The Impact of extreme storm waves on rock coasts

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That major storms are capable of producing extreme ocean waves with heights of well in excess of 20m is well known. The frequency of such waves appears to be increasing over the last 30 years. Less well known is the impact of these extreme waves on coasts, especially rocky coasts. This paper examines the spatial distribution and processes of quarrying, transport and deposition of rocky sediments that we have termed Cliff Top Storm Deposits or CTSDs that are found sitting on top of rock cliffs along the Atlantic seaboard of Europe. We show that extreme offshore waves regularly arrive at some coasts with enough un-attenuated energy to be capable of substantial cliff-face and cliff-top quarrying at altitudes well in excess of those normally found. We propose mechanisms to account for both the removal of rock from the cliff face under extreme wave impact and for the subsequent transport of boulders inland under the exceptional velocities experienced under bore flow conditions and can demonstrate this by videos and time-series cliff-top laser scans of quarrying and boulder movements. Whereas substantial reworking during modern storms is an important ongoing coastal process, over longer time spans dateable material interbedded with CTSDs allows 14C and optically stimulated luminescence (OSL) dating of phases of CTSD activity to provide an indication of the frequency and timing of severe storms. As such CTSDs represent an overlooked archive of storm sedimentation with potential to elucidate local storm chronologies as well as informing debate surrounding the palaeo-tempestology and impact of major cyclones and hurricanes. That extreme storm waves are capable of quarrying, transporting and depositing large blocks at altitude and significant distances inland raises questions about the use of such deposits as diagnostic of palaeo-tsunami.

References