

- Lyons, W.B., and others. 1985. Nitrate concentrations in snow from remote areas, by W.B. Lyons, P.A. Mayewski, and M.J. Spencer. [Abstract.] *EOS. Transactions, American Geophysical Union*, Vol. 66, No. 46, p. 891-92.
- Mayewski, P.A., and others. 1981. Reconnaissance glacio-chemical studies in the Indian Himalayas, by P.A. Mayewski, W.B. Lyons, and N. Ahmad. *Proceedings of the Eastern Snow Conference*, 38th annual meeting, p. 45-58.
- Mayewski, P.A., and others. 1983. Chemical composition of a high altitude fresh snowfall in the Ladakh Himalayas, by P.A. Mayewski, W.B. Lyons, and N. Ahmad. *Geophysical Research Letters*, Vol. 10, No. 1, p. 105-08.
- Mayewski, P.A., and others. 1984. Interpretation of the chemical and physical time-series retrieved from Sentik Glacier, Ladakh, Himalayas, India, by P.A. Mayewski, W.B. Lyons, N. Ahmad, G. Smith, and M. Pouchet. *Journal of Glaciology*, Vol. 30, No. 104, p. 66-76.

SIR,

Winter-talus ridges, nivation ridges, and pro-talus ramparts

A "pro-talus rampart" is a ridge or ramp of debris that forms where clasts fall from a cliff face, slide, or roll across the surface of a perennial snow bank of somewhat standard dimensions, and accumulate at its base (Richmond, 1962; Washburn, 1973; Ballantyne, 1986). Recent studies have focused attention on the use of "pro-talus ramparts" as palaeoenvironmental indicators of severe periglacial conditions during the late Pleistocene and Holocene (Ballantyne, 1984, 1986; Butler, 1984, 1986). Because of their significance in palaeoenvironmental research, I was interested in the background and origin of the term "pro-talus rampart". In the course of this historical research, I have been consistently amazed at the injustice done to the individual who first described and named these features.

In 1912, R.A. Daly provided the first written description of what were much later called "pro-talus ramparts" (Daly, 1912, p. 593). He provided both a schematic drawing and photograph (p. 592) of these land forms, and named them in the following way:

"Since these special accumulations of debris are dependent on the formation of heavy snow-banks and on specially rapid frost-action before the summer heat has melted the snow in large measure, the wall-like piles may be called 'winter-talus ridges'" (Daly, 1912, p. 593).

Both the accompanying drawing and photograph are clearly labelled, i.e. named, as winter-talus ridges.

How, then, did these features come instead to be known as "pro-talus ramparts" (a term arguably more confusing and less descriptive as to origin than winter-talus ridge)? In 1933, Behre published a more broadly available article, in which he described land forms which were clearly winter-talus ridges. He called these features "nivation ridges" (Behre, 1933, p. 630). Behre correctly recognized the written description of these land forms in another earlier publication, by Crawford (1913, p. 34, pl. VIIA). Crawford did not provide a name/term for these land forms, and Behre therefore created his term for them, apparently never having been aware of the work of Daly (1912).

The following year, Kirk Bryan (1934) reviewed Behre's (1933) paper, and criticized the term "nivation ridges" as misleading, because of the use of the term nivation for the process of excavation around snow banks (Bryan, 1934, p. 656). Bryan went on to provide the first usage of the term "pro-talus rampart":

"The use of the same word (nivation) for these ramparts of blocks is likely to be misleading, and the reviewer suggests that 'pro-talus rampart' would be appropriate for the features." (Bryan, 1934, p. 656).

The term was adopted and apparently never challenged. Some later works have belatedly credited Daly with the first description of the features in question, but without acknowledging that Daly actually also named them.

The numerous examples include the works by Blagbrough and Breed (1967, p. 762), Rapp and Fairbridge (1968, p. 1107), Flint (1971, p. 134), Washburn (1973, p. 199), Embleton and King (1975, p. 140), and Richmond (1962, p. 61).

It should be categorically stated that: (1) neither Crawford (1913) or Behre (1933) used the term "winter-talus ridge"; (2) the originator of the term "winter-talus ridge" was Daly (1912), who did more than merely describe the features; and (3) Bryan (1934) introduced a redundant term because of a lack of familiarity with Daly's (1912) work, based partially on Behre's (1933) similar lack of familiarity. The term "pro-talus rampart" is not necessary, nor has it been so since 1912.

Department of Geography,
University of Georgia,
Athens,
Georgia 30602,
U.S.A.

DAVID R. BUTLER

6 August 1986

REFERENCES

- Ballantyne, C.K. 1984. The Late Devensian periglacial of upland Scotland. *Quaternary Science Reviews*, Vol. 3, No. 4, p. 311-43.
- Ballantyne, C.K. 1986. Protalus rampart development and the limits of former glaciers in the vicinity of Baosheinn, western Ross. *Scottish Journal of Geology*, Vol. 22, No. 1, p. 13-25.
- Behre, C.H., jr. 1933. Talus behavior above timber in the Rocky Mountains. *Journal of Geology*, Vol. 41, No. 6, p. 622-35.
- Blagbrough, J.W., and Breed, W.J. 1967. Protalus ramparts on Navajo Mountains, southern Utah. *American Journal of Science*, Vol. 265, No. 9, p. 759-72.
- Bryan, K. 1934. Geomorphic processes at high altitudes. *Geographical Review*, Vol. 24, No. 4, p. 655-56.
- Butler, D.R. 1984. A late Quaternary chronology of mass wasting for a small valley in the Lemhi Mountains of Idaho. *Northwest Science*, Vol. 57, No. 1, p. 1-13.
- Butler, D.R. 1986. Pinedale deglaciation and subsequent Holocene environmental changes and geomorphic responses in the central Lemhi Mountains, Idaho, U.S.A. *Géographie Physique et Quaternaire*, Vol. 40, No. 1, p. 39-46.
- Crawford, R.D. 1913. Geology and ore deposits of the Monarch and Tomichi districts, Colorado. *Colorado Geological Survey Bulletin* 4.
- Daly, R.A. 1912. Geology of the North American Cordillera at the forty-ninth parallel. *Geological Survey of Canada. Memoir*, No. 38.
- Embleton, C., and King, C.A.M. 1975. *Periglacial geomorphology*. New York, Halstead Press.
- Flint, R.F. 1971. *Glacial and Quaternary geology*. New York, etc., John Wiley and Sons, Inc.
- Rapp, A., and Fairbridge, R.W. 1968. Talus fan or cone; scree and cliff debris. (In Fairbridge, R.W., ed. *The encyclopedia of geomorphology*. New York, Halstead Press, p. 1106-09.)
- Richmond, G.M. 1962. Quaternary stratigraphy of the La Sal Mountains, Utah. *U.S. Geological Survey. Professional Paper* 324.
- Washburn, A.L. 1973. *Periglacial processes and environments*. New York, St. Martin's Press.