and mean grain size for surface sediments. Circle size represents approximate % TOC. Green, yellow and magenta circles represent samples with mean grain size of <63 μm and $\Delta^{14}C_{org}$ <–250 ‰ (green), mean grain size <63 μm and $\Delta^{14}C_{org}$ >–250 ‰ (magenta), and mean grain size >63 μm (yellow). Vertical green bar highlights those samples with a mean grain size <63 μm, including those that exhibit depleted $\Delta^{14}C_{org}$ values. B: Locations of the three corresponding sample types. Inner-shelf and highly energetic regime samples selected for geochemical analysis of grain size fractions are highlighted by black circles (n = 12) and squares (n = 4), respectively. Regional circulation patterns are also shown with white arrows indicating the inferred current directions and bathymetric contours (modified from Chen, 2009; Liu et al., 2007).

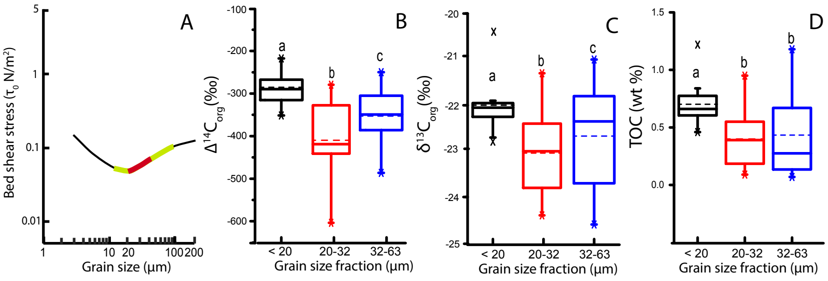
Figure 3. A: Black line shows the idealized behavior of bed shear stress (*y* axis) as a function of grain size (*x* axis) (modified from McCave and Hall, 2006), and green and red curves highlight 10–63 and 20–32 μm grain size ranges, respectively. Box and whisker plots showing $\Delta^{14}C_{org}$ (n = 12; Figure 2B, samples denoted with black circles) (B), $\delta^{13}C_{org}$ (n = 16) (C), and total organic cabon (TOC %) values (n = 16) (D) of <20, 20–32, and 32–63 μm grain size fractions in surface sediments from shallow, near-shore regions of the Chinese marginal seas (CMS) (Fig. 2B). Dashed and solid horizontal lines in the box

indicate mean and median value, respectively; upper/lower “x” symbols and box represent 1% and 99%, 25%, and 75% statistics. Letters (a, b, c) above the boxes indicate a significant statistical difference at the level of $p < 0.05$.

1GSA Data Repository item 2016xxx, xxxxxxxx, is available online at www.geosociety.org/pubs/ft2016.htm, or on request from editing@geosociety.org or Documents Secretary, GSA, P.O. Box 9140, Boulder, CO 80301, USA.


TOC (wt %)
A
BS
YS
ECS
Yellow R.
Old Yellow R.
Yangtze R.
Korea Pen.
Cheju
Japan
China
Taiwan
N
0 400 km
1.5
1.25
1
0.75
0.5
0.25
0
40°N
35°N
30°N
25°N
Latitude
120°E
125°E
130°E
Longitude
Ocean Data View
Δ ^{14}C$_{org}$(‰)
B
-200
-300
-400
-500
-600
-700
Mean grain size (μm)
C
0
50
100
150
200
250
300


A
-100
-200
-300
-400
-500
-600
-700
$\Delta^{14}C_{org}$ (‰)
0
63
200
400
Mean grain size (μm)
TOC
1%
0.5%
0.1%
B
BS
Delta
Coast
Current
Yellow River
YS
Old Yellow River
Yellow Sea Warm Current
Korea Pen.
Cheju
Yangtze River
Delta
China
ECS
Current
Coast
Taiwan warm Current
Kuroshio Current
Taiwan
50
50
50
100
500
40ºN
35ºN
30ºN
25ºN
120ºE
125ºE
130ºE


A
Bed shear stress (τ0 N/m²)
5
1
0.1
0.01
1
10
20
100
200
Grain size (µm)
B
Δ14Corg(‰)
-100
-200
-300
-400
-500
-600
a
b
c
< 20
20-32
32-63
Grain size fraction (µm)
C
δ13Corg(‰)
-20
-21
-22
-23
-24
-25
x
a
b
c
< 20
20-32
32-63
Grain size fraction (µm)
D
TOC (wt %)
1.5
1.0
0.5
0.0
x
a
b
b
< 20
20-32
32-63
Grain size fraction (µm)

Supplementary Table 1.

Results of analysis for bulk organic carbon isotopic composition and content, and mean grain size of surface sediments in the CMS.
Samples for ^{14}C were analyzed directly as CO_2 gas (G) or as solid graphite (S). ^{14}C precision for solids was better than ±5‰ on a modern standard and better than ±10‰ for gas. TOC was measured to a precision of better than 0.03%.

No.	Station	Longitude (°E)	Latitude (°N)	Depth [m]	G/S	R/V	Collected year	Surface sediments depth (cm)	Fm	$\Delta^{14}C_{org}$ (‰)	TOC (wt%)	Mean grain size (µm)	Reference
1	A07	124.8318	33.7889	81.0	S	Dongfanghong II	2013	0-2	0.7025	-302.8	0.21	302.1	This study
2	B01	123.2291	36.2639	75.0	G	Dongfanghong II	2011	0-2	0.8184	-187.6	1.31	7.2	This study
3	B05	122.6853	36.9847	40.7	S	Dongfanghong II	2011	0-2	0.7652	-240.4	0.41	30.7	This study
4	B06	122.8800	37.0000	28.5	S	Dongfanghong II	2011	0-2	0.7388	-266.6	0.24	39.8	This study
5	B08	123.4289	36.9830	73.0	S	Dongfanghong II	2011	0-2	0.7340	-271.4	0.47	46.6	This study
6	B10	123.9925	36.9843	77.0	S	Dongfanghong II	2011	0-2	0.8253	-180.8	0.47	74.0	This study
7	B12	123.0598	37.8947	61.0	S	Dongfanghong II	2011	0-2	0.7684	-237.3	0.33	70.6	This study
8	B13	123.2499	38.1392	65.0	S	Dongfanghong II	2011	0-2	0.8154	-190.6	0.42	67.6	This study
9	B14	123.4784	38.4323	66.0	S	Dongfanghong II	2011	0-2	0.7922	-213.6	0.09	162.1	This study
10	B17	124.0863	39.2084	41.0	S	Dongfanghong II	2011	0-2	0.6971	-308.0	0.00	271.3	This study
11	B22	122.4999	38.7479	54.9	S	Dongfanghong II	2011	0-2	0.8693	-137.1	0.75	40.2	This study
12	B24	122.4800	38.1500	51.0	S	Dongfanghong II	2011	0-2	0.8621	-144.3	1.37	11.9	This study
13	B27	122.4741	37.5958	26.0	S	Dongfanghong II	2011	0-2	0.7454	-260.1	0.35	28.1	This study
14	B28	121.9915	37.7002	22.8	G	Dongfanghong II	2011	0-2	0.7588	-246.8	0.20	45.8	This study
15	B30	121.9979	38.1987	55.0	S	Dongfanghong II	2011	0-2	0.8584	-148.0	1.21	18.6	This study
16	B38	121.1582	37.9109	22.0	S	Dongfanghong II	2011	0-2	0.7745	-231.2	0.46	31.2	This study
17	B39	120.7408	38.3481	29.6	S	Dongfanghong II	2011	0-2	0.8115	-194.5	0.08	162.9	This study
18	B41	120.2013	38.3465	28.0	S	Dongfanghong II	2011	0-2	0.7451	-260.3	0.41	35.3	This study
19	B43	119.4408	38.3252	24.0	S	Dongfanghong II	2011	0-2	0.8002	-205.7	0.44	25.7	This study

