SOURCE OF SEDIMENTARY ORGANIC CARBON IN THE EASTERN YELLOW SEA (THE NORTHWESTERN PACIFIC)

Jung-Hyun Kim¹, Suk-Hee Yoon², Dong-Hun Lee², Hi-Il Yi³, Kap-Sik Jeong³, Masanobu Yamamoto⁴, Jong-Ku Gal², Sujin Kang⁵, Bohyung Choi², Kyung-Hoon Shin²

¹Korea Polar Research Institute, South Korea
²Hanyang University, South Korea
³Korea Institute of Ocean Science and Technology, South Korea
⁴Hokkaido University, Japan

Introduction
River-dominated marginal seas are one of the most important sites of organic carbon (OC) burial in the marine environment. The Yellow Sea is a semi-enclosed, northwestern Pacific marginal sea. Two of the largest rivers in the world, the Huanghe River (Yellow River) and the Changjiang River (Yangtze River) and several smaller Korean rivers (e.g. Han, Geum, and Youngsan Rivers) are flowing into the Yellow Sea, supplying high amounts of terrigenous sediments. Previous bulk- and biomarker-based studies on the origin and distribution of sedimentary OC in the Yellow Sea have shown that the contribution of terrestrial OC is predominant along the coast while that of marine OC is in the central basin. However, most of the studies have thus far focused on the western Yellow Sea, and comparable studies have rarely been conducted in the eastern Yellow Sea. In this study, we aimed to provide qualitative and quantitative assessments of sedimentary OC source and composition in the eastern Yellow Sea. For this purpose, we used a multi-proxy approach on 9 riverbank sediments and 69 marine surface sediments, combining bulk (C/N and δ13C_TOC) and lipid biomarker (GDGTs and n-alkanes) parameters.

Results
The riverbank sediments have low C/N ratios (on average 4.8±0.5, n=9) and enriched δ13C_TOC values (on average −21.5±0.6 ‰, n=9) while the BIT index is on average 0.27. The C/N ratio and δ13C_TOC in the marine surface sediments (n=69) are on average 7.0±0.6 and −21.9±0.5 ‰, respectively, whereas the average BIT index is 0.00±0.01. The Δ14C values of the marine surface sediments are depleted (on average −227±53 ‰, n=8). Molecular distributions of n-alkanes are overall dominated by odd-carbon-numbered high molecular weight n-C27, n-C29, and n-C31. The δ13C signatures of n-C27, n-C29, and n-C31 indicate a large contribution of C3 gymnosperms as the main source of n-alkanes. However, the contribution of thermally matured petroleum-derived OC to the sedimentary OC pool is also evident, especially in the southern part of the study area. Notably, the even-carbon-numbered long-chain n-C28 and n-C30 in this area have higher δ13C values (−26.2±1.5 ‰ and −26.5±1.9 ‰, respectively) than the odd-carbon-numbered long-chain n-C29 and n-C31 (−28.4±2.7 ‰ and −28.4±2.4 ‰, respectively).

Conclusions
The sedimentary OC in the muddy deposits in the eastern Yellow Sea appears to have a predominantly marine origin with minor contribution of continental (i.e. soil- and lake/river-derived) OC. Fossil OC, potentially derived from waste discharges from rivers and oil spills due to shipping activities, is also being contributed to the sedimentary OC pool in the eastern Yellow Sea. Hence, our results highlight a possible influence of petroleum-induced OC on benthic food webs in this ecosystem.