

Characteristics and Vertical Sedimentary Succession of the Early Cretaceous Supercritical Hyperpycnal Flow Deposits on Lingshan Island, Eastern China

Tian Yang¹ and Yingchang Cao¹

¹School of Geoscience, China university of petroleum(East China), Qingdao, China.

ABSTRACT

The discovery of supercritical gravity flow provides some new viewpoints for the explanation the deposits of gravity flows. However, the dynamics, formation, evolution processes of supercritical deep-water gravity flow and diagnosis criteria of their deposits are still controversial worldwide. The supercritical hyperpycnal flow deposits in the upper part of the Early Cretaceous Lingshandao Formation on the north end of Lingshan Island provide a rare opportunity to understand their sedimentary characteristics and vertical sedimentary succession. Field observations, photomosaics, logs and sketches of sections (1:200), and thin sections analysis were performed for this study. Suspended-load-dominated hyperpycnal flow deposits are characterized by typical inverse then normal grading hyperpycnite in siltstones to fine-grained sandstones. Moreover, clear climbing ripples on both lower and upper part of hyperpycnite can also be observed. Bedload-dominated hyperpycnal-flow deposits are characterized by erosion and filling features. The scour filling deposits are dominated by pebbly coarse-grained sandstone with frequent stratification, which is composed of floating pebbles and mud clasts. The gently dipping fore- and backsets laminations in siltstones to fine-grained sandstones are interpreted as the deposits of breaking antidune. The gently dipping concave- to convex-up foresets in siltstone to fine-grained sandstones are interpreted as the deposits of chutes-and-pools. The wide distribution scours are interpreted as erosion by a hydraulic jump of supercritical waxing flow. The lenticular scours infilled by backste stratification in pebbly coarse-grained sandstone are interpreted as the deposits of cyclic steps. The appearance of above sedimentary structures strongly indicated the deposits of supercritical gravity flows. Six fining-upward sequences stacking succession can be recognized in Belaishi section. The deposits of cyclic steps and bedload-dominated hyperpycnal-flow deposits are mainly distributed in the lower part of the fining-upward sequence, while the deposits of breaking antidune, chutes-and-pools, and suspended-load-dominated hyperpycnal flow deposits are mainly distributed in the upper part of the sequence. The vertical organization of those deposits indicated the possible bedform evolution processes of supercritical gravity flow from cyclic steps to chutes-and-pools to breaking antidunes to normal deposition laterally.