20	B45	119.0000	38.3200	20.5	G	Dongfanghong II	2011	0-2	0.6420	-362.9	0.39	16.0	This study
21	B49	118.9711	39.0001	21.4	S	Dongfanghong II	2011	0-2	0.7595	-246.1	0.14	172.6	This study
22	B51	120.0663	39.1826	51.0	G	Dongfanghong II	2011	0-2	0.7424	-263.1	0.50	56.7	This study
23	B53	120.6101	39.0585	36.5	S	Dongfanghong II	2011	0-2	0.7539	-251.7	0.35	105.3	This study
24	B56	120.9000	39.5500	31.5	S	Dongfanghong II	2011	0-2	0.7140	-291.2	0.15	117.8	This study
25	B65	119.3220	37.9195	16.0	S	Dongfanghong II	2011	0-2	0.6435	-361.2	0.25	33.3	This study
26	B68	119.7557	37.7387	16.6	S	Dongfanghong II	2011	0-2	0.7403	-265.1	0.36	29.2	This study
27	B70	120.1158	37.7181	17.0	S	Dongfanghong II	2011	0-2	0.7252	-280.2	0.38	29.2	This study
28	C05	123.5012	35.0022	78.0	G	Dongfanghong II	2013	0-2	0.7669	-238.9	0.89	11.9	This study
29	D05	124.2702	32.4435	47.0	G	Dongfanghong II	2013	0-2	0.6971	-308.2	0.30	242.4	This study
30	DH1-3	123.5069	31.9980	40.0	S	Dongfanghong II	2011	0-2	0.6846	-320.4	0.19	187.0	This study
31	DH1-5	124.5000	32.0006	40.0	S	Dongfanghong II	2011	0-2	0.7520	-253.5	0.47	145.4	This study
32	DH1-6	125.0081	32.0003	45.3	S	Dongfanghong II	2011	0-2	0.7379	-267.5	0.21	208.7	This study
33	DH1-7	125.5000	32.0000	60.5	S	Dongfanghong II	2011	0-2	0.7972	-208.7	0.69	10.7	This study
34	DH1-8	126.0000	32.0000	80.0	S	Dongfanghong II	2011	0-2	0.7576	-248.0	0.65	11.1	This study
35	DH2-0	122.4311	30.9535	12.0	S	Dongfanghong II	2011	0-2	0.6986	-306.6	0.62	13.2	This study
36	DH2-1	122.9977	31.0022	47.7	S	Dongfanghong II	2011	0-2	0.6399	-364.8	0.18	224.9	This study
37	DH2-2	123.5137	31.0023	54.5	S	Dongfanghong II	2011	0-2	0.7244	-280.9	0.25	119.3	This study
38	DH2-4	124.4762	30.9754	45.0	S	Dongfanghong II	2011	0-2	0.7572	-248.4	0.37	149.9	This study
39	DH2-5	124.9921	30.9998	55.0	S	Dongfanghong II	2011	0-2	0.7815	-224.3	0.36	118.3	This study
40	DH2-6	125.5265	31.0143	61.5	S	Dongfanghong II	2011	0-2	0.7473	-258.2	0.32	98.0	This study
41	DH2-7	125.9890	31.0036	67.0	S	Dongfanghong II	2011	0-2	0.7864	-219.3	0.51	52.5	This study
42	DH3-1	122.5518	29.9993	22.0	S	Dongfanghong II	2011	0-2	0.6834	-321.6	0.52	13.5	This study
43	DH3-2	123.0027	29.9993	49.3	S	Dongfanghong II	2011	0-2	0.6720	-333.0	0.28	157.9	This study
44	DH3-3	123.5030	29.9967	67.0	S	Dongfanghong II	2011	0-2	0.7297	-275.6	0.29	117.4	This study
45	DH3-4	123.9986	29.9964	64.0	S	Dongfanghong II	2011	0-2	0.6708	-334.2	0.28	97.7	This study
46	DH3-5	124.5005	30.0018	64.0	S	Dongfanghong II	2011	0-2	0.7277	-277.7	0.26	133.5	This study
47	DH3-7	125.5071	30.0047	60.0	S	Dongfanghong II	2011	0-2	0.7890	-216.8	0.32	129.7	This study
48	DH3-8	126.0071	29.9996	77.0	S	Dongfanghong II	2011	0-2	0.7860	-219.7	0.32	116.1	This study

49	DH4-0	122.8818	29.5188	54.3	G	Dongfanghong II	2011	0-2	0.7331	-272.3	0.67	39.2	This study
50	DH4-1	123.1118	29.4653	61.0	S	Dongfanghong II	2011	0-2	0.7296	-275.7	0.43	91.3	This study
51	DH4-2	123.3788	29.3166	68.0	S	Dongfanghong II	2011	0-2	0.7599	-245.7	0.53	34.4	This study
52	DH4-3	123.7990	29.0914	76.0	S	Dongfanghong II	2011	0-2	0.6764	-328.5	0.45	97.2	This study
53	DH4-4	124.2138	28.8659	72.5	S	Dongfanghong II	2011	0-2	0.6743	-330.7	0.27	286.6	This study
54	DH4-5	124.6297	28.6400	82.3	S	Dongfanghong II	2011	0-2	0.6877	-317.4	0.25	182.9	This study
55	DH4-6	125.0502	28.4136	98.5	S	Dongfanghong II	2011	0-2	0.6905	-314.5	0.24	178.0	This study
56	DH5-2	122.4300	28.2800	65.0	S	Dongfanghong II	2011	0-2	0.6782	-326.8	0.42	159.6	This study
57	DH5-3	122.7892	28.0435	83.8	S	Dongfanghong II	2011	0-2	0.6784	-326.7	0.25	205.0	This study
58	DH6-2	122.1300	27.6300	78.5	S	Dongfanghong II	2011	0-2	0.7828	-223.0	0.57	30.6	This study
59	DH6-4	122.6924	27.2985	96.0	S	Dongfanghong II	2011	0-2	0.6684	-336.5	0.17	183.1	This study
60	DH6-5	122.9648	27.1353	112.0	S	Dongfanghong II	2011	0-2	0.7029	-302.3	0.18	165.0	This study
61	DH7-1	121.1700	27.3800	30.0	G	Dongfanghong II	2011	0-2	0.7161	-289.3	0.66	12.4	This study
62	DH7-2	121.5014	27.1821	58.2	S	Dongfanghong II	2011	0-2	0.6707	-334.2	0.64	11.9	This study
63	DH7-3	121.8146	26.9936	88.0	S	Dongfanghong II	2011	0-2	0.5886	-415.8	0.37	50.8	This study
64	DH7-4	122.1668	26.7915	98.0	S	Dongfanghong II	2011	0-2	0.6133	-391.2	0.13	195.7	This study
65	DH8-1	120.8342	26.7685	47.0	G	Dongfanghong II	2011	0-2	0.6864	-318.6	0.69	12.9	This study
66	DH8-2	121.1406	26.5825	69.0	S	Dongfanghong II	2011	0-2	0.5967	-407.7	0.48	24.5	This study
67	DH8-3	121.4475	26.4022	79.0	S	Dongfanghong II	2011	0-2	0.5761	-428.2	0.40	54.5	This study
68	E01	122.4200	31.2700	19.2	S	Dongfanghong II	2011	0-2	0.7451	-260.4	0.55	13.2	This study
69	E02	123.1000	31.2700	55.0	S	Dongfanghong II	2011	0-2	0.7422	-263.3	0.35	95.6	This study
70	E03	123.9200	31.2800	51.0	S	Dongfanghong II	2011	0-2	0.7402	-265.2	0.25	228.5	This study
71	E04	124.5100	31.2700	54.0	S	Dongfanghong II	2011	0-2	0.7932	-212.6	0.28	187.0	This study
72	E05	125.3300	31.2700	54.0	S	Dongfanghong II	2011	0-2	0.7603	-245.3	0.31	124.7	This study
73	F10	126.1145	31.7502	76.0	S	Dongfanghong II	2013	0-2	0.7327	-272.9	0.74	8.5	This study
74	F1-1	122.6255	30.0355	27.0	S	Dongfanghong II	2007	0-5	0.6818	-322.9	0.7*	14.3*	This study
75	F1-2	123.1600	30.0000	57.0	G	Dongfanghong II	2007	0-5	0.6292	-375.1	0.3*	157.*	This study
76	F1-6	126.8774	29.8624	103.0	S	Dongfanghong II	2007	0-5	0.7251	-279.9	0.4*	150.8*	This study
77	F2-1	122.4993	29.4994	29.0	S	Dongfanghong II	2007	0-5	0.6968	-308.0	0.7*	19.6*	This study

