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変形構造から推定される巨大海中土石流内部の応力および間隙水圧の変化：北海道東部根室層群厚岸層の例
Temporal changes of internal stresses and pore pressures of a large-scale submarine debris flow

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Mass-transport deposits are major components of depositional systems in the deep sea environments. These deposits usually are composed of muddy chaotic deposits, and are expected to conduct as permeability seals over channel deposits. These mass transport deposits appear as transparent layers on seismic data and chaotic intervals in cores (e.g., Weimer, 1991). Regardless of their common occurrence and distinctive geometry, the dynamics of subaqueous mass transport processes (debris flows) are not well known. It is great difficult to observe directly a subaqueous debris flow.

Naruse and Otsubo (2011) documented quantitatively the internal structures of a mass-transport deposit in the Akkeshi Formation, from the middle part of the Cretaceous-Paleocene Nemuro Group, Japan. The paleostress analysis using meso-scale faults (Yamaji, 2000) of a large-scale mass-transport deposit revealed that the flow experienced two different stress fields: (1) a vertical uni-axial compressional stress field with the sigma1-axes oriented normal to the bedding surface (Phase I) and (2) horizontal tri-axial compressional stress fields with the sigma1-axes oriented parallel to paleocurrent direction (Phase II) (Naruse and Otsubo, 2011).

We examined the temporal changes of internal stresses and pore fluid pressures in a submarine mass transport from the relationships between the principal stresses axes and attitude of fault planes in the mass transports deposits in the Akkeshi Formation. We used 22 fault data and stresses of two Phases in a mass transport deposits. We attribute fault variations to the degree of fault overpressure acting on faults to estimate the pore fluid pressure ratio in the submarine mass-transport deposits. The theory can be explained using the Mohr circles. The inferred internal stresses results imply that the stress fields of Phase I are created by a radial spreading of the flow during its downcurrent movement, while the stress fields of Phase II result from compression during deposition on the basin plain (Naruse and Otsubo, 2011). The increase of pore fluid pressure ratio from Phases I to II represents that the pore fluid pressures have been recognized as playing an important role in the occurrence of the faults in Phase II. On the subdivided Phase II, pore fluid pressure ratio increases until Phase IIa and decreases after Phase IIb while sigma-hmax increases during Phase II.

References:

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