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Gravity flows, turbidites and submarine erosion from slope failure on the Piton de La Fournaise volcano (La Réunion Island)

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The aim of the present work is to understand the interaction between the submarine geomorphology and the sediment gravity flows that erode Piton de la Fournaise volcano (La Réunion), one of the most active oceanic volcanoes on the Earth. Our study gives a new interpretation of geophysical surveys and gravity cores from the 1988 offshore campaign “Fournaise 2” aboard R/V Marion Dufresne. Past submarine studies on the volcano have evidenced many huge and successive debris avalanche deposits. These deposits are surrounded and covered by coarse volcanic sand, positively graded gravel and fine-grained turbidites. Away from the shore, the top of the sedimentary pile is made of hemipelagic sediments dated 12000yr BP.

We used the 14 cores that were drilled during the “Fournaise 2” cruise, on which we carried out Rx radioscopy and laser grading (whenever possible). We combine these data with a new compilation of bathymetry and acoustic data. Lithologic cores analysis allows distinguishing different sediment origin, as alluvial origin or submarine origin. The cores exhibit sandy debris flows that arise essentially from submarine instability. Five cores show a great number of turbidite layers. These turbidites are present not only in the distal part of the volcano, but also in a recess of the northeast rift zone, in the vicinity of the shore. The lack of obvious sediment layer correlation between cores suggests that most of sediment gravity flows are confined by the morphology. This implies that most of gravity flows that occur on the submarine flanks of the Piton de La Fournaise volcano originate from small events. Therefore, thalwegs are quickly formed and filled at all scales, yielding a rapid evolution of distal facies.