Arctic and Alpine Research, Vol. 26, No. 2, 1994, pp. 128–129

Snow-Avalanche Impact Landforms: A Brief Discussion of Terminology

*Brian H. Luckman,**
John A. Matthews,†
Daniel J. Smith,‡
Danny McCarroll,†
and Daniel P. McCarthy§

*Department of Geography, University of Western Ontario, London, Ontario N6A 5C2, Canada.
†Department of Geography, University of Wales at Swansea, Swansea SA2 8PP, Wales, U.K.
‡Department of Geography, University of Victoria, P.O. Box 3050, Victoria, British Columbia V8W 3P5, Canada.
§Northwest Community College, 130 First Ave. West, Prince Rupert, British Columbia V8J 1A8, Canada.

Abstract

It is suggested that features produced by the erosional impact of snow avalanches on water bodies be termed snow-avalanche impact landforms and deposits. The specific examples described by Matthews and McCarroll (1994) and Smith et al. (1994) are seen as distinctive end members of the range of depositional landforms produced by these processes.

The papers by Matthews and McCarroll (1994, this issue) and Smith et al. (1994, this issue) both discuss landforms resulting from snow-avalanche impact on water bodies but utilize different terms for the resulting depositional landforms. The original discussion of avalanche plunge pool effects (Liestøl, 1974) described features resulting from both the impact of snow avalanches on rivers (see his Figure 1) and lakes. Most of the subsequent literature has focused on the features associated with avalanche impact erosion (pools and pits): there has been little discussion of the associated depositional landforms and no consistent terminology developed for these features. The term avalanche boulder tongue (Rapp, 1959) is clearly inappropriate to describe any of the features discussed in Matthews and McCarroll (1994) or Smith et al. (1994).

Corner (1980) identified three types of avalanche-impact landforms: pits, pools, and tongues. The depositional landforms he described have a "ridged-tongue" morphology and are associated with both rivers and pools. Submerged arcuate ridges may be formed by impacts into large water bodies. Matthews and McCarroll (1994) propose the term "snow-avalanche boulder ramparts" for depositional landforms associated with avalanche impact in rivers. Smith et al. (1994) discuss both the water-filled erosional landform (pool) and the down-track deposit (which they call a mound) resulting from avalanche impact in lakes. There are clearly some similarities between all these depositional landforms. They are formed by snow-avalanche impact into water bodies and the subsequent entrainment, transport, and deposition of debris from these water bodies. They occur down-track of the impact point and are asymmetric in long profile with the shallower slope facing away from the avalanche source. However, the landforms differ in gross morphology because of variation in several controlling factors, namely, (1) differences in the erosional forces and processes generated by the confined impact of avalanches within pools of different depths and the laterally unconstrained impact on rivers; (2) differences between the effects of "plunging" airborne avalanches and possible "ground-based avalanches" running across rivers; (3) differences in the amount and spatial distribution of debris within the avalanche impact area; and (4) differences in the topography of the runout zone.

In the case of avalanche impact on riverbed material the available debris occurs in a relatively narrow belt, transverse to the avalanche track, and is moved into a linear depositional feature (usually a ridge) paralleling the streamcourse. Maximum development occurs either opposite the center of the avalanche track or downtrack of the zone of greatest debris availability and the landform tapers in both width and height up and down-stream. Avalanche impact into a pool or lake creates a more focused depositional pattern around the impact point and the circular or oval pools (pits) are partially or completely enclosed by a ridge or mound with a pronounced arcuate form. Generally these mounds are elongated and taper in a downtrack direction. The figures in Smith et al. (1994) and Matthews and McCarroll (1994) clearly demonstrate the differences in these landforms. Obviously the use of the terms "tongue," "mound," or "rampart" for all these features would be inappropriate and confusing. A more general term is needed.

We propose the collective terms of snow-avalanche impact landforms (both erosional and depositional) and snow-avalanche impact deposits for these phenomena. Corner (1980) used the term "avalanche impact tongue" for the depositional landforms but this term does not cover the full range of variation of these forms. We suggest that within the class of snow-avalanche impact depositional landforms the terms of rampart and mound be retained and used when the morphology warrants it. These forms can be envisaged as end members of a range of landforms produced by snow avalanche impact deposits in much the same way as "roadbank tongues" and "fan tongues" are used in describing particular variants of avalanche boulder tongue morphology (see Rapp, 1959; Luckman, 1977). The term snow-avalanche impact deposit can be used for a wide range of features, some of which may not have the degree of morphological expression

to warrant specific landform terms. This term would be quite useful because of the probability of finding new, intermediate forms resulting from different combinations of the controlling factors discussed above.

Acknowledgment

We thank Kathleen Salzberg, *Arctic and Alpine Research,* for the opportunity to write this brief commentary on our two independent papers.

References Cited

Corner, G. D., 1980: Avalanche impact landforms in Trøms, North Norway. *Geografiska Annaler,* 62A: 1–10.

Liestøl, O., 1974: Avalanche plunge pool effect. *Norsk Polarinstitutt Arbok,* 1972: 179–181.

Luckman, B. H., 1977: The geomorphic activity of snow avalanches. *Geografiska Annaler,* 59A: 31–48.

Matthews, J. A. and McCarroll, D., 1994: Snow-avalanche impact landforms in Breheimen, Southern Norway: Origin, age, and paleoclimatic implications. *Arctic and Alpine Research,* 26: 103–115.

Rapp, A., 1959: Avalanche boulder tongues in Lapland. *Geografiska Annaler,* 41: 34–48.

Smith, D. J., McCarthy, D. P., and Luckman, B. H., 1994: Snow-avalanche impact pools in the Canadian Rocky Mountains. *Arctic and Alpine Research,* 26: 116–127.

Ms submitted December 1993