

The Desertization and its Derived Deposits of Yellow Sea Shelf During the Last Stage of Late Pleistocene

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The author have made a detailed analysis of the records of shallow stratigraphic profiling across the shelves of the Huanghai (Yellow Sea), total profiling line were more than 3,000 km long over the Yellow sea. We found that in course of the regression during the last stage of late Pleistocene, several areas on the shelves were desertized. The author consider that desert deposits and their derivative sediments had constituted the material base of the so-called "residual sediments" in the shelf areas of the Yellow Sea.

I. The environmental conditions of the shelves of Yellow Sea in the Last Stage of Late Pleistocene.

The climax stage of the last glacial period began from about 25,000y BP. During that stage, the average annual temperature of the whole globe was 6°C lower than at present (Emiliani, 1966). As a result, the Antarctic Ice Sheet spread out further, the Laurentide Ice Sheet developed in North America, and the Scandinavian Ice Sheet was formed in Europe. The ocean lost at least 7,000,000 km³ of water to the land, of which 3,000,000 km³. This volume is large enough to lower the global ocean level by 132m (Flint, 1971).

With sharp temperature drop in that period, the Mongolian High Pressure became much stronger, conducting to the particular monsoon climate in Eastern Asia. Under Mongolian High Pressure, cold and dry air current were prevailing which prevented ice-sheet from being formed in the northern part of Asia Continent (Asia was the only continent in the Northern Hemisphere which was devoid of ice sheet in the Quaternary glacial period). Instead of ice sheet, a semi-ring like desert belt was formed in the middle part of Asia. The exposed shelves of the Yellow Sea in that time were just located on the eastern margin of that desert belt. A drainage systems degenerated under cold climatic condition at that time, rivers becoming shorter and narrower and even dried up or disappeared. Therefore, fluvial process gave way to wind process, the exposed shelf areas of loose sediments with sparse plants, were subject to strong deflation, thus turned to be desertized.

II. The Desertization of the shelf areas of Yellow Sea and its derived deposits

Eolation was not only the major exogenetic force on land but also on shelf region in the ice age. At the climax stage of last ice-age, northern part of China developed with thick layer of loess deposit. the shelf region at that time had a similar climatic condition and deserved same sediment. Because the shelf region was unable to be protected by vegetation in the ice-age, primary deposit strata, under the intensive effect of wind storm, were naturally to be remoulded to produce new sedimentary differentiation and mould new series of land sediment.

Based on available data, the distribution of the desertized area on the shelves of the Yellow Sea and its derivative deposits formed in the last stage of late Pleistocene are plotted.

(1) The desertized areas

There are lots of evidences of shelf desertization revealed in the shallow stratigraphic profiling records acquired from the shelves of the Yellow Sea.

1. the boundary of late/mid-Pleistocene sequences is well preserved and can be traced and correlated over wide areas;
2. the transgressive sequence of the last interglacial period is well preserved in the most part with its top surface cut by later deflation, characterized by relatively high relief in some place, indicating the intensity of desertization.
3. the transgressive sequences formed in the two interstadial stages of the last glacial period and the regressive sequence intercalated between them are mostly destroyed and replaced by new desert deposits.
4. a series of sand deposits with "steep repose-angle" were formed upon the deflation base, with a thickness of about 30m.
5. sand dunes, dune chains and vast sand flats are widely found on the shelves.
6. a thin Holocene depositional sequence with horizontal beddings is completely preserved;
7. the depositional sequence formed in the climax stage of the last glacial period is relatively thick, and in same stations of shallow stratigraphic profiling, it can be divided into two layers: the lower layer consists of sand dune deposit or other eolian sand deposit, while the upper layer formed before the Holocene transgression shows low-angle bedding, indicating that fluvial process had begun to dominate in the sedimentary environment of the shelf seas.

(2) The derivative depositional areas

The derivative deposits from the desertized shelf areas of the Yellow Sea can be classified into three types: completely submerged, partly submerged and completely exposed ones.

A. Completely submerged type

The muddy deposit areas in the centre of the North Yellow sea, in the northern part of South Yellow Sea and on the shelf area to the southwest of the Jizhou (Cheju) Island are typical of it. Among them, the muddy sediments in the northern part of south Yellow Sea have been most thoroughly researched. Based on our study, their characteristics are as follows:

1. they are distributed in patches on the slope of the northern part of the Yellow Sea Trough, indicating that southwesterly or southeasterly monsoon wind were dominant in the South Yellow Sea shelf during their deposits.
2. the sediments are composed of silty clay or clayed silt, with a thickness of 30-40m (Liu Xiqing, 1987; Qin Yunshan, *et al.* 1989).
3. this muddy depositional area has most abundant occurrence of foraminifera and Ostracoda on the South Yellow Sea shelf (Wang, 1980).
4. the ¹⁴C datings of the calcareous concretions contained in these muddy sediments mostly fall between 10000 and 20000 ys, BP.
5. the underlying sequences beneath the derivative deposits are preserved intact, without any indications of being desertized

B. Partly submerged type

This type of derived deposits from the shelf deserts can be represented by the loess deposits

distributed along the southeastern coastal areas of the Bohai Sea, such as those on the west coast Liaodong Peninsula, of Miaodao Islands and along the northwestern coastal zone of Penglai County. They are characterized by partly submersion due to Holocene transgression, while those exposed on land form steep sea cliffs.

C. Completely exposed type

The North Jiangsu Shoal was the largest desert in the western part of South Yellow Sea shelf during late Pleistocene (it has been regarded by many scholars as the deltaic deposit of the ancient Changjiang and Huanghe Rivers). As the ancient monsoon wind coming from mongolian High Pressure Zone had turned northeastly as it reached the eastern side of Shandong peninsula, the dominant wind here should have been also northeastly. Therefore, the derivative deposits of the North Jiangsu Shoal Desert must be distributed to the lee of it. They are the loess deposits in Nanjing and its adjacent areas.

III. Concluding remarks

The revelation of the desertization of the shelf areas of the Yellow Sea and the derivative deposits of the deserts have provided an important scientific basis for the research of genetic relationship among different types of submarine sediments on the shelves. As the shelves of the Yellow Sea had become a part of the land of Asia Continent and was located on the eastern margin of the semi-ringlike desert belt, they were of course in the same climatic environment.

Therefore, desertization processes must have taken place on the shelves of the Yellow Sea, and a series of relevant derivative deposits were formed. The deposits of the deserts and their derivative sediments jointly constituted the material base of the so-called "residual sediments" on the shelves, so the latter could not be simply considered as successive relict sedimentary types.