

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CHINA-BEIJING

May 1st, 2018 to April 30th, 2019

New scientific results

The $^{224}\text{Ra}/^{228}\text{Th}$ disequilibrium method is extended to quantify benthic fluxes of Fe from coastal sediments. Benthic Fe flux estimates along the China coastal seas are compiled and a correlation of benthic Fe fluxes and water depth in China coastal seas is identified.

Seasonal hypoxia proxy on benthic foraminifera shells: the possible use of Mn/Ca ratios in benthic foraminifera as a proxy for hypoxia have been examined, which has increasingly become a serious environmental issue in many coastal zones. Results showed that a relatively simple physical cleaning approach coupled to LA-ICP-MS provided excellent results on single specimens. Using the LA methodology, Mn/Ca ratios from living *Florilus decorus* (*F. decorus*) specimens from stations in the Yangtze River Estuary are analyzed, and Mn/Ca ratios in penultimate chambers of living benthic foraminifera are found to be sensitive to bottom water DO concentrations. Significant variations of both Mn/Ca and Mg/Ca ratios from different chambers within foraminiferal shell specimens are observed. These fluctuations are likely a response to changing ambient water DO and temperature during the specimen's growth history. Combined use of foraminiferal Mn/Ca ratios together with other proxies could provide a powerful tool for historical reconstruction of low oxygen conditions in seasonal hypoxia areas.

Multi radium isotopes to assess hydrodynamics and retention effect of river-reservoir systems: Radioactive tracer techniques may be useful for assessing water transport and the overall effects of concurrent biogeochemical processes in river-reservoir systems. Results show that radium isotopes can assess the hydrodynamics and sediment/nutrient retention in the Xiaolangdi Reservoir, the largest impoundment along the Yellow River, China. Activity ratios of $^{224}\text{Ra}/^{226}\text{Ra}$ and $^{223}\text{Ra}/^{226}\text{Ra}$ were used for water mass 'age' calculations in the riverine, transition and lentic reaches of the reservoir. Water ages were combined with the length scale of three river-reservoir zones to determine water transport rates of 3.6 ± 1.2 , 1.3 ± 0.3 , and 0.16 ± 0.14 km/day, respectively. Radium ages were also used to quantify the net retention of sediment and nutrients in different parts of the river-reservoir system. Suspended sediment was removed at a rate of 1.4 ± 0.6 g/m³/day, mainly in the riverine zone. Nutrient dynamics were more complicated, with addition or removal at different rates within the three zones.

New publications (published or in press)

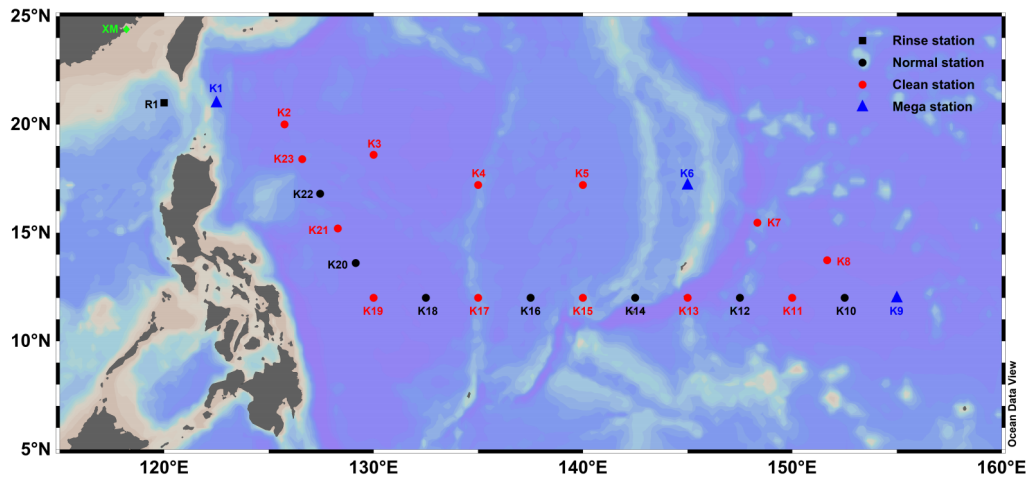
- Guo, X.Y., Xu, B.C., Burnett, W.C., Yu, Z.G., Yang, S.Y., Huang, X.T., Wang, F.F., Nan, H.M., Yao, P., Sun, F.L. A potential proxy for seasonal hypoxia: LA-ICP-MS Mn/Ca ratios in benthic foraminifera from the Yangtze River Estuary. *Geochimica et Cosmochimica Acta*, 2019, 245: 290-303.
- Hong, Q.Q., Cai, P.H., Geibert, W. Zhimian Cao, Ingrid Stimac, Lingfeng Liu, Qing Li (2018), Benthic fluxes of trace metals into the Pearl River Estuary based on $^{224}\text{Ra}/^{228}\text{Th}$ disequilibrium: From alkaline earth elements (Ba) to redox sensitive metals (U, Mn, and Fe). *Geochimica et Cosmochimica Acta*, 237, 223-239.
- Li, L., Li, F.M., Wang, Z.W., Zhao, M.X., Zhang, J., & Ren, J.L. Factors influencing the use of dissolved aluminum as a source tracer in the East China Sea and adjacent waters, *Marine Chemistry*, 2018, 204, 133–143.

