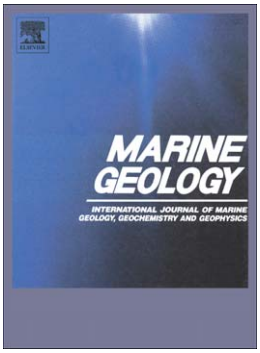

How does wave impact generate large boulders? Modelling hydraulic fracture of cliffs and shore platforms

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How does wave impact generate large boulders? Modelling hydraulic fracture of cliffs and shore platforms

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Abstract

Boulder quarrying by large waves along steep, high-energy coastlines contributes to erosion both by causing inland migration of cliff faces and by vertical lowering of coastal platform surfaces. It also leads to the formation of coastal boulder deposits (CBD) above and inland of the high water mark. We describe mechanisms by which hydraulic fracture creates boulders from cliffs and bedrock platforms. Intense fluid pressures are induced by wave impact on the base of overhanging ledges, and also along interior surfaces as cracks fill with water during wave runup and overtopping. These processes impose large loads on the overlying rock, and bending stresses thus induced can create or propagate microcracks in the rock. Repeated loading leads to complete fracture and detachment of bedrock slabs, which are liberated as boulders.

We consider these processes using the Aran Islands (Ireland) as a type locality, both because CBD there are well documented and because flat-lying strata and orthogonal joint patterns yield tabular bedrock geometry, which lends itself to modelling. The loaded rock is modelled as a beam with a