



Geohazards in rocky coastal areas

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Rocky coasts occur in a variety of geological settings with a wide range of morphologies depending on rock type, tectonics and climate. Rocky coastal areas can be associated with mountainous regions characterized by active or recent tectonics or volcanic activity, or develop as low relief cliffs along non-active margins limiting seawards flattened areas. Besides coastal slope, tectonic activity may shapes seafloor morphology of marine areas, characterized by high gradients, low width and abrupt continental margins, with submarine canyons close to the shoreline. Steep coasts commonly occur also in glacial environments, such as fjords or lakes. In all these settings, slope instability represent the most effective hazardous process, able to erode and transfer large volume of materials directly, or via coastal streams, into the sea, lake or a fjord. The geological processes that regulate sediment transfer in these environments also cause major physical changes both onshore and at sea, and their understanding is essential for hazard assessment and related geological risk.

Material eroded from rocky coasts is mostly delivered in the form of cliff debris, landslide accumulations, coarse-grain deltas and ultimately as fluvial turbiditic flows (hyperpycnal flows). Due to high gradient seafloor topography and narrow or non-existent shelf often facing rocky coasts, the latter deposits are often bypassed to open sea and less frequently, as wider shelf develop, can be trapped at shallow depth as sandy lobes.

Coastal evolution mainly depends on the balance between sediment availability and wave reworking processes. As regards to rocky coast, delivery of sediment typically occur through a variety of mass wasting processes with a significant impact on human activity. The intermittent nature of such processes also imply low persistence of the displaced material in the littoral environment to act as armour for further erosion. This

exposes rocky coasts to an irreversible loss of land over human-scale periods.

Mass movement is a fundamental component of landscape evolution in rocky coasts, that accounts for active cliff recession, and induce sudden increase of sediment load in short coastal rivers. This expose coastal communities to significant hazard, particularly ones located on unstable alluvial deltas or along the path of floodwaters. A major source of materials at rocky coasts is further related to catastrophic collapse of coastal volcanic structures and rocky slopes with significant tsunamigenic implications as the displaced materials impact a lake or the sea.