VARIATIONS OF BOUNDARY CURRENTS IN WEST PACIFIC MARGINAL SEAS AND THEIR CLIMATE IMPACT: IOC/WESTPAC WORKING GROUP ON PALEOCURRENTS

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INTRODUCTION

The Yellow Sea is the epicontinental shelf, which is faced by Korea and China. Its water depth is about 55 m in average and more than 100 m in the maximum. The distribution of surface sediments in the Yellow Sea has been studied by many researchers. The grain composition of these sediments is determined by the composition of both the meteorological and oceanic components. Folk's grain classification were mainly focused on grain-size classification of rocks and fluvial deposits, not modern unconsolidated marine sediments. Marine sediments contain fine particles such as fine sand, silt and clay. Therefore, the importance of silt and clay's role in the marine environments is very crucial for transportation, deposition, erosion and resuspension. Recently, the new grain classification for the epicontinental sea sediments has been studied from this project. This work contributes to knowledge of the sediment transportation of the Yellow Sea.

MATERIALS AND METHODS

Grain-size distribution of surface sediments are analyzed in the study area. This study is the result from "Korea-China Joint Study of Sedimentary Dynamics and Paleoenvironments in the Yellow Sea" cooperated since 1998 until the present by KORDI (Korea Ocean Research and Development Institute) of MOMAF (Ministry of Marine affairs and Fisheries) and FIO (First Institute of Oceanography) of SOA (State of Ocean Administration).

All sediment samples are selected only on the surface part including less than 1 cm deep from the grab sampler. Analysis of sediment grain size was done by a sieving method for the sediments larger than 63 ㎛, and by a pipette method for the sediments smaller than 63 ㎛. Coarse sediments greater than sand size (> 63 ㎛) sieved in 0.5 φ interval by the rotap shaker, while fine sediments (silt and clay size) are analyzed by the sedigraph 5100D machine. These results of surface sediment distribution can be scrutinized and compared with those from the previous studies.

RESULTS AND DISCUSSION

From Folk's grain-size classification, mud is composed of silt and clay together, while sand and gravel are separated respectively. Sands are named in which the percentage of sand amounts (2 mm ~ 64 ㎛) is over 90 wt. % of total sediments. Muddy sands range from 50 ~ 90 wt. % of sands and rest of them are muds (silt and clay). Conversely, sandy muds range from 50 ~ 90 wt. % of muds (silts and clays) and the rest of them are sands. Muds are defined as more than 90 wt. % of muds. In this case, muds are composed of silts and clays.

Fourteen divisions of sediment types are identified in this study area based on the modification of Folk's method. The fourteen sediment types are as follows: 1) clay, 2) silty clay, 3) silt-clay, 4) clayey silt, 5) sandy-silty clay, 6) clayey- sandy, 7) clayey-sandy silt, 8) silty clay-sand, 9) clayey-sandy silt, 10) silty clayey sand, 11) silty-clayey sand, 12) clayey silt-sand, 13) clayey silty sand, and 14) sand. The four divisions of sediment types, which are typically used in the rocks and fluvial deposits, are too simplified to the detailed changes of grain sizes. Yi's grain-size classification is composed of fourteen classifications of sediment type. The detailed division of grain particles presents more clearly the pattern and source direction of sediments. Here, the classification of clay ranges 90 ~ 100 wt. % of clay/total sediment sample. The same ranges are applied to those of sand and silt, i. e., 90 ~ 100 wt. % of sand/total sediment sample and 90 ~ 100 wt. % of silt/total sediment sample, respectively. The advantage of this classification shows the specific direction of sediment transportation). Of course, the simple classification can be used a general picture of sediment distribution.

Only sand, silt and clay particles in the total sediment sizes are selected and drawn. The distribution of sands shows clearly that high percentage of sands exists in the northeastern part of Yellow Sea and this distribution is narrowed toward the south. Sand rarely exists in the northwestern part of Yellow Sea. The mechanisms of the very fine grain particles in the central Yellow Sea are already discussed in the above. The

high percentages of silt content are found in the south of Central Mud Deposits (CMD) and in HuckShan Mud Deposits (HSMD) and JeJu Mud Deposits (JJMD). The widespread distribution of sands and muddy sands is found in the eastern part of middle Yellow Sea. And the transportation direction of these sediments shows a tendency to the south. The southern boundary of sands is slightly the south of 35.5 oN, and the western limit is about 123 oE to 124 oE. Sand deposits in the southeastern part of Yellow Sea are identified subtlely in the position of 35.0 oN ~ 35.5 oN and about 121.54 oE from this study area.

Clay content of surface sediments is shown that the depocenter of clay particles in the northwestern Yellow Sea which is the south of Shandong Peninsula. This zone is corresponded with the weakest point of Ms tides. The depocenter of clay particles are believed to be resulted from anticlockwise eddy. The distribution of combined silt and clay contents is shown in the bottom. The distribution pattern of silt-clay content is similar to that of the detailed sediment types classified by Yi. It shows that sediment dynamics are more complicated in the southwestern Korean coasts and adjacent to Jeju Island. In this area, at least 6 isolated mud packages are recognized including the coastal mudbelt in the South of Korea. The muddy sands by Folk's classification are found neighboring sand deposits, whilst the sandy muds are adjacent to the mud distribution. These characteristics indicate muddy sands and sandy muds are the mixture zone by sand and mud areas. As the mechanisms and complex position of CMD, HSMD and JJMD formation in the Yellow Sea are explained above, the interaction of coarse and fine sediments results in the mixture zone of two extreme grain particles.

CONCLUSIONS

1. The surface sediments are analyzed the grain size and show the well-distributed pattern of sediment transportation pattern.
2. The distribution of two types of sediment characteristics, the weight percentage of sands, silts, muds, clays, and mean grain-size contain the specific pattern of sediment transport.
3. The fine sediments (including the mudbelt deposits) in the surrounding area of Hucksan Island are formed also by the strong front of water properties. This mud patch exists adjacentto the coarse sediments such as sands and muddy sands which are explained clearly by the block of strong water front zone.
4. The distribution of surface sedimentological data shows that the sediment transport boundary exhibits approximately 123 oE to 124 oE in the Yellow Sea.

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