



Genesis and morphological evolution of coastal talus-platforms (fajãs) with lagoons: the case study of the recently-formed Fajã dos Milagres (Corvo Island, Azores)

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Supratidal talus-platforms are low-relief subaerial accumulations of debris resulting from mass wasting along high coastal cliffs, being especially abundant at reefless volcanic islands exposed to high wave energy. Known as “fajãs” across the Portuguese-speaking Atlantic archipelagos, these coastal morphologies may occasionally feature lagoons, constituting sites of high geological, biological, landscape, and social value. Whilst the origin of fajãs is firmly established as being the product of landslides, little is known about the processes that shape fajãs with lagoons. In particular, doubts still remain concerning whether fajãs featuring lagoons are a fortuitous product of mass wasting, or conversely result from marine reworking by waves and currents after emplacement. On October 30, 2012, a coastal landslide (~0.001 km³) occurred on Corvo Island, Azores Archipelago, forming a nearshore gravel islet that later evolved to form a fajã with an ephemeral lagoon system (Fajã dos Milagres). This event provided a unique opportunity to study the generation and development of fajãs with lagoons, and therefore a 3-year survey was carried out to record its evolution. Here we present the results of this GIS-based study, which used aerial oblique photography and satellite optical imagery, complemented with a land survey. Analysis of data concerning bathymetry, precipitation, and wave regime was also employed to investigate the driving forces behind the morphodynamic evolution of the deposit. Our observations on this case study suggest that fajãs with lagoons may develop very rapidly, possibly through an evolutionary pattern with five main stages: 1) “islet stage”; 2) “gravel spit stage”; 3) “early lagoon system stage”; 4) “mature lagoon system stage”; and 5) “fajã (without lagoon) stage”. Moreover, our work shows that marine reworking of sediments across a wide and shallow shelf is a key factor in the development of this type of fajãs. Observations also suggest that, for fajãs with lagoons to be formed, several factors should converge: a) presence of high coastal cliffs, capable of producing sufficiently large landslides; b) presence of cliffs made up of composite volcanic sequences, which promote large debris avalanches capable of supplying mobile sediment to the shelf; c) presence of a shallow, wide insular shelf where the sediments can be transported without significant loss to the submarine slopes; and d) a wave-dominated, high-energy regime, capable of significant cross-shore and longshore sediment drift. Based on our observations we propose a preliminary conceptual evolutionary model for the generation of fajãs with lagoons, where marine reworking plays a fundamental role. Finally, this study documents the generation and very rapid subsequent evolution of a clastic coastal morphology solely driven by the action of waves and currents, and without interference from relative sea level and/or external sediment replenishment, with possible implications to other coastal settings.

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