Paleocurrent of the tidal sand body in Subei coastal plain

ZHANG Jiaqiang¹, LI Congxian¹ and CONG Youzi²

¹. Laboratory of Marine Geology, Tongji University, Shanghai 200092, China; ². First Institute of Oceanography, State Oceanic Administration, Qingdao 266003, China

Abstract Based on analysis of magnetic fabric and magnetic relict, the paleocurrents recorded in drilling cores in Subei coastal plain are bidirectional. NE-SW in the northern core and NW-SE in the southern core. The paleocurrent pattern in the area is similar to that of the tidal current system in the South Yellow Sea. So it is inferred that the convergent-divergent tidal current system existed during stage of sand body formation, and they should be radial in plane.

Keywords: magnetic fabric, paleocurrent, tidal sand body, Subei coastal plain.

The numerous cores drilled in the past few years revealed that there is a fan-shaped sand body with an apex at Dongtai and an area of about 3 000 km² in the postglacial mud deposit area of Subei coastal plain, which is similar, in distributive pattern, to adjacent tidal sand ridge with an apex at Qianggang in south Yellow Sea. The sand body is thin in the west and thick in the east, and the thickest part is more than 30 m. The sand body was believed to be tidal sediments based on tidal sedimentary structures, such as mud banding, vein bedding and bidirectional cross-bedding, and granulometric and heavy mineral features similar to those of radial sand ridge¹,². It is a question whether the sand body formed in a similar current field, while the radial sand ridges formed in south Yellow Sea convergent-divergent tidal current field².

A number of cores have already been obtained from the sand body area in recent years. Among them, the

![Fig. 1. The distribution of Subei tidal sand body and the core stations.](image)
Dinghe core in the south and Dongtao core in the north (fig. 1) were chosen in this note for magnetic fabric and magnetic relict measurement aimed at revealing the paleocurrent of the tidal sand body and discussing distributive pattern of the tidal current during the formation of the sand body.

1 Materials and method

Paleocurrent analysis on drilling core by means of magnetic fabric and magnetic relict is a new method found out in recent years, and its feasibility and good effect have already been verified by application in Chinese oil prospecting. Its principle is that susceptibility anisotropy is caused by shape anisotropy of magnetic mineral; long axis ($K_{max}$), middle axis ($K_{int}$) and short axis ($K_{min}$) of susceptibility ellipsoid correspond to long axis, middle axis and short axis of magnetic mineral, respectively; preferred orientation of magnetic mineral represents that of the grain of sediments, and both were controlled by paleocurrent. Therefore, calculation of paleocurrent can be made by analysis on occurrence of magnetic fabric and principle axis orientation of susceptibility ellipsoid. For drilling core, the paleocurrent calculated from magnetic fabric parameter is apparent. To obtain real paleocurrent, apparent paleocurrent needs to be corrected with orientation of viscous magnetic relict and local magnetic indication.

Experimental materials should be undisturbed sediments. Therefore, the engineering penetration method was applied to taking out a core by a standard core in the field, and non-magnetic, plastic, cylindrical box (length: 2.54 cm, diametre: 2.2 cm) was used to sample the sediments continuously from top to bottom along single core, while the descending direction of the core was marked on every sample. Two cores are typical and both located in the sand body, and 135 samples were obtained from them.

In the laboratory, HKB-1 type susceptor was used to measure susceptibility of 15 orientations for every sample, and magnetic fabric parameters were calculated by means of least squares method; then, JR-4 type spinner magnetometer and JB-1 type alternating field demagnetometer were used to measure magnetic relict and demagnetize every sample step by step, until variability of magnetic relict intensity is very low with increasing intensity of demagnetic field. The obtained magnetic relict can be believed as viscous magnetic relict, its direction represents that of the earth magnetic field. Finally, apparent paleocurrent was calculated on magnetic fabric parameter. Real paleocurrent was obtained by correcting apparent paleocurrent with orientation of viscous magnetic relict and local magnetic indication.

2 Results and discussion

The paleocurrent analysis results of 135 samples from the Dongtao core and the Dinghe core are shown in fig. 2. The results indicate that the paleocurrents of the two core have some common characteristics. First, the paleocurrents of two cores show obvious bidirections from top to bottom, in other words, the paleocurrents of every core section vary frequently in two reverse directions from top to bottom for every sample. Especially, two reverse or approximately reverse paleocurrents may exist in a short core section (table 1). It indicates that the sedimentation at that time was controlled by bidirectional current. Second, the paleocurrents of the two cores show certain