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Commentaires

COMMENTS ON "FROST-HEAVED BEDROCK FEATURES: A VALUABLE PERMAFROST INDICATOR", BY JEAN-CLAUDE DIONNE

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DIONNE'S (1983) recent paper on frost-heaved bedrock features contains a valuable summary of their distribution in Canada, particularly Québec. However, the principal argument in the paper, that such features are endemic to permafrost conditions (see the last two sentences of the abstract) requires some further comment.

First and foremost, Dionne cites a personal communication with R.F. Black (p. 242) which indicates that forms resembling frost-heaved bedrock features occur in temperate regions and may be related to seasonal frost action. This reiterates his earlier statement that these features are "periglacial forms", in other words the product of frost action and not permafrost conditions, and renders his conclusions invalid.

Second, the use of air temperatures, measured in several cases at same distance from the site of the feature, to infer ground temperature conditions, *i.e.* permafrost, near the features is suspect. The paper does not contain any field evidence demonstrating permafrost conditions adjacent to an example of the features in northern Canada. As several researchers have shown (*e.g.* SMITH, 1975; BROWN, 1978) there is no simple relationship between ground temperature conditions and air temperature. Instead, atmospheric conditions are modified by the surface characteristics and thermal properties of the ground to produce subsurface temperatures that may vary laterally be more than 10°C over 10 m (SMITH, 1975; 1432). Particularly in the discontinuous zone, from where Dionne reports 65% of features in Québec, microclimatic conditions are critical controls of permafrost distribution (SMITH and RISEBOROUGH, 1983). It is disappointing that no field data were provided supporting the association of active frost-heaved bedrock features and permafrost conditions in this region.

Third, even a brief consideration of the processes involved in the formation of these features is not given. Both FRENCH (1976, p. 30-31) and WASHBURN (1979, p. 86-91) have presented basic reviews of the processes that result in the frost-heaving of rock. French makes it clear that neither the 'frost-pull' nor 'frost-push' mechanisms require permafrost conditions in order to operate, although Washburn indicates that heaving may result from upward-freezing at the base of the active layer during the fall. However, if one of the former mechanisms is responsible for these features, and there is no evidence to the contrary, then there is no genetic relationship between permafrost conditions and these features. Instead, the relationship is similar to that between the distribution of cariboo herds and permafrost — close, but not isomorphic.

Until the pertinent ground temperature data or a genetic explanation can be provided, there seems to be little reason to consider these features as 'second order' permafrost indicators (p. 250), rather than simply as indicators of a very active periglacial environment (FRENCH, 1981).

REFERENCES

BROWN, R.J.E. (1978): Influence of climate and terrain on ground temperatures in the continuous permafrost zone of northern Manitoba and Keewatin District, Canada, *in Proceedings of the Third International Conference on Permafrost*, National Research Council of Canada, Vol. 1, p. 15-21.

DIONNE, J.-C. (1983): Frost-heaved features: a valuable permafrost indicator, *Géographie physique et Quaternaire*, Vol. 37, p. 241-251.

FRENCH, H.M. (1976): *The periglacial environment*, London, Longman, 309 p.

——— (1981): Periglacial phenomena near Churchill, Manitoba, *in The Hudson-James Bay Symposium*, University of Guelph, Ontario, Abstracts, p. 6.

SMITH, M.W. (1975): Microclimatic influences on ground temperatures and permafrost distribution, Mackenzie Delta, Northwest Territories, *Canadian Journal of Earth Sciences*, Vol. 12, p. 1421-1438.

SMITH, M.W. and RISEBOROUGH, D.W. (1983): Permafrost sensitivity to climate change, *in Proceedings of the Fourth International Conference on Permafrost*, National Academy of Sciences, p. 1178-1183.

WASHBURN, A.L. (1979): *Geocryology: A survey of periglacial processes and environments*, London, Edward Arnold, 406 p.