78	F2-2	122.8300	29.5000	55.0	S	Dongfanghong II	2007	0-5	0.7305	-274.5	0.5*	66.6*	This study
79	F2-3	123.5000	29.4000	70.0	S	Dongfanghong II	2007	0-5	0.7247	-280.2	0.4*	84.5*	This study
80	F2-4	125.0005	29.1599	82.7	S	Dongfanghong II	2007	0-5	0.6529	-351.6	0.3*	178.7*	This study
81	F3-1	122.2518	29.1198	21.5	S	Dongfanghong II	2007	0-5	0.6800	-324.7	0.5*	14.3*	This study
82	F3-2	122.5943	29.0283	53.6	S	Dongfanghong II	2007	0-5	0.7450	-260.1	0.7*	15.1*	This study
83	F3-3	123.1698	28.8882	70.9	S	Dongfanghong II	2007	0-5	0.7403	-264.8	0.6*	14.9*	This study
84	F3-4	123.4984	28.7917	72.0	S	Dongfanghong II	2007	0-5	0.6762	-328.4	0.3*	126.4*	This study
85	F3-6	124.4984	28.5334	96.6	S	Dongfanghong II	2007	0-5	0.6853	-319.4	0.4*	130.9*	This study
86	F3-7	125.0016	28.0627	105.0	S	Dongfanghong II	2007	0-5	0.7213	-283.6	0.3*	110.0*	This study
87	F3-8	126.0000	28.1239	116.0	S	Dongfanghong II	2007	0-5	0.7153	-289.6	0.3*	188.6*	This study
88	F4-1	121.7494	28.2503	17.7	S	Dongfanghong II	2007	0-5	0.6784	-326.3	0.7*	27.0*	This study
89	F4-2	122.0001	28.1681	39.0	S	Dongfanghong II	2007	0-5	0.7269	-278.1	0.8*	10.4*	This study
90	F4-3	122.2505	28.0838	69.8	S	Dongfanghong II	2007	0-5	0.7062	-298.6	0.9*	87.9*	This study
91	F4-4	122.5004	28.0007	77.7	S	Dongfanghong II	2007	0-5	0.6786	-326.1	0.7*	196.2*	This study
92	F4-5	122.9995	27.8205	87.9	S	Dongfanghong II	2007	0-5	0.5236	-480.0	0.2*	136.4*	This study
93	F4-7	123.3318	27.3791	106.0	S	Dongfanghong II	2007	0-5	0.6293	-375.0	0.2*	221.4*	This study
94	F4-8	123.9997	27.1164	109.0	S	Dongfanghong II	2007	0-5	0.6325	-371.9	0.2*	190.7*	This study
95	F4-9	124.4894	27.3276	101.0	S	Dongfanghong II	2007	0-5	0.6459	-358.5	0.2*	187.4*	This study
96	F5-1	121.2517	27.5878	27.1	S	Dongfanghong II	2007	0-5	0.7308	-274.2	0.8*	18.6*	This study
97	F5-3	121.8747	27.2573	84.7	S	Dongfanghong II	2007	0-5	0.6348	-369.6	0.6*	29.9*	This study
98	F5-5	122.5003	26.9331	99.8	S	Dongfanghong II	2007	0-5	0.6418	-362.6	0.3*	236.4*	This study
99	F5-7	122.9999	26.6696	128.0	S	Dongfanghong II	2007	0-5	0.6400	-364.4	0.3*	163.3*	This study
100	F6-1	120.7472	26.5994	56.5	S	Dongfanghong II	2007	0-5	0.6839	-320.8	1.1*	13.4*	This study
101	F6-3	121.2514	26.2941	79.1	S	Dongfanghong II	2007	0-5	0.4481	-554.9	0.4*	44.6*	This study
102	FE-1	125.0028	28.7776	96.5	S	Dongfanghong II	2007	0-5	0.6709	-333.7	0.2*	202.5*	This study
103	FE-2	126.0000	28.5600	108.0	S	Dongfanghong II	2007	0-5	0.6912	-313.5	0.5*	130.2*	This study
104	FP05	126.7514	30.1005	96.0	S	Dongfanghong II	2013	0-2	0.7812	-224.7	0.43	280.4	This study
105	FP06	126.7520	29.4001	115.0	S	Dongfanghong II	2013	0-2	0.7251	-280.4	0.24	205.0	This study
106	H01B	122.1191	36.3689	21.0	G	Dongfanghong II	2013	0-2	0.7497	-256.0	0.39	32.0	This study

