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COMMENTS ON PERIGLACIAL TERMINOLOGY

In reply to the request dated December 20, 1963, I shall attempt to bring together some of my thoughts on the terminology relating to the questionnaire accompanying the letter, and specifically, to frost in the ground and to permafrost. It should be made clear that my thoughts do not necessarily conform to the general thinking of other geomorphologists in the United States. In fact, it seems clear to me that we in the United States working with these phenomena are perhaps less concerned about terminology than are the workers in other countries. We did have a serious attempt some years ago to revise our terms. It would be of interest to the members of the working commission to know that on October 16, 1952, Gerald M. Richmond wrote me suggesting that a group interested in mass wasting deposits, exclusive of landslides, get together at our annual meeting of the Geological Society of America to discuss this problem of terminology and hopefully, to define or redefine the terminology involved. The mass wasting phenomena included all of the terms we consider as part of seasonal frost phenomena, permafrost phenomena and périglacial phenomena. A committee under the chairmanship of G. M. Richmond included R. F. Black, Charles S. Denny, Richard Foster Flint, David M. Hopkins, Hugh M. Raup, H. T. U. Smith and A. L. Washburn. We met on November 14 to discuss various aspects of this problem. The committee experienced some difficulty in selecting the scope of the subject matter, which was carried over finally into the name for the committee. We selected the term *colluvium* as a general term for any deposit moved by mass wasting. Under this, a number of kinds of mantle were selected as major types. *Mantle* was used as a broad term to include any unconsolidated material overlying bedrock. Such mantle may be further subdivided into transported mantle, or sedimentary mantle, for example, each of which lends itself to further subdivision. I need not go through all of the details of the history of the committee's works and the numerous discussions and written reports on these various problems. Needless to say, however, the

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committee was not able to agree on all aspects of the various problems. No overall report was accepted by all members of the committee. Individual facets have been published, particularly that of A. L. Washburn on classification of patterned ground. But it does seem clear to me that in this country we have so many diverse interests that uniform acceptance of a terminology will be difficult for some time to come. This does not mean that attempting to obtain uniformity in our terminology is not desirable. I believe seriously that it is, however, I give this brief review to emphasize the fact that my comments will be personal comments and not necessarily those of the geomorphologists of the United States in general.

In answer to the specific questions, I will have only brief comments for each.

(1) *What are the essential characteristics implied in the concept of periglacial or periglacial areas?*

This denotes first, cold climates in which frost action is recognized as a dominant process. It may or may not be accompanied by strong mass movement and/or wind action. If either is present, however, cold climate indicators must also be present, in contra-distinction to desert and tropical areas where such processes are also present. Hence, I use the term very broadly and loosely to include the cold climates from polar regions into the north temperate latitudes or farther south in the high Alpine regions of the temperate to tropical regions.

(2) *What is the relationship between periglacial regions (or phenomena) and extraglacial ones?*

The relations between the areas of periglacial phenomena and the areas outside may then be separated by latitude or by elevation. The areas are currently gradational, literally on a day-to-day or week-to-week basis, just as they have been gradational, and in part interchangeable on larger cycles involving whole stages of the Pleistocene.

(3) *What is the relationship between periglacial areas and permafrost?*

The relation of the periglacial areas to permafrost is also loosely applied. Permafrost may or may not be present. It is not necessary within the definition of the term.

(4) *Does periglacial mean any particular phenomena (e. g. frost weathering, wind action, structure formation, morphogenetic processes) or does it imply an areal sense defined by a system combined of various elements?*

I prefer to use the term *periglacial* very loosely and broadly as indicated above, and generally speaking, then, it involves a combination of various elements, forms and processes, and is not limited to one specifically. However, if any one process dominates, it is that of frost action.

(5) *Does periglacial refer to phenomena and regions that are directly controlled by corresponding climate or to such as are due to the influence of glacier-ice masses?*

Generally, we recognize that large ice sheets exert some influence on the climate, just as the climate influences most ice sheets, consequently, we are begging the issue if we attempt to answer the question as to whether periglacial phenomena are conditioned directly by the climate or by adjoining influence of a glacier. The one goes in hand with the other. I do not see a need for hard and fast control by a glacier or the lack of it, in regarding the distribution of periglacial processes or phenomena.