- Shi, X.M., Mason, R.P., Charette, M.A., Mazrui, N.M., Cai, P.H. (2018), Mercury flux from salt marsh sediments: Insights from a comparison between ²²⁴Ra/²²⁸Th disequilibrium and core incubation methods. *Geochimica et Cosmochimica Acta* 222, 569-583.
- Wang, J.L., Fan, Y.K., Liu, D.T., Lu, T., Hou, X.L., Du, J.Z. Spatial and vertical distribution of ¹²⁹I and ¹²⁷I in the East China Sea: Inventory, source and transportation. *Science of the Total Environment*, 2019 652, 177–188.
- Wang, Z.W., Ren, J.L., Xuan, J.L., Li, F.M., Yang, T.T., & Guo, Y. Processes controlling the distribution and cycling of dissolved manganese in the northern South China Sea. *Marine Chemistry*, 2018, 204, 152–162.
- Wang, Z.W., Ren, J.L., Zhang, R.F., Xu, D.F., & Wu, Y. Physical and biological controls of dissolved manganese on the northern slope of the South China Sea. *Deep Sea Research Part II*, 2018. <http://doi.org/10.1016/j.dsr2.2018.07.006>
- Xu, B.C., Yang, D.S., Yao, P., Burnett, W.C., Ran, X.B., Charette, M., Huang, X.Y., Sumei Liu, X.M., Yu, Z.G. A new perspective for assessing water transport and associated retention effects in a large reservoir. *Geophysical Research Letters*. 2018, DOI:10.1029/2018GL079687.
- Yang, D.S., Xu, B.C., Burnett, W., Yu, Z.G., Jiang, X.Y., Zhang, X.J., Zhao, S.B. & Xia, X. Radium isotopes-suspended sediment relationship in a muddy river. *Chemosphere*, 2019, 214, 250-258.
- Zhang, J., Liu, Q., Bai, L.L., & Matsuno, T. Water mass analysis and contribution estimation using heavy rare earth elements: Significance of Kuroshio intermediate water to Central East China Sea shelf water, *Marine Chemistry*, 2018, 204, 174–180.
- Zhang, R., Zhu, X., Yang, C., Ye, L., Zhang, G., Ren, J., Wu, Y., Liu, S., Zhang, J., Zhou, M., 2018. Distribution of dissolved iron in the Pearl River (Zhujiang) Estuary and the northern continental slope of the South China Sea. *Deep Sea Res. Part II Top. Stud. Oceanogr.* <https://doi.org/10.1016/J.DSR2.2018.12.006>.

Cruises

- Two cruises in Xiaoliangdi Reservoir in May and September 2018.
- One cruise in Yellow Sea and East China Sea in June 2018.
- Three cruises in the Yangtze River estuary in March, July and August 2018.
- GEOTRACES-China Testing Cruise II, *R/V TAN KAH KEE*, Chief Scientist: Yihua Cai, March 9-18, 2018.
- GEOTRACES-China Testing Cruise III, *R/V TAN KAH KEE*, Chief Scientist: Yihua Cai, February 27 - March 2, 2019.

First GEOTRACES-China Section Cruise (GP09): 25 April -10 June 2019. Cruise chief scientists: Yihua Cai and Kuanbo Zhou (Xiamen University). Departed from Xiamen, China. *R/V “TAN KAH KEE” (Jia-Geng)*. The major objectives are (1) To investigate the horizontal and vertical distribution of trace elements and their isotopes (e.g., Fe, Cu, Ni, REEs, etc) in the western North Pacific (wNP); (2) To identify the source/sink and internal cycle of trace elements/micro-nutrients in the wNP and their coupling with macro-nutrients; and (3) To examine the relation of trace element cycling in the wNP to the oceanic carbon cycle and global environmental and climatic change. Cruise website: <http://geotraces.xmu.edu.cn>



New projects and/or funding

- NSFC project, Using multi-isotopes to study the contribution of Submarine Groundwater Discharge to hypoxia formation off the Yangtze River Estuary, 41876075, 2019.01-2022.12.

PhD theses

- LI Huanxin. The geochemical characteristic and application of rare earth elements in the marginal seas of China Meetings. PhD thesis, 2019, Ocean University of China.

Meetings

- 2019 GEOTRACES-CHINA Cruise Planning Workshop, May 5-6, 2018, Xiamen China. Participants: Robert Anderson, Ken Buesseler, Greg Cutter, Liping Zhou, Jing Zhang, Jingling Ren, Fei Chai, Minhan Dai, Yihua Cai, Kuanbo Zhou, Zhimian Cao.
- A Training Workshop on Metal Speciation and Isotopes in the Ocean for GEOTRACES and Beyond, May 12-17, 2018 Xiamen China. Lecturers and instructors: George Luther III, Edward Boyle, William Sunda, Mustafa Yucel, Xiangkun Zhu, Yihua Cai, Zhimian Cao, Minhan Dai, Kunming Xu, Deli Wang, Xinyuan Zheng, Kuanbo Zhou.
- The Fourth Xiamen Symposium on Marine Environmental Sciences, Xiamen, China, January 6th-9th, 2019 with C3-Bio-GEOTRACES: Trace metals & microbes: The role of trace metals in controlling structure and function of microbial communities in contemporary oceans. The conveners are Punyasloke Bhadury (Indian Institute of Science Education and Research Kolkata, India), Yeala Shaked (The Hebrew University of Jerusalem, Israel), Maria Maldonado (The University of British Columbia, Canada), Yihua Cai (Xiamen University, China), Chris Bowler (Ecole Normale Supérieure, France).
- 4th International Conference on Po and Radioactive Pb Isotopes (INCO-PoPb-2019) East China Normal University, Shanghai, April 8th-11th, 2019.

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