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Depositional processes of mass flows beyond the base-of-slope area and changes in slope failures in the SW Ulleung Basin (East Sea, Korea)

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A detailed analysis of MR1 sonar and chirp (2−7 kHz) profiles with 5 (2.9−9.4 m long) piston cores and 17 AMS 14C ages reveals spatial and temporal variations in depositional style of mass-flow lobes in the Ulleung Basin. On MR1 sonar image, eight N−S elongated mass-flow lobes are identified in the western basin plain (>2100 m). Lobes 1−4, deposited retrogressively, have large dimensions (>27 km long and 15−25 km wide) and occupy in the lower stratigraphic position. On the other hand, lobes 5−8, deposited in the more proximal area, have small dimensions (8.8−31.5 km long and $1.2^{-1}2$ km wide) and occur in the upper stratigraphic position. Lobes 1 and 2 are characterized by relatively strong back-scattering intensity with smooth surfaces on MR1 image, and show flat, sharp bottom echo and several distinct to diffuse internal reflectors in chirp profiles. Sediments near their edges consist of fine-grained (muddy) turbidites with minor massive clay-rich sand. However, they change to coarse-grained debrites and turbidites with the overlying fine-grained turbidites toward the proximal part. Lobes 1 and 2 deposited between ca. 20 and 18 cal. ka B.P. Lobes 3 and 4, overlying lobe 2, show weak to medium back-scattering intensity on MR1 image with slightly irregular to hummocky surfaces corresponding to small-scale (<100 m wide and <5 m high) hyperbolic bottom echoes in chirp profiles. Upper surfaces of the lobes are nearly flat to convex-up in cross section. Widths of lobes 5−8 abruptly decrease to the proximal part, forming a bottle-neck morphology. They generally show weak to medium back-scattering intensity with relatively strong back-scattering intensity along the margins on MR1 image. They exhibit convex-up upper surfaces with distinct lateral margins in chirp profiles as their bottom echoes are seafloor-tangent hyperbolic to small (<100 m wide and <5 m high) hummocky. Near the edges of lobe 6 and 7, sediments comprise coarse-grained debrites and turbidites with the overlying thin fine-grained turbidites. Lobes 6 and 7 were deposited prior to ca. 16 cal. ka B.P. The larger dimensions of lobes 1−4 with the dominant fine-grained turbidites at their edges suggest that relatively huge masses including high contents of mud failed on the slope area and transported downslope in the early stage of sea-level rise after the Last Glacial Maximum. After that, the volume of failed mass with mud contents had decreased, depositing lobes 5−8. The downslope (i.e. toward the distal area) decrease in convexity of upper surface, irregularity of bottom echo and contents of sand and gravel in the mass-flow lobes is suggestive of dilution in mass-flow concentration, probably due to mixing of ambient water and removal of coarse-grained sediments by deposition during downslope movement.