Transition from traction carpet deposits to massive structureless unit at the basal part of a turbidite bed

*石原 与四郎[1]、大西 由梨[2]、津田 佳祐[3]、横川 美和[4]
*Yoshiro Ishihara[1], Yuri Onishi[2], Keisuke Tsuda[3], Miwa Yokokawa[4]

1. 福岡大学理学部地球圏科学科地学分野、2. 応用地質株式会社四国支社、3. 日本地研株式会社、4. 大阪工業大学情報科学部
1. Department of Earth System Science Faculty of Science, Fukuoka University, 2. OYO Corporation, 3. Nihon Chiken, 4. Osaka Institute of Technology

An ideal succession of sandy turbidite is from traction carpet deposits to a massive structureless unit (Bouma Ta division) with a sharp erosion surface at the base, overlain by parallel and ripple-cross laminations deposited by a traction current. Depositional processes of traction carpet deposits and massive structureless units suggesting processes of an upper flow-regime condition have been studied, and several models are proposed based on outcrop observations, flume experiments, and numerical simulations. Traction carpet deposits consisting of several inversely graded units may be deposited by successive freezing events of traction carpets at the base of a sediment gravity flow or by repetitive freezes of a basal highly concentrated part of a sediment gravity flow maintaining inverse grading. Typically, each inversely graded unit in traction carpet deposits has an erosion surface at the base. On the other hand, a massive structureless unit of turbidites may be formed when a sediment gravity flow has exceptionally high sedimentation rates that prevent formation of sedimentary structures, or when a sandy debris flow suddenly freezes. Because the head of a sediment gravity flow maintains relatively high shear stresses that prevent sediment deposition, traction carpet deposits are probably deposited during higher shear stress conditions than a massive-structureless unit deposition. Traction carpet deposits and a massive structureless unit can transition between each other when undulations of basal topography are expected. However, detailed transition processes of these units has yet to be clearly explained. In this study, we examined transition processes between traction carpet deposits and a massive structureless unit based on observations of outcrop examples.

Continuous traction carpet deposits overlain by a massive structureless unit are frequently observed at the base of turbidites in the Pliocene Aoshima Formation of the Miyazaki Group, southwest Japan. Turbidites, including several inversely-graded units (thickness of each is ca. 1 cm and upper units are relatively coarser) i.e., traction carpet deposits, dominate the formation. Along the paleocurrent direction, well-continued units that can trace 50 m or more without thickness change and units showing long-wavelength swell-like erosion structures on upcurrent-dip basal topographies are observed at this well-exposed site. In turbidites of the formation, traction carpet deposits gradually transition into a massive structureless unit because basal finer parts of an inversely-graded unit become thinner and disappear toward the top of the bed.

A turbidite in the uppermost part of the Pliocene Kiyosumi Formation, central Japan, has traction carpet deposits showing a bedform-like structure. This structure has a wavelength of 6–7 m and an amplitude ranging from a few cm to 10 cm. Amplitudes of the bedform waves become slightly larger as each unit thickness of traction carpet deposit becomes thicker in the downcurrent direction. Unit boundaries of the traction carpet deposits become unclear and eventually the traction carpet deposits transition into a massive structureless unit. Traction carpet deposits on upcurrent-dip flanks of the bedform-like structure are thin and sometimes show lens-like structures by basal erosion of units. On the other hand, thick and

distinctive inversely graded units are frequently observed on downcurrent-dip flanks of the bedform.

Based on observation of outcrop examples, the following can be concluded: (1) traction carpet deposits can transition into a massive structureless unit both stratigraphically and laterally; (2) thickness and continuity of units in traction carpet deposits have a relation to basal topographies; and (3) some massive structureless units can be observed when erosion surfaces beneath each inversely graded unit of traction carpet deposit become unclear. Traction carpet deposits, i.e., repetitive inversely graded units, are probably formed by erosion pulses (e.g., internal waves) in a sediment gravity flow. In fact, massive structureless units can form in high sedimentation rate conditions of a sediment gravity flow. On the other hand, higher shear stress conditions, such as at or near a front of sediment gravity flow or on upcurrent-dip flanks of basal topography, can form traction carpet deposits by internal waves responsible for repetitive burst and sweep and/or rushes of higher Froude numbers.

キーワード：タービダイト、トラクションカーペットの堆積物、塊状層理、青島層、清澄層
Keywords: turbidite, traction carpet deposit, massive structureless bed, Aoshima Formation, Kiyosumi Formation