107	H01	121.0122	35.9646	33.0	S	Dongfanghong II	2011	0-2	0.8315	-174.6	0.33	89.8	This study
108	H02	121.3360	35.9678	37.0	S	Dongfanghong II	2011	0-2	0.7823	-223.5	0.40	38.9	This study
109	H03	121.6658	35.9687	37.0	S	Dongfanghong II	2011	0-2	0.8054	-200.5	0.24	70.0	This study
110	H04	121.9905	35.9653	45.0	S	Dongfanghong II	2011	0-2	0.8034	-202.5	0.58	30.4	This study
111	H05	122.3262	35.9660	55.0	S	Dongfanghong II	2011	0-2	0.7954	-210.4	0.97	7.4	This study
112	H06	122.6627	35.9666	66.0	S	Dongfanghong II	2011	0-2	0.8159	-190.1	1.23	6.3	This study
113	H07	122.9968	35.9662	71.0	S	Dongfanghong II	2011	0-2	0.8254	-180.6	1.35	6.9	This study
114	H08	123.4957	35.9628	73.5	S	Dongfanghong II	2011	0-2	0.8318	-174.3	1.21	7.7	This study
115	H09	123.5000	35.5000	72.0	S	Dongfanghong II	2011	0-2	0.7872	-218.5	0.97	28.6	This study
116	H13	122.3364	35.0122	62.0	S	Dongfanghong II	2011	0-2	0.7672	-238.5	0.78	16.7	This study
117	H15	121.6534	35.0028	46.0	S	Dongfanghong II	2011	0-2	0.8140	-191.9	0.25	96.0	This study
118	H19	120.3433	34.9970	28.0	S	Dongfanghong II	2011	0-2	0.7968	-209.0	0.23	315.2	This study
119	H20	120.6700	34.5000	20.0	S	Dongfanghong II	2011	0-2	0.5039	-499.8	0.23	53.8	This study
120	H21	120.9993	34.0006	19.0	S	Dongfanghong II	2011	0-2	0.5867	-417.6	0.46	17.0	This study
121	H23	121.6604	33.9960	20.0	S	Dongfanghong II	2011	0-2	0.5568	-447.3	0.25	43.1	This study
122	H26	122.6595	34.0017	56.0	S	Dongfanghong II	2011	0-2	0.7514	-254.1	0.40	38.3	This study
123	H27	123.0790	33.9973	68.0	S	Dongfanghong II	2011	0-2	0.7554	-250.2	0.64	33.1	This study
124	H30	124.0000	33.5000	69.0	S	Dongfanghong II	2011	0-2	0.7844	-221.4	0.73	13.0	This study
125	H32	123.4972	32.9957	39.0	S	Dongfanghong II	2011	0-2	0.7692	-236.4	0.44	86.5	This study
126	H33	122.9931	33.0032	36.0	S	Dongfanghong II	2011	0-2	0.7215	-283.8	0.30	113.7	This study
127	H35	123.3465	33.0030	26.0	S	Dongfanghong II	2011	0-2	0.6812	-323.8	0.48	31.0	This study
128	H36	122.0014	32.9984	14.0	S	Dongfanghong II	2011	0-2	0.3247	-677.7	0.04	171.5	This study
129	H37	122.2862	32.3070	25.0	S	Dongfanghong II	2011	0-2	0.6265	-378.2	0.31	36.5	This study
130	H38	122.5037	31.9748	27.0	S	Dongfanghong II	2011	0-2	0.5398	-464.2	0.12	164.9	This study
131	H39	123.0100	31.9600	38.0	S	Dongfanghong II	2011	0-2	0.7187	-286.6	0.34	139.8	This study
132	H43	122.9767	35.4918	70.0	S	Dongfanghong II	2011	0-2	0.7825	-223.3	1.03	7.9	This study
133	H44	122.6671	35.5001	69.0	S	Dongfanghong II	2011	0-2	0.7965	-209.3	1.03	8.4	This study
134	HE-6	124.5000	32.3475	44.0	S	Dongfanghong II	2011	0-2	0.7202	-285.1	0.83	61.2	This study
135	HF1	123.7100	34.4200	78.0	S	Dongfanghong II	2011	0-2	0.7628	-242.9	0.70	9.2	This study

136	KH-HR2	127.4005	27.6828	1676.0	G	Hakuhu Maru	2013	0-1	0.7312	-274.4	0.88		This study
137	KH-HR6	128.4238	29.2903	1065.0	G	Hakuhu Maru	2013	0-1	0.7544	-251.3	1.09		This study
138	KH-HR8	127.3307	30.2113	118.0	G	Hakuhu Maru	2013	0-1	0.7367	-268.9	0.21		This study
139	KH-MT4	127.6875	30.9070	130.0	G	Hakuhu Maru	2013	0-1	0.6773	-327.8	0.15		This study
140	KH-MT5	128.3902	30.5203	822.0	G	Hakuhu Maru	2013	0-1	0.8279	-178.4	0.90		This study
141	KH-YR10	128.0035	31.5037	140.0	G	Hakuhu Maru	2013	0-1	0.6649	-340.1	0.15		This study
142	KH-YR11	129.0308	31.6767	732.0	G	Hakuhu Maru	2013	0-1	0.8523	-154.2	2.14		This study
143	KH-YR9	129.5215	30.4710	687.0	G	Hakuhu Maru	2013	0-1	0.8486	-157.8	1.57		This study
144	KH-YS1	124.6610	33.4967	81.0	G	Hakuhu Maru	2013	0-1	0.7292	-276.3	0.62		This study
145	KH-YS2	124.6678	34.0067	90.0	G	Hakuhu Maru	2013	0-1	0.7512	-254.5	0.50		This study
146	KH-YS3	124.6673	34.9940	94.0	G	Hakuhu Maru	2013	0-1	0.7731	-232.8	0.63		This study
147	LS02	125.4010	27.8517	110.0	G	Dongfanghong II	2013	0-2	0.7528	-252.9	0.34	150.3	This study
148	ME1B	122.0977	29.0232	15.0	S	Dongfanghong II	2013	0-2	0.6581	-346.9	0.64	13.2	This study
149	ME2	122.2282	28.9628	24.0	G	Dongfanghong II	2013	0-2	0.6999	-305.4	0.64	11.6	This study
150	ME3	122.5817	28.7322	63.0	G	Dongfanghong II	2013	0-2	0.7312	-274.4	0.79	11.7	This study
151	ME13	123.0344	30.5215	63.0	G	Dongfanghong II	2013	0-2	0.6648	-340.1	0.45	172.0	This study
152	ME5	123.7520	27.9991	91.0	G	Dongfanghong II	2013	0-2	0.6354	-369.4	0.24	267.6	This study
153	P01	122.7266	31.0170	29.0	G	Dongfanghong II	2013	0-2	0.7000	-305.3	0.64	16.4	This study
154	P02	123.0075	30.8397	47.0	G	Dongfanghong II	2013	0-2	0.5489	-455.3	0.34	229.5	This study
155	P03	123.6633	30.6312	58.0	G	Dongfanghong II	2013	0-2	0.6309	-373.9	0.35	232.6	This study
156	P05	124.1528	30.2002	53.0	G	Dongfanghong II	2013	0-2	0.5451	-459.0	0.13	283.1	This study
157	P07	124.9524	29.9034	56.0	G	Dongfanghong II	2013	0-2	0.6275	-377.2	0.15	238.8	This study
158	P09	125.6666	29.3620	96.0	G	Dongfanghong II	2013	0-2	0.7459	-259.8	0.28	130.2	This study
159	P11	126.8501	28.7107	194.0	G	Dongfanghong II	2013	0-2	0.8002	-205.9	0.58	297.6	This study
160	R01B	122.4537	32.8322	27.0	G	Dongfanghong II	2013	0-2	0.7622	-243.6	0.57	34.9	This study
161	R3	121.8973	31.1588	8.0	S	R/V “Jiang Yu”	2005	0-5	0.6114	-392.7	0.9*	41.1*	This study
162	R4	121.4347	31.4846	16.0	S	R/V “Jiang Yu”	2005	0-5	0.6437	-360.6	0.8*	23.9*	This study
163	S1-4	123.4978	32.3333	40.0	S	Dongfanghong II	2007	0-5	0.6848	-319.9	0.5*	223.3*	This study

