TRANSFORMATION OF COHESIVE AND NONCOHESIVE DEBRIS FLOWS IN SUBAERIAL AND SUBAQUEOUS SETTINGS

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Debris flows are an important means of sediment transport and deposition in subaerial and subaqueous settings. They commonly transform into dilute flow types (e.g., hyperconcentrated flow, concentrated density flow, or turbidity current) when they mix with ambient water. In subaerial settings, noncohesive debris flows transform easily into dilute flow types when they run over a streamflow, producing a transition facies composed of a hyperconcentrated-flow deposit overlain by a debris-flow deposit in one sedimentation unit. On the other hand, cohesive debris flows are able to maintain their coherence and textural uniformity over 100 km without transforming into dilute flows. The behavioral difference between the cohesive and the noncohesive flows is caused mainly by the difference in the miscibility of the flows with associated streamflows, which depends strongly on the mud content in the matrix. In subaqueous settings, cohesive debris flows can be efficiently diluted because their impermeable (muddy) matrix facilitates hydroplaning. In this case, they produce a transition facies similar to that of subaerial noncohesive debris flows. Noncohesive debris flows in subaqueous settings may transform into dilute flow types as readily as subaerial ones because of larger flow resistance and the lack of surface tension effects by interstitial water. Some studies suggest, however, that clast-rich debris flows may be subject to neither hydroplaning nor vigorous surface transformation, remaining as debris flows to their termini. Further study on the transformation processes and related sedimentary features is necessary for resolving a number of problems regarding hazard assessment of mass-movement processes, characterization of reservoir rocks, and the definition and classification of sediment gravity flows.