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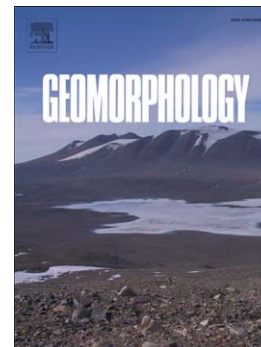
Rock avalanches clusters along the northern Chile coastal scarp

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**Rock avalanches clusters along the northern Chile coastal scarp**

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**Abstract**

*Rock avalanche clusters can be relevant indicators of the evolution of specific regions. They can be used to define: the type and intensity of triggering events, their recurrence and potential probability of occurrence, the progressive damage of the rock mass, the mechanisms of transport and deposition, as well as the environmental conditions at the time of occurrence. This paper tackles these subjects by analyzing two main clusters of rock avalanches (each event between 0.6 and 30 Mm<sup>3</sup>), separated by few kilometers and located along the coastal scarp of Northern Chile, south of Iquique. It lies, hence, within a seismic area characterized by a long seismic gap that ended on April 1st, 2014 with a  $M_w$  8.2 earthquake. The scar position, high along the coastal cliff, supports seismic triggering for these clusters. The deposits' relative positions are used to obtain the sequence of rock avalanching events for each cluster. The progressive decrease of volume in the sequence of rock avalanches forming each cluster fits well the theoretical models for successive slope failures. These sequences seem to agree with those derived by dating the deposits with ages spanning between 4 kyr and 60 kyr. An average uplift rate of 0.2 mm/yr in the last 40 kyr is estimated for the coastal plain giving a further constraint to the rock avalanche deposition considering the absence of reworking of the deposits. Volume estimates and datings allow the estimation of an erosion rate contribution of about 0.098-0.112 mm km<sup>-2</sup> yr<sup>-1</sup> which is well comparable to values presented in the literature for earthquake induced landslides. We have carried out numerical modelling in order to analyze the mobility of the rock avalanches and examine the environmental conditions that controlled the runout. In doing so, we have considered the sequence of individual rock avalanches within the specific clusters, thus including in the models the confining effect caused by the presence of previous deposits. Bingham rheology was the most successful at explaining both the distance and the geometry of the observed events.*

**Keywords:** rock avalanches, dating, modeling, runout, coastal scarp, sediment yield, erosion rate

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