164	S1-5	123.9940	32.3340	40.0	S	Dongfanghong II	2007	0-5	0.7447	-260.5	0.3^{*}	123.4^{*}	This study
165	S2-1	122.3745	31.7529	24.0	S	Dongfanghong II	2007	0-5	0.6978	-307.0	0.5^{*}	20.9^{*}	This study
166	S2-3	123.4977	31.7502	36.0	S	Dongfanghong II	2007	0-5	0.4389	-564.2	0.2^{*}	265.4^{*}	This study
167	S2-6	125.9985	31.6682	70.0	S	Dongfanghong II	2007	0-5	0.7580	-247.2	0.7^{*}	11.6^{*}	This study
168	S3-1	122.1292	31.0352	4.0	S	Dongfanghong II	2007	0-5	0.6732	-331.5	0.7^{*}	49.9^{*}	This study
169	S3-10	126.9982	31.0021	100.0	S	Dongfanghong II	2007	0-5	0.7763	-229.0	0.7^{*}	41.0^{*}	This study
170	S3-3	122.6285	30.9983	21.0	S	Dongfanghong II	2007	0-5	0.6956	-309.2	0.6^{*}	12.8^{*}	This study
171	S3-5	123.4993	31.0018	54.0	S	Dongfanghong II	2007	0-5	0.7593	-245.9	0.2^{*}	87.8^{*}	This study
172	S3-6	123.9945	30.9967	39.0	S	Dongfanghong II	2007	0-5	0.4476	-555.5	0.2^{*}	259.4^{*}	This study
173	S3-7	124.3340	30.9947	44.0	S	Dongfanghong II	2007	0-5	0.7337	-271.3	0.3^{*}	135.8^{*}	This study
174	S3-8	125.0326	31.0095	56.0	S	Dongfanghong II	2007	0-5	0.7674	-237.9	0.4^{*}	58.1^{*}	This study
175	S4-3	125.0018	30.3331	63.0	S	Dongfanghong II	2007	0-5	0.7327	-272.3	0.3	128.7^{*}	This study
176	S4-4	126.0000	30.3330	74.0	S	Dongfanghong II	2007	0-5	0.7610	-244.2	0.4^{*}	84.8^{*}	This study
177	S4-5	127.0043	30.3332	100.0	S	Dongfanghong II	2007	0-5	0.7834	-222.0	0.5^{*}	143.1^{*}	This study
178	SE-1	123.0122	31.5010	35.0	S	Dongfanghong II	2007	0-5	0.4778	-525.5	0.2^{*}	257.4^{*}	This study
179	SE-2	122.4957	31.2928	22.0	S	Dongfanghong II	2007	0-5	0.6733	-331.3	0.5^{*}	36.2^{*}	This study
180	Z04	123.0697	31.7122	40.0	G	Dongfanghong II	2013	0-2	0.4527	-535.3	0.10	452.8	This study
181	Z3	124.8351	31.6582	47.0	S	Dongfanghong II	2013	0-2	0.7391	-266.5	0.22	189.0	This study
182	ECS-5221	122.1700	25.3500	380.0	G	Crusie 249	1990	0-2	0.1309	-869.7	$0.3^{\#}$		This study
183	ECS-5224	122.8500	25.2500	831.0	G	Crusie 249	1990	0-2	0.1295	-871.1	$0.7^{\#}$		This study
184	ECS-5321	122.5200	25.3200	137.0	G	Crusie 249	1990	0-2	0.4611	-541.1	$0.2^{\#}$		This study
185	ECS-551-14	123.5000	30.0000	64.0	G	Cruise 551	1999	0-2	0.7030	-301.2	$0.4^{\#}$		This study
186	ECS-551-15	123.5000	29.5000	65.0	G	Cruise 551	1999	0-2	0.6927	-311.4	$0.4^{\#}$		This study
187	ECS-551-16	123.5100	29.0000	67.0	G	Cruise 551	1999	0-2	0.6712	-332.7	$0.4^{\#}$		This study
188	ECS-551-17	123.5000	28.5100	67.0	G	Cruise 551	1999	0-2	0.5983	-405.2	$0.3^{\#}$		This study
189	ECS-551-20	124.0000	29.4900	73.0	G	Cruise 551	1999	0-2	0.6680	-336.0	$0.4^{\#}$		This study
190	ECS-551-22	124.0000	30.5000	50.0	G	Cruise 551	1999	0-2	0.6644	-339.6	$0.3^{\#}$		This study
191	ECS-551-30	124.5000	30.0000	62.0	G	Cruise 551	1999	0-2	0.7128	-291.4	$0.3^{\#}$		This study
192	ECS-551-34	125.0000	31.5000	44.0	G	Cruise 551	1999	0-2	0.7201	-284.2	$0.4^{\#}$		This study

193	ECS-551-38	124.5000	29.0000	81.0	G	Cruise 551	1999	0-2	0.6130	-390.6	0.3$^{\#}$	This study
194	ECS-E-10	125.3000	27.7300	101.0	G	KEEPMASS Cruise	1992	0-2	0.6523	-351.0	0.2$^{\#}$	This study
195	ECS-E-12	124.7400	28.0100	104.0	G	KEEPMASS Cruise	1992	0-2	0.7265	-277.2	0.3$^{\#}$	This study
196	ECS-E-14	124.1700	28.2800	84.0	G	KEEPMASS Cruise	1992	0-2	0.6221	-381.0	0.3$^{\#}$	This study
197	ECS-E-2	122.8300	27.6800	82.0	G	KEEPMASS Cruise	1992	0-2	0.5476	-455.2	0.3$^{\#}$	This study
198	ECS-E-25	127.2000	29.0300	390.0	G	KEEPMASS Cruise	1992	0-2	0.5469	-455.9	0.4$^{\#}$	This study
199	ECS-E-28	126.4400	29.5300	100.0	G	KEEPMASS Cruise	1992	0-2	0.7385	-265.2	0.2$^{\#}$	This study
200	ECS-E-30	125.9100	29.8700	77.0	G	KEEPMASS Cruise	1992	0-2	0.7100	-293.6	0.3$^{\#}$	This study
201	ECS-E-32	125.4000	30.2400	69.0	G	KEEPMASS Cruise	1992	0-2	0.6823	-321.2	0.3$^{\#}$	This study
202	ECS-E-35	124.7100	30.6600	53.0	G	KEEPMASS Cruise	1992	0-2	0.6582	-345.1	0.2$^{\#}$	This study
203	ECS-E-36	125.3100	32.0000	51.0	G	KEEPMASS Cruise	1992	0-2	0.7448	-259.0	0.6$^{\#}$	This study
204	ECS-E-38	125.7800	31.6300	60.0	G	KEEPMASS Cruise	1992	0-2	0.7416	-262.1	0.8$^{\#}$	This study
205	ECS-E-39	126.0600	31.4300	67.0	G	KEEPMASS Cruise	1992	0-2	0.7328	-270.9	0.6$^{\#}$	This study
206	ECS-E-4	123.3800	27.3500	104.0	G	KEEPMASS Cruise	1992	0-2	0.6466	-356.6	0.2$^{\#}$	This study
207	ECS-E-41	126.6000	31.0600	86.0	G	KEEPMASS Cruise	1992	0-2	0.7098	-293.8	0.5$^{\#}$	This study
208	ECS-E-43	127.0100	30.7100	96.0	G	KEEPMASS Cruise	1992	0-2	0.7172	-286.4	0.5$^{\#}$	This study
209	ECS-E-45	127.5500	30.2900	128.0	G	KEEPMASS Cruise	1992	0-2	0.5900	-413.0	0.3$^{\#}$	This study
210	ECS-E-6	124.0100	27.0000	121.0	G	KEEPMASS Cruise	1992	0-2	0.5778	-425.1	0.2$^{\#}$	This study
211	ECS-E-7	126.0900	27.3800	330.0	G	KEEPMASS Cruise	1992	0-2	0.4423	-569.9	0.1$^{\#}$	This study
212	ECS-E-8	125.8500	27.4500	123.0	G	KEEPMASS Cruise	1992	0-2	0.4732	-529.2	0.1$^{\#}$	This study
213	TS-TS01	119.7500	26.2400	7.0	G	Yan Ping-2	2014	0-2	0.8418	-164.6	1.20	This study
214	TS-TS16	119.6725	25.8197	13.0	G	Yan Ping-2	2014	0-2	0.7776	-228.4	0.73	This study
215	TS-TS22	119.9014	25.6650	30.0	G	Yan Ping-2	2014	0-2	0.7160	-289.5	0.70	This study
216	TS-TS27	120.0975	25.5306	47.0	G	Yan Ping-2	2014	0-2	0.5985	-406.1	0.39	This study
217	TS-TS33	120.2492	25.4008	52.0	G	Yan Ping-2	2014	0-2	0.5179	-486.1	0.36	This study
218	TS-TS34	120.3572	25.3506	57.0	G	Yan Ping-2	2014	0-2	0.5340	-470.1	0.47	This study
219	TS-TS41	119.6681	25.1897	28.0	G	Yan Ping-2	2014	0-2	0.6903	-315.0	0.64	This study
220	TS-TS42	119.7883	25.1169	61.0	G	Yan Ping-2	2014	0-2	0.6222	-382.6	0.44	This study
221	TS-TS49	120.0028	25.0044	58.0	G	Yan Ping-2	2014	0-2	0.4532	-550.3	0.26	This study

