Paper Number: 2287

Inferred short-period internal-wave deposits in geological records from cross laminations in deep-water environment

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A new sedimentary deposit in the Xujiajuan Formation, Xiangshan Group (Middle Ordovician), Northwest China, is identified based on three types of sedimentary structures that develop in deep-water environments: (1) bidirectional cross-laminations, which are differed from internal-tide origins [1-2] from the shape of erosion and back-filled surface and its relatively high angle straight and curved lamina; (2) compound wave-ripple laminations, which include offshooting laminations and cross-laminated lenses; and (3) combined-flow related sedimentary structures, which include combined-flow-ripple laminations, quasi-planar laminations, asymmetric small-scale hummocky cross-stratifications (HCS), and combined-flow-ripple marks. We attribute the new sedimentary deposits to the short-period internal wave (SPIW) origin according to its obviously oscillatory flow generated sedimentary structures in deep-water environment [3], and we also attribute the combined-flow related sedimentary structures to the action of SPIWs and the upper dilute flows of bipartite turbidity currents.

A tripartite succession can be determined based on field observation and measuring. The lithology of the lower (Ⅰ), intermediate (Ⅱ), and upper (Ⅲ) divisions is fine-grained sandstone (FGS) to fine-grained silt-rich (40% to 50% silt) sandstone (FGSRS), siltstone to silty shale, and shale, respectively. And the cross laminations are restricted to division Ⅱ. We interpret this tripartite succession into lower SPIWs interacts with dense-flow (upper part of bipartite turbidity currents) deposit division, intermediate SPIW deposit division, and upper-suspension deposit division, as described in this study.

All these observations add to the existing knowledge of the depositional mechanisms of internal waves and internal tides not only from alternating bidirectional currents to oscillatory flows and combined flows, but also from sediment reworking to current reworking.

References:

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