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# Slope Failure Hazards at Basalt Geomorphosites: A Comparative Analysis of the Giant's Causeway World Heritage Site, UK and Penghu Marine Geopark, Taiwan.

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Columnar basalt landscapes hold a fascination that transcends geographical and cultural boundaries. It is because of this that they feature so prominently on the global register of significant geomorphosites. Arguably the most iconic of these basalt landscapes is the Giant's Causeway in Northern Ireland, a status recognized by its inscription as a World Heritage Site. Recognition at this level invariably brings visitor pressure, and with it concern as to the impact they exert on site integrity. Rarely, however, is the same overt concern expressed for the risks that such sites pose to the visitors – or not at least until disaster strikes. Yet, the very features that make these sites attractive – tall, exposed, largely unconstrained columns – render many of them intrinsically unstable, prone to catastrophic collapse and potentially hazardous to visitors. In this presentation we highlight the nature of these slope instability issues through a comparative analysis of two geographically contrasting basalt geomorphosites. Investigations of slope hazard at the Giant's Causeway have shown that many are linked to the distinctive structural characteristics and weathering patterns of flood basalts. Typically, individual flows comprise a columnar 'colonnade', topped by a blocky 'entablature' and separated from the flows above and below it by a structurally weaker, but often less-permeable, palaeosol that formed during periods of volcanic quiescence. The collapse of columns is often facilitated by a combination of weathering along ever-widening joints and wedging outwards by debris that falls into them. This gradual distortion of the colonnade makes columns increasingly susceptible to collapse. Often this is triggered by intense rainfall (perhaps following a dry spell) that rapidly infiltrates joints and is ponded on the underlying palaeosol. The precise nature of the failure (toppling or outwards rotation of the column base) is largely dictated by the nature of the palaeosol/flow boundary. This interpretation is shown to be equally applicable to the columnar basalts of the recently designated Penghu Marine Geopark in Taiwan, and is used to demonstrate the dominance of intrinsic structural controls in determining patterns of failure that can cut across morphoclimatic boundaries. Although studies from a key site on Tongpan Island do demonstrate the importance of extreme meteorological events – typhoons in this case – in triggering final collapse. Results from these comparisons are used to develop a potential hazard zoning system for Tongpan as a first step towards integrating slope instability into future management strategies.