222	TS-X11	118.6931	24.5167	34.0	G	Yan Ping-2	2014	0-2	0.6931	-312.2	0.54	This study
223	TS-X12	118.7631	24.4378	47.0	G	Yan Ping-2	2014	0-2	0.6022	-402.5	0.31	This study
224	TS-X14	118.8986	24.2478	61.0	G	Yan Ping-2	2014	0-2	0.7806	-225.4	0.22	This study
225	TS-X21	118.5744	24.4372	25.0	G	Yan Ping-2	2014	0-2	0.7648	-241.1	0.46	This study
226	TS-X22	118.6419	24.3453	41.0	G	Yan Ping-2	2014	0-2	0.6795	-325.8	0.39	This study
227	TS-X25	118.8461	24.0714	57.0	G	Yan Ping-2	2014	0-2	0.7670	-238.9	0.11	This study
228	TS-X32	118.5214	24.2608	42.0	G	Yan Ping-2	2014	0-2	0.6964	-309.0	0.26	This study
229	TS-X33	118.5928	24.1681	48.0	G	Yan Ping-2	2014	0-2	0.7032	-302.2	0.21	This study
230	TS-X41	118.3444	24.2664	26.0	G	Yan Ping-2	2014	0-2	0.7564	-249.4	0.15	This study
231	TS-X42	118.4036	24.1764	32.0	G	Yan Ping-2	2014	0-2	0.7744	-231.6	0.44	This study
232	TS-X43	118.4756	24.0794	45.0	G	Yan Ping-2	2014	0-2	0.7735	-232.4	0.18	This study
233	TS-X50	118.1628	24.2497	39.0	G	Yan Ping-2	2014	0-2	0.6581	-347.0	0.44	This study
234	TS-X51	118.2178	24.1750	23.0	G	Yan Ping-2	2014	0-2	0.7338	-271.9	0.29	This study
235	TS-X52	118.2961	24.0853	26.0	G	Yan Ping-2	2014	0-2	0.7987	-207.5	0.08	This study
236	TS-X53	118.3564	23.9939	34.0	G	Yan Ping-2	2014	0-2	0.7145	-291.0	0.40	This study
237	TS-X54	118.4269	23.9025	49.0	G	Yan Ping-2	2014	0-2	0.6907	-314.6	0.26	This study
238	TS-Y11	119.9778	26.0481	37.0	G	Yan Ping-2	2014	0-2	0.7248	-280.8	0.65	This study
239	TS-Y12	120.2072	25.8675	50.0	G	Yan Ping-2	2014	0-2	0.7144	-291.1	0.68	This study
240	TS-Y13	120.4350	25.7144	61.0	G	Yan Ping-2	2014	0-2	0.6369	-368.0	0.58	This study
241	TS-Y14	120.5800	25.6061	71.0	G	Yan Ping-2	2014	0-2	0.6026	-402.0	0.49	This study
242	TS-Y21	119.8586	25.4272	29.0	G	Yan Ping-2	2014	0-2	0.7120	-293.5	0.70	This study
243	TS-Y22	119.9586	25.3272	62.0	G	Yan Ping-2	2014	0-2	0.4683	-535.3	0.25	This study
244	TS-Y23	120.1447	25.1817	55.0	G	Yan Ping-2	2014	0-2	0.4670	-536.6	0.31	This study
245	TS-Y31	119.4247	25.0572	23.0	G	Yan Ping-2	2014	0-2	0.7419	-263.8	0.76	This study
246	TS-Y32	119.5983	24.9681	47.0	G	Yan Ping-2	2014	0-2	0.6316	-373.3	0.31	This study
247	TS-Y33	119.7933	24.8325	66.0	G	Yan Ping-2	2014	0-2	0.4609	-542.7	0.25	This study
248	TS-Z1	119.2997	24.6989	63.0	G	Yan Ping-2	2014	0-2	0.6896	-315.7	0.28	This study
249	TS-Z2	118.9431	24.4000	53.0	G	Yan Ping-2	2014	0-2	0.7593	-246.5	0.19	This study
250	TS-Z3	119.4872	24.3469	56.0	G	Yan Ping-2	2014	0-2	0.3120	-690.4	0.10	This study

251	A1-201307	123.0050	31.1920		G	Dongfanghong II	2013	0-2	0.7031	-302.3	0.32	156.7	This study
252	A7-201307	125.6597	32.8026		G	Dongfanghong II	2013	0-2	0.7172	-288.2	0.40	66.2	This study
253	C2-201307	122.2051	32.4655		G	Dongfanghong II	2013	0-2	0.6834	-321.8	0.45	21.6	This study
254	D3-201307	122.3362	32.5414		G	Dongfanghong II	2013	0-2	0.7355	-270.1	0.49	35.6	This study
255	D9-201307	124.9917	33.3338		G	Dongfanghong II	2013	0-2	0.7346	-271.0	0.33	92.1	This study
256	E3-201307	121.9948	33.9984		G	Dongfanghong II	2013	0-2	0.4730	-530.6	0.11	62.6	This study
257	E7-201307	123.9947	33.9965		G	Dongfanghong II	2013	0-2	0.7280	-277.5	0.58	25.1	This study
258	F4-201307	121.8400	35.0096		G	Dongfanghong II	2013	0-2	0.7843	-221.7	0.37	29.4	This study
259	F8-201307	124.0030	35.0091		G	Dongfanghong II	2013	0-2	0.7576	-248.1	0.68	20.2	This study
260	G3-201307	121.9944	35.9848		G	Dongfanghong II	2013	0-2	0.7835	-222.4	0.51	22.2	This study
261	G5-201307	122.9989	36.0022		G	Dongfanghong II	2013	0-2	0.8015	-204.5	1.08	7.6	This study
262	G7-201307	123.9886	35.9966		G	Dongfanghong II	2013	0-2	0.7483	-257.4	0.97	10.7	This study
263	H1-201307	122.6698	36.9961		G	Dongfanghong II	2013	0-2	0.7269	-278.6	0.34	28.4	This study
264	I5-201307	124.2567	39.3865		G	Dongfanghong II	2013	0-2	0.8171	-189.1	0.07	448.7	This study
265	K7-201307	122.4682	37.7653		G	Dongfanghong II	2013	0-2	0.7223	-283.2	0.38	26.5	This study
266	L6-201307	121.0424	38.0869		G	Dongfanghong II	2013	0-2	0.7282	-277.3	0.35	34.8	This study
267	M1-201307	119.0422	38.2325		G	Dongfanghong II	2013	0-2	0.6464	-358.5	0.40	19.8	This study
268	M3-201307	119.5424	38.6617		G	Dongfanghong II	2013	0-2	0.7530	-252.7	0.59	21.1	This study
269	M5-201307	119.9992	39.0908		G	Dongfanghong II	2013	0-2	0.7471	-258.6	0.42	38.2	This study
270	N05-201307	120.9987	39.0307		G	Dongfanghong II	2013	0-2	0.7348	-270.8	0.33	100.7	This study
271	P02-201307	119.4885	37.9679		G	Dongfanghong II	2013	0-2	0.6796	-325.5	0.45	20.0	This study
272	P3-201307	119.6888	37.8363		G	Dongfanghong II	2013	0-2	0.6694	-335.7	0.31	33.6	This study
273	P4-201307	119.8831	37.7017		G	Dongfanghong II	2013	0-2	0.7150	-290.4	0.38	28.2	This study
274	1-AS-2013	124.7908	32.2653		G	Dongfanghong II	2013	0-2	0.7612	-244.6	0.69	11.5	This study
275	B3-201307	123.0151	32.1925		G	Dongfanghong II	2013	0-2	0.4343	-569.0	0.09	317.1	This study
276	D5-201307	122.9959	32.9290		G	Dongfanghong II	2013	0-2	0.6879	-317.3	0.31	14.2	This study
277	D7-201307	124.0012	33.1421		G	Dongfanghong II	2013	0-2	0.7540	-251.7	0.54	13.3	This study
278	E5-201307	123.0092	34.0069		G	Dongfanghong II	2013	0-2	0.7074	-297.9	0.57	16.1	This study
279	F6-201307	123.0025	35.0000		G	Dongfanghong II	2013	0-2	0.7514	-254.3	0.83	11.6	This study