(6) *Which climatic features (thermal conditions, humidity) or climate types are predominant in or characteristic of a periglacial environment?*

Both thermal and moisture relations must be considered in the relations of the climate to periglacial processes and phenomena. The temperature must be sufficiently low to create freezing conditions. The temperature needs to be lower, or fluctuations more extreme where moisture conditions are lower. The reverse, however, is not necessarily true. The optimum moisture and the optimum temperature ranges are not fully understood for all features or processes and I would hesitate at this time to place specific limits on them.

(7) *Does the term periglacial imply a topographic (vicinity of glaciers), morphogenetic (any morphogenetic processes such as frost weathering, cryergy, wind-action) or rather a geographic connotation (zones, stages)?*

The concept of *periglacial* obviously has been used to include the zone in the vicinity of glaciers as well as morphogenetic processes. So long as we all recognize that it has and can be used loosely in these various senses I am not in disagreement with it.

(8) *What would you suggest with regard to the problem of the lowest or outermost Equatorward limit of periglacial regions or phenomena?*

I would not suggest any particular problems relevant to the altitudinal or latitudinal limit of the periglacial regions or phenomena. I believe that those limits are fluctuating today just as they have through the Pleistocene and bulk of geologic time. All we need to do in this regard is to recognize

that such fluctuations have occurred, are occurring and will occur in the future.

(9) *What would you suggest concerning the division of periglacial areas?*

It would be desirable, ultimately, to subdivide the periglacial regions into such subdivisions which can be characterized by distinct, different effects in the formation of land forms. They may be recognized at the surface today or in fossil variety wherein peculiar combinations of temperature and moisture conditions have exemplified a particular area. Not all parts of the periglacial region may be subdivided in this way, but hopefully, fortuitous combinations of temperature and moisture should lead to characteristic forms. The palsa, for example of the Swedish Laplands, have been described as indicative of a particular climatic zone today. We also know that ice wedges are found only in certain environments, just as sand wedges which may be found in the same temperature environment are restricted to the drier areas versus the ice wedges. Other examples come immediately to mind but need not be cited here.

(10) *Must or may a term used to qualify something as periglacial fully agree with the etymologic sense of the word?*

It is not necessary in my opinion that the term *periglacial* be in strict accord with its etymological sense.

(11) *Would you kindly give your opinion on the terms: periglacial, paraglacial, subnival, cryonival, cryology?*

Of all the various terms cited, I would prefer to continue the use of the term *periglacial* in its broad sense. I do so only as a matter of usage for historical purposes. If I were to adopt one of the newer terms, I would vote for *cryology*, using the adjective *cryologic* to refer to the various cold climate features. If the committee is interested in a new term, I should like to suggest the term *cryomorphology* as part of geomorphology pertaining to the various processes and products of cold climates.

To me the definition of *permafrost* as now used is satisfactory. I would urge that the committee consider the terms *saturated permafrost* to mean permafrost in which all available pores are filled with ice; *supersaturated permafrost* in which more ice is present than pore spaces; and *undersaturated permafrost* where open pores are present. This does not negate the use of such descriptive terms as *dry permafrost*, *loose permafrost*, etc. I prefer a dual classification of ice in ground. First and most important is a geo-

metric classification based on size, shape and distribution of ice particles. Secondly, a genetic classification can be applied. So long as the first classification is applied rigorously, we can always appreciate what someone else is discussing, no matter the language or usage. Further, at any later date, the origin of the ice as originally postulated, can be changed without affecting the original geometric description. Thus, a wedge-shaped mass of ice may be a true ice wedge, an injection ice-mass, refrozen snow filling a V-shaped gully, etc. I think our main problem is that we have always attempted to classify genetically the various kinds of ice without first adequately defining its dimensions.