Depositional features and emplacement processes of the 1980 Mount St. Helens (USA) and Usu Zenkoji (Japan) volcanic debris avalanches.

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More than 20 dynamic emplacement models have been proposed to explain the high mobility of large volcanic debris avalanches. Formation processes of debris-avalanche blocks (DBs), jigsaw cracks, and hummocky surface morphology are not yet clearly explained. To explain these formation processes and emplacement mechanism, the 1980 St. Helens and Usu Zenkoji debris avalanche deposits were surveyed. Hummocks, <500 m in diamter, are distributed on the 1980 St. Helens debris avalanche deposit. Fresh hummocks sometimes show steep slopes up to 25^{o}-35^{o} (angles of repose). DBs made of same rock types are located close positions. These evidence suggest that hummocks were formed by disaggregation due to lateral extension and gravitational collapse. Deformations structures in DBs include block deformations by normal faults, and vertical cracks filled by debris-avalanche matrix (DM). These deformation also suggest disaggregation due to lateral extension. The Zenkoji debris avalanche deposit, 7-8ka, $<2km^3$, is widely distributed at the SE foot of Usu Volcano. Echelon-type deformation of unconsolidated DBs made of Toya ignimbrite and river deposits were observed. In the proximal area, amoeba-like thin DM was injected into the DB made of Toya ignimbrite. This structure indicates that fracture of DB was caused by shear stress, the cracks then filled by injection of DM, produced at the bottom of the debris avalanche. Many jigsaw cracks were observed in DBs made of massive Somma lava. Budding-type connections between cracks were common, indicating that these cracks were formed by shear stress. This suggests that jigsaw cracks in the DB were not formed by collision between DBs but by large shear stress within the DB due to a large velocity gradient in the laminar boundary layer at the bottom of the flow.