280	H3-201307	123.0011	37.0014		G	Dongfanghong II	2013	0-2	0.7259	-279.6	0.38	29.0	This study
281	H5-201307	123.5117	36.9995		G	Dongfanghong II	2013	0-2	0.6549	-350.0	0.39	40.1	This study
282	J1-201307	124.0354	39.2037		G	Dongfanghong II	2013	0-2	0.7876	-218.3	0.08	309.4	This study
283	J3-201307	123.6195	38.6186		G	Dongfanghong II	2013	0-2	0.6938	-311.5	0.10	241.7	This study
284	J5-201307	123.1845	38.0526		G	Dongfanghong II	2013	0-2	0.8042	-201.9	0.32	48.9	This study
285	J7-201307	122.6857	37.4925		G	Dongfanghong II	2013	0-2	0.6590	-346.0	0.32	30.3	This study
286	K5-201307	122.1861	38.1816		G	Dongfanghong II	2013	0-2	0.8172	-189.0	1.26	12.5	This study
287	M2-201307	119.3097	38.4405		G	Dongfanghong II	2013	0-2	0.7190	-286.4	0.53	14.2	This study
288	M7-201307	120.4581	39.5324		G	Dongfanghong II	2013	0-2	0.7416	-264.1	0.61	20.1	This study
289	O1-201307	118.8935	39.0132		G	Dongfanghong II	2013	0-2	0.7613	-244.5	0.43	12.8	This study
290	O3-201307	118.9853	38.6198		G	Dongfanghong II	2013	0-2	0.7313	-274.2	0.59	10.2	This study
291	P1-201307	119.3016	38.0753		G	Dongfanghong II	2013	0-2	0.6691	-336.0	0.33	23.3	This study
292	B2 SW	125.7525	31.7497	65.0	G	Dongfanghong II	2011	0-2	0.8188	-187.2	0.80	8.3	This study
293	B50	119.7081	39.3082	26.1	G	Dongfanghong II	2011	0-2	0.7557	-249.9	0.71	16.4	This study
294	B52	120.3371	39.1003	22.0	G	Dongfanghong II	2011	0-2	0.7645	-241.2	0.20	134.1	This study
295	B48	118.9510	38.8338	30.5	G	Dongfanghong II	2011	0-2	0.6710	-333.9	0.25	134.7	This study
296	B47	118.9734	38.6668	25.5	G	Dongfanghong II	2011	0-2	0.7293	-276.1	0.61	14.9	This study
297	B46	118.9830	38.5015	24.0	G	Dongfanghong II	2011	0-2	0.6988	-306.3	0.54	20.4	This study
298	B44	119.2001	38.3157	23.0	G	Dongfanghong II	2011	0-2	0.6001	-404.3	0.41	16.5	This study
299	B42	119.7826	38.3314	26.0	G	Dongfanghong II	2011	0-2	0.7761	-229.6	0.44	22.2	This study
300	B40	120.4501	38.3398	30.1	G	Dongfanghong II	2011	0-2	0.7654	-240.2	0.35	43.2	This study
301	B71	120.3270	38.0093	19.9	G	Dongfanghong II	2011	0-2	0.7053	-299.8	0.20	41.4	This study
302	B69	119.9422	37.7281	16.6	G	Dongfanghong II	2011	0-2	0.6954	-309.7	0.32	24.6	This study
303	B33	121.6252	38.6668	61.0	G	Dongfanghong II	2011	0-2	0.7499	-255.6	0.21	150.2	This study
304	B35	121.3302	38.4006	50.8	G	Dongfanghong II	2011	0-2	0.5981	-406.3	0.26	251.1	This study
305	B36	121.2674	38.2674	41.0	G	Dongfanghong II	2011	0-2	0.7761	-229.6	0.24	101.7	This study
306	B37	121.2174	38.1072	23.0	G	Dongfanghong II	2011	0-2	0.7898	-216.0	0.34	50.1	This study
307	B29	121.9910	37.9488	44.0	G	Dongfanghong II	2011	0-2	0.8618	-144.5	0.98	20.5	This study
308	B31	121.9981	38.4932	52.8	G	Dongfanghong II	2011	0-2	0.8443	-161.9	0.64	33.4	This study

309	B23	122.4898	38.4402	55.0	G	Dongfanghong II	2011	0-2	0.8387	-167.5	1.28	16.0	This study
310	B25	122.4836	37.9475	49.0	G	Dongfanghong II	2011	0-2	0.8339	-172.2	0.98	14.6	This study
311	B09	123.7177	36.9837	76.0	G	Dongfanghong II	2011	0-2	0.6752	-329.7	0.38	51.8	This study
312	B26	122.4809	37.7701	35.0	G	Dongfanghong II	2011	0-2	0.8225	-183.5	0.48	29.2	This study
313	B03	122.7946	36.6535	25.6	G	Dongfanghong II	2011	0-2	0.7644	-241.2	0.46	25.4	This study
314	B02	122.9580	36.4661	62.0	G	Dongfanghong II	2011	0-2	0.7951	-210.7	0.98	12.8	This study
315	H17	120.9996	34.9971	38.0	G	Dongfanghong II	2011	0-2	0.7487	-256.8	0.24	111.9	This study
316	H16	121.3291	34.9965	37.0	G	Dongfanghong II	2011	0-2	0.8278	-178.3	0.16	154.1	This study
317	H10	123.4989	34.9900	77.0	G	Dongfanghong II	2011	0-2	0.7830	-222.8	0.89	14.5	This study
318	H34	122.6738	33.0048	33.0	G	Dongfanghong II	2011	0-2	0.6639	-341.0	0.35	44.3	This study
319	Hailong	120.2800	34.2700		G	Dongfanghong II	2012	0-2	0.4910	-512.7	0.05		This study
320	H18	120.6701	34.9994	33.0	G	Dongfanghong II	2011	0-2	0.7920	-213.9	0.22	97.0	This study
321	5123	122.3640	25.3690							-586.0	0.68		Kao et al., (2014)
322	431y	121.9320	24.5760							-703.0	0.49		Kao et al., (2014)
323	502l	122.3520	25.0040							-682.0	0.56		Kao et al., (2014)
324	k1-0	120.4150	22.4580							-794.0	0.70		Kao et al., (2014)
325	K11A-0	120.1760	22.2530							-637.0	0.69		Kao et al., (2014)
326	KP-05-B	120.2520	22.4170							-669.0	0.47		Kao et al., (2014)
327	KP-3B	120.0850	22.3370							-622.0	0.70		Kao et al., (2014)
328	KP-5A	120.2070	22.3740							-676.0	0.49		Kao et al., (2014)
329	KP-6B	120.1670	22.3300							-651.0	0.58		Kao et al., (2014)
330	KP-B-9	119.9160	22.0820							-501.0	0.90		Kao et al., (2014)
331	NE441w	121.9120	24.7070							-711.0	0.52		Kao et al.,

