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Seismically induced soft-sediment deformation structures in the Cretaceous non-marine deposits of the southeastern Gyeongsang Basin, Korea

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A variety of soft-sediment deformation structures formed during or shortly after deposition occur in the Cretaceous Seongpori, Goseong, and Dadaepo formations of the southeastern Gyeongsang Basin of South Korea exposed along coastal areas for 0.5$\tilde{2}$ km long. These are mostly present in a fluvial plain facies, which interbedded with lacustrine clay beds and fluvio-volcanic pyroclastic surges or flows. In this study, the features of different kinds of soft-sediment deformation structures have been interpreted on the basis of the sedimentology of structure-bearing deposits, the comparison of generally sedimentary structures, the timing and mechanism of deformation, and the trigger mechanisms.

Soft-sediment deformation structures can be classified into four morphological groups: load structures (load casts, ball-and-pillow structures), soft-sediment intrusive structures (pillars, clastic dykes and sills), ductile disturbed structures (convolute folds, slumps, bed separations), and brittle deformed structures (dislocation breccias, syndepositional faulting).

The most probable triggering mechanisms for these deformations are deemed as seismic shocks, based on following field observations: (1) lateral continuity and occurrences of numerous soft-sediment deformation structures in single level; (2) the restriction of the structures to discrete stratigraphic intervals being correlatable over large areas; (3) distinction between undeformed layer and deformed layer different in origin; (4) absence of slope to indicate gravity sliding or slumping (5) similarity to the structures produced experimentally. The soft-sediment deformation structures in the study areas are thus interpreted to be seismites, which represent an intermittent record of the active tectonic and sedimentary processes during the development and evolution of three formations from the upper Early Cretaceous to the Late Cretaceous. In addition, the paleostress analysis using the orientation of clastic dykes and syndepositional fault-slip data shows that the tectonic events recorded in the deformed unit are divided into E-W or ENE-WSW extension and NE-SW extension in chronological order. The kinematic analysis is concordant with the paleostress field as well as with the regional tectonic setting around the Korean Peninsula during the upper Early Cretaceous to the Late Cretaceous in which the plate motion of Pacific changed from northward or north-northwestward to northwestward subduction beneath the Eurasia Plate.