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Depositional History and Sequence Stratigraphy of the Middle Ordovician Yeongheung Formation (Yeongweol Group), Taebaeksan Basin, mid-east Korea

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The Middle Ordovician Yeongheung Formation consists of numerous meter-scale, shallowing-upward cycles which were deposited on a shallow-marine carbonate platform. Many diagnostic sedimentary textures and structures such as supratidal laminite, tepee structure, and solution-collapsed breccia are observed, which enable to infer the dry climate and high salinity conditions during deposition of the formation. In order to understand its depositional history, this study focuses on vertical and spatial stacking patterns of the second- to third-order sequences through the detailed outcrop description and geologic mapping. A total 19 lithofacies have been recognized, which can be grouped into 5 facies associations (FAs): FA1 (Supratidal flat), FA2 (Supratidal or dolomitization of peritidal facies), FA3 (Intertidal flat), FA4 (Shallow subtidal to peritidal platform), FA5 (Shallow subtidal shoal). Global mega-sequence boundary (Sauk-Tippecanoe) occurs in solution-collapsed breccia zone in the lower part of the formation. Correlation of the shallowing-upward cycle stacking pattern across the study area defines 6 transgressive-regressive depositional sequences. Each depositional sequences comprises a package of vertical and spatial staking of shallow subtidal cycles in the lower part and peritidal cycles in the upper part of the formation. According to sequence stratigraphic interpretation, the reconstructed relative sea-level curve of the Yeongweol platform is very similar to that of the Taebaek platform. Based on the absence of siliciclastic sequence such as the Jigunsan Formation and the lithologic & stratigraphic differences, however, the Yeongweol and Taebaek groups might not belong to a single depositional system within the North China platform. The Yeongweol Group can be divided by the four subunits into their unique lithologic successions and geographic distributions. The Eastern subunit of the Yeongweol Group is composed dominantly of carbonate rocks with a high composition ratio of siliciclastic materials dominated facies in the upper part of the Yeongheung Formation. The Middle1 subunit is pervasively recognized by subaerial exposures facies (carbonate breccia, paleosol), whereas the Middle2 subunit is similar to the Middle1 subunit except for the absence of subaerial exposure features. The Western subunit lost some of its primary sedimentary structure and texture in comparison to other subunits, because of the active recrystallization, metamorphism, structural deformation and carbonate diagenesis. This study reveals depositional history and refines sequence stratigraphy of the Yeongheung Formation, promoting understanding of the basin evolution of the Yeongweol Group.