NIVATION OR CRYOPLANATION: IS THERE ANY DIFFERENCE?

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'Nivation' and 'cryoplanation' are terms indicative of two distinct process-landform associations. In some discussions there is a time-process continuum between the two defining terms but the threshold of transition and the resulting process-landform difference is not clear. For example, many discussions on 'cryoplanation' resort to the role of 'nivation' in the early stages but the actual threshold of transition and the character of process and landform change at this transition are not explained. Some authors suggest the difference appears to be no more than size or maturity. The absence of objective, quantified thresholds with respect to size or maturity prohibit these attributes from distinguishing between features and, at a fundamental level, how can size or maturity be used to justify two distinct terms even if such thresholds could be established? Further, where palaeo-reconstructions are undertaken, is it possible to distinguish between the fossil forms of a 'cryoplanation terrace' and a 'transverse nivation hollow'? Despite this duality of terms, both groups utilize the same basic processes and the resultant landforms may be very similar, if not identical.

Comparison of the literature on nivation and cryoplanation serves only to confuse rather than enlighten. Nivation is clearly described in its literature as exploiting *pre-existing* hollows to produce the nivation hollow or bench. Cryoplanation in its literature is seen as an initiator, the end result of which is the cryoplanation bench. Thus it would *not* be possible for nivation to initiate cryoplanation on an otherwise undifferentiated slope as is suggested in the cryoplanation literature. Further, nivation requires snow, usually in some quantity, which must suffer melt, whilst cryoplanation is said to characterize arid or semi-arid regions. A number of authors associate permafrost with cryoplanation whilst this has never been the case with nivation and so the transition between the two process-landform suites may be problematic. Lastly, as both concepts utilize the same basic suite of processes so the question arises as to what is, then, sufficiently different to justify the respective terms?

With regard to processes, both concepts (nivation and cryoplanation) identify frost weathering as the dominant, if not sole, cause of rock breakdown; some authors even identify the resultant landforms as indicative of a "frost-shattering zone". Conceptually, the questions arise as to why fost weathering, is there any proof for this and, what is the implication if it is *not* frost weathering? To compound the problem, there is no way to determine whether bedrock fragments are the product of frost weathering and recent studies in cold, arid environments suggest that thermal stress may be the dominant weathering process. Failing unequivocal identification of frost weathering, then both concepts lack a working operational definition.

The proposition is made that the two terms and their respective concepts are obsolete. Rather, 'nivation' and 'cryoplanation' are the two end members of the same process-landform continuum. With the transition from nival to arid conditions, so there is a decrease in the action of water and, likely, an increase in the *potential* for permafrost (due to the diminished insulation from snow cover). The "core" processes remain the same as, in essence, does the landform: the 'transverse nivation hollow' - 'the cryoplanation terrace'. Whilst mechanical weathering may predominate, there is no necessity for it to be frost weathering. The continued use of two terms, particularly if associated with climatic, size or age considerations, only serves to confuse. Rather, we have a single process suite that has end members that are 'wet' and 'dry' and, probably at distinctly different rates, produce similar landforms. It is here suggested that all such features could be called "periglacial mountain

benches", this having no process connotation beyond the association with a 'periglacial' environment and no form linkage other than it is a 'bench' in the 'mountains' (resulting from unspecified periglacial processes - i.e. it is not a glacial bench).

Key words: Nivation Cryoplanation Weathering Periglacial mountain benches