										(2014)
332	TS-12	119.5000	23.9990					-552.0	0.35	Kao et al., (2014)
333	TS-21	120.6660	25.0000					-379.0	0.79	Kao et al., (2014)
334	ECS1	122.7600	30.9600	25.0	2009	0-1		-466.0	0.59	*Li* et al., (2012)
335	ECS2	122.6400	29.8900	36.0	2009	0-1		-296.9	0.41	*Li* et al., (2012)
336	ECS3	122.2400	28.8200	31.0	2010	0-1		-382.3	0.69	*Li* et al., (2012)
337	ECS5	120.3600	26.2800	47.0	2010	0-1		-245.2	0.47	*Li* et al., (2012)
338	M1	125.0000	32.0300	47.0	2006		0.6900	-311.7	0.36	Wu et al., (2013)
339	M10	123.5400	26.5300	151.0	2006		0.5800	-423.0	0.21	Wu et al., (2013)
340	M12	123.1900	29.3700	67.0	2006		0.3700	-634.1	0.72	Wu et al., (2013)
341	M13	123.5000	29.1200	68.0	2006		0.6100	-392.1	0.32	Wu et al., (2013)
342	M2	124.0000	31.7000		2004		0.5900	-421.3	0.26	Wu et al., (2013)
343	M4	124.8900	30.9600	57.0	2006		0.6600	-340.5	0.37	Wu et al., (2013)
344	M5	124.9800	30.0000	57.0	2006		0.6800	-326.1	0.20	Wu et al., (2013)
345	M6	124.0000	30.3600		2004		0.4200	-584.0	0.30	Wu et al., (2013)
346	M7	125.0100	28.2700	100.0	2006		0.5100	-494.2	0.28	Wu et al., (2013)
347	M9	122.6300	27.0800	106.0	2006		0.4800	-476.8	0.28	Wu et al., (2013)
348	R2	122.4800	30.3000		2005		0.5100	-486.7	0.36	Wu et al., (2013)

349	R3	122.5000	30.7800		2005	0.6100	-385.1	0.47	Wu et al., (2013)
350	R5	122.8800	31.6100		2005	0.6700	-328.3	0.41	Wu et al., (2013)
351	R6	122.5000	31.1500		2006	0.5900	-417.2	0.56	Wu et al., (2013)
352	S2	122.5100	29.8000	23.0	2006	0.5600	-437.1	0.47	Wu et al., (2013)
353	S3	122.0100	28.7400	18.0	2006	0.5200	-477.2	0.69	Wu et al., (2013)
354	S4	122.6200	28.3600	73.0	2006	0.5600	-437.3	0.53	Wu et al., (2013)
355	S5	121.9300	27.5200	80.0	2006	0.5800	-422.6	0.62	Wu et al., (2013)
356	S7	121.3400	26.7100	73.0	2006	0.5500	-450.9	0.59	Wu et al., (2013)
357	S8	120.1000	26.2900	32.0	2006	0.6200	-385.7	0.69	Wu et al., (2013)
358	S9	120.5100	25.8700	66.0	2006	0.6000	-408.8	0.67	Wu et al., (2013)

* indicates data from Zhu et al. (2011).
# indicated data from Kao et al. (2003).

Supplementary Table 2

Results of OC%, $\delta^{13}C_{org}$, and $\Delta^{14}C_{org}$ value (‰) in all the grain size fractions.

Station	Longitude (°E)	Latitude (°N)	Water depth (m)	< 20 μm			20-32 μm			32-63 μm		
				OC (%)	$\delta^{13}C_{org}$	$\Delta^{14}C_{org}$	OC (%)	$\delta^{13}C_{org}$	$\Delta^{14}C_{org}$	OC (%)	$\delta^{13}C_{org}$	$\Delta^{14}C_{org}$
B45	119.0000	38.3200	20.5	0.64	-22.8	-347.8	0.17	-24.0	-603.7	0.26	-23.7	-386.1
B70	120.1158	37.7181	17.0	0.67	-22.0	-291.2	0.52	-22.2	-391.7	0.21	-22.2	-323.2
B28†	121.9915	37.7002	22.8	0.83	-22.2	-217.5	0.20	-22.8	-415.9	0.10	-21.6	-314.0
B06	122.8762	36.9977	28.5	0.64	-22.7	-264.0	0.29	-22.4	-439.3	0.14	-22.0	-355.6
H01B	122.1191	36.3689	21.0	0.57	-22.0	-264.0	0.15	-22.4	-439.3	0.13	-21.9	-355.6
H20	120.6700	34.5000	20.0	0.55	-22.3	-433.2	0.14	-23.4	-638.3	0.09	-22.5	-776.8
H21	120.9993	34.0006	19.0	0.46	-22.6	-463.2	0.21	-23.2	-441.0	0.23	-23.6	-533.5
H23	121.6604	33.9960	20.0	0.48	-22.2	-397.9	0.09	-23.2	-663.2	0.07	-22.5	-708.6
P01	122.7266	31.0170	29.0	0.65	-21.9	-302.9	0.37	-24.4	-408.8	0.56	-24.6	-428.7
P02	123.0075	30.8397	47.0	0.84	-21.0	-270.8*	0.41	-22.7	-425.8*	0.72	-21.7	-385.8*
MZ13A	123.0344	30.5215	63.0	1.22	-20.4	-200.8	0.61	-22.6	-311.6	0.29	-22.0	-296.2
DH4-0	122.8818	29.5188	54.3	0.69	-22.0	-281.5	0.78	-21.9	-279.2	0.74	-21.6	-249.8
ME1	122.0977	29.0232	15.0	0.66	-22.1	-321.9*	0.48	-24.4	-421.9	0.44	-24.6	-443.2*
ME3	122.5817	28.7322	63.0	0.80	-21.4	-351.3	0.95	-21.3	-295.7	0.97	-21.0	-269.2
DH7-1	121.1700	27.3800	30.0	0.66	-22.1	-287.8	0.58	-23.7	-442.8	1.18	-23.8	-383.9
DH8-1	120.8342	26.7685	47.0	0.75	-22.0	-294.4	0.49	-23.9	-513.1	0.62	-23.7	-486.2

* indicates that the ^{14}C measurements were analyzed directly as solid graphite. Others were analyzed as CO_2 gas. The precisions were same as the bulk measurements.

† Bulk $\Delta^{14}C_{org}$ at B28 station is -246.8 ‰.

References:

Zhu, C., Wang, Z. H., Xue, B., Yu, P. S., Pan, J. M., Wagner, T. and Pancost, R., D., 2011, Characterizing the depositional settings for sedimentary organic matter distributions in the Lower Yangtze River- East China Sea Shelf System: Estuarine, Coastal and Shelf Science, v. 93, p. 182-191, doi:10.1016/j.ecss.2010.08.001.

Kao, S.J. Lin, F.J. and Liu, K.K. 2003, Organic carbon and nitrogen contents and their isotopic compositions in surficial sediments from the East China Sea shelf and the southern Okinawa Trough: Deep Sea Research II, v. 50, p. 1203-1217, doi:10.1016/S0967-0645(03)00018-3.

Li, X.X., Bianchi, T., Allison, N. A., Chapman, P., Mitra, S., Zhang, Z. R., Yang, G. P., and Yu, Z. G., 2012, The composition, abundance and age of organic matter in surface sediments from the inner shelf of the East China Sea: Marine Chemistry, v. 145-147, p. 37-52, doi:10.1016/j.marchem.2012.10.001.